AUTORITÉ DE SÛRETÉ NUCLÉAIRE

www.asn.fr

Nuclear safety and radiation protection in France in 2011

The Nuclear Safety Authority presents its Report abstracts on the state of nuclear safety and radiation protection in France in 2011.

This report is required by article 7 of the 13th June 2006 Act on transparency and security in the nuclear field, now integrated into the Environment Code (article L. 592-31).

It was submitted to the President of the Republic, the Prime Minister and the Presidents of the Senate and the National Assembly, pursuant to article 7 of the above-mentioned Act.

P. 4
Editorial





P. 7
Nuclear safety authority (ASN):
its roles
key figures
its organisation

ASN actions

CHAPTER 1
NUCLEAR ACTIVITIES: IONISING RADIATION AND HEALTH AND ENVIRONMENTAL RISKS 29
1 Knowledge of the hazards and risks from ionising radiation 31
2 Nuclear activities 35
3 Monitoring of exposure to ionising radiation 37
4 Outlook 45

CHAPTER 2
THE PRINCIPLES AND STAKEHOLDERS IN NUCLEAR SAFETY REGULATION, RADIATION PROTECTION AND PROTECTION OF THE ENVIRONMENT 47
1 The principles of nuclear safety, radiation protection and protection of the environment 49
2 The stakeholders 53
3 Outlook 65

CHAPTER 3
REGULATION 67
1 The general legal framework applicable to nuclear activities 69
2 Regulatory requirements applicable to small-scale nuclear activities 77
3 The legal system applicable to basic nuclear installations (BNIs) 83
4 Regulations governing the transport of radioactive materials 96
5 Requirements applicable to certain risks or certain particular activities 97
6 Outlook 99

CHAPTER 4
REGULATION OF NUCLEAR ACTIVITIES AND EXPOSURE TO IONISING RADIATION 105
1 Verifying that the licensee assumes its responsibilities 105
2 Regulation that is proportionate to the issues involved in the activities 108
3 Deploying the most efficient regulation and inspection means 111
4 Monitoring environmental radioactivity 125
5 Identifying and penalising infringements 131
6 Outlook 133

CHAPTER 5
RADIOLOGICAL EMERGENCIES 137
1 Anticipating 137
2 Responding to an emergency situation 143
3 Learning from experience 149
4 Outlook 152

CHAPTER 6
PUBLIC INFORMATION AND TRANSPARENCY 155
1 Developing relations between asn and the public 155
2 Enhancing the right to nuclear safety and radiation protection information 169
3 Outlook 179

CHAPTER 7
INTERNATIONAL RELATIONS 183
1 ASN objectives in europe and worldwide 183
2 European union and multilateral relations 185
3 Bilateral relations 195
4 International agreements 201
5 International conferences 203
6 Outlook 204

CHAPTER 8
REGIONAL OVERVIEW OF NUCLEAR SAFETY AND RADIATION PROTECTION 209
1 Aquitaine, Poitou-Charentes and Midi-Pyrénées regions 213
2 Basse and Haute-Normandie regions 215
3 Champagne-Ardenne and Picardie regions 221
4 Bourgogne and Franche-Comté regions 225
5 Nord-Pas-de-Calais regions 227
6 Rhône-Alpes and Auvergne regions 231
7 Provence-Alpes-Côte-d'Azur and Languedoc-Roussillon regions 237
8 Pays de la Loire and Bretagne regions 243
9 Centre, Limousin and Ile-de-France regions 247
10 Ile-de-France and overseas *départements* regions 251
11 Alsace and Lorraine regions 253

summary



P. 12
the year 2011

P. 16

Fukushima : one year later



Activities regulated by ASN

CHAPTER 9
MEDICAL USES OF IONISING RADIATION 257
1 Medical and dental radiodiagnosis installations 253
2 Nuclear medicine 258
3 External-beam radiotherapy and brachytherapy 261
4 Blood product irradiators 265
5 The state of radiation protection in the medical field 265
6 Outlook 275

CHAPTER 10
NON-MEDICAL USES OF IONISING RADIATION 281
1 Presentation of non-medical activities using ionising radiation 279
2 Regulating non-medical activities 286
3 Monitoring non-medical activities 293
4 Assessment of radiation protection in the non-medical sector and outlook 294

CHAPTER 11
TRANSPORT OF RADIOACTIVE MATERIALS 301
1 Movements and risks in the transport sector 299
2 Regulation duties and responsibilities in the transport of radioactive materials 301
3 Development of the international and european regulations relative to the transport of radioactive materials 302
4 ASN action in the transport of radioactive materials 305
5 ASN's opinion on the safety of transport of radioactive materials, and prospects 312

CHAPTER 12
NUCLEAR POWER PLANTS 319
1 Overview of nuclear power plants 317
2 The major nuclear safety and radiation protection issues 324
3 Nuclear safety 338
4 Radiation protection, protection of workers and the environment 349
5 Current status of nuclear safety and radiation protection 352
6 Assessments 361
7 Outlook 375

CHAPTER 13
NUCLEAR FUEL CYCLE INSTALLATIONS 383
1 Main installations in operation 379
2 Installations in closure phase 389
3 Regulating controlling the nuclear fuel cycle facilities 392
4 International action 396
5 Experience feedback from the fukushima daiichi accident 397
6 Outlook 398

CHAPTER 14
NUCLEAR RESEARCH FACILITIES AND VARIOUS NUCLEAR INSTALLATIONSA 405
1 The french alternative energies and atomic energy commission's installations 401
2 Non-CEA nuclear research installations 411
3 Ionisers, the production of radionuclides for pharmaceutical use, the maintenance units and the other nuclear facilities 413
4 International actions 416
5 Outlook 417

CHAPTER 15
SAFE DECOMMISSIONING OF BASIC NUCLEAR INSTALLATIONS (BNIS) 425
1 Technical and legal requirements applicable to decommissioning 421
2 Situation of nuclear installations undergoing decommissioning in 2011 426
3 Outlook 437

CHAPTER 16
RADIOACTIVE WASTE AND CONTAMINED SITES AND SOLS 447
1 Radioactive waste 449
2 Management of sites and soils contaminated by radioactivity 469
3 Outlook 474

APPENDIX
A – List of basic nuclear installations as at 31.12.2011 408
b – Acronyms and abbreviations 420



ASN Commission

Jean-Jacques DUMONT
Michel BOURGUIGNON
André-Claude LACOSTE
Marie-Pierre COMETS
Philippe JAMET

Paris, April 2, 2012

« There is a before and after Fukushima »

This is the fifth year running that the ASN Commission presents the annual report on the state of nuclear safety and radiation protection in France.

It represents an opportunity to conduct a first review of these five years, before two members of the Commission, including the Chairman, are replaced at the end of 2012.

As in previous years, 2011 was relatively satisfactory in France in terms of nuclear safety and radiation protection. At the end of this five-year period, it is worth highlighting the progress made in the field of patient safety, owing to the rise in the number of radiological physicists and the tightening up of procedures. Also worthy of note is the progress achieved with regard to transparency, in particular thanks to the work done by the French High Committee for Transparency and Information on Nuclear Security and by the local information committees, as well as the publication by ASN of follow-up letters to all the inspections it carries out and of the opinions of the Advisory Committees of experts, which are an important factor in the decisions it takes.

The ASN Commission considers that there are a number of key issues and challenges for the next few years..

The Fukushima accident

2011 was marked by the Fukushima accident. This major accident reminded everyone that despite all the precautions taken, an accident can never be completely ruled out. There is most clearly a before and after Fukushima, because this accident raises fundamental questions which go far beyond the specific characteristics of the Fukushima reactors and how they were operated. Full analysis of the feedback could take up to 10 years, but ASN immediately initiated a series of targeted inspections on topics related to the accident and a series of complementary safety assessments on the French civil nuclear facilities. These assessments are in response to the Prime Minister's 23rd March 2011 request for an audit of French facilities and that of the European Council of 24th and 25th March 2011, for the performance of stress tests on the European nuclear power generating reactors. ASN published its report, which was submitted to the Prime Minister and forwarded to the European Commission in early 2012.

Subsequent to the complementary safety assessments, ASN considers that the level of safety in the facilities examined is high enough not to require that any of them be shutdown. At the same time, it considers that their continued operation is conditional upon increasing their robustness to extreme situations, over and above their existing safety margins, as rapidly as possible. It therefore imposes a range of measures on the licensees. Furthermore, ASN considers that social, organisational and human factors are a key aspect of safety. It will thus be particularly attentive to the renewal of licensee staff and skills, as well as how the use of subcontractors is organised. All the steps taken and the opinions issued by ASN following the Fukushima accident are described in the "Fukushima: one year later" part.

A process of peer-review of the national reports, conducted at a European level, has already started and should continue until June 2012. ASN will draw its conclusions from the results of these peer reviews.

In order to improve safety worldwide, it is essential that there be complete feedback from the Fukushima accident and Europe must promote the stress tests approach and results internationally. A major step will be the extraordinary meeting of the Convention on Nuclear Safety, to be held in Vienna at the end of August 2012.

As part of the energy debate currently ongoing in France, ASN would recall that, whichever scenario is chosen, the safety of the nuclear facilities must be guaranteed in all circumstances, whether in terms of construction, operation or decommissioning. ASN will ensure that the necessary investments are made and that sufficient skills are maintained for all the scenarios.

It stresses the fact that were reactor operations to be continued beyond 40 years, this would require significant safety improvements, in particular with respect to severe accidents. It

would adopt as its benchmark the safety objectives of the new reactors (EPR), taking account of the experience feedback from the Fukushima accident. ASN will require shutdown of those facilities unable to achieve the required level of safety. In this context, to avoid creating situations in which the demands of safety conflict with those of energy supply, it is crucial to be able to anticipate the renewal of electricity production capacity, whichever production method is chosen.

Radioactive waste management

In the field of the regulation of radioactive waste management, 2012 will be devoted to preparing the new edition of the national radioactive materials and waste management plan (PNGMDR) (2013-2015), which is a key element in waste management because its aim is to ensure that there are reliable management solutions for each category of radioactive material and waste, to identify the foreseeable needs in terms of storage and disposal facilities and to define all the corresponding steps and measures to be taken. ASN considers that in terms of nuclear safety and radiation protection, it is essential that for each category of waste, there is a management and disposal solution and that this solution is put into place as rapidly as possible. ASN will ensure that the preparations for the public debate concerning the geological disposal project for intermediate level and high level, long-lived waste, which should take place in 2013, are carried out in the best possible conditions. Prior to the examination of the application file for such a disposal facility, it will continue to work on the subject of reversibility with its European counterparts.

Regulating the medical sector

After radiotherapy, ASN focused its efforts on medical imaging, which represents significant issues in terms of radiation protection of patients.

The performance of medical imaging, in particular computed tomography, is continuing to rise, leading to improvements in diagnosis quality, more precisely targeted therapeutic strategies and treatment under radiological visual control. However, this is also leading to a significant rise in the average dose per inhabitant, a trend that is being observed worldwide. ASN therefore considers that it is becoming urgent to take steps to control this rise in doses.

In addition to increasing the number of MRI machines, it recommends working with the health professionals on reinforcing application of the principle of the justification of radiological examinations and with the equipment manufacturers on equipment optimisation. This is a subject on which it works together with its European counterparts within the Heads of European Radiological Protection Competent Authorities association, HERCA.

It also stresses the importance of continuing research into individual radiation sensitivity with a view to developing a detection test. It would appear that about 10% of the population is hyper-sensitive to ionising radiation, as a result of genetic anomalies in the signalling and repair of DNA damage, itself a factor in the onset of cancers. Individual radiation sensitivity would also seem to be responsible for serious undesirable effects observed in radiotherapy, even when no dose error is involved. A routine detection test would help ensure progress in radiobiology, radiation protection and cancerology.

Regulating source security

The aim of achieving consistency between the radiation protection and security approaches (in other words the prevention of malicious acts) led ASN to suggest to the Government that it take charge of regulating source security, an area for which there was as yet no specific framework. The principle was adopted in 2008. An Act is needed to entrust this mission to ASN. The relevant provisions were included in a Bill intended, among other things, to ratify the ordinance of 5th January 2012 which codified the TSN Act. ASN has begun to set up an organisation to take charge of this new role.

Construction of a European nuclear safety and radiation protection area

For ASN, the construction of a European nuclear safety and radiation protection area has always been a major objective. The construction of this area has made progress, with the adoption of two European directives, one in 2009 on nuclear safety, the other in 2011 on the management of radioactive waste and spent fuel. The first European conference on nuclear safety was also held in Brussels in June 2011. The work done by WENRA, the Western European Nuclear Regulators' Association, enabled the specifications to be rapidly drafted for the European stress tests conducted subsequent to the Fukushima accident.

In the same way, work is progressing within HERCA on, for example, medical imaging. ASN will continue to heavily involved at a European level, so that Europe can discuss its positions with its American and Asian colleagues and promote them.

* * *

Faced with the challenges mentioned, in particular the need to improve the approach to safety in order to take account of the lessons learned from the Fukushima disaster, ASN will continue to carry out its role of regulating nuclear safety and radiation protection, while striving to strengthen the implementation of its four fundamental values: competence, independence, rigor and transparency. ASN will continue with its goal of improving nuclear safety worldwide. The quality of its own staff and the expertise contributed by those at IRSN are key factors in its success. ■

Nuclear safety authority (ASN)



ASN was created by the 13th June 2006 Nuclear Security and Transparency Act. It is an independent administrative authority responsible for regulating civil nuclear activities in France. It also contributes towards informing citizens.

ASN is tasked, on behalf of the State, with regulating nuclear safety and radiation protection in order to protect workers, patients, the public and the environment from the hazards involved in nuclear activities.

ASN aims to provide efficient, impartial, legitimate and credible nuclear regulation, recognised by the citizens and regarded internationally as a benchmark for good practice.

its roles, key figures, its organisation



competence
independence
rigour
transparency

Its roles

REGULATING

ASN contributes to drafting regulations, by giving the Government its opinion on draft decrees and ministerial orders, or by taking regulatory decisions of a technical nature.

AUTHORISING

ASN examines all individual authorisation applications for nuclear facilities. It can grant all authorisations, with the exception of major authorisations for basic nuclear installations, such as creation and decommissioning. ASN also issues the licenses provided for in the Public Health Code concerning small-scale nuclear activities and issues authorisations or approvals for radioactive material transport operations.

MONITORING

SN is responsible for ensuring compliance with the rules and requirements applicable to the facilities or activities within its field of competence. Inspection is one of ASN's main means of monitoring, although it also has appropriate powers of enforcement and sanction.

INFORMING

Primarily through its website www.asn.fr and its *Contrôle* magazine, ASN informs the public and the stakeholders (local information committees, environmental protection associations, etc.) of its activity and the state of nuclear safety and radiation protection in France.

IN EMERGENCY SITUATIONS

ASN assists the Government and in particular sends the competent Authorities its recommendations concerning the civil security measures to be taken. It monitors the steps taken by the licensee to make the facility safe. It informs the public of the situation.

REGULATION AND MONITORING OF DIVERSE ACTIVITIES AND FACILITIES

Nuclear power plants, management of radioactive waste, nuclear fuel shipments, radioactive material packages, medical facilities, research laboratories, industrial activities, and so on. ASN regulates a wide variety of activities and facilities. This regulation covers:

– 58 nuclear reactors producing nearly 80% of the electricity consumed in France, along with the EPR reactor currently under construction;
– all French fuel cycle facilities, from fuel enrichment to reprocessing;
– several thousand facilities or activities which use sources of ionising radiation for medical, industrial or research purposes;
– several hundred thousand shipments of radioactive materials made annually nationwide..

THE HELP OF EXPERTS

When taking certain decisions, ASN calls on the expertise of technical support bodies. This is primarily the case with the Institute for Radiation Protection and Nuclear Safety (IRSN). ASN also requests opinions and recommendations from scientific and technical Advisory Committees of experts.

Key figures in 2011

456 STAFF

593 TECHNICAL OPINIONS — sent to ASN by IRSN

250 INSPECTORS

8,795 INSPECTION FOLLOW-UP LETTERS — available on the website *www.asn.fr*

80% MANAGEMENT

34 MEETINGS — of the Advisory Committees of experts

2,061 INSPECTIONS — in the nuclear facilities; radioactive material shipments; the medical, industrial and research sectors; approved organisations.

46 PRESS CONFERENCES

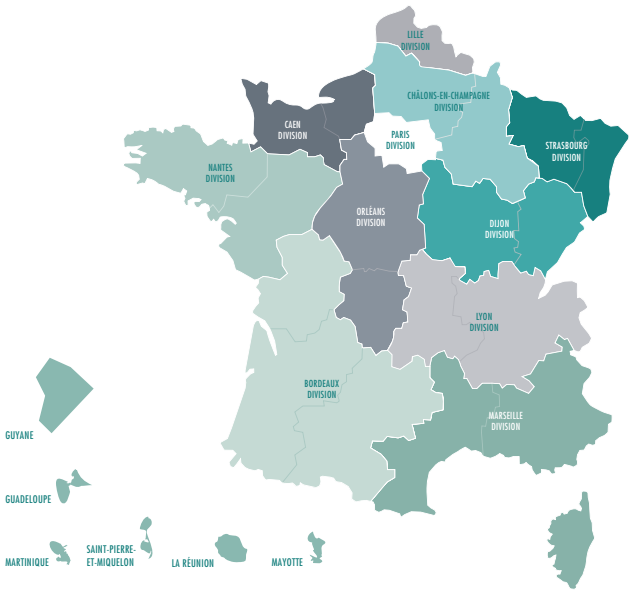
68 MILLION — Total budget for ASN

76.5 MILLIONS € — budget devoted to IRSN appraisal work

3,348 AUTHORISATIONS

7 ACCIDENT SIMULATION EXERCISES

Its organisation



ORGANISATION

ASN comprises head office departments and eleven regional divisions with competence for one or more administrative regions. This organisation enables ASN to carry out its regulation and monitoring duties over the entire country and in the overseas territories of France.

THE ASN ORGANISATION CHART

The departments are organised thematically and manage national affairs concerning the activities for which they are responsible.
The ASN regional divisions operate under the authority of the regional representatives, appointed by the ASN Chairman. They are ASN's representatives in the regions and contribute to the ASN's public information role. The divisions carry out most of the direct inspections on nuclear facilities, radioactive material transport operations and small-scale nuclear activities.
In emergency situations, the divisions assist the *préfet* of the *département*, who is in charge of protection of the populations, and monitor operations to safeguard the installation on the site, provided that it is accessible and does not constitute a hazard.

Commission

André-Claude LACOSTE, CHAIRMAN

Michel BOURGUIGNON, Marie-Pierre COMETS, Jean-Jacques DUMONT, Philippe JAMET, COMMISSIONERS

HEAD OF PRIVATE OFFICE
Joseph-Michaël LEBLANC DE MOLINES

Management and expertise office (MEA)
Martine BAUDOIN

Director General Office
DIRECTOR-GENERAL
Jean-Christophe NIEL
DEPUTY DIRECTOR-GENERAL
Alain DELMESTRE, Jean-Luc LACHAUME, Sophie MOURLON
ADVISER
Henri LEGRAND
HEAD OF STAFF
Pascal LIGNÈRES

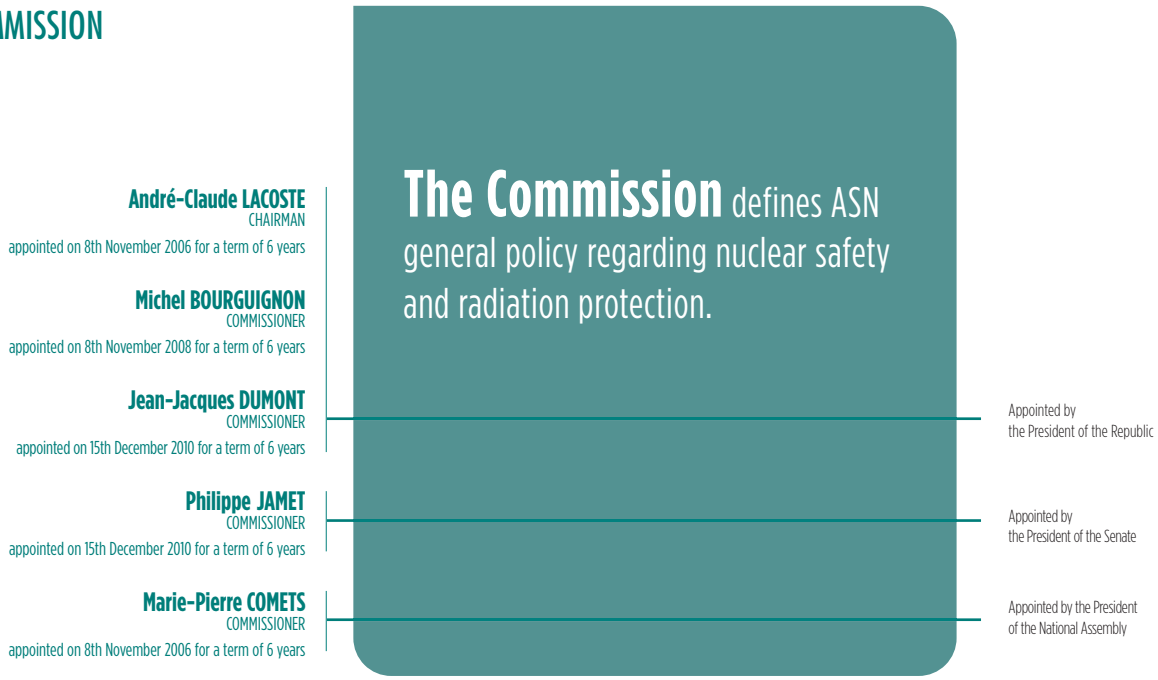
Office of administration (SG)
Luc CHANIAL

Nuclear power plant department (DCN)	Nuclear pressure equipment department (DEP)	Transport and sources department (DTS)	Waste, research facilities and fuel cycle facilities department (DRC)	Ionising radiation and health department (DIS)	Environment and emergency department (DEU)	International relations department (DRI)	Communication and public information department (DCI)
Thomas HOUDRÉ	**Sébastien CROMBEZ**	**Laurent KUENY**	**Lydie ÉVRARD**	**Jean-Luc GODET**	**Sophie CHEVALIER**	**Guillaume GILLET**	**Alain DELMESTRE**

BORDEAUX DIVISION	CAEN DIVISION	CHÂLONS-EN-CHAMPAGNE DIVISION	DIJON DIVISION	LILLE DIVISION	LYON DIVISION	MARSEILLE DIVISION	NANTES DIVISION	ORLÉANS DIVISION	PARIS DIVISION	STRASBOURG DIVISION
Regional representative **Patrice RUSSAC**	Regional representative **Christophe QUINTIN**	Regional representative **Jean-Christophe VILLEMAUD**	Regional representative **Corinne ETAIX**	Regional representative **Michel PASCAL**	Regional representative **Philippe LEDENVIC**	Regional representative **Laurent ROY**	Regional representative **Hubert FERRY-WILCZEK**	Regional representative **Nicolas FORRAY**	Regional representative **Bernard DOROSZCZUK**	Regional representative **Marc HOELTZEL**
Regional Head **Anne-Cécile RIGAIL**	Regional Head **Simon HUFFETEAU**	Regional Head **Jean-Michel FERAT**	Regional Head **Alain RIVIÈRE**	Regional Head **François GODIN**	Regional Head **Grégoire DEYIRMENDJIAN**	Regional Head **Pierre PERDIGUIER**	Regional Head **Pierre SIEFRIDT**	Regional Head **Fabien SCHILZ**	Regional Head **Delphine RÜEL**	Regional Head **Florien KRAFT**

on 31th december 201

ASN COMMISSION



85 SESSIONS

34 OPINIONS

50 DECISIONS

9 DEBATES

Impartiality

The Commissioners perform their duties in complete impartiality and receive no instructions either from the Government or from any other person or institution.

Independence

The Commissioners perform their duties on a full-time basis. Their mandate is for a six-year term. It is not renewable. The duties of a member can only be terminated if a majority of the Commissioners sitting on the Commission rule on his or her incapacity or accept his or her resignation. The President of the Republic may also terminate the duties of a member of the Commission in the event of a serious breach of his or her obligations.

Competences

The Commission takes decisions and publishes opinions in ASN's *Official Bulletin*. It defines ASN external relations policy both nationally and internationally.

It defines ASN regulatory policy. The Chairman appoints the nuclear safety inspectors, the radiation protection inspectors, the conventional safety inspectors for the nuclear power plants and the staff responsible for verifying compliance with the requirements applicable to pressure vessels.

The Commission opens inquiries following incidents or accidents. It presents the ASN Report on the state of nuclear safety and radiation protection in France. Its Chairman reports on ASN activities to the relevant commissions of the French Parliament's National Assembly and Senate as well as to the Parliamentary Office for the Evaluation of Scientific and Technological Choices.

It drafts ASN internal regulations and appoints its representatives to the High Committee for Transparency and Information on Nuclear Security.



Jean-Christophe NIEL
ASN DIRECTOR GENERAL

Paris, April 2, 2012

2011, a pivotal year for nuclear safety

For ASN, 2011 is the fiftieth anniversary of the creation of the basic nuclear installations regime, the fifth anniversary of the creation of ASN and, finally, the year of the Fukushima disaster.

50th birthday
of the basic nuclear installation.

In the 1950s, the Minister of Health tasked the central service for the protection against ionising radiation (SCPRI) with handling radiation protection issues; the French atomic energy commission (CEA) for its part dealt with regulating the safety of its own facilities. The Government felt no need to establish a regulatory system that involved them directly. The very notion of nuclear facilities – later to be known as "basic nuclear installations (BNI)" – that represented a particular risk requiring monitoring and regulation, did not even exist.

This notion came about in France almost unintentionally, as a result of international constraints. The Euratom Treaty, signed in 1957, stipulated that nuclear facilities should be subject to a regime of authorisation, or at the very least notification; moreover, the Paris Convention on Nuclear Third Party Liability, signed in 1960, required identification of the facilities which could be the source of any damage.

To establish the basic nuclear installations administrative regime, the Government then chose a relatively unusual legislative vehicle; a bill concerning mitigation of atmospheric pollution, which became the atmospheric pollution and odours Act. This bill, submitted by the Government in 1960, did not primarily target industrial facilities, which had been regulated for a long time by a law dating back to 1917. It was therefore aimed mainly at other sources of potential atmospheric pollution: vehicles, non-industrial facilities such as domestic hearths and diffuse sources.

However, the text of the Government's draft contained the word radioactive: radioactivity was just beginning to be recognised as a component of ambient atmospheric pollution, mainly as a result of the atmospheric atomic tests being carried out by the major powers.

It was thus designated as the appropriate medium for introducing an administrative regime for basic nuclear installations, in order to meet France's international obligations.

One could be forgiven for thinking that it would have been simpler to change the nomenclature of installations covered by the 1917 Act on classified installations and simply add nuclear facilities.

There would appear to be two reasons for not having done so:
– the scope of the 1917 Act was then limited to industrial and commercial establishments; however CEA's sites, which housed a large number of the nuclear facilities, did not fall into this category;
– the other reason was the extremely specific technical nature of these facilities, which justified centralised monitoring and regulation, by specialised individuals, whereas the principle of the classified facilities was that the inspectors of these facilities be appointed in each *département*[1] by the *préfet*[2], and be able to cover all facility categories.

The first provisions concerning nuclear facilities were therefore incorporated into an Act dealing with mitigation of atmospheric pollution and odours. According to the minutes of the debates in the National Assembly and the Senate, the members of parliament showed that even at that time, they were aware of the problems of radioactivity:

1. In a *département*, representative of the State appointed by the President
2. Administrative region headed by a *préfet*

the problem of ambient radioactivity as a result of atomic testing was highlighted by a number of speakers. Fewer speakers however mentioned nuclear facilities, although one member of parliament did express concern about sites too close to Paris.

This is how the BNI came about, almost as an afterthought.

ASN is 5 years old.

In November 2006, the ASN Chairman, André-Claude Lacoste, stated that the creation of ASN would lead initially to little change but that after five years, we would be able to see how far we had come. I believe that the best way to talk about these five years is to present the significant milestones reached during the period, although this choice has to be somewhat arbitrary given the wealth of potential topics:

The lessons learned from the Épinal and Toulouse accidents

Following these accidents, ASN took steps to promote the safety of radiotherapy treatment.

For example:
– jointly with the French Society for Radiation Oncology (SFRO), by creating the scale for rating radiation protection events affecting patients receiving radiotherapy treatment;
– by recommending an increase in the number of radiological physicists;
– by suspending the operations of several radiotherapy centres as a result of major anomalies;
– by organising an international conference in Versailles, in 2007, entitled "Advances and challenges in radiation protection of patients";
– by adopting a decision concerning radiotherapy quality management in 2008.

BNI regulatory provisions

The regulations applicable to BNIs were already well under way with the "BNI procedures" decree of 2007. The BNI order was published on 7th February 2012 and a dozen regulatory decisions are already well advanced: this work was extensively discussed with the various stakeholders. ASN will be implementing a complete and rigorous working and intervention framework that is consistent with that of its European colleagues, as it is using the "reference levels" of WENRA, the Western European Nuclear Regulators' Association.

Source security

Source security is a new role, taken on by ASN in 2008. ASN is making active preparations for effective performance of this role, which requires legislation: the Government has decided to include it in the draft bill ratifying the ordinance codifying the TSN Act and to table it before the Senate. It could thus be passed by the next Parliament.

Transparency on environmental matters

Jointly with the Institute for Radiation Protection and Nuclear Safety (IRSN) and the stakeholders, ASN has developed the www.mesure-radioactivite.fr website which collates all environmental radioactivity measurements made by the licensees, institutions and approved associations. The events of Socatri, Fukushima and Centraco have shown that the public is increasingly interested in these questions.

Continued operation of the 900 MWe reactors

ASN has issued an initial generic opinion on the continued operation of the 900 MWe reactors beyond thirty years. This assessment will need to be supplemented by a position statement reactor by reactor. This has already been done for Tricastin 1 and Fessenheim 1.

Monitoring the EPR construction site

ASN is heavily involved on a day to day basis in monitoring of the Flamanville 3 construction site. This is an activity that had to be re-learned after more than ten years with no construction work on such a scale. This monitoring is leading to a number of important decisions, such as the decree creating this facility, suspension of the site, in particular the concrete pouring activities, or the joint position statement by the British, Finnish and French regulatory authorities concerning the architecture of the EPR reactor's instrumentation and control system.

Production of the PNGMDR

This is a requirement of "the other 2006 Act", that concerning radioactive waste. ASN and the ministry responsible for ecology have, since then, drafted two editions of the national radioactive material and waste management plant.

Construction of the European nuclear safety and radiation protection area

Over the past five years, nuclear safety and radiation protection in Europe has been strengthened:
– WENRA finalised its "safety reference levels" for the European power plants in service and each of its members has agreed to incorporate them into its national regulations;
– WENRA drafted safety objectives for new reactors;
– HERCA, the association of Heads of European Radiological Protection Competent Authorities, was created;
– the European Union issued two directives, one on nuclear safety and one on the management of radioactive waste and spent fuel;
– ENSREG, a grouping of all the European safety regulators and the Commission, has been adopted as an advisory body for the European institutions;
– the first European conference on nuclear safety was held in Brussels in the post-Fukushima context.

Dose optimisation in medical imaging

Exposure linked to medical examinations has increased by more than 70% in five years.

ASN organised a seminar on medical imaging in order to raise the awareness of institutions, professionals and manufacturers of the need for more rigorous application of the principles of radiation protection (justification of procedures and dose optimisation) and the development of alternative techniques, a prime example of which is MRI.

Following on from this seminar, it issued several position statements on this subject last July.

The post-accident approach

Post-accident doctrine is being clarified: it is presented in guidelines, tested during exercises and should be integrated into the off-site emergency plans (PPI).

The full value of an approach such as this became apparent at the time of the Fukushima accident. It was presented to the Codirpa international seminar on 5th and 6th May 2011.

And now to 2011.

What a contrast between the beginning of the year, when ASN was criticised by some for over-playing the safety card and issued warnings concerning the risk of creating a two-speed nuclear world, and the end of 2011 in the wake of the Fukushima accident! 2011 will remain synonymous with Fukushima.

This accident is a major event and it will for ever mark the history of nuclear power, as did Three Mile Island and Chernobyl: there will be a before and after Fukushima.

As early as 11th March, ASN foresaw the potential scale of this natural disaster, combined with a nuclear crisis. Its emergency centre was activated on the afternoon of 11th March and remained operational round the clock, 7 days a week, until 13th April. Its activities were subsequently scaled back but it remained operational for a considerable time.

Two hundred people, or nearly half the ASN workforce, in the regions and the Paris area, were mobilised in the emergency centre.

Daily audio-conferences were held with IRSN, the International Atomic Energy Agency (IAEA), the foreign safety regulators and the French Embassy in Japan.

During the course of this first month, the level of communication was intense, with ASN holding seventeen press conferences and publishing twenty-eight press releases. About fifteen staff were mobilized to answer 1200 media queries. A special website was created and received more than 700,000 hits. A call centre was set up to answer the public's questions.

At the same time, ASN initiated the complementary safety assessments (CSA) process. In addition to these CSAs, ASN in 2011 organised a campaign of targeted inspections on topics related to the Fukushima accident. Thirty-eight inspections were thus carried out on all the nuclear facilities felt to be high-priority, corresponding to a total of one hundred and ten days of inspection.

ASN also wanted to ensure that this process was transparent and to involve civil society. Therefore the members of the local information committees (CLI) and foreign experts, representing a total of fifty people, were able to take part in the inspections. Foreign experts and members of the French High Committee for Transparency and Information on Nuclear Security (HCTISN) took part in the meetings of the Advisory Committees of experts, which for three days in November brought together more than two hundred people.

ASN received and took full account of numerous contributions from the CLIs, the ANCCLI, foreign experts and trade union organisations

Given the exceptional nature of this situation, ASN made public in real-time the reports from its licensees, that from the IRSN produced at its request and the opinions of the Advisory Committees. ASN published its report and its opinion on 3rd January 2012.

ASN worked with the HCTISN, which issued two opinions, one on 3rd May concerning the specifications for the complementary safety assessments, the other on 8th December concerning the transparency of the process. The involvement of the HCTISN and the CLIs represented a crucial contribution to the necessary transparency and openness of this entire approach.

Considerable work was done in a very short time, commensurate with the scale of the disaster.

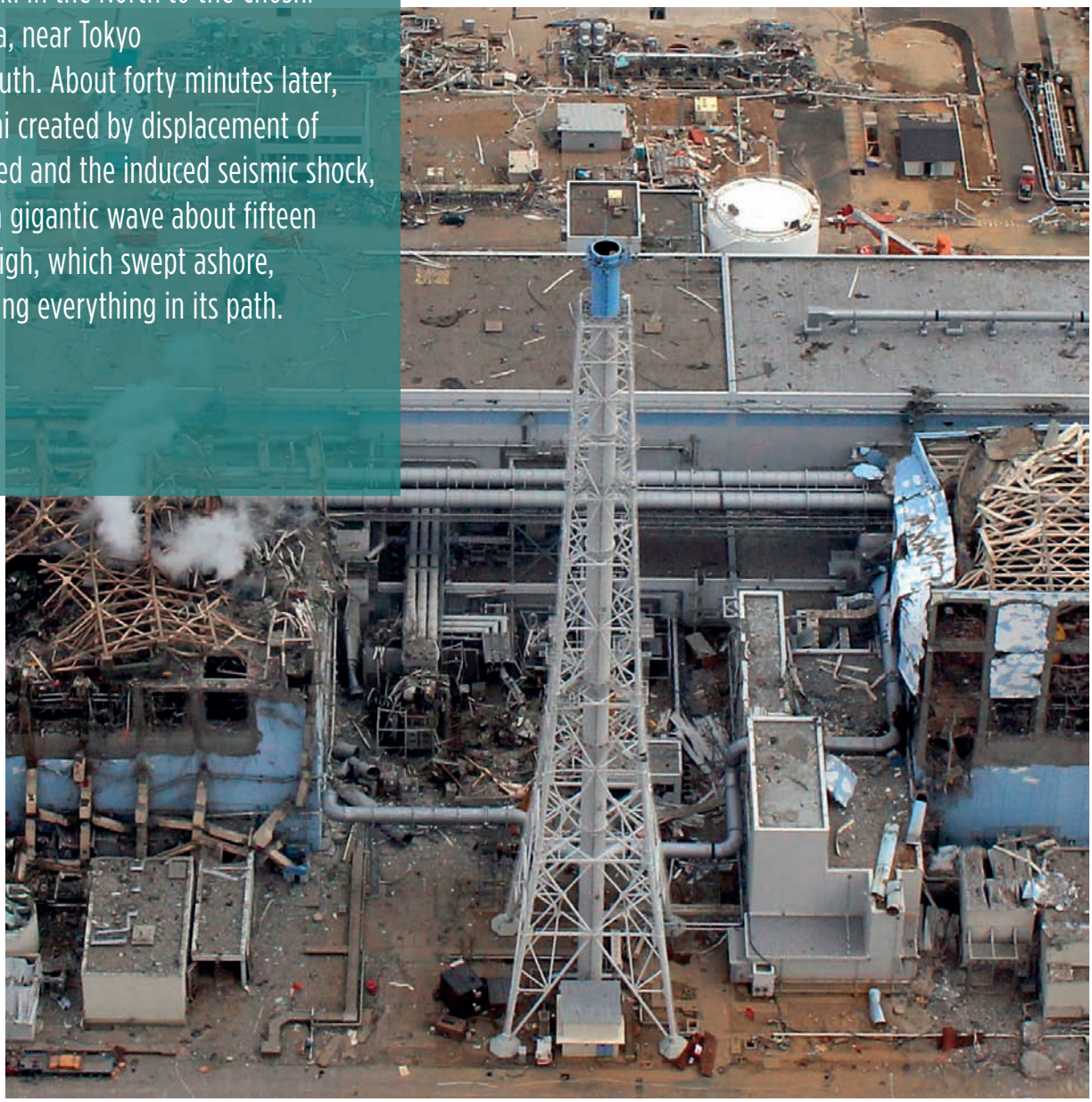
This work needs to be continued nationally, at a European level, and internationally. It must concern both the safety of the facilities and the management of emergencies.

The commitment, professionalism and availability of the ASN and IRSN staff, as well as the considerable work they have done since 11th March 2011, has enabled ASN to learn the first lessons from the Fukushima accident, for which complete experience feedback analysis will take many years.

These three periods - 50 years, 5 years, last year - remind us that the time-scale of change in nuclear safety, radiation protection and their regulation, is a very long one. It is essential that adaptation is always based on experience feedback and stringency and vigilance must be the watchwords at all times. ■

Fukushima: one year later

In 2011, ASN's activities were significantly affected by the disaster that struck Fukushima in Japan. On 11th March 2011, at about 14 h 45 local time, an exceptional earthquake, of magnitude 9 on the Richter scale, occurred off the coast of Honshu, Japan's main island, and struck the entire north-eastern shoreline over several hundred kilometres, from Cape Shiriyazaki in the North to the Choshi peninsula, near Tokyo in the South. About forty minutes later, a tsunami created by displacement of the seabed and the induced seismic shock, created a gigantic wave about fifteen metres high, which swept ashore, devastating everything in its path.



The epicentre of this earthquake, referred to as the "Pacific coast of Tohoku", is located in the Pacific Ocean, along the Japan Trench, off the north-eastern coast of the Island of Honshu, at a depth of about 25km below the seabed and 130km from the port of Sendai, itself located about 300km North of Tokyo, the capital of Japan. This earthquake was preceded by a number of shocks starting on 9th March, and was followed by numerous after-shocks in the hours and then the days and weeks that followed, including about fifty with a magnitude of 6 to 7, but there were no further tsunamis.

According to the available information on the subject, this earthquake resulted in relatively few victims and little damage despite its considerable intensity, thanks to the quality of anti-seismic construction and know-how in Japan. It would appear than more than 90% of the victims and the destruction were because of the enormous tsunami wave which followed.

This extraordinary wave, more than 20m high in places, swept up to 10km inland, destroying everything in its path. The coastal zone around the port of Sendai, located right opposite the epicentre, was particularly badly affected. The earthquake and the tsunami together resulted in more than 20,000 dead and missing, about 6,000 injured and several hundred thousand homeless. They destroyed several coastal towns, residential areas by the seaside, the port of Sendai, and severely damaged various industrial facilities such as refineries, oil depots, chemical plants, and so on. They damaged infrastructure, in particular roads, water supply and sanitation networks, electrical power transmission and telecommunication lines, as well as certain hydroelectric dams. This resulted in a widespread power black-out, fires and the dispersal of chemical, toxic and radiological pollutants. The emergency response was considerably disrupted by the generally chaotic situation which followed these events.

This major natural disaster had consequences for Japan's nuclear facilities. Six nuclear sites located along the north-eastern edge of the Island of Honshu were affected by the earthquake and tsunami. From North to South, these are the spent fuel reprocessing plant at Rokkasho Mura, and the nuclear power plants of Higashidori, Onagawa, Fukushima Daiichi, Fukushima Daini and Tokai Mura, representing a total of fifteen boiling water reactors, four of which were shutdown for maintenance at the time.

At first, following the violent shocks created by the earthquake, the seismic wave detectors fitted to the nuclear reactors triggered automatic insertion of the control rods into the core, to quench the nuclear reaction. Off-site electrical power having been lost, the backup diesel generators automatically started up to provide the necessary power to operate the pumps circulating the cooling water. The facilities were thus automatically shut down in accordance with their seismic risk management design specifications.

Subsequently, the tsunami wave overtopped the protective embankment of the Fukushima Daiichi power plant and submerged the facilities, destroying the electricity generators and damaging the cooling installations. Consequently, the reactor cores and the nuclear fuel storage pools could no longer be cooled, resulting in a nuclear accident.

The other sites did not experience the same problems, either because they were not submerged, or because the electricity generators were spared or rapidly returned to service to perform their emergency functions, or because connection to the power grid was restored rapidly. A fire following the earthquake broke out in the Onagawa nuclear power plant, but was brought under control without any radioactive leaks being detected in the environment.

This is the scenario as constructed from the information so far available. A complete understanding of all aspects of the accident will take years, as was the case following the accidents at Three Mile Island and Chernobyl. This may even lead to the first lessons already learned from this accident having to be revised.

Emergency management by ASN

As soon as the disaster was announced, ASN activated its emergency centre in order to obtain a clear picture of the accident which had struck the Fukushima Daiichi nuclear power plant, so that the French population could be informed.

With the help of the Institute for Radiation Protection and Nuclear Safety (IRSN) which had also activated its emergency centre, it sought to collate all the information enabling it to understand the events and how the situation was developing.

The emergency centre, which was operational 24/7, was kept active for a month, until the situation was stabilised. ASN then kept a team on duty, to monitor how the situation was developing and issue information on a regular basis.

To obtain information about the local situation and any developments, the emergency team was in daily contact with the emergency unit at the French Embassy in Japan, in particular with the Ambassador's technical adviser and then with the expert sent out by IRSN. It permanently analysed the Japanese press releases, the information supplied by the

Japanese organisations (NISA[1], METI[2], MEXT[3], JAIF[4], etc.) and the information broadcast by the Japanese media, especially the television stations.

Daily telephone conferences with the International Atomic Energy Agency (IAEA), with the western safety regulators – who were also monitoring the events, in particular the United States NRC, the Canadian CNSC and the ONR of Great Britain, led to a clearer understanding of the events and enabled the steps taken or required to be assessed.

This work led ASN to regularly inform and advise the French Authorities, especially the General Secretariat for Defence and National Security (SGDSN) and the Interministerial Emergency Unit (CIC). ASN also informed the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST) and the High Committee for Transparency and Information on Nuclear Security (HCTISN). It issued a daily press release and organised daily press conferences. In the regions, this information was relayed by ASN's regional divisions to the préfets, the local information committees (CLI), the nuclear sites and the local media.

To facilitate public information, ASN set up a special website which it kept permanently updated, as and when new information became available. This site is still on-line and it is regularly updated to keep pace with the developing situation (*http://japon.asn.fr*). Anyone can visit it to obtain more information about the accident and its consequences.

ASN also made sure that information about radioactivity levels and advice on precautions to be taken and checks to be carried out was given to French nationals in Japan, travellers returning from Japan and the inhabitants of French Polynesia.

11st March 2011, an exceptional earthquake, of magnitude 9 on the Richter scale, occurred off the Japanese coast. Forty minutes later, a tsunami of unprecedented proportions swept ashore and destroyed everything in its path. The auxiliary facilities of the Fukushima nuclear power plant were affected, in particular the emergency installations ensuring cooling of the reactors. ASN activated its emergency centre to monitors the events round the clock and inform the French Authorities and population.

1. Nuclear and Industrial Safety Agency
2. Ministry of Economy, Trade and Industry
3. Ministry of Education, Culture, Sports, Science and Technology
4. Japan Atomic Industrial Foruma



In a letter dated 22nd March 2011, ASN also asked the nuclear licensees (EDF, CEA, AREVA, ANDRA) to reinforce monitoring around their sites in order to detect any atmospheric fallout from Japan. All the results obtained were published on the information website of the national environmental radioactivity monitoring network, set up jointly by ASN and IRSN (*www.mesure-radioactivite.fr*), in addition to the information placed directly by IRSN on its own website (http://environnement.irsn.fr). Given the very low radioactive impact observed on French territory and the constant fall in the values measured, this arrangement was lifted on 26th May 2011.

On 20th April 2011, ASN issued recommendations concerning contamination checks on goods other than foodstuffs imported from Japan. Foodstuffs were for their part covered by an amended European regulation dated 25th March 2011, which automatically applies in France.

ASN offered the Japanese safety regulator (NISA) assistance with emergency management, especially in the post-accident phase, for which, as a result of the lessons learned from analysing the Chernobyl accident, it had developed a doctrine through the work done by the Steering committee for managing the post-accident phase of a nuclear accident or radiological emergency situation (CODIRPA).

Throughout the management of this emergency, the large scale mobilisation and commitment by the ASN staff must be underlined:

– the emergency centre was activated on the afternoon of 11th March 2011 and remained operational 24/7 until 13th April 2011. Scaled-back operations continued for much longer. ASN is even now still regularly monitoring what is happening in Japan;
– 200 staff, or nearly half the ASN workforce, from the Paris and regional divisions, were mobilised in the emergency centre during this period;
– daily audio-conferences were held with IRSN, the IAEA, foreign safety regulators and the French Embassy;
– ASN took part in numerous ministerial meetings, including 13 meetings of the Interministerial Emergency Unit (CIC);
– ASN communications involved:
• 17 press conferences,
• 28 press releases,
• 1,200 media queries,
• more than 700,000 visits to the *http://japon.asn.fr* website,
• and the opening of a telephone call centre to answer the public's questions.

The lessons of Fukushima

The Fukushima accident confirms that, despite the precautions taken in the design, construction and operation of nuclear facilities, an accident can never be completely ruled out.

The role of ASN is to ensure that the probability of a severe accident is extremely low and that any consequences are also as limited as possible.

As a result of nuclear safety issues, French nuclear facilities are – as of the design stage – the subject of nuclear safety studies which envisage all plausible scenarios liable to lead to accident situations. The design and the operating rules applicable to these facilities aim to minimise these risks. However, the occurrence of such accidents is examined so as to assess the consequences and make provision for an emergency response to protect the population against the effects of such an event.

The facilities, in particular all the equipment important for safety and the emergency equipment, undergo checks and periodic tests to verify their conformity and their availability. ASN regularly carries out inspections to check that the facilities are in conformity with their baseline safety standards and that the licensee's organisation is capable of guaranteeing safe operations, including in the event of incidents, or human or material failures.

Every ten years, the licensee carries out a periodic safety review and the nuclear power plants are shut down for a ten-year inspection, during which a complete and exhaustive check is conducted on the facilities, maintenance is carried out and modifications made if considered necessary to improve safety, plus post-maintenance qualification of equipment for a further period of operation. These operations are monitored particularly closely by ASN, which issues a ruling on the ability of the facility to continue to operate, in the light of the objectives set for the periodic safety review.

Drawing on the lessons learned from the Three Mile Island accident in the United States, the French facilities were thus equipped with:

– hydrogen recombiners working independently by means of catalysis to produce water by combining hydrogen and oxygen, thus limiting the risk of explosion from a build-up of hydrogen in the facilities;
– sand-bed, or ultimate filters, to trap certain radioactive elements in the event of intentional discharge from the containment to lower the internal pressure in the event of a severe accident affecting the reactor; these filters are capable of trapping more than 90% of radioactive discharges, hence a significantly reduced environmental impact.

In the same way, the steps taken to organise the emergency response, both at the facility and in its environment, were reinforced. Periodic exercises are held, including for management of the post-accident phase, which was extensively reviewed by the CODIRPA in the wake of the Chernobyl accident.

As with the major accidents mentioned above, the Fukushima accident will be the subject of in-depth analysis in order to learn all the lessons. This process is a lengthy one, which will last nearly a decade if the sequence of



12th to 15th March 2011,
the fuel began to melt, generating hydrogen which built up in the buildings housing the reactors. Explosions blew out the superstructures, leading to fears of reactor containment cracking.

events is to be analysed in detail and countermeasures defined to prevent such an accident happening again, in particular on French facilities. However, an initial analysis clearly identifies one area for investigation: the widespread destruction caused by the tsunami wave showed that in exceptional circumstances, it was possible to lose all the back-up and emergency systems designed to ensure the safety of the facilities.

This led ASN to envisage studying these disaster scenarios in order to identify measures and systems to be implemented to deal with such situations, no matter how improbable they may appear.

Aware of the importance of the safety of the French nuclear facilities and the emotion triggered by this nuclear accident, the Prime Minister asked ASN, in a letter of 23rd March 2011, pursuant to article 8 of the TSN Act of 13th June 2006, to perform a safety audit of the nuclear facilities in the light of the Fukushima accident. At its meeting of 24th and 25th March 2011, the Council of the European Union asked the Safety regulators of the European union countries to perform stress tests to check the robustness of the nuclear power plants to a certain number of extreme conditions with which they could be faced. These were earthquake, flooding, loss of electrical power supplies, loss of heatsinks, combinations of various events, as well as failure of the emergency organisation. These assessments were in particular to look at situations not considered in the design of the facilities and specify where the robustness of these installations could be reinforced to deal with these extreme situations.

In response to this request, each country is required to present an interim report by the end of the summer and a final report by the end of 2011.

To meet these complementary objectives, ASN drafted a plan of action comprising two aspects:

– a complementary safety assessment of the French nuclear facilities;
– a campaign of targeted inspections on these facilities.

ASN also took part in the work initiated following the Fukushima accident concerning:
– nuclear emergency management;
– international harmonisation of standards.

The complementary safety assessments

ASN played an active part in the work of the Western European Nuclear Regulators' Association (WENRA) to draft the specifications for the stress tests to be carried out on the nuclear power plants, which was approved on 25th May by the European Nuclear Safety Regulators Group (ENSREG).

At the national level, to ensure that the French and European approaches were consistent, ASN adopted these specifications for the complementary safety assessments and, even though the request from the Council of the European Union only concerned nuclear power plants, ASN decided to extend the approach to all French nuclear facilities, in particular research reactors and facilities involved in the fabrication or reprocessing of nuclear fuel and presenting a potential criticality risk related to the handling of fissile nuclear materials.

12th March 2011, the Japanese authorities evacuated the population from a zone 20 km around the plant and monitored the contamination of individuals who could have been exposed to radionuclides.



ASN consulted the HCTISN regarding the orientations of its approach. In its opinion dated 3rd May 2011, the High Committee stated that it was in favour of the approach and the specifications and stipulated that this assessment should also take account of social, organisational and human factors, in particular for subcontracted activities within the nuclear facilities. ASN thus decided to enhance the French specifications with respect to those adopted by ENSREG at a European level, by in particular emphasising social, organisational and human factors, especially with regard to subcontracting. The Fukushima accident in fact showed that the ability of the licensee and, as necessary, its subcontractors, to organise their work in a severe accident situation is a key factor in controlling such a situation. This ability is also decisive in accident prevention, facility maintenance and the quality of operations. This is why the conditions for the use of subcontracting are included in the French complementary safety assessments.

5th May 2011, twelve ASN decisions require the French nuclear licensees to carry out a complementary safety assessment of their facilities, in accordance with precise specifications incorporating those approved by Europe for nuclear power plants and expanding them to take account of social, organisational and human factors according to the HCTISN recommendations and to cover all nuclear facilities, including laboratories and fuel cycle plants.



Finally, although the Fukushima accident was not linked to any malicious act and even if consideration of such acts is not included in the conclusions of the European Council of March 2011, the complementary safety assessments approach is able to cover some of the situations following a malicious act. Malicious acts are in fact one of the possible causes (equipment failure, natural hazard, etc.) of a loss of electrical power supply or cooling which can lead to a nuclear accident. The loss of electrical power or cooling, regardless of the cause, is specifically dealt with in the complementary safety assessments.

According to the specifications, the complementary safety assessment thus consists of a targeted re-appraisal of the safety margins of the nuclear facilities in the light of the events which took place in Fukushima, in other words, extreme natural phenomena (earthquake, flooding) and their combination, which overwhelmed the safety functions of the facilities and led to a severe accident. The assessment first of all concerns the effects of these natural phenomena; it then looks at the loss of one or more systems important for safety involved at Fukushima (electrical power supplies and cooling systems), regardless of the probability or the cause of loss of these functions; finally, it deals with the organisation and management of severe accidents which could occur as a result of these events.

Three main aspects are included in this assessment:
– the steps included in the design of the facility and its conformity with the design requirements applicable to it;
– the robustness of the facility beyond its design parameters; the licensee must in particular identify those situations leading to a sudden deterioration of the accident sequences (cliff-edge effect) and present the measures capable of avoiding them;
– any possible modification liable to improve the level of safety of the facility.

In these extreme situations, the approach adopted assumes the successive loss of the lines of defence, by applying a deterministic approach, independently of the probability of this loss. For a given facility, the assessment covers, on the one hand, the facility's behaviour in the face of extreme situations and, on the other, the effectiveness of the prevention and mitigation measures, in particular all potential weak points and all "cliff-edge effects", for each of the extreme situations. The aim is to assess the robustness of the defence in depth approach and the pertinence of the accident management measures, as well as to identify possible areas for safety improvements, both technical and organisational.

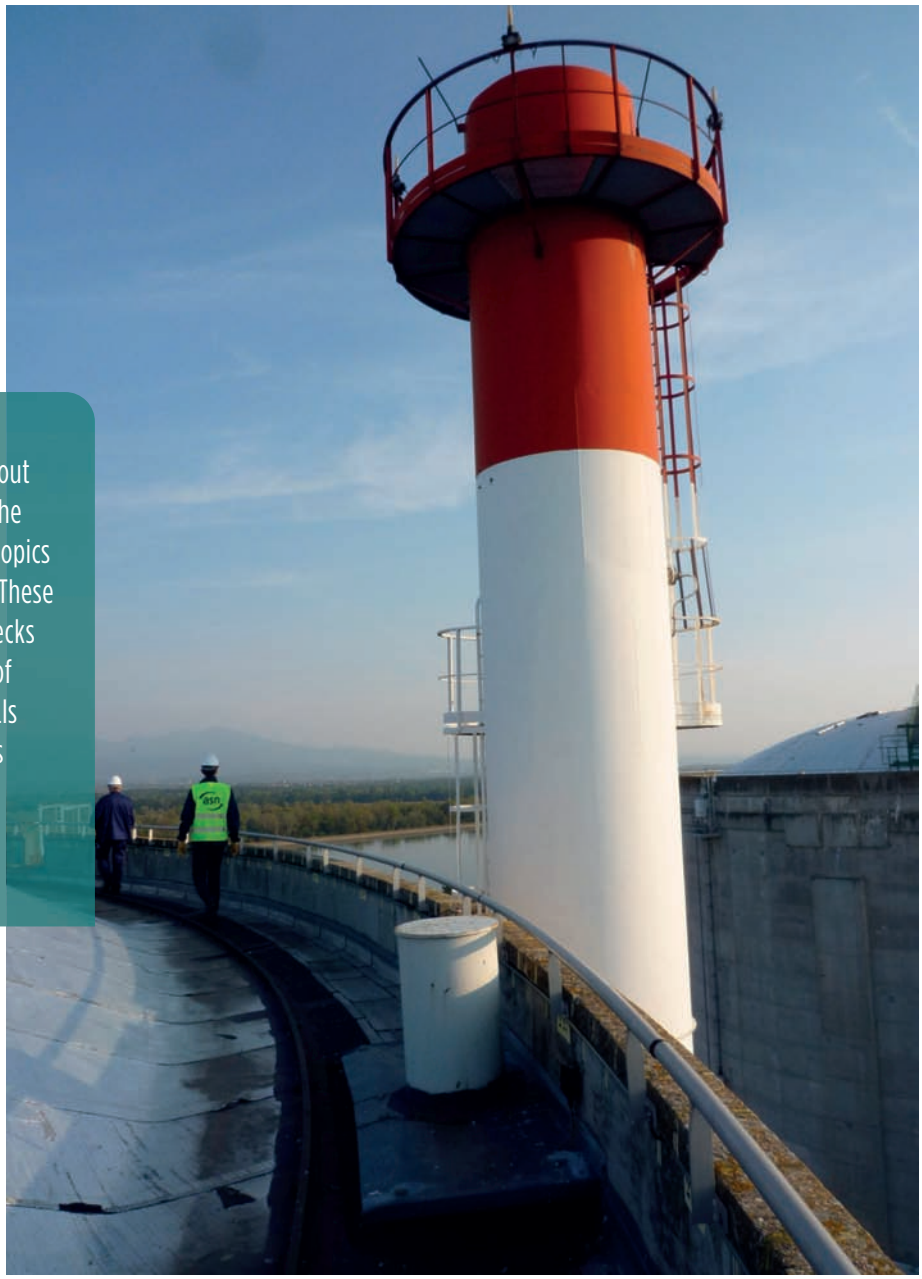
The scope of the complementary safety assessment includes the following situations:
– conceivable initiating events on the site: earthquake, flooding, other extreme natural phenomena;
– resulting losses of safety systems: loss of all electrical power supplies, loss of heatsinks, including ultimate heatsink, combination of the two;
– management of severe accidents;
– conditions for use of subcontractors.

For each technical field, the licensee was required to check the design of the facility and assess the available margins, by identifying the level beyond which the severe accident becomes inevitable ("cliff-edge effect") and the level which the facility can withstand with no loss of containment integrity.

In its decisions of 5th May 2011, the ASN Commission instructed the French nuclear licensees (EDF, CEA, AREVA, Institut Laue-Langevin, CIS bio and ITER) to carry out a complementary safety assessment on each of their facilities. These facilities were divided into three categories:
– the first, comprising the nuclear power plants in operation, the main research reactors and the main facilities of the nuclear fuel cycle, for which the licensees were to submit their reports by 15th September 2011;
– a second, in particular comprising facilities undergoing decommissioning and research facilities, for which the licensee were to submit their reports by 15th September 2012;
– and a third, in particular comprising waste disposal facilities and other facilities entailing lesser risks, for which experience feedback from analysis of the Fukushima accident will be incorporated on the occasion of the next periodic safety reviews, which could if necessary be brought forward.

Given that in 2011, the complementary safety assessment approach concerned a large number of facilities (79) and that they are operated by a s mall number of licensees, ASN introduced an intermediate step into the assessment process, requiring that the licensees present their methodologies by 1st June 2011. The Advisory Committee of experts for reactors (GPR) and the Advisory Committee

19th July 2011, ASN issues a position statement on the methodologies presented by the licensees.



Summer 2011, ASN carried out 38 complementary inspections on the French nuclear facilities, targeting topics related to the Fukushima accident. These inspections involved 110 days of checks in the field, with the participation of fifty members of the HCTISN, the CLIs and certain foreign counterparts, as observers.

of experts for laboratories and plants (GPU) took due note of IRSN's analysis of the approaches adopted by the licensees in response to the ASN specifications, at their meeting of 6th July 2011. Following this analysis, ASN on 19th July 2011 considered that the approaches adopted were on the whole satisfactory, but that the licensees should take account of certain particular requests expressed by ASN.

The reports submitted by the licensees on 15th September 2011 were immediately published on the ASN website. At the request of ASN, these reports were analysed by IRSN, with its findings presented to the Advisory Committees (GPR et GPU) from 8th to 10th November 2011. Following these presentations, the Advisory Committees formulated about ten recommendations, incorporated by ASN into its conclusions.

ASN attached the greatest importance to this approach being carried out openly and transparently: the French High Committee for Transparency and Information on Nuclear Security (HCTISN), the local information committees (CLI) and several foreign national safety regulators – from Belgium, Germany, Luxembourg, Switzerland and the Netherlands – were invited to take part in the targeted inspections carried out by ASN, as observers, and to attend the meetings of the Advisory Committees; these various stakeholders were also sent the reports submitted by the licensees and were asked to submit contributions, which were taken into account by ASN. In addition, ASN placed the licensee reports, the IRSN report, the opinions of the Advisory Committees and the inspection follow-up letters on-line on its website. It also published

several information notices and organised four press conferences between May 2011 and January 2012.

On 8th December 2011, the HCTISN issued an opinion on the complementary safety assessment process. This opinion underlines the good level of public information throughout the complementary safety assessment process, whether through press conferences, virtually immediate placing of reports and opinions on-line, or through the contribution of the local information committees, plus the quality of the analyses produced by the licensees, IRSN, the Advisory Committees and ASN. It nonetheless recommends greater openness on the part of CEA and AREVA, as well as efforts with regard to presentation in order to make it easier for the public to understand highly technical subjects. It confirms that it hopes to see social, organisational and human factors incorporated into the next steps of the process.

ASN opinion of the complementary safety assessments

On 3rd January 2012, ASN published its conclusions in the form of a report and a formal opinion, which it transmitted to the Prime Minister.

In its opinion, ASN recallend that:
– the natural disaster which struck the Fukushima Daiichi nuclear power plant confirms that, whatever the precautions taken in the design, construction and operation of nuclear facilities, an accident can never be completely ruled out;
– the licensee has overall responsibility for the safety of its facilities while, on behalf of the State, ASN is responsible for regulating and monitoring nuclear safety, with the technical support of IRSN and its Advisory Committees. Pursuant to the law, ASN ensures that the safety of French civil nuclear facilities is continuously, in particular through the periodic review process and the integration of experience feedback.

15th September 2011,
the nuclear licensees submit their reports to ASN, which publishes them on its website and then undertakes to analyse them with the assistance of IRSN.

Following the complementary safety assessments on the high-priority nuclear facilities, ASN considers that those examined show a level of safety that is sufficient to warrant no immediate closure of any of them. At the same time, ASN considers that their continued operation demands that their robustness to extreme situations be increased beyond their existing safety margins, as rapidly as possible.

ASN is thus requiring that the licensees adopt a range of measures designed to provide the facilities with the means to enable them to deal with:
– a combination of natural phenomena of an exceptional scale and exceeding those adopted in the design or the periodic safety review of the facilities,
– severe accident situations following the prolonged loss of electrical power or cooling and liable to affect all the facilities on a given site.

Among these new provisions, ASN would in particular stress the importance of the following measures:
– for all the facilities, the creation of a "hard core" of material and organisational arrangements making it possible to manage the fundamental safety functions in extreme situations, with the aim of preventing a severe accident, limiting large-scale radioactive releases if the accident cannot be controlled and enabling the licensee, even in extreme situations, to perform its emergency management duties. This will for example involve setting up a "bunkerised" emergency management centre with diesel electricity generator, and an ultimate backup water supply. The equipment to be included in this hard core must be designed to withstand major events (earthquake, flood, etc.), of a scale far in excess of those used to determine the strength of the facilities, even if not considered to be plausible. By 30th June 2012, the licensees shall notify ASN of the content and the specifications of the "hard core" for each facility;
– for nuclear power plants, gradual deployment, as of 2012, of the "Nuclear Rapid Intervention Force (FARN)" proposed by EDF. This is a national intervention force comprising specialised teams and equipment, able to take over from the personnel of the site affected by the accident and deploy additional emergency response means within 24 hours. The system will be fully operational by the end of 2014;
– for the fuel storage pools in the various facilities, the implementation of reinforced measures designed to reduce the risk of uncovering of the fuel;
– for the nuclear power plants and the silos at La Hague, feasibility studies concerning the use of technical measures such as a geotechnical containment or system

with equivalent effect, designed to protect the ground and surface waters in the event of a severe accident.

These new requirements entail considerable work and large-scale investments, which are beginning in 2012 and will be spread over several years.

Over and above these measures, ASN considers that particular attention must be focused on social, organisational and human factors. As a result of the appraisals conducted on these assessments, ASN has identified a number of priorities in this field:
– renewal of licensee manpower and skills, which is a crucial point at a time when one generation is replacing another and when considerable work is required as a result of the CSAs;
– the organisation of the use of subcontracting, which is an important and complicated subject;
– research on these topics, for which programmes must be set up, at national or European levels.

ASN will be setting up a pluralistic working group on these subjects.

ASN has placed all the information concerning the complementary safety assessments on-line on its website *www.asn.fr,* under the heading "Complementary safety assessments" which is regularly updated, in particular on the occasion of the key steps scheduled for monitoring the work resulting from this approach.

The ASN report also constitutes France's report for the European stress tests. The reports from the various countries were transmitted to the European Commission by early January 2012 and are undergoing peer review by experts from all the safety regulators and the European Commission, from January to April 2012.

8th to 10th November 2011,
the Advisory Committees examine the complementary safety assessments produced by the licensees, and the analyses made by IRSN and ASN.

Targeted inspections

In addition to the complementary safety assessments, ASN initiated a campaign of complementary inspections of the nuclear facilities, targeting topics related to the Fukushima accident. The purpose of these complementary inspections was to run checks in the field on the conformity of the licensees' equipment and organisations with the existing safety baseline standards.

The following topics were covered during these inspections:
– protection against off-site hazards, in particular earthquake resistance and protection against flooding;
– loss of electrical power supplies;
– loss of heatsinks;
– operational management of emergency situations.

These inspections were carried out during the summer of 2011, on all the nuclear facilities felt to be of high priority for the complementary safety assessments.

Each one was carried out by a team of several inspectors accompanied by IRSN experts. For each given site, they took the form of in-depth inspections lasting several days (either consecutive or not) such as to cover all the topics mentioned above. They were based on baseline safety standards common on the one hand to the nuclear power plants, and on the other to the other nuclear facilities. They placed emphasis on field visits rather than documentary checks. For each of the nuclear facilities, following the inspection on the various topics, a follow-up letter was sent out to the licensee and published on the website (*www.asn.fr*). Thirty-eight complementary inspections were thus performed on the French nuclear facilities considered to be high-priority, corresponding to a total of 110 days of inspection. The overall results of these inspections were incorporated into the ASN final report published on 3rd January 2012.

Inspectors from Belgium, Luxembourg, Germany, Switzerland, the Netherlands and representatives of the CLIs and the HCTISN took part in the EDF site

inspections as observers. Conversely, ASN staff took part in the inspections conducted in Belgium by the Belgian safety regulator, the Agence fédérale de contrôle nucléaire (AFCN).

Feedback from nuclear emergency management

ASN is a participant in all the national and international reviews concerning the organisational measures to be adopted by the public authorities in the wake of the Fukushima nuclear accident.

At a national level, therefore, ASN takes part in the ministerial work being done on experience feedback concerning management of a nuclear emergency. At an international level, ASN takes part in the experience feedback work being done within international bodies such

3rd January 2012,
ASN submits its report and its opinion to the Prime Minister.
These documents are transmitted to the European Commission.
They specify a plan of action for improvements to the safety of the French nuclear facilities.



as IAEA or NEA, or within regulatory body networks, such as WENRA and HERCA, which bring together the heads of the European nuclear safety and radiation protection authorities.

Experience feedback from the Fukushima Daiichi accident will also be an opportunity for ASN to take further the work being done by CODIRPA on management of the post-accident phase, concerning the processing of the consequences of a nuclear accident, from the economic, health and social standpoints in the short, medium and long terms, with a view to returning to a situation considered to be acceptable. The doctrine concerning post-nuclear accident management, which will collate in a single document the specific recommendations for exiting the emergency phase and the guidelines for the transitional and long-term phases, should be approved by CODIRPA in 2012. Experience feedback from the accident in Japan will make a valuable contribution to this approach.

Revision of international safety standards

In order to harmonise practices and exchanges with its foreign counterparts, ASN is heavily committed to international relations, whether bilateral, European or international. It in particular took an active role in the international consulting bodies which worked on the follow-up to the Fukushima accident, in particular within WENRA and the IAEA.

One ASN commissioner took part in a fact-finding mission comprising representatives of safety regulators and IAEA members, which went to Japan from 22nd May to 1st June 2011, visiting the Fukushima Daiichi site in particular. ASN also took part in the ministerial level conference organised by the IAEA from 20th to 24th June 2011. This event laid the bases for the IAEA action plan, which was approved by the Council of Governors in September 2011.

At a European level, ASN took part in the first European conference on nuclear safety organised by ENSREG in

Brussels, on 28th and 29th June 2011. It contributed to the work done by WENRA to draft the stress test specifications. It is a stakeholder in the peer review of the national reports on the nuclear power plant reactors stress tests, from January to June 2012, under the supervision of an ASN commissioner. ASN is also a source of proposals for changes to the European nuclear safety regulatory framework. It will continue to be heavily involved and aims to see Europe become a driving force behind improvements to nuclear safety worldwide.

Programme of future actions

Over and above the initial steps taken in 2011, experience feedback from the Fukushima accident needs to be further analysed. As with the Three Mile Island and Chernobyl accidents, detailed analysis of experience feedback from the Fukushima accident could take about a decade.

However, ASN has already identified a certain number of measures:

– in its opinion following the complementary safety assessments, ASN considers that continued operation of the facilities requires that their robustness to extreme situations needs to be increased as rapidly as possible. In the first half of 2012, ASN will thus be taking a range of decisions, officially requiring that the licensees implement the specified measures. In the light of experience feedback from the Fukushima accident, it will reinforce the safety requirements concerning the prevention of natural hazards (earthquake and flooding), the prevention of risks linked to other industrial activities, subcontractor surveillance and the processing of deviations. The corresponding ASN decisions will be published on the www.asn.fr website;
– ASN will take part in the in the European peer reviews, the conclusions of which should be examined by ENSREG in April 2012 and presented to the European Council at the end of June 2012, and it will aim to draw the relevant consequences from their results;
– ASN also considers that additional studies are required to complete certain aspects, in particular the initial analyses made by the licensees. It will ask the licensees to do so in letters which will also be posted on its website;
– ASN will be particularly vigilant in monitoring the implementation of all of its stipulations, as well as in reinforcing the baseline safety standards, especially with regard to earthquakes, flooding and risks linked to other industrial activities. As of the summer of 2012, it will periodically present the progress of all of these actions;
– ASN will continue to run the complementary safety assessment process on lower priority facilities, for which the reports must be submitted by the licensees before 15th September 2012;
– ASN considers that the first complementary safety assessments confirmed the benefits of this innovative approach, which complements the existing safety approach. It envisages making this complementary assessment of safety margins a permanent feature, by adding it as a requirement of the future ten-year periodic safety reviews;
– finally, ASN will continue to play an active part in all the analyses to be carried out worldwide, to gain a clearer understanding of the Fukushima accident and learn the relevant lessons.

NUCLEAR ACTIVITIES: IONISING RADIATION AND HEALTH AND ENVIRONMENTAL RISKS

1 **KNOWLEDGE OF THE HAZARDS AND RISKS FROM IONISING RADIATION** 31

1|1 Biological and health effects

1|2 Evaluation of risks linked to ionising radiation

1|3 Scientific uncertainty and vigilance

1|3|1 Radio-sensitivity

1|3|2 Effects of low doses

2 **NUCLEAR ACTIVITIES** 35

2|1 Basic nuclear installations

2|1|1 Definition

2|1|2 Accident prevention and nuclear safety

2|2 Transport of radioactive and fissile material for civil use

2|3 Small-scale nuclear activities

2|4 Disposal of radioactive waste

2|5 Management of contaminated sites

2|6 Industrial activities enhancing natural ionising radiation

3 **MONITORING OF EXPOSURE TO IONISING RADIATION** 37

3|1 Exposures of the population to natural ionising radiation sources

3|1|1 Radiations of natural origin (excluding radon)

3|1|2 Exposure to radon

3|1|3 External exposure due to cosmic radiation

3|2 Doses received by workers

3|2|1 Exposure of nuclear workers

3|2|2 Worker exposure to TENORM

3|2|3 Flight crew exposure to cosmic radiation

3|3 Doses received by the population as a result of nuclear activities

3|4 Doses received by patients

3|5 Protection of non-human species

4 **OUTLOOK** 45

CHAPTER 1

Nuclear activities are defined by the Public Health Code as "activities involving a risk of human exposure to ionising radiation, emanating either from an artificial source – whether a material or device – or from a natural source when natural radionuclides are or have been processed for their fissile or fertile radioactive properties, as well as interventions designed to prevent or mitigate a radiological risk following an accident or contamination of the environment". These nuclear activities include those conducted in basic nuclear installations (BNIs) and for the transport of radioactive materials, as well as in all medical, veterinary, industrial and research facilities where ionising radiation is used.

The various principles with which the nuclear activities must comply, and particularly those of nuclear safety and radiation protection, are set forth in chapter 3.

In addition to the effects of ionising radiation, BNIs are similar to all industrial installations in that they are the source of non-radiological risks and detrimental effects such as the discharge of chemical substances into the environment, or noise. The provisions relative to environmental protection are described in chapter 3.

1 KNOWLEDGE OF THE HAZARDS AND RISKS FROM IONISING RADIATION

Ionising radiation is defined as being capable of producing ions- directly or indirectly - when it passes through matter. It includes X-rays, alpha, beta and gamma rays, and neutronic radiation, all of which have different energies and penetration powers.

1|1 Biological and health effects

Whether it consists of charged particles, for example an electron (beta radiation) or a helium nucleus (alpha radiation), or of electromagnetic radiation photons (X rays or gamma rays), ionising radiation interacts with the atoms and molecules making up the cells of living matter and alters them chemically. Of the resulting damage, the most significant concerns the DNA of the cells and is not fundamentally different from that caused by certain toxic chemical substances, whether exogenous or endogenous (resulting from cellular metabolism).

When not repaired by the cells themselves, this damage can lead to cell death and the appearance of health effects once tissues are no longer able to carry out their functions.

These effects, called "deterministic effects", have been known for a long time, as the first effects were observed with the discovery of X rays by Roentgen (1895). They depend on the type of tissue exposed and are certain to appear as soon as the quantity of radiation absorbed exceeds a certain dose level. These effects include, for example, erythema, radiodermatitis, radionecrosis and cataract formation. The higher the radiation dose received by the tissue, the more serious the effects.

Cells can also repair the damage thus caused, although imperfectly or incorrectly. Of the damage that persists, that to the DNA is of a particular type, because residual genetic anomalies can be transmitted by successive cellular divisions to new cells. A genetic mutation is still far removed from transformation into a cancerous cell, but the damage due to ionising radiation may be a first step towards cancerisation.

The suspicion of a causal link between exposure to ionising radiation and the appearance of a cancer dates back to the early 20th century (observation of skin cancer on a case of radiodermatitis).

Since then, several types of cancers have been observed in occupational situations, including certain types of leukaemia, broncho-pulmonary cancers (owing to radon inhalation) and bone sarcomas. In addition to the study of occupational cancers, the monitoring of a cohort of about 85,000 people irradiated in Hiroshima and Nagasaki shed light on the morbidity and mortality from cancer following exposure to ionising radiation. Other epidemiological work, for example, has revealed a statistically significant rise in cancers (secondary



Preparation for radioactivity counting using a beta-gamma counter in the laboratory of the cancer biology and infections unit of the CEA Grenoble centre

UNDERSTAND

UNSCEAR

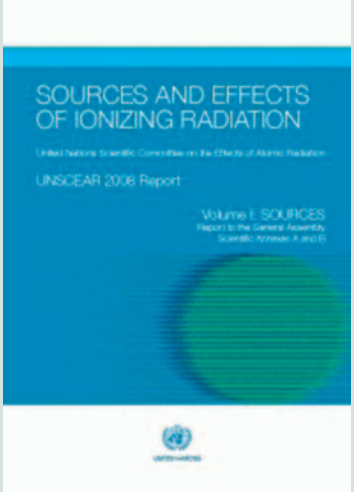
The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) was set up in 1955 during the 10th session of the General Assembly of the United Nations. It comprises representatives from 21 countries and reports to the General Assembly of the United Nations. It is a scientific organisation created to conduct global and regional studies and evaluations of exposure to radiation and its effects on the health of the exposed groups. The committee also studies the progress made in understanding the biological mechanisms whereby radiation influences health or the environment.

Recent publications:

– Summary of low-dose radiation effects on health (2010 report)

– Sources and effects of ionising radiation (2008 report):

- *Volume 1 – annex A (Medical radiation exposures), annex B (Exposures of the public and workers from various sources of radiation).*
- *Volume 2 – annex C (Radiation exposures in accidents), annex D (Health effects due to radiation from the Chernobyl accident) and annex E (Effects of ionising radiation on no-human biota).*



UNSCEAR 2008 Report
"Sources and effects of ionizing radiation"

effects) among patients treated using radiotherapy and attributable to ionising radiation. The Chernobyl accident which, as a result of the radioactive iodines released, caused a peak in the incidence of thyroid cancers in children in the areas near the accident, should also be mentioned.

The occurrence of carcinogenic effects is not linked to a dose threshold; only a probability of occurrence can be stated for any given individual. This is the case with occurrence of radiation-induced cancers. These are called probabilistic, stochastic or random effects.

The internationally established health goals of radiation protection are to prevent the appearance of deterministic effects and to reduce the probability of occurrence of radiation-induced cancers.

1|2 Evaluation of risks linked to ionising radiation

Cancer monitoring is organised on the basis of *département*[1] registers (10 registers covering 11 *départements* i.e. about 15% of the general public) and specialised registers (12 specialised registers, including 2 national registers for cancers in children under 15 years old, concerning haematological malignancy and solid tumours in children).

The aim of the register for a given area is to highlight spatial differences in incidence and to reveal trends in terms of increased or reduced incidence over time in the different cancer locations, or to identify clusters of cases.

This method of monitoring, which is primarily descriptive, does not however make it possible to reveal a possible link between these cancers and exposure to ionising radiation, given that other environmental factors can be suspected.

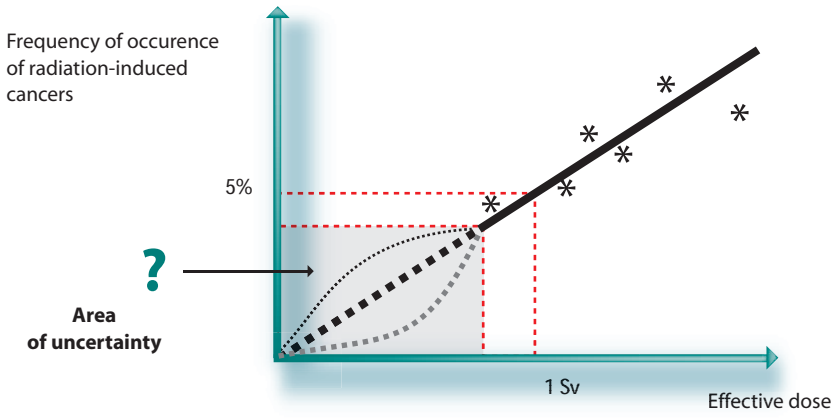
Epidemiological investigation supplements monitoring. The purpose of epidemiological surveys is to highlight an association between a risk factor and the occurrence of a disease, between a possible cause and an effect, or at least to enable such a causal relation to be postulated with a very high degree of probability. However, one should not ignore the difficulty in conducting these surveys or arriving at convincing conclusions when the latency of the disease is long or when the number of expected cases is small, which are both characteristics of exposure to ionising radiation of less than 100 mSv. The epidemiological surveys were thus only able to link pathologies to ionising radiation for relatively high radiation doses at high dose rates (for example: monitoring of the populations exposed to the Hiroshima and Nagasaki bombings).

With a view to risk management, use is then made of the risk evaluation technique which uses calculations to extrapolate the risks observed at higher doses in order to estimate the risks incurred during exposure to low doses of ionising radiation. For these estimates, the prudent hypothesis of a linear no-threshold relationship between exposure and the number of deaths from cancer (see diagram 1) has been adopted internationally. With this hypothesis, it is considered that there is no dose threshold below which one can claim that there is no effect. The legitimacy of these estimates and this hypothesis however remain controversial within the scientific community.

On the basis of the scientific work of the United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), the International Commission on Radiological Protection (see publication ICRP 103, chapter 3,

1. Administrative region headed by a *préfet*.

Diagram 1: linear "dose-effects" relationship (no-threshold)



point 1|1|1) has published risk coefficients for death from cancer due to ionising radiation, showing a 4.1% excess risk per sievert for workers and 5.5% per sievert for the general public. Use of this model, for example, would lead to an estimate of about 7,000 deaths in France every year, as a result of cancer due to natural ionising radiation.

Evaluation of the risk of lung cancer due to radon is the subject of a specific model, based on observation of epidemiological data concerning mine workers. Assuming a linear no-threshold relationship for low-dose exposures, the relative risk linked to radon exposure, for a radon concentration of 230 Bq/m^3, would be about the same as passive smoking (USA Academy of Science, 1999).

1|3 Scientific uncertainty and vigilance

The action taken in the fields of nuclear safety and radiation protection in order to prevent accidents and limit detrimental effects has led to a reduction in risks but not to zero risk, whether in terms of the doses received by workers or those associated with discharges from BNIs. However, many uncertainties and unknown factors persist and require that ASN remain attentive to the results of the scientific work in progress, for example in radiobiology and radiopathology, with possible spin-offs for radiation protection, particularly with regard to management of risks at low doses.

There are several examples of areas of uncertainty concerning high dose radiation-induced pathologies, the effects of low doses and environmental protection.

1|3|1 Radio-sensitivity

The effects of ionising radiation on personal health vary from one individual to the next. Since it was stated for the first time by Bergonié and Tribondeau in 1906, it is for example known that the same dose does not have the same effect when received by a growing child and when received by an adult.

Individual hypersensitivity to high doses of ionising radiation has been extensively documented by radiotherapists and radiobiologists. This is the case with genetic anomalies in DNA repair and cell signalling, which means that certain patients may display extreme hypersensitivity that can lead to "radiological burns".

At low doses, there is both cell radiosensitivity and individual radiosensitivity, which could concern about 5 to 10% of the population. Recent methods of immunofluorescence of molecular targets for signalling and repairing DNA damage help to document the effects of ionising radiation at low doses, reducing the detection thresholds by a factor of 100. The effects of a simple X-ray examination then become visible and measurable. The research carried out using these new investigative methods is producing results, although they still have to be confirmed before they can be considered conclusive.

This then raises delicate questions, some of which go beyond the strict context of radiation protection:

– once individual radiation hypersensitivity tests become available, should screening prior to any radiotherapy or repeated computed tomography examinations be recommended?

– should hypersensitivity screening be carried out on all workers liable to be exposed to ionising radiation?

– should the general regulations, for example, provide for specific protection for those concerned by hypersensitivity to ionising radiation?

These questions have ethical implications owing to the potential use of the results of individual radiation sensitivity tests, for example to discriminate between potential employees.

Whatever the case, there should be no unnecessary exposure of individuals to ionising radiation, in other words without justification. Children should receive particularly close attention in the event of exposure to ionising radiation for medical purposes.

1|3|2 Effects of low doses

The linear no-threshold relationship - This assumption, adopted to model the effects of low doses on health (see point 1|2), albeit practical from the regulatory standpoint, and albeit conservative from the health standpoint, is not as scientifically well-grounded as might be hoped for: there are those who feel that the effects of low doses could be higher, while others believe that these doses could have no effect below a certain threshold, and some people even assert that low doses have a beneficial effect! Research into molecular and cellular biology is leading to progress, as are epidemiological surveys of large groups. But faced with the complexity of the DNA repair and mutation phenomena, and faced with the limitations of the methods used in epidemiology, uncertainties remain and the public authorities must exercise precaution.

Dose, dose rate and chronic contamination – The epidemiological studies performed on individuals exposed to the Hiroshima and Nagasaki bombings have given a clearer picture of the effects of radiation on health, concerning exposure due to external irradiation (external exposure) at high dose and high dose rate. The studies begun in the countries most affected by the Chernobyl accident (Belarus, Ukraine and Russia) could also advance current knowledge of the effects of radiation on human health, for lower dose and lower dose rate internal contamination levels (internal exposure), as well as of the consequences of chronic exposure to ionising radiation (by external exposure and contamination through food) owing to the long-term contamination of the environment.

Hereditary effects – The appearance of possible hereditary effects from ionising radiation in man remains uncertain. Such effects have not been observed among the survivors of the Hiroshima and Nagasaki bombings. However, hereditary effects are well documented in experimental work on animals: the mutations induced by ionising radiation in the embryonic germ cells can be transmitted to the descendents. The recessive mutation of a chromosome gene will remain invisible as long as the same gene carried by the other counterpart chromosome is not affected. Although it cannot be absolutely ruled out, the probability of this type of event nonetheless remains low.

Environmental protection – The purpose of radiation protection is to prevent or mitigate the direct or indirect harmful effects of ionising radiation on individuals, including in situations of environmental contamination. Over and above environmental protection with a view to protecting man and present or future generations, there remains the practical question of protecting nature in the specific interests of the animal and plant species (see point 3|5), now that the protection of non-human species is among the ICRP recommendations (ICRP 103).



Sea bed in Brittany

TO BE NOTED IN 2011

Child leukaemia



In 2008, ASN, the DGS (General Directorate for Health) and the DGPR (General Directorate for Risk Prevention) set up a pluralistic working group on the risks of leukaemia around basic nuclear installations (BNIs). This group, chaired by Professor Ms Danièle Sommelet, was mandated to assess current knowledge concerning the risk of leukaemia in children living in the vicinity of BNIs. The working group's report was submitted in April 2011 and then presented to the press on 7 November 2011. It is available on the ASN website. To address the group's recommendations, several measures are currently under preparation:

• definition of a new study and research programme (by the INCa), taking account of those currently ongoing nationally and internationally;

• international evaluation of the methods used in the epidemiological studies looking at the risk of leukaemia in children living near nuclear facilities (by IRSN);

• creation of a new information and communication working group, whose aim will be to better understand the needs of the populations and improve how they are informed, in particular with respect to cancers (Cancer Plan).

2 NUCLEAR ACTIVITIES

The activities involving a risk of exposure to ionising radiation can be grouped into the following categories:
– basic nuclear installations;
– transport of radioactive and fissile material for civil use;
– small-scale nuclear activities;
– disposal of radioactive waste;
– management of contaminated sites;
– activities enhancing natural ionising radiation.

2|1 Basic nuclear installations

2|1|1 Definition

The regulations classify nuclear facilities, called basic nuclear installations (BNI), in various categories corresponding to more or less restrictive procedures, depending on the scale of the potential risks (see chapter 3, point 3).

The main BNIs are:
– nuclear reactors;
– particle accelerators;
– plants for the separation, manufacture or transformation of radioactive materials, in particular nuclear fuel manufacturing plants, spent fuel reprocessing plants or radioactive waste packaging plants;
– facilities designed for the disposal, storage or use of radioactive materials, including waste.

The list of BNIs on 31 December 2011 is given in appendix A.

2|1|2 Accident prevention and nuclear safety

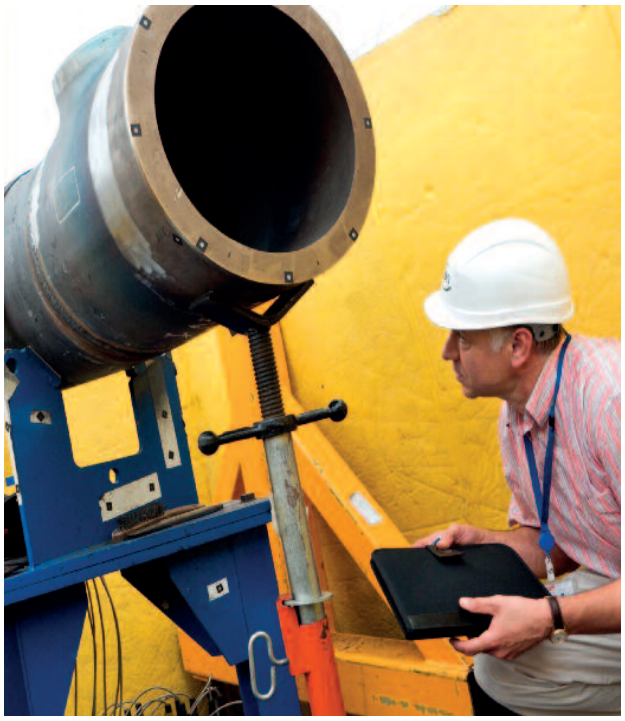
The fundamental principle underpinning the organisational system and the specific regulations applicable to nuclear safety is that the licensee is responsible for safety (see chapter 2). The public authorities ensure that this responsibility is fully assumed, in compliance with the regulatory requirements.

As regards the prevention of risks for workers, BNI licensees are required to implement all necessary means to protect workers against the hazards of ionising radiation, and more particularly to apply the general rules applicable to all workers exposed to ionising radiation (work organisation, accident prevention, medical monitoring of workers from outside contractors, etc.) (see chapter 3).

As regards protection of the population and the environment, the BNI licensee must also take all necessary steps to achieve and maintain an optimum level of protection. Discharges of liquid and gaseous effluents, whether or not radioactive, are in particular strictly limited (see chapter 4).

2|2 Transport of radioactive and fissile material for civil use

When transporting radioactive or fissile materials, the main risks are those of internal or external exposure, criticality, or



ASN check on prefabrication of a secondary system pipe during replacement of steam generators at Fessenheim 2 – September 2011



ASN transport inspection at La Hague – September 2011

chemical hazard. Safe transport of radioactive materials relies on an approach called defence in depth:
– the package, consisting of the container and its content, is the first line of defence. It plays a vital role and must be able to withstand all foreseeable transport conditions;
– the transport means and its reliability constitute the second line of defence;
– finally, the third line of defence consists of the response resources implemented to deal with an incident or accident.

2|3 Small-scale nuclear activities

Ionising radiation, whether emitted by radionuclides or generated by electrical equipment (X-rays), is used in many areas, including medicine (radiology, radiotherapy, nuclear medicine), human biology, research, industry, but also for veterinary and forensic applications as well as for the conservation of foodstuffs.

The employer is required to take all necessary measures to protect workers against the hazards of ionising radiation. The licensee must also adhere to the provisions of the Public Health Code for the management of the ionising radiation sources in its possession - radioactive sources in particular, and where applicable manage the waste produced and limit discharges of liquid and gaseous effluents. In the case of use for medical purposes, patient protection issues are also taken into account (see chapter 3).

2|4 Disposal of radioactive waste

Like all industrial activities, nuclear activities can generate waste. Some are radioactive. The three fundamental principles on which strict radioactive waste management is based are the responsibility of the waste producer, the traceability of the waste and public information.

The technical management provisions to be implemented must be tailored to the hazard presented by the radioactive waste. This hazard can be mainly assessed through two parameters: the activity level, which contributes to the toxicity of the waste, and the lifetime defined by the half-life, the time after which the activity level is halved.

Finally, management of radioactive waste must be determined prior to any creation of new activities or modification of existing activities in order to:
– optimise the waste disposal routes;
– ensure control of the processing channels for the various categories of waste likely to be produced, from the front-end phase (production of waste and packaging) to the back-end phase (storage, transport and disposal).

2|5 Management of contaminated sites

Management of sites contaminated by residual radioactivity resulting either from a past nuclear activity, or an activity which generated deposits of natural radionuclides, warrants specific radiation protection actions, in particular if rehabilitation is envisaged.

In the light of the current or future uses of the site, decontamination targets must be set and disposal of the waste produced during clean-out of the premises and the contaminated soils must be controlled, from the site up to the storage or disposal location. The management of contaminated objects also follows these same principles.

2|6 Industrial activities enhancing natural ionising radiation

Exposure to natural ionising radiation, when enhanced by human activities, justifies monitoring and even risk evaluation and management, if likely to generate a risk for exposed workers and, as applicable, the population in general.

Certain professional activities which are not covered by the definition of "nuclear activities" can thus significantly increase exposure to ionising radiation on the part of the workers and, to a lesser extent, the populations living in the vicinity of the locations where these activities are carried out, in the event of discharge of effluents or disposal of low-level radioactive waste. This is in particular the case with activities using raw materials or industrial residues containing natural radionuclides which are not used for their fissile or fertile radioactive properties.

The natural families of uranium and thorium are the main radionuclides found. The industries concerned include the phosphate mining and phosphated fertiliser manufacturing industries, the dyes industries, in particular those using titanium oxide and those using rare earth ores such as monazite.

The radiation protection actions required in this field are based on precise identification of the activities, estimation of the impact of the exposure on the individuals concerned, taking corrective action to reduce this exposure if necessary, and monitoring.

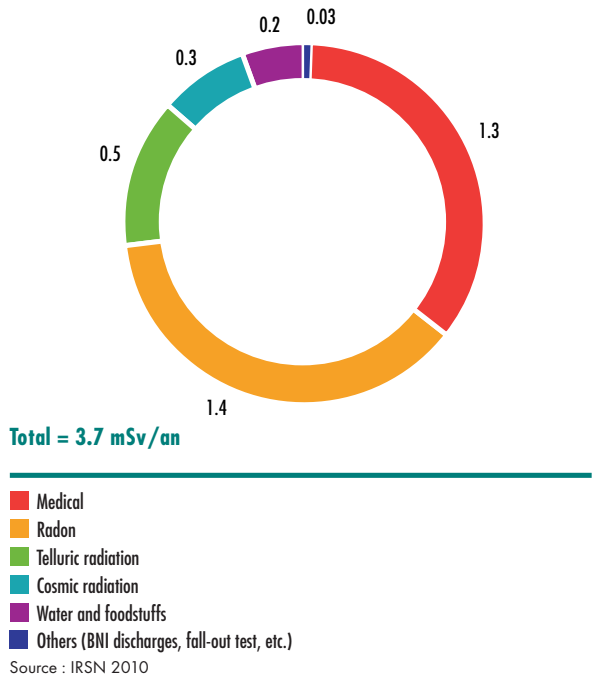
3 MONITORING OF EXPOSURE TO IONISING RADIATION

The pathology monitoring systems set up (cancer registers for example) do not enable those pathologies attributable to ionising radiation to be determined. Nor do we have reliable and easily measurable biological indicators which could be easily used to reconstruct the doses to which the individuals were exposed. In this context, "risk monitoring" is performed by measuring ambient radioactivity indicators (measurement of dose rates for example), internal contamination or, failing which, by measuring values (concentration of radionuclides in radioactive effluent discharges) which can then be used - by modelling or calculation - to estimate the doses received by the exposed populations.

The entire population of France is potentially exposed to ionising radiation of natural or anthropogenic origin, but to different extents across the country. The average exposure of the French population per inhabitant is estimated at 3.7 mSv per year, but this exposure is subject to wide individual variability, in particular depending on the place of residence and the number of radiological examinations received (source: IRSN 2010). Depending on the location, the average individual effective dose can vary by a factor of 2 to 5. Diagram 2 represents an estimate of the respective contributions of the various sources of French population exposure to ionising radiation.

These data are however still too imprecise to allow identification of the most exposed categories or groups of individuals for each exposure source category.

Diagram 2: the French population's exposure to ionising radiation



Source : IRSN 2010

3|1 Exposures of the population to natural ionising radiation sources

People have always been exposed to natural ionising radiation owing to the presence of radionuclides of terrestrial origin in the environment, radon emanations from the ground and exposure to cosmic radiation. Exposure to natural radioactivity represents about 65% of the total annual exposure on average.

3|1|1 Radiation of natural origin (excluding radon)

Natural radionuclides of terrestrial origin are present at various levels in all aspects of our environment, including inside the human organism. They lead to external exposure of the population owing to gamma radiation emissions produced by the uranium 238 and thorium 232 chains and by the potassium 40 present in the soil, but also to internal exposure by inhalation of particles in suspension and by ingestion of foodstuffs or drinking water.

The levels of natural radionuclides in the ground are extremely variable. The highest external exposure dose rates in the open air in France, depending on the region, range from a few nanosieverts per hour (nSv/h) to 100 nSv/h.

The dose rate values inside residential premises are generally higher owing to the contribution of construction materials (about 20% higher on average).

Based on scenarios covering the time individuals spend inside and outside residential premises (90% and 10% respectively), the average effective dose due to external exposure to gamma radiation of terrestrial origin in France is estimated at about 0.5 mSv per person per year.

The doses due to internal exposure of natural origin vary according to the quantities of radionuclides of the uranium and thorium families incorporated through the food chain, which depend on each individual's eating habits. According to UNSCEAR (2000), the average dose per individual is about 0.23 mSv per year. The average concentration of potassium 40 in the organism is about 55 Bq per kg, resulting in an average effective dose of about 0.18 mSv per year.

Waters intended for human consumption, in particular groundwater and mineral waters, become charged in natural radionuclides owing to the nature of the geological strata in which they spend time. The concentration of uranium and thorium daughters, and of potassium 40, varies according to the resource exploited according to the geological nature of the ground. For waters with high radioactivity, the annual effective

dose resulting from daily consumption (2 litres/inhabitant/day) may reach several tens or hundreds of microsieverts (µSv).

The results of the Regional Health Agencies' monitoring of the radiological quality of the tap water distributed to consumers between 2008 and 2009 (DGS/ASN/IRSN report published in 2011) showed that 99.83% of the population receives tap water whose quality complies at all times with the total indicative dose of 0.1 mSv/year set by the regulations.

3|1|2 Exposure to radon

Monitoring human exposure to radon in premises open to the public is a priority radiation protection measure in geographical areas where there is a high potential for exhalation of radon owing to the local geological characteristics. A strategy to reduce this exposure is necessary, should the measurements taken exceed the action levels laid down in the regulations.

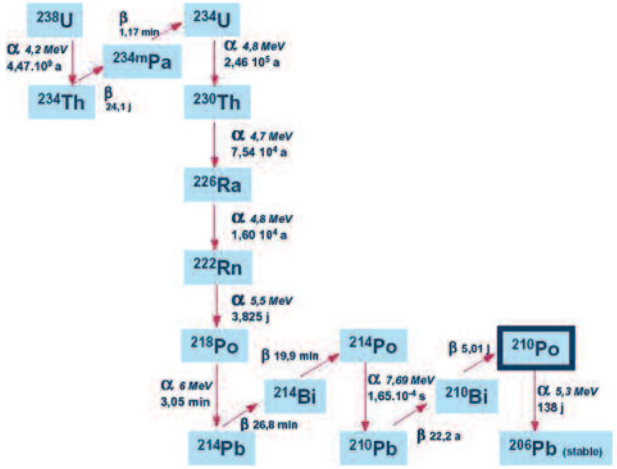
Exposure to radon in dwellings was estimated by measurement campaigns, followed by statistical interpretations (see IRSN atlas). The average radon activity value measured in France is 63 Bq/m^3, with about half the results being below 50 Bq/m^3, 9% above 200 Bq/m^3 and 2.3% above 400 Bq/m^3.

These measurements led to a classification of the *départements* according to the radon exhalation potential of the land (see chapter 3 point 2). For methodological reasons, the results of this monitoring are however still too imprecise to allow an accurate assessment of the doses associated with the actual exposure of the individuals.

In premises open to the public, and in particular in teaching and health and social care establishments, radon measurements have been taken since 1999.

Since August 2008, this monitoring has been extended to workplaces located in priority geographical areas. It should be extended to residential buildings as of 2012.

Results of the measurement campaigns conducted since 2005 by organisations approved by ASN are presented in table 1. The percentages of the measurement results higher than the action levels (400 and 1000 Bq/m^3) remain comparable from one year to the next. A new screening cycle (10 years) was started in 2009.



Uranium 238 chain

3|1|3 External exposure due to cosmic radiation

Cosmic radiation is of two types, with an ionic component and a neutronic component. At sea level, the ionic component is estimated at 32 nSv per hour and the neutronic component at 3.6 nSv per hour. The average dose due to cosmic radiation in France is estimated at 0.3 mSv per person per year.

Considering the average time spent inside dwellings (which itself attenuates the ionic component of the cosmic radiation), the average individual effective dose in a locality at sea level in France is 0.27 mSv per year, whereas it could exceed 1.1 mSv per year in a mountain locality situated at about 2,800 m altitude. The average annual effective dose per individual in France is 0.33 mSv per year. It is lower than the global average value of 0.38 mSv per year published by UNSCEAR.

Finally the exposure of aircrews to cosmic radiation, aggravated by prolonged periods at altitude, also warrants dosimetric monitoring (see point 3|2|3).

Table 1: results of radon measurement campaigns since 2005

Measurement campaign	Number of establishments checked	Establishments classified at less than 400 Bq/m^3		Establishments classified between 400 Bq/m^3 and 1,000 Bq/m^3		Establishments classified at higher than 1,000 Bq/m^3	
		number	%	number	%	number	%
2005/2006	2,966	2,570	87	314	10	82	3
2006/2007	3,000	2,560	85	315	11	125	4
2007/2008	1,204	952	79	174	15	78	6
2008/2009	800	659	82	94	12	47	6
2009/2010	510	409	80	78	15	23	5
2010/2011	644	520	81	92	14	32	5

3|2 Doses received by workers

3|2|1 Exposure of nuclear workers

The system of monitoring external exposure of individuals working in facilities where ionising radiation is used has been in place for a number of decades. This system is primarily based on the mandatory wearing of a passive dosimeter by workers liable to be exposed and it is used to check compliance with the regulation limits applicable to workers: these limits concern, on the one hand, the total exposure (since 2003, the annual limit, expressed in terms of effective dose, has been 20 mSv for 12 consecutive months), obtained by adding the dose due to external exposure to that resulting from any internal contamination and, on the other, the external exposure of certain parts of the body, such as hands and the lens of the eye (equivalent dose).

The data recorded give the cumulative exposure dose over a given period (month or quarter). They are collated in the SISERI system managed by IRSN and are published annually.

The results of dosimetric monitoring of worker external exposure in 2010 show on the whole that the prevention system introduced in facilities where sources of ionising radiation are used is effective, because for more than 96% of the population monitored, the annual dose remained lower than 1 mSv (effective annual dose limit for the public).

For each sector, tables 2 and 3 give the breakdown into the populations monitored, the collective dose and the number of times the annual limit of 20 mSv was exceeded. They clearly show a significant disparity in the breakdown of doses depending on the sector. For example, the medical and veterinary activities sector, which comprises a significant share of the population monitored (more than 62%), in fact only accounts for about 34% of the collective dose; however the annual limit of 20 mSv was exceeded in the medical sector 4 times (out of a total of 8), including two occasions (out of a total of 3) when 50 mSv was exceeded.

The latest statistics published by the IRSN in September 2011 show a small but steady increase in the populations subject to dosimetric monitoring since 2005 (see diagram 3), with the milestone of 330,000 people monitored being reached in 2010. This development is largely due to the increase in monitoring of populations involved in medical and veterinary activities, which has gained momentum since 2005, with the progressive implementation of the provisions of the Labour Code and of the implementing orders updated between 2003 and 2005, accompanied by information and verification campaigns. The collective dose, consisting of the sum of the individual doses, has been falling (about 48%) since 1996 at a time when the populations monitored have grown by about 44%. The optimisation approach implemented by the nuclear licensees during the 1990s no doubt explains this positive trend.

TO BE NOTED IN 2011

Results of dosimetry monitoring of worker external exposure to ionising radiation in 2010 (source: IRSN, September 2011)

Total population monitored: 330,618 workers

Monitored population for whom the dose remained below the detection threshold: 254,808, or about 77%

Monitored population for whom the dose remained between the detection threshold and 1 mSv: 61,959, or about 19%

Monitored population for whom the dose remained between 1 mSv and 20 mSv: 13,843 workers, or about 4.2%

Monitored population for whom the annual effective dose of 20 mSv was exceeded: 8 including 3 above 50 mSv

Collective dose (sum of individual doses): 62.40 Man.Sv

Annual average individual dose in the population which recorded a dose higher than the detection threshold: 0.82 mSv

Results of internal exposure monitoring in 2010

Number of routine examinations carried out: 310,342 examinations (of which fewer than 1% were considered positive)

Population concerned by a dosimetric estimation: 531 workers

Number of special monitoring or verification examinations performed: 11,395 (of which fewer than 2% were above the detection threshold)

Population having recorded a committed effective dose exceeding 1 mSv: 15 workers

Results of cosmic radiation exposure monitoring in 2010 (civil aviation)

Collective dose for 19,532 flight crew members: 41 Man.Sv

Annual average individual dose: 2.1 mSv

Table 2: occupational dosimetry in the nuclear field (year 2010 – source IRSN)

	Number of individuals monitored	Collective doses (Man.Sv)	Doses > 20 mSv
Reactors and energy production (EDF)	21,036	5.68	0
Fuel cycle; decommissioning	8,225	2.28	0
Transport	1,118	0.1	0
Logistics and maintenance (contractors)	7,849	6.23	0
Others	22,333	8.27	0

Table 3: dosimetry of workers in small-scale nuclear activities (year 2010 – source: IRSN)

	Number of individuals monitored	Collective doses (Man.Sv)	Doses > 20 mSv
Medicine	146,020	18.28	4
Dental	42,053	2.1	0
Veterinary	17,122	0.67	0
Industry	32,276	16.44	3
Research	14,174	0.56	1
Miscellaneous	13,620	0.96	0

The number of monitored workers whose annual dose exceeded 20 mSv has also been falling significantly (see diagram 4). Each occurrence of the 20 mSv exposure limit being exceeded must be written up in a significant event notification to ASN by the person responsible for the nuclear activity, leading to a specific investigation, jointly conducted with the occupational physician.

With regard to extremity dosimetry (ring and wrist dosimeters), 21,499 workers were monitored and the total dose was 133.2 Sv. An annual dose at the extremities higher than the regulation limit of 500 mSv was recorded on five workers, including four from the medical sector (interventional radiology) and one nuclear facilities logistics and maintenance contractor worker.

Diagram 3: monitored population and collective dose trends, from 1996 to 2010 (source IRSN)

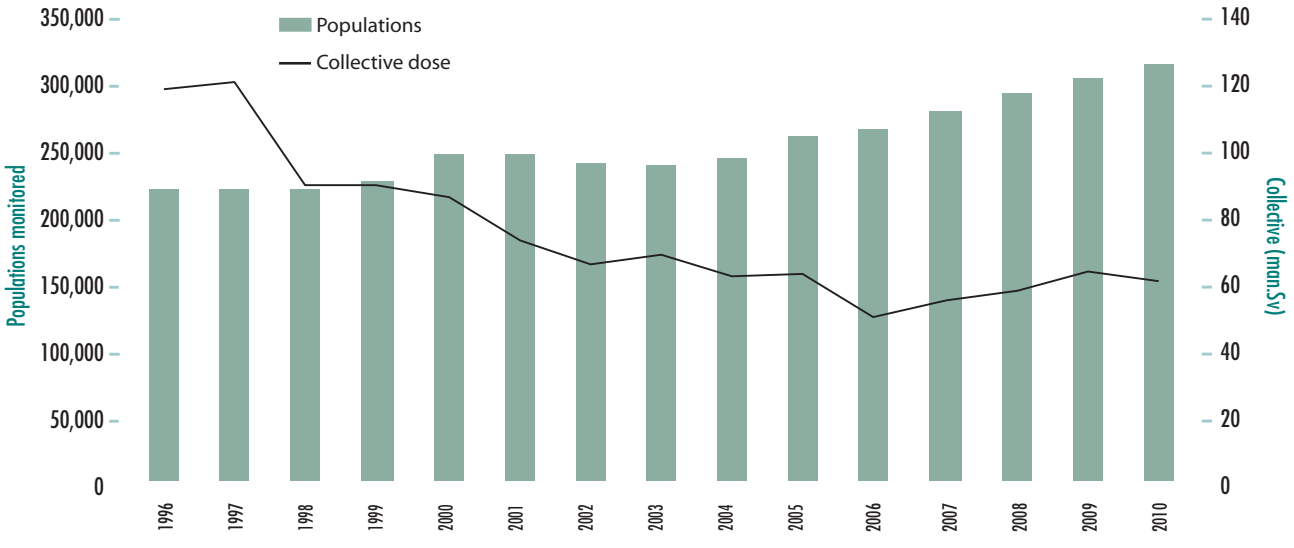
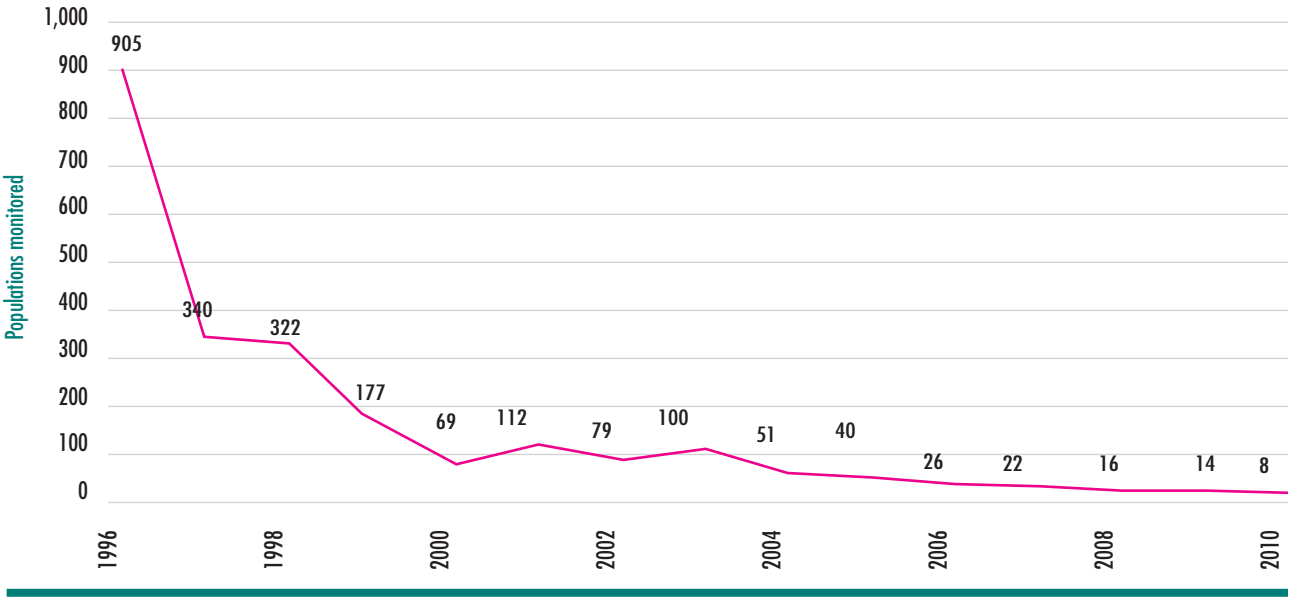


Diagram 4: evolution of number of workers monitored, with an annual effective dose in excess of 20 mSv, from 1996 to 2010



3|2|2 Worker exposure to TENORM

Occupational exposure to enhanced natural ionising radiation is the result either of the ingestion of dust containing large amounts of radionuclides (phosphates, metal ore), or of the inhalation of radon formed by uranium decay (poorly ventilated warehouses, thermal baths) or of external exposure due to process deposits (scale forming in piping for example).

The results of the studies carried out in France since 2005 and published by ASN in January 2010 show that 85% of the doses received by workers in the industries concerned remained below 1 mSv/year. The industrial sectors in which worker exposure is liable to exceed 1 mSv/year are the following: titanium ore processing, heating systems and recycling of refractory ceramics, maintenance of parts comprising thorium alloys in the aeronautical sector, chemical processing of zircon ore, mechanical transformation and utilisation of zircon and processing of rare earths.

3|2|3 Flight crew exposure to cosmic radiation

Airline flight crews and certain frequent travellers are exposed to significant doses owing to the altitude and the intensity of cosmic radiation at high altitude. These doses can exceed 1 mSv/year.

The observation system called "SIEVERT", set up by the General Directorate for Civil Aviation, the IRSN, the Paris Observatory and the Paul-Émile Victor French Institute for Polar Research (*www.sievert-system.com*), is used to estimate flight crew exposure to cosmic radiation based on the flights they make during the course of the year.

The doses received by 19,532 flight crew members were recorded in SISERI in 2010. 15% of the annual individual doses were below 1 mSv and 85% were between 1 mSv and 5 mSv.

3|3 Doses received by the population as a result of nuclear activities

The automated monitoring networks managed nationwide by IRSN (Téléray, Hydrotéléray and Téléhydro networks) offer real-time monitoring of environmental radioactivity and can highlight any abnormal variation. In the case of an accident or incident leading to the release of radioactive materials, these measurement networks would play an essential role by providing data to back the decisions to be made by the authorities and by notifying the population. In a normal situation, they contribute to the evaluation of the impact of BNIs (see chapter 4).

However, there is no overall monitoring system able to provide an exhaustive picture of the doses received by the population as a result of nuclear activities. Consequently, compliance with the population exposure limit (effective dose set at 1 mSv per year) cannot be controlled directly. However, for BNIs, there is detailed accounting of radioactive effluent discharges and radiological monitoring of the environment is implemented around the installations. On the basis of the data collected, the dosimetric impact of these discharges on the populations in the immediate vicinity of the installations is then calculated using models for simulating transfers to the environment. The dosimetric impacts vary, according to the type of installation and the lifestyles of the reference groups chosen, from a few microsieverts to several tens of microsieverts per year.

There are no known estimates for nuclear activities other than basic nuclear installations, owing to the methodological difficulties involved in identifying the impact of the facilities and in particular the impact of discharges containing small quantities of artificial radionuclides resulting from the use of unsealed radioactive sources in research or biology laboratories, or in nuclear medicine units. For example, the impact of hospital discharges leads to doses of several microsieverts per year for the most exposed persons, in particular workers in the sewer networks (IRSN study 2005).

Situations inherited from the past, such as atmospheric nuclear tests and the Chernobyl accident, can make a marginal contribution to population exposure. Thus the average individual effective dose currently being received in metropolitan France as a result of fall-out from the Chernobyl accident is estimated at between 0.010 mSv and 0.030 mSv/year (IRSN 2001). That due to the fall-out from atmospheric testing was estimated in 1980 at about 0.020 mSv. Given a decay factor of about 2 in 10 years, current doses are estimated at well below 0.010 mSv per year (IRSN, 2006). With regard to the fall-out in France from the Fukushima accident (Japan), the results published by IRSN in 2011 showed the presence of very low levels of radioactive iodine, with no health impact for the populations or the environment.



Installing a filter on one of IRSN's "OPERA AIR" aerosol sampling network stations (OPERA programme: permanent environmental radioactivity observatories)

3|4 Doses received by patients

Exposure to ionising radiation of medical origin is on the increase in most countries (source: UNSCEAR). In the USA, the average annual effective dose per person rose from 0.53 mSv in 1983 to 3 mSv in 2006. Worldwide:

• the number of radiological examinations rose from 1.6 to 4 billion between 1993 and 2008, i.e. an increase of some 150%. About 17 million nuclear medicine examinations were carried out yearly in the 1970s, a figure which leapt to 35 million (+100%) in the early years of this millennium.

• the share of the dose due to computed tomography (CT) represents 42% of medical exposures in 2008, compared with 34% in 2000, while in developed countries the share of CT examinations is 8% and the associated dose represents 47% of medical exposures.

The average effective dose per inhabitant in France resulting from radiological examinations for diagnostic purposes has been reassessed: between 2002 and 2007 it increased from 0.83 to 1.3 mSv per year per inhabitant (the last exposure data update, published by the IRSN and the InVS in April 2010, is based on information relating to 2007).

Conventional radiology represents the largest number of examinations (63 %), but in terms of exposure, CT scans account for almost 58% of the doses delivered to patients (diagram 7).

In 2007, the overall number of procedures and the average effective dose per inhabitant increased with age (diagrams 6 and 7):

• among infants (under 1 year old) the procedures performed most frequently and contributing most to the effective dose are radiography of the pelvis (approximately 0.2 procedures per year per infant) and of the thorax (approximately 0.15 procedures per year per infant);

• among adolescents, an increase in the number of procedures and the average effective individual dose is observed due to an increase in radiography of the limbs (approximately 0.3 procedures per year per child) and extra-oral dental radiography, such as the panoramic dental examination (approximately 0.1 procedures per year per child).

Among adults, the number of procedures and average effective individual doses vary with gender and age. Therefore:

• among women, the average effective individual dose varies from 0.4 mSv per year between 20 and 24 years of age to 2.5 mSv per year between 70 and 90 years of age, the most frequent procedures being mammography (0.4 procedures per year per woman between 50 and 70 years of age), and radiography of the limbs and thorax;

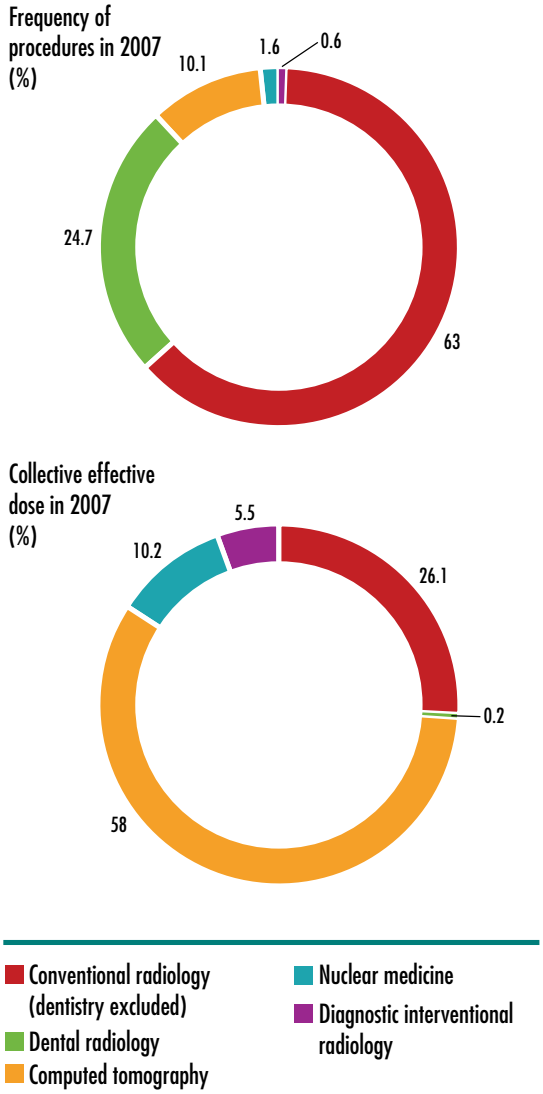
• among men, the individual dose varies from 0.4 mSv per year between 20 and 24 years of age, to 3 mSv per year between 70 and 90 years of age, the most frequent procedure being radiography of the thorax, the frequency of which increases steadily with age, rising from 0.1 to 0.7 procedures per year per man between the age of 20 and 80.

Among both men and women, computed tomography scans contribute more to the average effective individual dose than radiological procedures. The CT procedures delivering the highest doses are abdomino-pelvic and thoracic CT scans. By way of example, at 50 years of age the average effective individual doses that can be attributed to radiological and

Table 4: average number of medical imaging procedures and average effective dose in France in 2002 and 2007 (source IRSN)

Year	Average number of procedures		Average effective dose per inhabitant per year
	Total	Per inhabitant	
2002 • (61.4 million inhabitants)	73.3 million	1.2	0.83 mSv
2007 • (63.7 million inhabitants)	74.6 million	1.2	1.3 mSv

Diagram 5: breakdown of procedures and associated doses per field



CT examinations respectively are 0.5 and 1 mSV per year for women and 0.3 and 1 mSV per year for men.

Medical exposure to ionising radiation (computed tomography, positron emission tomography (PET), interventional radiology) represents the largest contribution to artificial exposure in the developed countries. These practices are continuing to grow and are unavoidable except when alternative techniques can be used.

Particular attention must be given to monitoring and reducing the doses received from medical imaging, because if a given individual undergoes a large number of examinations involving high levels of irradiation, the value of 100 mSv could be reached, and epidemiological studies have shown that above this value there is a significant probability of developing a radiation-induced cancer.

3|5 Protection of non-human species

The international radiation protection system was created to protect man against the effects of ionising radiation. Environmental radioactivity is thus assessed with respect to its impact on human beings and, in the absence of any evidence to the contrary, it is today considered that the current standards also protect other species.

It must however be possible to guarantee that the environment is protected against the radiological risk regardless of the effects on man (see ICRP 103). ASN is in favour of greater consideration being given to the impact of ionising radiation on non-human species in the regulations and in the nuclear activity licenses, while stressing that evaluation methods will need to be published for effective implementation of any new regulations on this subject.

Diagram 6: per individual, average number of conventional radiology (excluding intra-oral dental) and computed tomography procedures, according to gender and age in 2007 (source IRSN/InVS)

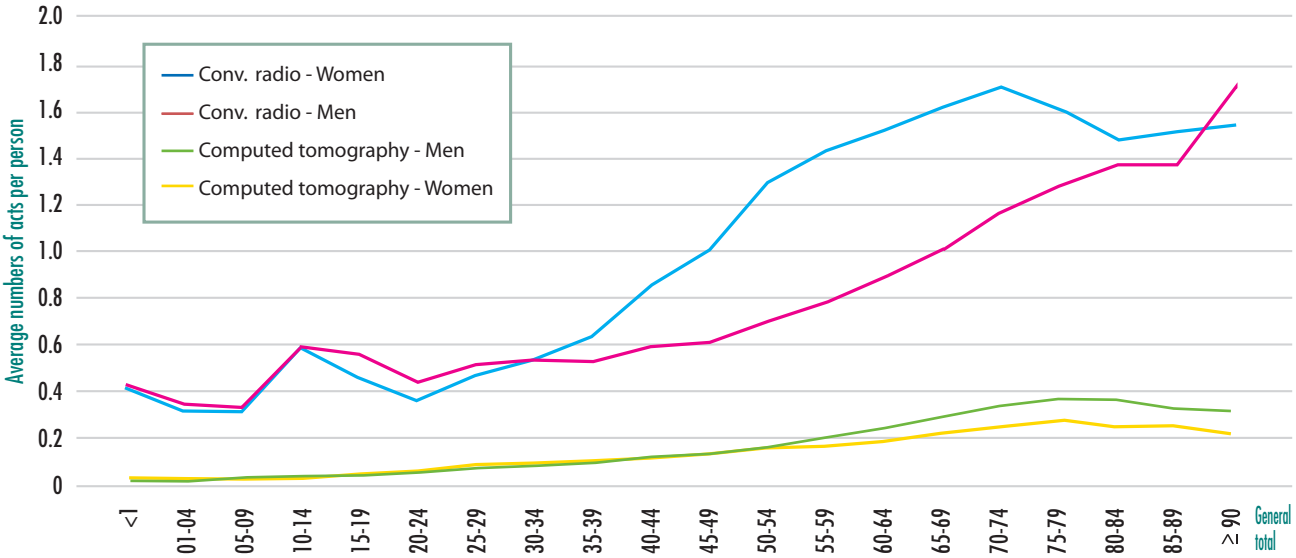


Diagram 7: average effective dose per inhabitant in 2007 linked to radiological procedures (sources IRSN/InVS)

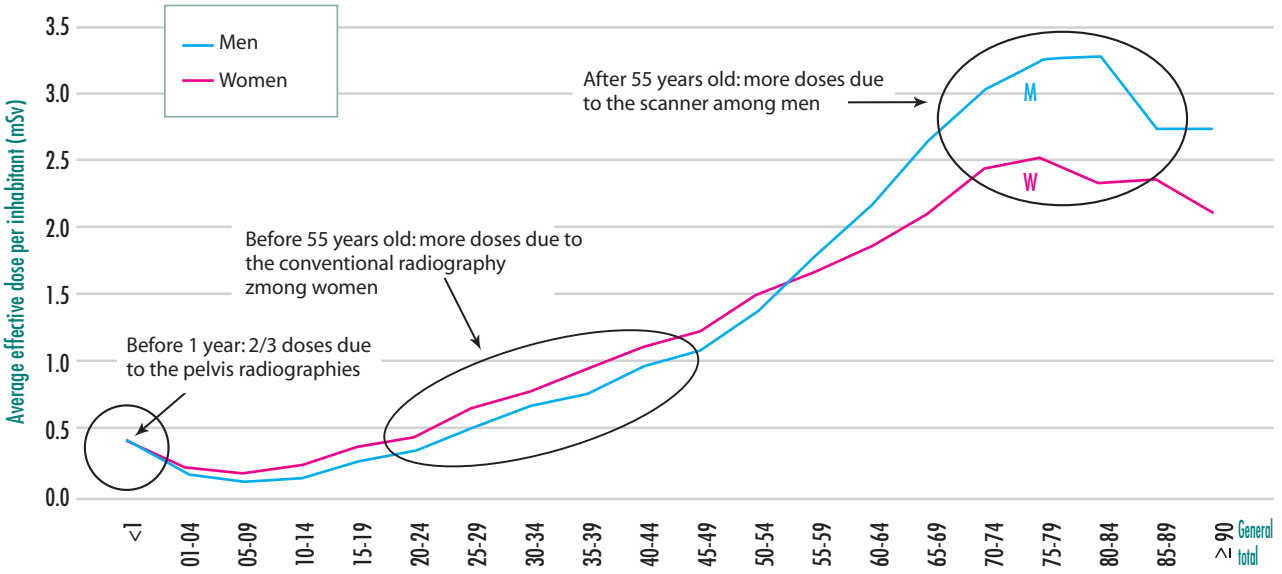
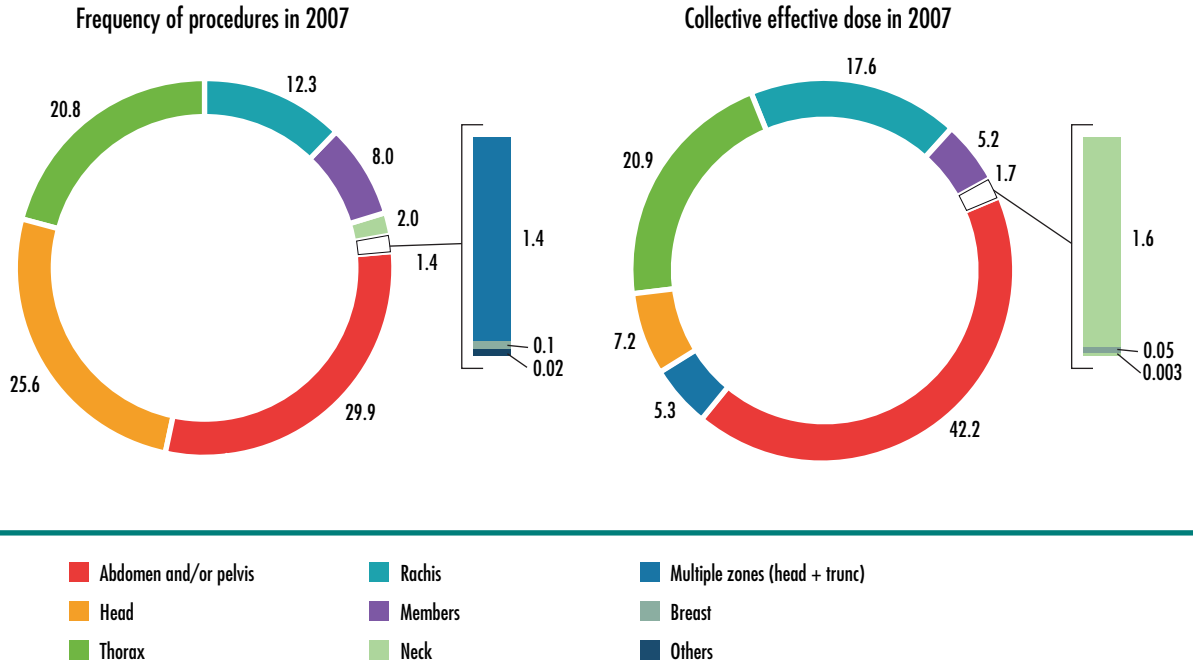


Diagram 8: breakdown of frequency of procedures and collective effective dose per anatomical region examined using computed tomography, all of France – in %



4 OUTLOOK

ASN remains particularly attentive to the correct functioning of the occupational exposure monitoring system set up by IRSN (SISERI), in that the statistics provided constitute valuable national indicators of trends in occupational exposure and are useful in assessing the effectiveness of the measures taken by the licensees to implement the optimisation principle. As in the preceding years, the IRSN-published study of worker exposure in 2010 confirms the stabilisation at a low level of the number of monitored workers whose annual dose exceeded 20 mSv, and the stabilisation at a low level of the collective dose following the reduction that began in 1996. From 2012, owing to the probable reduction in the regulatory exposure dose limit for the lens of the eye, particular attention will need to be given to monitoring this specific exposure in health professionals associated with interventional practices.

The second national action plan for radon-related risks, published in November 2011, highlights the need to develop screening of radon exposure in dwellings. For ASN, the expected publication of new regulations on this subject should be an opportunity to compile all radon exposure data in a single national system comprising the results of measurements taken in premises open to the public, the workplace and dwellings.

ASN also remains attentive to the information produced by the national observatory of patient exposure, run by InVS and IRSN, whose first publication (April 2010) confirmed that, as in the other developed countries, the doses delivered to patients during diagnostic examinations was on the rise in France. Improvements of the precision of this monitoring system, involving the stakeholders, would however appear to be necessary.

The question of hypersensitivity to ionising radiation still requires particular attention in terms of applied research at both national and international level, with a view to rapidly devising a radiosensitivity test for patients, especially prior to radiotherapy treatment. In the field of low doses, this question must also continue to be examined, especially owing to the large-scale use of breast cancer screening using mammography.

Finally, ASN has decided in 2012 to implement pluralistic and effective monitoring of the actions initiated at the national level in response to the 2011 recommendations concerning the link between child leukaemia and environmental factors.

THE PRINCIPLES AND STAKEHOLDERS IN NUCLEAR SAFETY REGULATION, RADIATION PROTECTION AND PROTECTION OF THE ENVIRONMENT

1 **THE PRINCIPLES OF NUCLEAR SAFETY, RADIATION PROTECTION AND PROTECTION OF THE ENVIRONMENT** 49

1|1 **Fundamental principles**
1|1|1 Principle of the prime responsibility of licensees
1|1|2 "Polluter-pays" principle
1|1|3 Precautionary principle
1|1|4 Public participation principle
1|1|5 The principle of justification
1|1|6 The principle of optimisation
1|1|7 The principle of limitation
1|1|8 The principle of prevention

1|2 **Some aspects of the safety approach**
1|2|1 Safety management
1|2|2 The "Defence in Depth" concept
1|2|3 Interposing of barriers
1|2|4 Deterministic and probabilistic approaches
1|2|5 Operating experience feedback

2 **THE STAKEHOLDERS** 53

2|1 **Parliament**

2|2 **The Government**
2|2|1 Ministers responsible for nuclear safety and radiation protection
2|2|2 The *Préfets*

2|3 **ASN**
2|3|1 Role and duties
2|3|2 Organisation
2|3|3 Operation

2|4 **Consultative bodies**
2|4|1 High Committee for Transparency and Information on Nuclear Security
2|4|2 The High Council for Public Health
2|4|3 The High Council for Prevention of Technological Risks
2|4|4 The Central Committee for Pressure Equipment

2|5 **Technical support organisations**
2|5|1 IRSN
2|5|2 Advisory Committees of experts
2|5|3 The ASN's other technical support organisations

2|6 **Other stakeholders**
2|6|1 French National Authority for Health
2|6|2 The French Health Product Safety Agency (AFSSAPS)
2|6|3 The French Health Monitoring Institute (InVS)
2|6|4 French National Cancer Institute

3 **OUTLOOK** 65

CHAPTER 2

Nuclear safety and radiation protection comprise the measures that allow nuclear activities to be carried out under normal conditions, that prevent accidents – whether involuntary or the result of malicious intent – and that limit the effects of radiation for workers, for the general public and for the environment. Their common aim is to protect people and property against hazards, nuisances or inconveniences of whatever nature arising from nuclear activities and from exposure to natural radiation.

Nuclear safety and radiation protection obey principles and approaches that have been put in place progressively and continually enriched by a process of feedback. The basic guiding principles are advocated internationally by the International Atomic Energy Agency (IAEA). In France, they are included in the Constitution or enacted in law, as well as now figuring in a European directive.

The regulation of civil nuclear safety and radiation protection in France is the task of the ASN, an independent administrative authority, working with other bodies of State, within Parliament, the Government and the *Préfectures*[1], and relying on technical expertise provided, notably, by the French Institute for Radiation Protection and Nuclear Safety (IRSN).

Acting on behalf of the State, ASN regulates nuclear safety and radiation protection in order to protect workers, health care recipients, the public and the environment from risks arising from nuclear activities. It also contributes to informing the citizens.

1 THE PRINCIPLES OF NUCLEAR SAFETY, RADIATION PROTECTION AND PROTECTION OF THE ENVIRONMENT

1|1 Fundamental principles

Nuclear activities must be carried out in compliance with the principles that underlie the legislative texts.

The IAEA's Safety Standards (see chapter 7, point 2|2) establish ten fundamental safety principles which are applied internationally under the Convention on Nuclear Safety (CNS) (see chapter 7, point 4|1) and which establish an international framework for regulation of nuclear safety and radiation protection, at the European community level, via two directives establishing a community framework for the safety of nuclear installations and the responsible and safe management of spent fuel and radioactive waste. In France this is done via the Environment Charter, appended to the Constitution, and via laws and regulations.

1|1|1 Principle of the prime responsibility of licensees

This principle, defined in Article 9 of the CNS, stipulates that prime responsibility for the safety of nuclear activities entailing risk rests with those undertaking or carrying out such activities.

It applies directly to all nuclear activities.

UNDERSTAND

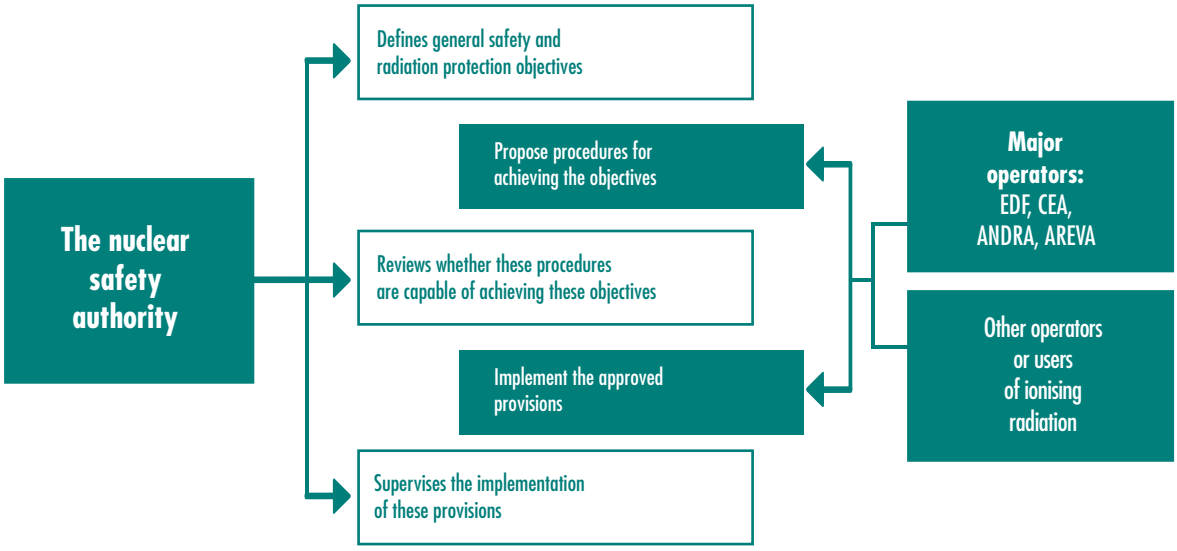
The fundamental safety principles

The IAEA establishes the following 10 principles in its publication "SF-1":

1. *The prime responsibility for safety must rest with the person or organisation responsible for facilities and activities that give rise to radiation risks.*
2. *An effective legal and governmental framework for safety, including an independent regulatory body, must be established and sustained.*
3. *Effective leadership and management for safety must be established and sustained in organisations concerned with, and facilities and activities that give rise to, radiation risks.*
4. *Facilities and activities that give rise to radiation risks must yield an overall benefit.*
5. *Protection must be optimised to provide the highest level of safety that can reasonably be achieved.*
6. *Measures for controlling radiation risks must ensure that no individual bears an unacceptable risk of harm.*
7. *People and the environment, both present and future, must be protected against radiation risks.*
8. *All practical efforts must be made to prevent and mitigate nuclear or radiation accidents.*
9. *Arrangements must be made for emergency preparedness and response for nuclear or radiation incidents.*
10. *Protective actions to reduce existing or unregulated radiation risks must be justified and optimised.*

1. Office of the *Préfet*

Responsibility of licensees and responsibility of ASN



UNDERSTAND

BNI tax, additional waste taxes, additional disposal tax and contribution to IRSN

The ASN Chairman is required by the TSN Act, now codified in books I and V of the Environment Code, to assess and order payment of the BNI tax, introduced under Article 43 of the 2000 Budget Act (Act 99-1172 of 30th December 1999). The revenue from this tax amounted to € 580.7 million in 2011. The proceeds go to the central state budget.

In addition, the "Waste" Act creates three further taxes levied on nuclear reactors and spent nuclear fuel reprocessing plants, known as the "research", "support" and "technological dissemination" taxes. They are allocated to the financing of economic growth and of ANDRA's research into underground disposal and storage. The revenue from these new taxes amounted to € 179.5 million in 2011.

Article 2 of Act 2009-1673 of 30th December 2009 also created an additional tax on ultimate disposal facilities. This tax is paid to the local communes[2] and inter-commune public cooperation establishments around the disposal facility. The revenue from this tax amounted to € 2.4 million in 2011.

Finally, article 96 of Act 2010-1658 of 29th December 2010 creates an annual contribution on behalf of the IRSN to be paid by BNI licensees. This contribution is in particular designed to finance the review of the safety cases submitted by the BNI licensees. The revenue from this contribution amounted to € 33.4 million in 2011.

Table 1: breakdown of licensee contributions

Licensee	Amount for 2011 (millions of euros)		
	BNI tax	Additional waste and disposal taxes	Contribution on behalf of IRSN
EDF	543.6	138.8	24.3
AREVA	16.3	8.9	2.5
CEA	6.6	29.5	5.1
ANDRA	6.5	*	0.2
OTHERS	7.7	2.3	1.3
TOTAL	**580.7**	**179.5***	**33.4**

* The €2.4 million revenue from the disposal tax for 2011 was collected in January 2012.

2. Smallest administrative subdivision administered by a mayor and a municipal council

1|1|2 "Polluter-pays" principle

The "polluter-pays" principle, spelling out the operator's prime responsibility, ensures that the costs of measures to prevent or reduce pollution are borne by those responsible for environmental damage. This principle is defined in Article 4 of the Environment Charter in these terms: *"An individual must contribute to reparation of the environmental damage he or she has caused"*.

This principle entails the taxation of Basic Nuclear Installations (BNI) ("BNI" tax and contribution to the IRSN), the taxation of radioactive waste producers (additional waste taxes), of disposal facilities (additional "disposal" tax) and of installations classified on environmental protection grounds (ICPE) (fraction of the general tax on polluting activities – TGAP).

1|1|3 Precautionary principle

The precautionary principle, defined in Article 5 of the Environment Charter, states that: *"the absence of certainty, in the light of current scientific and technical knowledge, must not delay the adoption of effective and proportionate measures to prevent a risk of serious and irreversible damage to the environment"*.

Application of this principle results, for example, in assuming a linear no-threshold dose-effect relationship where the biological effects of exposure to low doses of ionising radiation are concerned. This point is clarified in chapter 1 of this report.

1|1|4 Public participation principle

This principle allows public participation in the making of decisions by public authorities. It is defined in Article 7 of the Environment Charter as follows: "Within the conditions and limits defined by law, all individuals are entitled to access environmental information in the possession of the public authorities and to take part in the making of public decisions affecting the environment".

In the nuclear field, this principle entails the organisation of national public debates, which are mandatory prior to the construction of a nuclear power plant for example, as well as public enquiries, especially when examining the creation or decommissioning of nuclear facilities, as well as consultations and public access to information, which are mandatory for all matters liable to lead to a significant increase in water intakes or discharges in the environment of a nuclear facility.

Chapter 6 of this report describes application of the right of access to information over the full range of ASN's activities.

1|1|5 The principle of justification

The principle of justification, given expression in Article L. 1333-1 of the Public Health Code (CSP), states that: A nuclear activity or an intervention can only be undertaken or carried out if its health, social, economic or scientific benefits so justify, given the risks inherent in the human exposure to ionising radiation that it is likely to entail".

Depending on the type of activity, justification decisions are made at various levels of authority: they are the responsibility of Parliament for questions of general interest, of the Government for the creation or decommissioning of a BNI, and of ASN where transport operations or sources of radiation are concerned.

Assessment of the expected benefit of a nuclear activity and the corresponding health drawbacks may lead to prohibition of an activity for which the benefit would not seem to outweigh the health risk. For existing activities, justification may be reassessed if the state of know-how and technology so warrants.

1|1|6 The principle of optimisation

The principle of optimisation, formulated in Article L. 1333-1 of the Public Health Code, states that: *"Human exposure to ionising radiation as a result of a nuclear activity or medical procedure must be kept as low as reasonably achievable, given current technology, economic and social factors and, where applicable, the intended medical purpose."*

This principle, referred to as the ALARA principle, leads for example: to a reduction in discharge licenses of the quantities of radionuclides present in the radioactive effluents from nuclear installations; to requiring surveillance of exposure at the workstation in order to reduce it to the strict minimum; and to ensuring that medical exposure as a result of diagnostic procedures remains close to the pre-determined reference levels.

1|1|7 The principle of limitation

The principle of limitation, expressed in Article L. 1333-1 of the Public Health Code, states that: *"Exposure of an individual to ionising radiation as a result of a nuclear activity may not increase the sum of the doses received beyond the limits set by regulations, except when the individual is exposed for medical or biomedical research purposes"*.

The exposure of the general population or of workers as a result of nuclear activities is subject to strict limits. These comprise significant safety margins to prevent the appearance of deterministic effects. They are also far below the doses at which probabilistic effects begin to be observed.

Exceeding these limits leads to an abnormal situation and one which may give rise to administrative or legal sanction.

In the case of medical exposure, no strict dose limit is set, provided that this voluntary exposure is justified by the expected health benefits to the person exposed.

1|1|8 The principle of prevention

The prevention principle, defined in article 3 of the Environment Charter, requires the implementation of rules and actions designed to anticipate any environmental damage, which must take account of the *"best techniques available at an economically acceptable cost"*.

In the nuclear field, this principle underlies the concept of defence in depth, presented below.

1|2 Some aspects of the safety approach

The safety principles and approaches presented below were gradually implemented and incorporate experience feedback from accidents. Absolute safety can never be guaranteed and despite all the precautions taken in the design, construction and operation of nuclear facilities, an accident can never be completely ruled out. The willingness to move forward and to create a continuous improvement approach is thus essential if the risks are to be reduced.

1|2|1 Safety management

Safety management means fostering a safety culture within risk management organisations.

Safety culture is defined by the International Nuclear Safety Advisory Group (INSAG), an international nuclear safety consultative group reporting to the General Director of the IAEA, as: *"that assembly of characteristics and attitudes in organisations and individuals which establishes that, as an overriding priority, nuclear plant safety issues receive the attention warranted by their significance"*.

Safety culture therefore determines the ways in which an organisation and individuals perform their duties and accept responsibility, with safety in mind. It is one of the key fundamentals in maintaining and improving safety. It commits organisations and individuals to paying particular and appropriate attention to safety. At the individual level it is given expression by a rigorous and cautious approach and a questioning attitude making it possible to both obey rules and take initiative. In operational terms, the concept underpins decisions and actions relating to activities.

1|2|2 The "Defence in Depth" concept

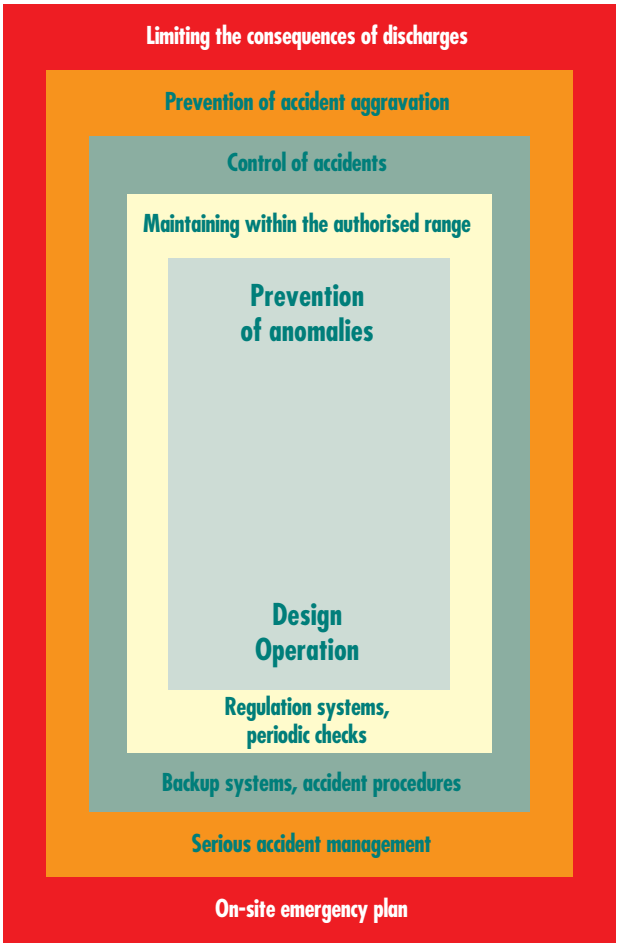
The main means of preventing accidents or of mitigating their consequences is the "Defence in Depth" concept. This is implemented in terms of successive and independent levels of protection: should one level of protection, or barrier, fail, the next comes into play.

An important element for the independence of the levels of defence is the use of different technologies (diversified systems).

The design of nuclear installations is based on a defence in depth approach. Five levels of protection are defined for nuclear reactors:

Level 1: Prevention of abnormal operation and failures
This is achieved by opting for robust and conservative installation design that includes safety margins and allows installations to withstand their own failures as well as the consequences of externally initiated events. It implies conducting the most exhaustive study possible of normal operating conditions to determine the severest stresses to which the systems will be subjected. It is then possible to produce an initial design basis of the facility, incorporating safety margins.

The five levels in "Defence in Depth"



Level 2: Keeping the installation within authorised limits
Regulation and governing systems must be designed to keep the installation within an operating range that is far from the safety limits. For example, if the temperature in a system increases, a cooling system starts up before the temperature reaches the authorised limit. Monitoring of the condition and correct operation of systems forms part of this level of defence.

Level 3: Control of accidents without core meltdown
The aim here is to postulate that certain accidents, chosen for their "envelope" characteristics (the most penalising in a given family) can happen, and to design and size backup systems to withstand those conditions.

Such accidents are generally studied with conservative hypotheses, that is to say the various parameters governing this accident are assumed to be the least favourable. The single-failure criterion is also applied, in other words, in the accident situation, we also postulate the failure of any given component. This means that systems that come into play in the event of an accident (emergency shutdown, safety injection, etc.) must have at least two redundant channels.

Level 4: Control of accidents with core meltdown
These accidents have been considered since the Three Mile Island accident (1979) and are now taken into account in the design of

new reactors such as the EPR. The aim is to preclude such accidents or to design systems that can withstand them. The study of these accidents will be reassessed in the light of experience feedback from the Fukushima accident.

Level 5: Mitigation of the radiological consequences of significant releases
This requires implementation of the emergency plan measures, including measures to protect the general public: shelter, taking of stable iodine tablets to saturate the thyroid and avoid fixation of radioactive iodine carried by the radioactive plume, evacuation, restrictions on consumption of water and of agricultural products, etc.

1|2|3 Interposing of barriers

To limit releases several superposed barriers are placed between the radioactive substances and the environment. Barriers must be designed to have a high degree of reliability and must be monitored to detect any weaknesses or failures. There are three such barriers for pressurised water reactors: the fuel cladding, the boundary of the reactor primary system, and the containment vessel (see chapter 12).

1|2|4 Deterministic and probabilistic approaches

Postulating the occurrence of a limited number of design accidents is an approach termed deterministic. This is a principle which is simple to apply and which allows design of installations with good safety margins, making use of the so-called "envelope" cases. It does not, however, lead to a very realistic view of the most probable scenarios and does not rank risks satisfactorily, since it focuses attention on accidents studied with very conservative assumptions.

The deterministic approach therefore needs to be completed with an approach that takes better account of accident scenarios in terms of their probability: the probabilistic approach, used in "probabilistic safety assessments" (PSA).

A PSA consists in taking each "initiator" event leading to activation of a safety system (defence in depth level 3) and building of an event tree, defined by failures (or successes) of reactor control procedure actions. The probability of each sequence is then calculated based on statistics on the reliability of systems and on the rate of success of actions (including data on "human reliability"). Similar sequences of events that correspond to the same "initiator" are grouped into families, making it possible to determine the contribution of each family to the probability of reactor core meltdown.

PSAs cover a wider range of accidents than the deterministic studies and make it possible to verify and possibly complete deterministic design. They are, however, limited by the uncertainties in reliability data and the approximations used in modelling installations. They are therefore to be used as a complement to deterministic studies and not as a substitute for them.

1|2|5 Operating experience feedback

Experience feedback contributes to defence in depth. It consists in implementing a reliable system for detecting any anomalies which can occur, such as equipment failures or procedural errors. This system should allow early detection of any abnormal operation and draw the relevant conclusions (especially in terms of organisation) such as to prevent these anomalies happening again. Operating experience feedback encompasses events, incidents and accidents occurring both in France and abroad, whenever relevant to enhancing nuclear safety or radiation protection.

2 THE STAKEHOLDERS

The organisation of the regulation of nuclear safety and radiation protection in France complies with the CNS, of which Article 7 requires that *"Each Contracting Party shall establish and maintain a legislative and regulatory framework to govern the safety of nuclear installations"* and of which Article 8 requires that each Party *"shall establish or designate a regulatory body entrusted with the implementation of the legislative and regulatory framework referred to in Article 7 and provided with adequate authority, competence and financial and human resources to fulfil its assigned responsibilities"*. These requirements are confirmed by the European Directive of 25 June 2009 on nuclear safety.

In France, the regulation of nuclear safety and radiation protection is primarily the responsibility of three parties: Parliament, the Government and ASN. Their respective competences are defined by the TSN Act, now codified in books I and V of the Environment Code, by ordinance 2012-6 of 5th January 2012.

2|1 Parliament

Parliament's principal role in the field of nuclear safety and radiation protection is to make laws. Two major Acts were

passed in 2006: The TSN Act, of 13th June 2006, on transparency and security in the nuclear field; and the Programme Act, of 28th June 2006, on the sustainable management of radioactive materials and waste.

In the same way as the other independent administrative authorities, and by virtue of the TSN Act, ASN reports regularly on its activities to Parliament. ASN in particular presents Parliament with its annual report on the state of nuclear safety and radiation protection in France.

The French Office for the Evaluation of Scientific and Technical Choices

The mission of the French Office for the Evaluation of Scientific and Technical Choices (OPECST) is to inform Parliament as to the consequences of scientific or technological choices, in order to ensure that parliamentary decisions are fully informed. To this end, the OPECST gathers information, implements study programmes and conducts evaluations.

In the field of nuclear safety, the OPECST has, since its creation, focused on the administrative organisation of nuclear safety and radiation protection, the measures taken by licensees in this field, the structures adopted in other countries and the adequacy of the resources allocated to ASN to meet its responsibilities. It is, notably, before the OPECST that ASN reports on its activities.

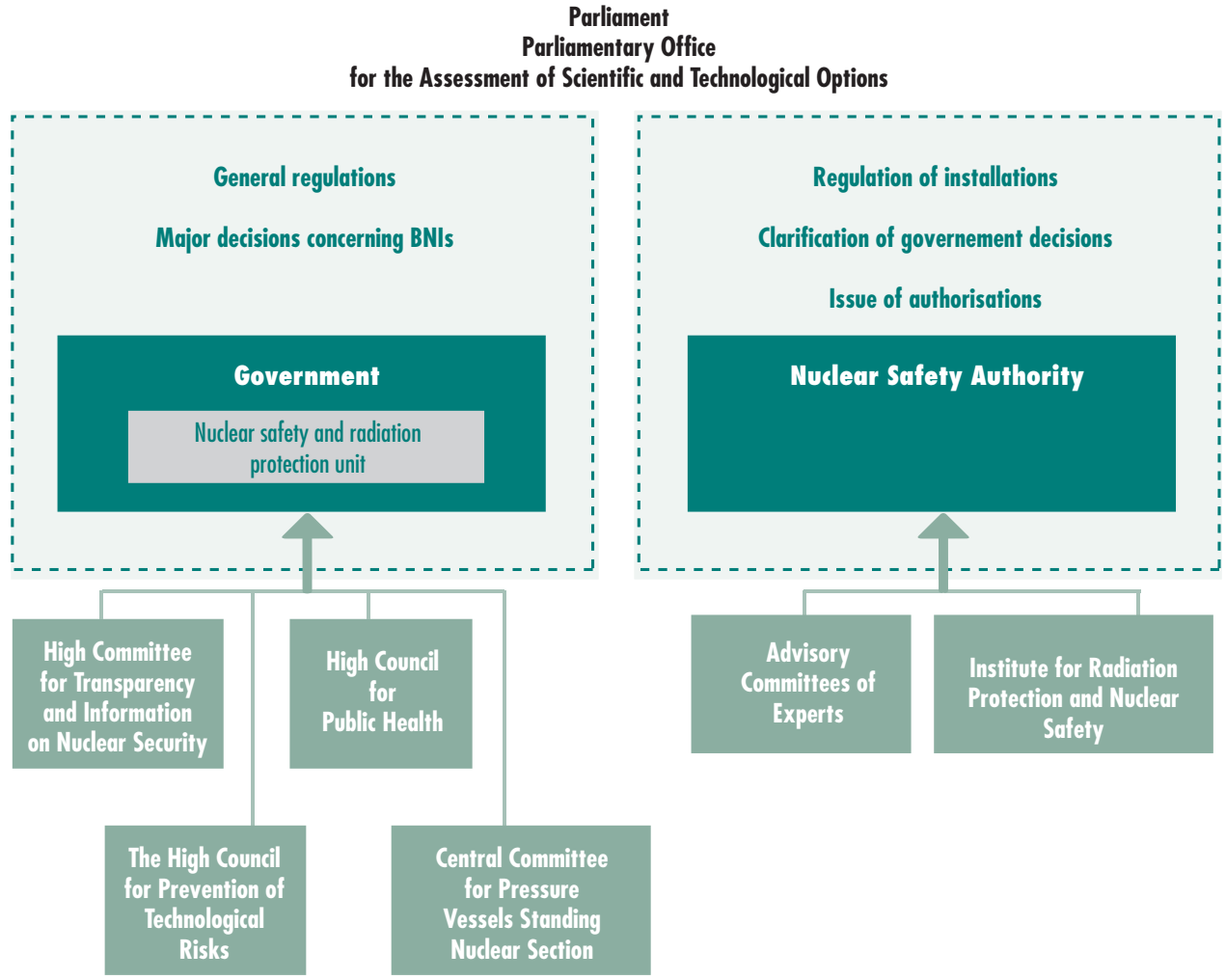
Following the Fukushima accident, the OPECST carried out a mission in 2011 on nuclear security and the future of nuclear energy, which led to the drafting of a report and recommendations.

2|2 The Government

The Government exercises regulatory powers. It is therefore in charge of laying down the general regulations concerning nuclear safety and radiation protection. The TSN Act also tasks it with making major decisions concerning BNIs, for which it relies on proposals or opinions from ASN. The Government can also call on consultative bodies such as the High Committee for Transparency and Information on Nuclear Safety (HCTISN).

The Government is responsible for civil protection in the event of an emergency.

Regulation of nuclear safety and radiation protection in France



2|2|1 Ministers responsible for nuclear safety and radiation protection

On the advice of ASN and, as applicable, following a proposal by it, the ministers responsible for nuclear safety define the general regulations applicable to BNIs and take major individual decisions concerning:
– the design, construction, operation, final shutdown and decommissioning of BNIs;
– the final shutdown, maintenance and surveillance of radioactive waste disposal facilities;
– the manufacturing and the operation of pressure vessels (ESP) specifically designed for these installations.

The minister responsible for radiation protection also defines the general regulations applicable to radiation protection, on the basis of ASN proposals as and when applicable.

The regulation of worker radiation protection is the responsibility of the Minister for labour.

Finally, the ministers responsible for nuclear safety and for radiation protection approve the ASN internal regulations by means of a Government order. Each of them also approves ASN technical regulatory decisions and certain individual decisions (setting BNI discharge limits, delicensing a BNI, etc.) affecting their own particular field.

The Nuclear Safety and Radiation Protection Mission

Under the authority of the ministers responsible for nuclear safety and for radiation protection, the Nuclear Safety and Radiation Protection Mission (MSNR), jointly with ASN, is tasked with proposing Government policy on nuclear safety and radiation protection, except for defence-related activities and installations and the radiation protection of workers against ionising radiation.

2|2|2 The *Préfets*

The *préfets*[3] are the State's representatives in the *départements*[4]. They are the guarantors of public order and play a particularly important role in the event of an emergency, in that they are responsible for measures to protect the general public.

The *préfet* intervenes during the various procedures presented in chapter 3.

He in particular issues his opinion on authorisation applications and, at the request of ASN, calls on the Departmental Council for the Environment and Health and Technological Risks, to obtain its opinion on water intake, effluent discharges and other detrimental effects of BNIs.

2|3 ASN

The TSN Act created an independent administrative nuclear safety authority (ASN) to monitor and regulate nuclear safety and radiation protection. ASN's remit comprises regulation, authorisation and monitoring as well as providing support to the public authorities for management of emergencies and contributing to informing the general public.



The ASN executive committee on 1st January 2012: (from left to right)
A. Delmestre, J-L. Lachaume, J-C. Niel, S. Mourlon, H. Legrand and P. Lignères

ASN is made up of a commission and of various departments.

From a technical point of view, ASN relies on the expertise with which it is provided, notably by the IRSN and by Advisory Committees of Experts (GPEs).

2|3|1 Role and duties

Regulation

ASN is consulted on draft decrees and ministerial orders of a regulatory nature and dealing with nuclear safety.

It can take regulatory decisions of a technical nature to complete the implementing procedures for decrees and orders adopted in the nuclear safety or radiation protection field, except for those relating to occupational medicine. These decisions are subject to approval by the ministers responsible for nuclear safety and for radiation protection.

Approval orders and approved decisions are published in the Official Gazette *(Journal officiel)*.

Authorisation

ASN reviews BNI authorisation or decommissioning applications, issues opinions and makes proposals to the Government concerning the decrees to be issued in these fields. It defines the requirements applicable to these installations with regard to the prevention of risks, pollution and detrimental effects. It authorises commissioning of these installations and pronounces delicensing following completion of decommissioning.

Some of these ASN decisions require approval by the ministers responsible for nuclear safety.

ASN also issues the licenses provided for in the Public Health Code (CSP) concerning small-scale nuclear activities and issues authorisations or approvals for radioactive material transport operations.

3. In a *département*, representative of the State appointed by the President
4. Administrative region headed by a *Préfet*

ASN's decisions and opinions are published in its *Official Bulletin* on its website (*www.asn.fr*).

Controls

ASN checks compliance with the general rules and specific requirements concerning nuclear safety and radiation protection applicable to BNIs, the design, manufacturing and use of pressure equipment designed specifically for these installations, the transport of radioactive substances and the activities mentioned in Article L. 1333-1 of the Public Health Code (CSP) and the persons mentioned in Article L. 1333-10 of the same code.

ASN organises a permanent radiation protection watch throughout the national territory.

From among its own staff, it appoints nuclear safety inspectors, radiation protection inspectors and officers in charge of verifying compliance with pressure equipment requirements. It issues the required approvals to the organisations participating in the verifications and nuclear safety or radiation protection watch.

Chapter 4 of this report presents ASN actions in this field.

Emergency situations

ASN takes part in managing radiological emergency situations. It provides technical assistance to the competent authorities for drafting of emergency response plans, taking account of the risks resulting from nuclear activities.

When an emergency situation of this nature occurs, ASN verifies the steps taken by the licensee to make the facility safe. It assists the Government with all matters within its field of competence and submits its recommendations on the medical or health measures or civil security steps to be taken. It informs the general public of the situation, of any releases into the environment and their consequences. It acts as the competent authority within the framework of international conventions, by notifying international organisations and foreign countries of the accident.

Chapter 5 of this report presents ASN actions in this field.

Investigation in the event of an accident

In the event of an incident or accident involving a nuclear activity, ASN may conduct a technical inquiry along similar lines to those applicable to "accident and investigation" boards called on to deal with transport accidents.

Information

ASN participates in informing the public in its areas of competence and in the nuclear safety and radiation protection level of activities and facilities under its monitoring and supervision. Chapter 6 of this report presents ASN actions in this field.

Research monitoring

The quality of ASN's decisions relies primarily on robust technical expertise which, in turn, requires the best and most up-to-date knowledge.

Consequently, ASN attaches great importance to the availability of the knowledge required to underpin the expertise it may need to call upon in the medium and long term. It is therefore important for the authority to identify the areas of research leading to acquisition of such knowledge, working with those involved in nuclear safety and radiation protection research and with its counterpart organisations in other countries.



The scientific committee at a meeting on 28th November 2011. (From left to right) Michel Spiro, Bernard Boullis, Vincent Favaudon, Jean-Claude Lehmann, Ashok Thadani and Victor Teschendorff

In 2010, ASN set up a Scientific Committee to examine its proposed orientations concerning the research work to be conducted or taken further in the fields of nuclear safety and radiation protection. The Scientific Committee comprises six members appointed for their expertise in the research field. Under the Chairmanship of Ashok Thadani, former research director of the United States Nuclear Regulatory Commission (NRC), the Scientific Committee met twice in 2011. It examined the following subjects:
– organisational and human factors
– radiobiology;
– the ageing of PWR metal components;
– nuclear fuel research facilities;
– non-destructive examinations.

The Fukushima nuclear accident also highlighted the need for more research in the field of nuclear safety. In 2011, ASN took part in the steering committee for the call for proposals issued by the French national research agency (ANR) for the nuclear safety part of the "investing in the future" programme.

2|3|2 Organisation

ASN is run by a Commission and comprises central services and regional divisions.

ASN Commission

The Commission comprises five Commissioners holding the post on a full-time basis. These are permanent appointments with a 6-year non-renewable mandate.

The Commission defines ASN strategy. More specifically, it is involved in developing overall policy, i.e. the doctrines and principles that underpin ASN's main missions of regulation, inspection, transparency, management of emergency situations and

international relations. The Commission also develops the Multi-Year Strategic Plan (PSP).

Pursuant to the TSN Act, the Commission submits ASN's opinions to the Government and takes the main ASN decisions. It decides on the public position to be adopted on the main issues within ASN's sphere of competence. The Commission adopts the ASN internal regulations which lay down its organisation and working rules, as well as its ethical guidelines. The Commission's decisions and opinions are published in ASN's Official Bulletin.

In 2011, the ASN Commission met 85 times. It issued 34 opinions and took 50 decisions.

ASN Central Services

The ASN central services comprise an Executive Committee, an Office of Administration, a Management and Expertise Office and eight departments covering specific themes.

Under the authority of the ASN Director-General, the Executive Committee organises and manages the departments on a day to day basis. It ensures that the orientations determined by the Commission are followed and that ASN's actions are effective. It oversees and coordinates the various entities.

The role of the departments is the national management of the activities for which they are responsible. They take part in drafting the general regulations and coordinate the actions of the ASN divisions.

– The Nuclear Power Plant Department (DCN) is responsible for regulating and inspecting the safety of the NPPs in operation, as well as the safety of future power generating reactor projects. It contributes to development of regulation/inspection strategies and ASN actions on subjects such as the safety consequences of deregulation of the electricity market, facility ageing, the extension of reactor service life, evaluation of NPP safety performance, and harmonisation of nuclear safety in Europe.

  The DCN comprises five branches: "Reassessment – Equipment – Hazard", "Operation", "Core – Studies", "Radiation Protection – Environment and labour Inspections" and "Regulations and New Installations".

– The Nuclear Pressure Equipment Department (DEP) is responsible for monitoring of safety of pressure equipment installed in BNIs. It is primarily tasked with developing regulations on the design, manufacture and operation of nuclear pressure equipment and for monitoring application of these regulations by manufacturers and their sub-contractors, and by nuclear operators. The DEP also considers applications from approved organisations wishing to carry out regulation inspections on nuclear pressure equipment.

  The DEP comprises three Branches: "Design – "Manufacturing", "In-service Monitoring" and "Relations with Divisions – Operations".

– The Transport and Radiation Sources Department (DTS) is responsible for monitoring of activities relating to sources of ionising radiation in the non-medical sectors and for transport of radioactive materials. It contributes to the development of technical regulations, to monitoring of their application and to management of authorisation procedures (installations and equipment emitting ionising radiation in non-medical sectors, suppliers of medical and non-medical sources, accreditation of packaging and of relevant organisations). It is preparing to take charge of regulating radioactive source security.

  The DTS comprises three Branches: "Transport Management", "Radiation Protection and Sources", and "Source Security".

– The Waste, Research Facilities and Fuel Cycle Department (DRC) is responsible for monitoring nuclear fuel cycle facilities, research facilities, nuclear installations being decommissioned, contaminated sites and radioactive waste management. It takes part in monitoring and inspecting the Bure underground research laboratory and the research facilities covered by international conventions, such as CERN or ITER.

  The DRC comprises three Branches: "Waste and Contaminated Sites", "Fuel Cycle" and "Research and Decommissioning Facilities".

– The Ionising Radiation and Health Department (DIS) is responsible for regulating the use of ionising radiation in the health sector. Working with IRSN and relevant health agencies, the prime responsibility of the DIS is to organise a scientific, health and medical watch on the effects of ionising radiation on health, to contribute to drafting of regulations in the fields of radiation protection and medical uses of ionising radiation, and to contribute to management of the health aspects of radiological incidents and accidents.

  The DIS comprises two Branches: "Exposure in the Medical Sector" and "Exposure of Workers and the Public".

– The Environment and Emergency Department (DEU) is responsible for monitoring of environmental protection and management of emergency situations. It establishes the policy on nationwide radiological monitoring and on provision of information to the public as well as helping to ensure that discharges from BNIs are as low as reasonably achievable, in particular by establishing general regulations. The DEU also contributes to defining the organisational framework of public authorities and nuclear operators where management of emergency situations is concerned and establishes ASN regulatory policy.

  The DEU comprises three Branches: "Safety and Preparedness for Emergencies", "Environment and Prevention of Nuisances" and "Development of Regulations".

– The International Relations Department (DRI) is in charge of ASN's bilateral and multilateral international relations. It develops exchanges with ASN's counterpart organisations in other countries to provide information about and explain French practices and to provide the countries concerned with useful information on the safety of French nuclear installations close to their borders. The DRI coordinates ASN representation within international bodies such as the European Union, the IAEA or the Nuclear Energy Agency (NEA).

– The Communication and Public Information Department (DCI) develops and implements ASN's policy on communication and information regarding nuclear safety and radiation protection. It coordinates communication and information actions targeting different audiences, with a focus on handling requests for documentation, making ASN's position known and explaining regulations.

  The DCI comprises two Branches: "Public Information" and "Publications and Multimedia".

– The Office of Administration (SG) helps to provide ASN with the adequate, appropriate and long-term resources the Authority requires to operate. It is responsible for management of human resources, including with regard to skills, and ensures that social dialogue is developed. It is also responsible for ASN real estate policy and its logistical and material resources. It is in charge of ASN budget policy and ensures optimised use of its financial resources. Finally, it provides legal expertise for ASN as a whole.

  The SG comprises four Branches: "Human Resources", "Budget – Finance", "Logistics – Real Estate", and "Legal Affairs".

– The Management and Expertise Office (MEA) provides ASN with IT resources and a high level of expertise. It ensures that ASN's actions are coherent, by means of a quality approach and by overseeing coordination of the workforce.

  The MEA comprises two Branches: "IT and Telephones" and "Expertise and Research".

ASN divisions

The eleven ASN regional divisions carry out their activities under the authority of regional representatives. It is the directors of the Regional Departments for Environment, Development and Housing (DREAL) for the areas in which the divisions are located who, acting as delegates, assume this responsibility. The directors are seconded to ASN in respect of these duties and are not under the authority of the *préfets* where their nuclear safety and radiation protection duties are concerned. Delegation of the power of signature by the Director-General gives them the authority to take decisions at a local level.

The divisions carry out most of the direct inspections on the BNIs, on radioactive material transport operations and on small-scale nuclear activities, and review most of the authorisation applications filed with ASN by the nuclear activity licensees within their regions.

In emergency situations, the divisions assist the *préfet* of the *département*, who is in charge of protecting the general public, and supervise the operations carried out to safeguard the facility on the site. To ensure preparedness for these situations, they take part in drawing up the emergency plans drafted by the *préfets* and in periodic emergency exercises.

The divisions contribute to ASN's public information duty. They for example take part in the meetings of the local information committees (CLIs) and maintain regular relations with the local media, elected officials, associations, licensees and local administrations.

ASN's divisions are presented in chapter 8 of this report.

2|3|3 Operation

Human resources

The total ASN workforce on 31st December 2011 stood at 456, with 244 people working in the central services and 212 in the regional divisions.

This workforce can be further broken down as follows:
– 373 tenured or contract staff;
– 83 staff seconded from public establishments (Assistance publique - Hôpitaux de Paris, CEA, IRSN, ANDRA, SDIS).

In order to launch the process of experience feedback from the Fukushima accident, the ASN workforce will be boosted by 22 staff seconded from IRSN.

On 31st December 2011, the average age of the ASN staff was 44.

A balanced age pyramid and a policy of diversity in recruitment (and thus of experience), gives ASN the qualified and complementary human resources it needs to meet its responsibilities. In addition, training and integration of the youngest staff members and transmission of know-how guarantee the required level of expertise.

So that its staff are at all times competent, ASN must be able to offer them a varied career path, related to their needs, in particular acknowledging their experience.

Skills management

Competence is one of the four key values of ASN. The tutor system, initial and continuous training, whether general, linked to nuclear techniques, the field of communication, or legal matters, as well as day-to-day practices, are essential aspects of the professionalism of ASN staff.

Management of the skills of ASN personnel is based primarily on training tailored for each staff member from a detailed and regularly updated core training corpus. This involves technical training, but also training in legal aspects and communication. In 2011, nearly 4,100 days of training were provided to ASN staff through 245 sessions forming part of 153 different courses. The financial cost of the courses, provided by organisations other than ASN, amounted to €520,000.

Since 1997, ASN has followed a programme of qualification of its inspectors, based on recognition of their technical competence. An Accreditation Committee was set up in 1997 to advise the Director-General on the entire qualification system. In particular, the Committee reviews the applicable training curriculum and the qualification reference systems and conducts interviews with inspectors as part of a confirmation process.

Chaired by Mr Philippe Saint Raymond, the Accreditation Committee comprises senior ASN inspectors and persons qualified in inspection, human resources, appraisal and teaching in the field of nuclear safety and inspection of classified installations. Its competence was confirmed in 2009 for the radiation protection field.

The Accreditation Committee met three times in 2011 and proposed the confirmation of 9 inspectors. As at 31st December

2011, 54 ASN nuclear safety or radiation protection inspectors are senior inspectors, or about 16% of the total number of ASN inspectors.

Financial resources

Since 2000, all the personnel and operating resources involved in the performance of the responsibilities entrusted to ASN have been covered by the State's general budget.

The ASN's budget amounted to €68 million in 2011. It comprises €39 million in ASN payroll credits and €29 million in operating credits for the ASN central services and the eleven regional divisions.

€76.5 million in credits were also devoted to the technical appraisal work performed by IRSN on behalf of ASN. It must be remembered that, as stipulated in the TSN Act, ASN relies on IRSN expertise. The credits financing IRSN actions on behalf of ASN come from a State subsidy, topped up since 2011 by an annual contribution from the BNI licensees. ASN is consulted by the Government concerning the corresponding part of the State subsidy to IRSN and the amount of the annual contribution owed by the BNI licensees.

In total, the State's 2011 budget for transparency and the regulation of nuclear safety and radiation protection in France, amounted to €148 million: €68 million for the ASN budget, €76.5 million for IRSN technical support to ASN, €3.5 million for other IRSN missions and €0.15 million for the working of the HCTISN.

As shown in the following table, these credits are split between five programmes (181, 217, 333, 218 and 190) to which must be added the annual contribution to the IRSN. This complex budget structure obscures the overall picture of the cost of regulation and inspection, as well as leading to difficulties in preparing, arbitrating and implementing budgets.

In order to initiate the process of experience feedback from the Fukushima accident, the 2012 budget for transparency and the regulation of nuclear safety and radiation protection is increased by €22.5 million: €7.5 million for the ASN credits, €7.5 million for IRSN technical support to ASN and €7.5 million for other IRSN missions.

ASN management tools

The strategy-based approache

The Multi-year Strategic Plan (PSP), prepared by the ASN Commission, outlines ASN's strategy for a three year period. It is presented annually in an operational orientation document that sets the year's priorities for ASN and also contains annual action plans, followed up periodically, for each of the component entities.

This three-level plan is an essential element of ASN's development, organisation and management.

Quality management system

To guarantee and improve the quality and effectiveness of its actions, ASN defines and implements a quality management system inspired by the ISO and IAEA international standards. This system is based on:
– an organisation manual containing organisation notes and procedures, defining the rules to be applied for each task;
– internal and external audits to check rigorous application of the system's requirements;
– listening to the stakeholders;
– performance indicators for monitoring the effectiveness of action taken;
– a periodic review of the system, to foster continuous improvement.

In 2006, in line with its continuous progress approach, ASN received an Integrated Regulatory Review Service (IRRS) peer review mission, to ensure that its organisation and practices comply with international IAEA standards. This "full scope" mission addressed all of the fields covered by the IRRS nuclear safety and radiation protection missions.

An IRRS follow up mission was organised in 2009. The participating international experts considered that ASN had responded satisfactorily to 90% of the recommendations and suggestions made in 2006. In a number of areas such as inspection, preparedness for emergencies, public information or ASN's international role, they were once again of the opinion that ASN's actions ranked amongst the some areas for improvement, notably in terms of skills management.

ASN took advantage of the conclusions of this mission to reinforce the conformity of its practices and its organisation with the best international standards. The next IRRS mission will be received in 2014.

The reports can be viewed on the ASN website.

Internal communication

Internal communication is a feature of ASN's multi-year strategy, one key aspect of which, for the period 2010-2012, is the development and full use of skills. It also supports the implementation of ASN's annual priorities laid out in the operational orientation document.

In 2011, ASN thus gave pride of place to ASN staff in the various media at their disposal, whether the intranet, the in-house magazine *Transparence*, which is also sent out to certain outside audiences, or the ASN activity report. One area for work was to develop exchanges with the agents through interviews in order to discuss their careers and the ongoing projects, to involve them to a greater extent in the preparation of media or the running of the intranet and to adopt a more direct and lively tone, in particular through the development of the in-house "web TV".

Internal communication also accompanied the year's major projects, including experience feedback from the Fukushima accident and the complementary safety assessments, the CODIRPA post-accident situation seminar, dose optimisation in medical imaging or, in the field of human resources, elections to the professional representative bodies, monitoring of the work of the ASN human resources committee, and the relocation of the regional divisions.

The in-house communication media are presented in chapter 6.

Table 2: credits allocated to transparency and the regulation of nuclear safety and radiation protection in France, in 2011 and 2012:

Mission	Programme manager	Programme	Action	Nature	2011 Budget Act (M€)	2012 Budget Act (M€)
Ministerial mission Ecology, sustainable development and spatial planning	**Laurent Michel** Director General for the prevention of risks at the ministry for ecology, sustainable development, transport and housing	**181 :** Risk Prevention	**Action 9** Regulation of nuclear safety and radiation protection	Staff costs (including seconded staff)	38.80	39.60
				Operating and intervention spending	13.10	18.50
				TOTAL	**51.90**	**58.10**
			Action 1 prevention of technological risks and pollution	Operation of the High Committee for Transparency and Information on Nuclear Security (HCTISN)	0.15	0.15
	Jean-François Monteils General Secretary of the ministry for ecology, sustainable development, transport and housing	**217:** Implementation and oversight of policy for ecology, energy, sustainable development and the sea	-	Operation of ASN's 11 regional divisions	9.77 (1)	10.08 (1)
Ministerial mission Oversight of government actions	**Serge Lasvignes** General Secretary of the Government	**333 :** Resources shared by decentralised administrations	-			1.15
Interministerial mission Management of public finances and human resources	**Dominique Lamiot** General Secretary of the ministries for economics and finance	**218 :** Implementation and oversight of economic and financial policies	-	Operation of the ASN central services (Paris and Fontenay-aux-Roses)	6.27 (2)	6.27 (2)
				SUB-TOTAL	**68.09**	**75.75**
Interministerial mission Research and higher education	**Régine Bréhier** Director of research and innovation at the ministry for ecology, sustainable development, transport and housing	**190 :** research in the fields of energy and sustainable development and spatial planning	**Sub-action 11-2 (area 3):** The French Institute for Radiation Protection and Nuclear Safety (IRSN)	IRSN technical support activities for ASN	46.40	46.40
2010 annual contribution on behalf of IRSN instituted by article 96 of budget amendment Act 2010-1658 of 29th December 2010					33.38 (3)	48.38 (3)
				SUB-TOTAL	**79.78**	**94.78**
				TOTAL	**147.87**	**170.53**

(1) Source: 2011 Budget Bill and 2012 Budget Bill (PAP of programme 181).
(2) Source: 2006 Budget Bill (after deduction of transfer made under 2008 Budget Bill).
(3) The share of the contribution actually allocated to ASN technical support was €30 million in 2011 and will be €37.6 million in 2012.

2|4 Consultative bodies

2|4|1 High Committee for Transparency and Information on Nuclear Security

The TSN Act created a High Committee for Transparency and Information on Nuclear Security (HCTISN), an information, discussion and debating body dealing with the risks inherent in nuclear activities and the impact of these activities on human health, the environment and nuclear safety.

The High Committee can issue an opinion on any question in these fields, as well as on controls and the relevant information. It can also deal with any issue concerning the accessibility of nuclear safety information and propose any measures such as to guarantee or improve nuclear transparency. It can be called on by the Government, Parliament, the local information committees or the licensees of nuclear facilities, with regard to all questions relating to information about nuclear safety and its regulation and monitoring.

The HCTISN's activities in 2011 are described in chapter 6.

2|4|2 The High Council for Public Health

The High Council for Public Health (HCSP), created by Act 2004-806 of 9th August 2004 concerning public health policy,

is a scientific and technical consultative body reporting to the minister responsible for health.

The HCSP contributes to defining the multi-year public health objectives, reviews the attainment of national public health objectives and contributes to the annual monitoring process. Together with the health agencies, it provides the public authorities with the expertise necessary for managing health risks and for defining and evaluating prevention and health safety policies and strategies. It also anticipates future developments and provides advice on public health issues.

2|4|3 The High Council for Prevention of Technological Risks

As part of the process to overhaul the technological risks consultation process, the Government issued a decree on 27th July 2010, abolishing the BNI Consultative Committee (CCINB) which had been created by decree on 2nd November 2007 and which was consulted on texts relating to the regulation of basic nuclear installations and the more important individual decisions regarding these facilities.

Henceforth, consultation will take place before the High Council for Prevention of Technological Risks (CSPRT), created by Order 2010-418 of 27th April 2010. Alongside representatives of the State, the Council will be made up of licensees, qualified personalities and representatives of environmental associations. The CSPRT, which takes over from the high council for classified facilities, will see the scope of its remit extended to pipelines transporting gas, hydrocarbons and chemicals, as well as covering BNIs.

The CSRPT must be called on by the Government for an opinion on ministerial BNI orders. It can also be called on by ASN for individual BNI-related decisions.

Where individual decisions regarding BNIs are concerned, ASN wished to preserve the process of collaboration which existed with the CCINB. To this end, on 13th April 2010, the ASN Commission adopted Decision 2010-DC-0179 instituting a procedure for hearing of BNI operators and CLIs who wish to participate, before the adoption of certain opinions or decisions relating to BNIs. In 2011, EDF and the local information committee thus applied for a hearing before the ASN Commission regarding the decommissioning of Brennilis.

At the current stage, ASN has decided to introduce hearings by its Commission in all cases where hearings before the CCINB were previously possible, and under similar arrangements. However, this decision includes the possibility of extending the hearing procedure to other ASN decisions or opinions, particularly in the light of appraisal of this initial implementation.

2|4|4 The Central Committee for Pressure Equipment

The Central Committee for Pressure Equipment (CCAP), created by Article 26 of decree 99-1046 of 13th December 1999 concerning pressure equipment, is a consultative organisation reporting to the minister responsible for industry.

It comprises members of the various administrations concerned, persons chosen for their particular competence and representatives of the manufacturers and users of pressure equipment and of the technical and professional organisations concerned. It is chaired by Mr Pierre Palat, who is also Vice-Chair of the Advisory Committee for Nuclear Pressure Equipment (GP ESPN), (see point 2|5|2).

It must be referred to by the Government and by ASN for all questions affecting the legislative and regulatory aspects of nuclear pressure equipment (both ministerial orders and individual decisions concerning BNIs). Accident reports are also forwarded to it.

2|5 Technical support organisations

ASN benefits from the expertise of technical support organisations when preparing its decisions. The French Institute for Radiation Protection and Nuclear Safety (IRSN, www.irsn.fr) is the main such organisation. ASN has been making efforts to diversify its experts for several years.

2|5|1 IRSN

IRSN, created by Act 2001-398 of 9th May 2001 and by decree 2002-254 of 22nd February 2002, was set up as an independent public industrial and commercial establishment, as part of the national reorganisation of nuclear safety and radiation protection regulation, in order to bring together public expertise and research resources in these fields. IRSN reports to the ministers for the environment, health, research, industry and defence.

The Institute conducts and implements research programmes in order to build its public expertise capacity on the very latest national and international scientific knowledge in the fields of nuclear and radiological risks. It is tasked with providing technical support for the public authorities with competence for safety, radiation protection and security, in both the civil and defence sectors.

IRSN also has certain public service responsibilities, in particular monitoring of the environment and of populations exposed to ionising radiation.

IRSN manages national databases (national nuclear material accounting, national inventory of radioactive sources, file for monitoring worker exposure to ionising radiation, etc.), and contributes to information of the public concerning the risks linked to ionising radiation.

IRSN workforce

As at 31st December 2011, the IRSN's overall workforce stood at 1,700, about 400 of whom are devoted to ASN technical support.

In order to initiate experience feedback from the Fukushima accident, the IRSN workforce was boosted by an extra 44 staff, 22 of whom are seconded to ASN.

IRSN budget

In 2011, IRSN's total budget amounted to €315 million, of which €76.5 million were devoted to providing ASN with technical support.

IRSN credits for ASN technical support are covered in part (€46.5 million) by a subsidy from the State's general budget allocated to IRSN and included in action 11 "Research in the field of risks" of programme 190 "Research in the fields of energy and sustainable development and spatial planning", of the interministerial "Research and higher education" mission. The rest (€30 million) is covered by a contribution from the nuclear licensees. This contribution was put into place by the budget amendment act of 29th December 2010.

An agreement was signed by ASN and IRSN to define the principles governing the technical support provided to ASN by the Institute. This agreement is clarified on a yearly basis by a protocol identifying the actions to be performed by IRSN to support ASN.

In order to initiate the process of experience feedback from the Fukushima accident, the 2012 amount of the contribution has been increased by €15 million: €7.5 million for IRSN technical support to ASN and €7.5 million for other IRSN missions.

2|5|2 Advisory Committees of experts

In preparing its decisions, ASN calls on the opinions and recommendations of seven Advisory Committees of Experts (GPE), with expert knowledge in the areas of waste, nuclear pressure equipment, medical exposure, non-medical radiation protection, reactors, transport, and laboratories and plants.

ASN consults the GPEs in preparing its main decisions. In particular, they review the preliminary, provisional and final safety analysis reports for each of the BNIs. They can also be consulted about changes in regulations or doctrine.

For each of the subjects covered, the GPEs examine the reports produced by IRSN, by a special working group or by one of the ASN departments. They issue an opinion backed up by recommendations.

The GPEs comprise experts nominated for their individual competence. They come from various backgrounds; universities, associations, appraisal and research organisations. They can also be licensees of nuclear facilities or come from other sectors (industrial, medical, etc.). Participation by foreign experts can help diversify the approach to problems and take advantage of experience acquired internationally.

In line with its policy of transparency in the area of nuclear safety and radiation protection, ASN has been making its position statements and documents concerning GPE meetings available to the public since 2009.

In 2011, the ASN budget allocated to the GPEs was around €250,000.

The Advisory Committee for waste (GPD)

The Advisory Committee for waste is chaired by Mr Pierre Bérest. It comprises experts appointed for their competence in the nuclear, geological and mining fields.

It held three meetings and visited two facilities in 2011.

The Advisory Committee for nuclear pressure equipment (GPESPN)

Since 2009, the GPESPN has replaced the Standing Nuclear Section (SPN) of the CCAP. The GPESPN is chaired by Mr Philippe Merle and comprises experts appointed for their competence in the field of pressure equipment.

It held four meetings in 2011.

The Advisory Committee for medical exposure (GPMED)

Chaired by Mr Yves Coquin, the GPMED comprises experts appointed for their competence in the field of radiation protection of health professionals, the general public and patients and for medical applications of ionising radiation.

It held two meetings in 2011.

The Advisory Committee for radiation protection (non-medical) (GPRAD)

Chaired by Mr Jean-Paul Samain, the GPRAD comprises experts appointed for their competence in the field of radiation protection of workers (other than health professionals) and radiation protection of the general public, for industrial and research applications of ionising radiation, as well as for natural ionising radiation.

It held three meetings in 2011.

A "Zoning" working group was also set up within the GPMED and the GPRAD. This working group is tasked with proposing recommendations on the delineation of and access to regulated zones defined pursuant to the labour code.

In 2011, this group met seven times and visited four nuclear and medical facilities. One highlight of the Zoning working group investigative programme was a national symposium organised on radiological zoning at the University of Caen, with the aim of collating experience feedback from stakeholders in the field and ultimately to contribute to the work done by the GPMED and GPRAD.

The Advisory Committee for reactors (GPR)

The Advisory Committee for reactors is chaired by Mr Pierre Govaerts and comprises experts appointed for their competence in the field of reactors.

It held eighteen meetings and visited three facilities in 2011.

The Advisory Committee for transport (GPT)

Chaired by Mr Jacques Aguilar, the GPT comprises experts appointed for their competence in the area of transport.

It held two meetings in 2011.

The Advisory Committee for laboratories and plants (GPU)

The Advisory Committee for laboratories and plants is chaired by Mr Philippe Saint Raymond. It comprises experts appointed for their competence in the field of laboratories and plants in which radioactive materials are used.

It held eight meetings and visited three facilities in 2011.

2|5|3 The ASN's other technical support organisations

To diversify its expertise and to benefit from other specific skills, ASN also has its own budget allowance, amounting to €0.65 million in 2011.

A significant part of this budget is allocated to subjects concerning exposure of the general public to radon in the home, as well as to the work of the Steering Committee for managing the post-nuclear accident phase (CODIRPA).

In 2011, ASN continued or initiated collaboration with:
– the Building Industry Scientific and Technical Centre (CSTB): help with radon standardisation, preparation of efficiency indicators for remediation technologies, assistance to those working in the field;
– French national institute for the study of industrial environments and risks (INERIS): Appraisal of the methodology developed by EDF to assess risks linked to emissions of chemical substances from nuclear power plants;
– the Bureau Veritas, jointly with the mechanical industries technical centre (CETIM): review of design and construction rules for mechanical equipment in nuclear power plants in order to check their ability to comply with certain essential safety requirements;
– the Nuclear Protection Evaluation Centre (CEPN): support for post-nuclear accident work, review of training programmes for radioprotection of patients;
– SYMLOG: methodological support for information and participation of the general public according to the terms of the Aarhus convention.

The ASN 2012 budget increase will enable the credits allocated by ASN to these diverse appraisals to be doubled and will allow complete analysis of the experience feedback from the Fukushima accident.

2|6 Other stakeholders

As part of its mission to protect the general population from the health risks of ionising radiation, the ASN cooperates closely with other competent institutional stakeholders addressing health issues.

2|6|1 French National Authority for Health

The French National Authority for Health (HAS), a body created by the French Government in 2004, is tasked primarily with maintaining an equitable health system and with improving patient care.

The Authority and its activities are presented on its website: *www.has-sante.fr.* An ASN-HAS convention was signed on 4th December 2008.

2|6|2 The French Health Product Safety Agency (AFSSAPS)

The main mission of the French Health Product Safety Agency (AFSSAPS), created in 1998, is to assess the risks and benefits associated with the use of health products.

The Agency and its activities are presented on its website: *www.afssaps.fr.* An ASN-AFSSAPS convention was signed on 15th July 2009.

2|6|3 The French Health Monitoring Institute (InVS)

The French Health Monitoring Institute (InVS), a public body created in 1998, is tasked primarily with monitoring and issuing of warnings in all areas of public health.

The Institute and its activities are presented on its website: *www.invs.sante.fr.* An ASN-InVS convention was signed on 7th September 2009.

2|6|4 French National Cancer Institute

The French National Cancer Institute (INCa), created in 2004, is primarily responsible for coordinating activities in the fight against cancer.

The Institute and its activities are presented on its website: *www.e-cancer.fr*

Table 3: advisory Committee meetings and visits in 2011

Committee	Main agenda	Date
GPR	Review of operating experience feedback from French and foreign PWRs for the period 2006 to 2008	13 January
GPR	Review of operating experience feedback from French and foreign PWRs for the period 2006 to 2008 (completion of review).	20 January
GPMED	Project to modify the annexes of the order concerning the diagnostic reference levels (DRL) in radiology and nuclear medicine	1 February
GPR	In-house meeting – Preparation for the quadripartite meeting	24 February
GPU	UP2-400 - La Hague (COGEMA) visit – review of decommissioning conditions for BNIs 33, 38 and 47	16 March
GPU	UP2-400 - La Hague (COGEMA) meeting – review of decommissioning conditions for BNIs 33, 38 and 47	23 March
GPR	Site visit to Flamanville 3	29 March
GPRAD	- Draft guide on exiting the emergency phase and initiating the post-nuclear accident phase - Revision of draft order of 30/12/2004	1 April
GPR	Flamanville 3 information meeting	7 April
GPMED	- Review of the draft referral concerning radiation protection during the use of injectable medical devices emitting ionising radiation. - Referral concerning the revision of the 30th December 2004 order concerning the individual medical monitoring card and individual dosimetry information for workers exposed to ionising radiation.	24 May
GPR	ATMEA 1™ reactor – safety options 1st session	26 May
GPRAD	- Draft guide on exiting the emergency phase and initiating the post-nuclear accident phase - Revision of draft order of 30/12/2004	7 June
GPR	EPR – I&C and in-house meeting	16 June
GPD	In-house meeting	21 June
GPR	Experience feedback on fuel for the period between 2003 and 2009	23 June
GPT	Conformity of the TN883 package model loaded with bituminised spent fuel, with the requirements applicable to type B packages loaded with fissile material	28 June
GPR	ATMEA 1™ reactor – safety options 2nd session	30 June
GPR GPU	Methodology of the complementary safety assessments for BNIs following the Fukushima accident	6 July
GPESPN	Operations to repair the vessel head intended for the Flamanville 3 EPR reactor	14 September
GPESPN	ATMEA 1™ – Review of design options for nuclear pressure equipment on the main primary system and the main secondary systems	14 September
GPU GPR GPD	Visit to the JET for ITER	19 September
GPR	Periodic safety review of the EOLE-MINERVE research reactors (BNI 42 and 95)	28 September
GPT	Conformity of TN843 package model	29 September
GPR	ATMEA 1™ reactor – safety options 3rd session	6 October
GPR	ATMEA 1™ reactor – safety options 4th session	14 October
GPR	ATMEA 1™ reactor – safety options 5th and last session	28 October
GPR GPU	Complementary safety assessments (CSAs) for BNIs following the Fukushima accident	8-10 November
GPESPN	Mechanical properties of materials of certain components intended for the Flamanville 3 EPR and the replacement steam generators	23 November
GPESPN	Use of steam generators manufactured in the 90s to replace the SGs at Paluel 2 in 2015	23 November
GPU GPR GPD	Review of the ITER BNI creation authorisation application file (1st session)	30 November
GPU GPR GPD	Visit to the ITER construction site at Cadarache	15 November
GPRAD	Draft order concerning the certification of outside contractors	1 December
GPU GPR GPD	Review of the ITER BNI creation authorisation application file (2nd session)	7 December
GPU	Safety and radiation protection management review of AREVA nuclear facilities	14 December

3 OUTLOOK

2011, ASN's fifth full year as an independent administrative authority, was marked by the nuclear accident at Fukushima.

Over and above the initial steps taken in 2011 (complementary safety assessments, targeted inspections, work on harmonisation of the international safety standards, etc.), detailed experience feedback from this accident must be analysed in detail. Detailed analysis of experience feedback from the Fukushima accident will take at least ten years.

To be able to carry out this feedback analysis, while continuing to perform its regular and demanding work on the regulation and monitoring of French civil nuclear facilities, ASN has requested additional resources. In its opinion 2011-AV-0135 of 9th November 2011, ASN duly noted the budgetary effort made by the Government at a time of economic crisis, but remains deeply concerned by the inadequacy of these measures in the light of the scale of the high-priority, long-term nuclear safety issues that France must address following the accident at the Fukushima nuclear power plant: this is for example the case of the addition of only 22 staff seconded from personnel recruited by IRSN.

ASN stresses that fact that these additional staff must be part of an increase in its permanent workforce rather than a temporary secondment. It points out that in the current context, only internal redeployments enable it to deal immediately with high-priority urgent matters, inevitably leading to slower handling of other matters that are less urgent in terms of safety.

Furthermore, in a context marked by the Fukushima accident, the State must give a clear and unambiguous presentation of the overall efforts being devoted to the public policy of nuclear safety and radiation protection regulation in France. The current structure of the budget devoted to this role fails to give Parliament and the general public a full and clear view of the credits allocated to it by the State. The complexity of the structure concerning ASN has been underlined on various occasions, for example by Parliament and the French Court of Audit *(Cour des comptes)*.

ASN considers that thought must continue to be given to simplifying the budget structure and, in the light of the current pressures on public spending, must include a search for sources of funding from outside the budget, such as that received by IRSN through budget amendment act 2010-1658 of 29th December 2010.

REGULATIONS

CHAPTER 3

1 THE GENERAL LEGAL FRAMEWORK APPLICABLE TO NUCLEAR ACTIVITIES 69

1|1 The regulatory basis of nuclear activities
1|1|1 Radiation protection international baseline requirements
1|1|2 The codes and the main Acts applicable to the regulation of nuclear activities in France

1|2 The regulations applicable to the various categories of individuals and the various situations involving exposure to ionising radiation
1|2|1 General protection of workers
1|2|2 General protection of the general public
1|2|3 Protection of persons in a radiological emergency situation
1|2|4 Protection of the general public in a long-term exposure situation

2 REGULATORY REQUIREMENTS APPLICABLE TO SMALL-SCALE NUCLEAR ACTIVITIES 77

2|1 The small-scale nuclear activities licensing and notification system
2|1|1 Licensing and declaration procedures for sources of ionising radiation
2|1|2 Approval of radiation protection technical supervision organisations
2|1|3 Licensing the suppliers of ionising radiation sources
2|1|4 Radioactive source management rules

2|2 Protection of persons exposed for medical and forensic purposes
2|2|1 Justification of practices
2|2|2 Optimisation of exposure
2|2|3 Forensic applications of ionising radiation

2|3 Protection of persons exposed to "enhanced" natural radiation
2|3|1 Protection of persons exposed to radon
2|3|2 Other sources of exposure to "enhanced" natural radiation

3 THE LEGAL SYSTEM APPLICABLE TO BASIC NUCLEAR INSTALLATIONS (BNIs) 83

3|1 The legal bases
3|1|1 International conventions and standards
3|1|2 European texts
3|1|3 National texts

3|2 General technical regulations
3|2|1 Ministerial and government orders
3|2|2 Overhaul of the general technical regulations
3|2|3 Basic safety rules and ASN guides
3|2|4 French nuclear industry professional codes and standards

3|3 Plant authorisation decrees and commissioning licences
3|3|1 Siting
3|3|2 Safety options
3|3|3 Public debate
3|3|4 Plant authorisation decrees
3|3|5 Commissioning licences

3|4 Particular requirements for the prevention of pollution and detrimental effects
3|4|1 The OSPAR convention
3|4|2 Discharges from basic nuclear installations
3|4|3 Prevention of accidental pollution
3|4|4 Protection against noise
3|4|5 Protection against the microbiological risk (legionella, amoebae)
3|5 Requirements concerning radioactive waste and decommissioning
3|5|1 Radioactive waste management in basic nuclear installations
3|5|2 Decommissioning
3|5|3 The financing of decommissioning and radioactive waste management
3|6 Particular requirements for pressure equipment

4 REGULATIONS GOVERNING THE TRANSPORT OF RADIOACTIVE MATERIALS 95
4|1 International regulations
4|2 National regulations

5 REQUIREMENTS APPLICABLE TO CERTAIN RISKS OR CERTAIN PARTICULAR ACTIVITIES 97
5|1 Installations classified on environmental protection grounds (ICPE) using radioactive materials
5|2 The regulations designed to combat malicious acts in nuclear activities
5|3 The particular system applicable to defence-related nuclear activities and installations

6 OUTLOOK 98

APPENDIX - REGULATION EXPOSURE LIMITS AND DOSE LEVELS 99

Nuclear activities are highly diverse, covering any activity relating to the preparation or utilisation of radioactive substances or ionising radiation. Nuclear activities are covered by a legal framework that aims to guarantee that, depending on the nature of the activity and the associated risks, it will not be likely to be detrimental to safety, public health or the protection of nature and the environment.

This legal framework is adapted to the type of nuclear activity. Consequently, medical or industrial activities that involve ionising radiation or radioactive sources are regulated by the French Public Health Code (CSP). Beyond a given threshold of radioactive substances contained or used in an installation, that installation falls within the system of basic nuclear installations (BNI).

The 13th June 2006 Act concerning transparency and security in the nuclear field (now codified in books I and V of the Environment Code by ordinance 2012-6 of 5th January 2012) extensively overhauled the BNI legal regime. It has in particular given this system an "integrated" nature, that is to say that it seeks to prevent the hazards and detrimental effects of any type that the BNIs could create: accidents - whether nuclear or not, pollution - whether radioactive or not, waste - whether radioactive or not, noise, etc.

1 THE GENERAL LEGAL FRAMEWORK APPLICABLE TO NUCLEAR ACTIVITIES

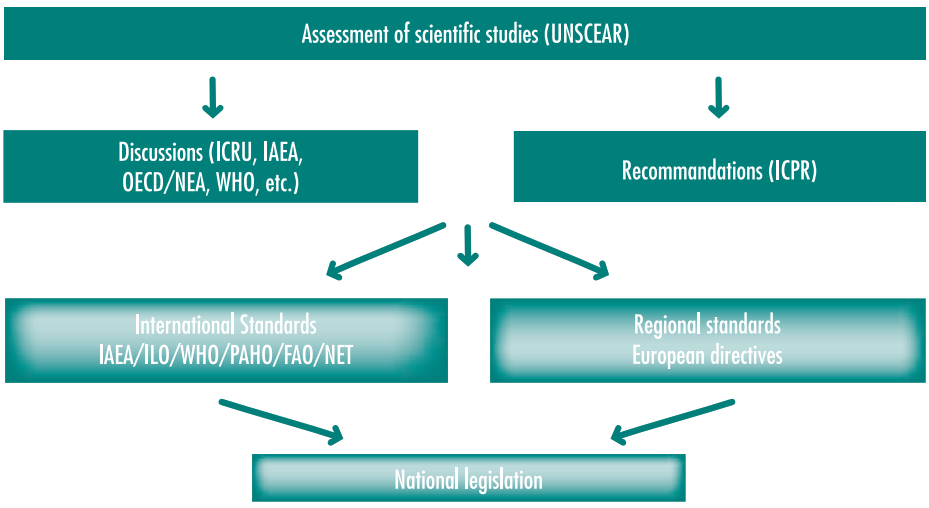
Nuclear activities are defined in article L. 1333-1 of the CSP (Public Health Code). As nuclear activities, they are subject to various specific requirements designed to protect individuals and the environment and applying either to all these activities, or only to certain categories. This set of regulations is described in this chapter.

1|1 The regulatory basis of nuclear activities

1|1|1 Radiation protection international baseline requirements

The specific legal requirements for radiation protection are based on various standards and recommendations issued internationally by various organisations. The following in particular can be mentioned:

– the International Commission on Radiation Protection (ICRP), a non-governmental organisation comprising international experts in various disciplines, which publishes recommendations concerning the protection of workers, the general public and patients against ionising radiation, based on an analysis of the available scientific and technical knowledge. The latest ICRP recommendations were published in 2007 in ICRP publication 103;
– the international atomic energy agency (IAEA) which regularly publishes and revises standards in the fields of nuclear safety and radiation protection. The basic requirements concerning protection against ionising radiation and the safety of radiation sources (basic safety standard no.115), based on the recommendations of ICRP 60, were published in 1996.



Drafting of radiation protection doctrine

A new standard on fundamental safety principles was published by the IAEA at the end of 2006 and, to take account of the new recommendations in ICRP 103, the basic safety standards (BSS) were updated in 2011 (Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards - Interim Edition);

– the International Standards Organisation (ISO) which publishes international technical standards which are a key part of the radiation protection system: they provide a bridge between the principles, concepts and units, and the body of regulatory texts for which they guarantee harmonised application.

At European level, the EURATOM treaty, in particular its Articles 30 to 33, defines the procedures for drafting EU provisions concerning protection against radiation and specifies the powers and obligations of the European Commission with respect to their enforcement. The corresponding EURATOM directives are binding on the various countries, such as directive 96/29/Euratom of 13th May 1996 laying down basic safety standards for the protection of the health of workers and the general public against the dangers arising from ionizing radiation; directive 97/43/Euratom of 30th June 1997 on health protection of individuals against the dangers of ionizing radiation in relation to medical exposure; and directive 2003/122/Euratom of 22nd December 2003 on the control of high-activity sealed radioactive sources and orphan sources.

In 2008, the European Commission initiated a process to merge and revise existing Euratom directives in order to incorporate the experience acquired by the Member States and the changes in international texts (ICRP, IAEA). A directive proposal, adopted in September 2011, is currently being reviewed at the European level, with publication scheduled for the end of 2012.

1|1|2 The codes and the main Acts applicable to the regulation of nuclear activities in France

The legal and regulatory requirements covering nuclear activities in France have been extensively revised in recent years. The legislative arsenal is now relatively complete and the publication of the implementing texts is well-advanced, even if not yet totally complete.

The Public Health Code (CSP) and the TSN Act (codified in books I and V of the Environment Code)

Chapter III ("ionising radiation") of part III of book III of the first part of the legislative part of the Public Health Code aims to cover all "nuclear activities", that is all activities involving a risk of human exposure to ionising radiation, emanating either from an artificial source, whether a substance or a device, or from a natural source when the natural radionuclides are or have been treated owing to their fissile or fertile radioactive properties. It also includes "interventions" aimed at preventing or mitigating a radiological risk following an accident, due to environmental contamination.



The European Parliament

Article L.1333-1 of the Public Health Code defines the general principles of radiation protection (justification, optimisation, limitation), established at international level (ICRP) and taken up in the requirements of the IAEA and directive 96/29/Euratom. These principles, described in chapter 2, constitute guidelines for the regulatory actions for which ASN is responsible.

The Public Health Code also institutes the radiation protection inspectorate, in charge of verifying compliance with its radiation protection requirements. This inspectorate, created and coordinated by ASN, is presented in chapter 4. The code also defines a system of administrative or criminal sanctions, described in the same chapter.

The Environment Code defines various notions

According to article L.591-1 of the Environment Code, nuclear security is a global concept encompassing "nuclear safety, radiation protection, the prevention and fight against malicious acts, and also civil security actions in the event of an accident". In some texts, however, the expression "nuclear security" remains limited to the prevention and mitigation of malicious acts.

Nuclear safety is "the set of technical provisions and organisational measures - related to the design, construction, operation, shut-down and decommissioning of basic nuclear installations (BNIs), as well as the transport of radioactive substances - which are adopted with a view to preventing accidents or limiting their effects".[1]

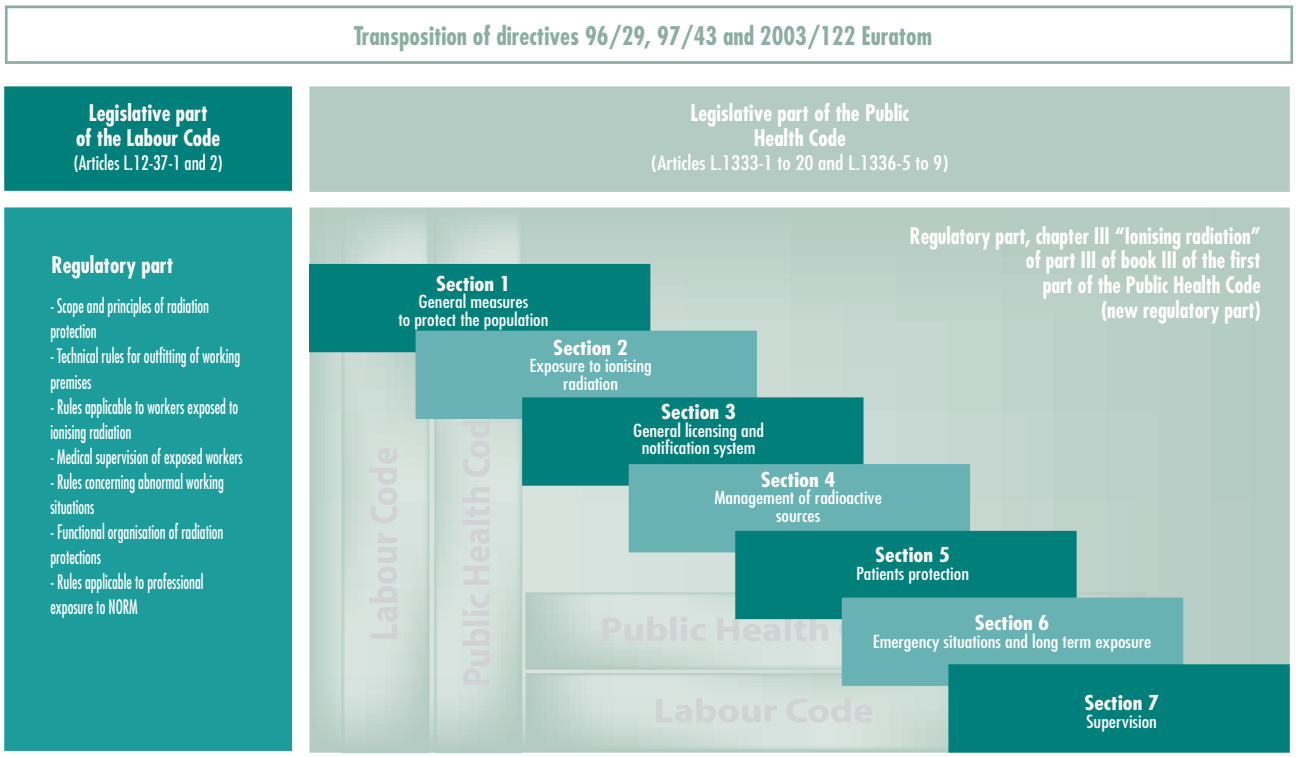
Radiation protection is defined as "the set of rules, procedures and prevention and surveillance means aimed at preventing or mitigating the direct or indirect harmful effects of ionising radiation on individuals, including in situations of environmental contamination".

Nuclear transparency is defined as "the set of provisions adopted to ensure the public's right to reliable and accessible information on nuclear security as defined in article L.591-1".

Article L. 591-2 of the Environment Code, stipulates the State's role in nuclear security: it "defines the nuclear security

1. Nuclear safety, as defined in the TSN Act, is thus a more limited concept than that of the objectives of the BNI regime as described in point 3 of this chapter.

Diagram 1: legislative and regulatory architecture of radiation protection



regulations and implements the checks necessary for their application". In accordance with Article L. 125-13 of the Environment Code, "the State is responsible for informing the public about the risks linked to nuclear activities defined in the first section of article L. 1333-1 of the Public Health Code and their impact on the health and safety of individuals and on the environment".

The general principles applicable to nuclear activities are mentioned in turn in Articles L. 591-3, L. 125-14 and L. 591-4 of the Environment Code (previously in article 2 of the TSN Act). These principles are presented in point 1 of chapter 2 of this report.

Chapter II of part IX of book V of the Environment Code (previously section II of the TSN Act) creates the ASN, defines its general duties and rights and specifies its composition and operation. Its missions are presented in points 2|3|1 et 2|3|2 of chapter 2.

The former part III of the TSN Act deals with public information about nuclear safety. This subject is detailed in chapter 6 of this report.

The TSN Act also contains measures specific to certain activities. They are presented in point 2|1|4 of this chapter.

Other codes or Acts containing requirements specific to nuclear activities

The Labour Code defines specific requirements for the protection of workers, whether or not salaried, exposed to ionising radiation. They are presented in point 1|2|1 of this chapter.

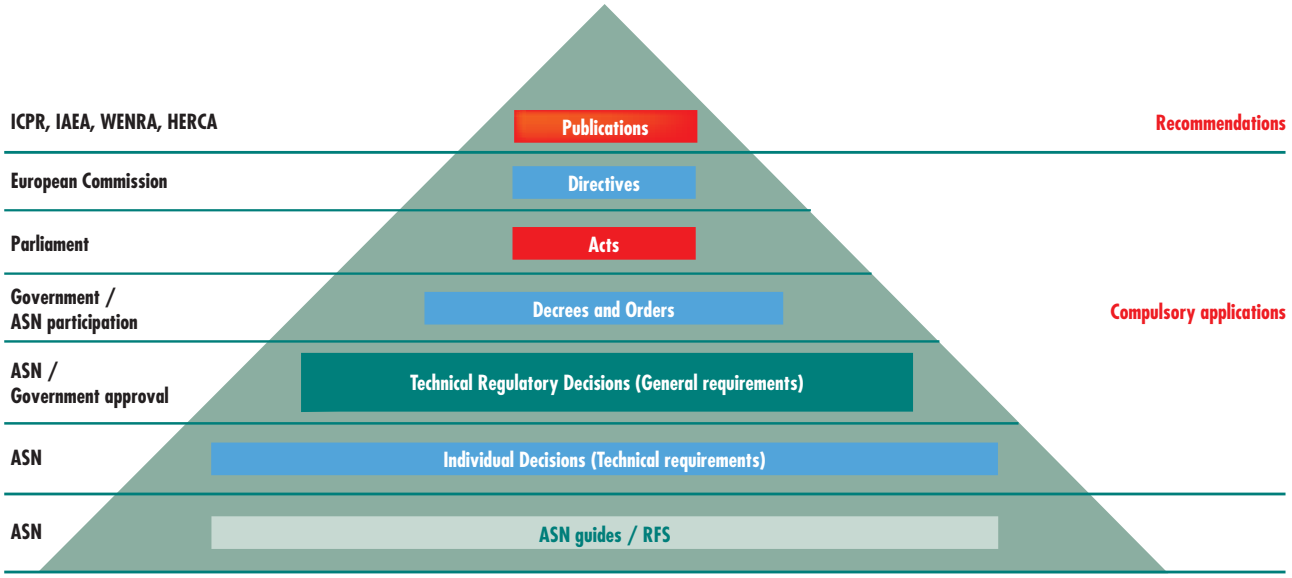
Programme Act 2006-739 of 28th June 2006 on the sustainable management of radioactive materials and waste, called the "Waste" Act, codified in books I and V of the Environment Code, sets the legal requirements for the management of radioactive materials and waste. It also requires that BNI licensees make provision for the cost of managing their waste and spent fuel, or the decommissioning of their installations Chapter 16 describes certain aspects of this Act in detail.

Finally, the Defence Code contains various measures concerning the fight against malicious acts in the nuclear field, or the regulation of defence-related nuclear activities and installations. They are presented further on in this chapter.

The other regulations concerning nuclear activities

Some nuclear activities are subject to a variety of rules with the same goal of protecting individuals and the environment as the above-mentioned regulations, but with a scope that is not limited to nuclear aspects alone. This for example includes European or Environment Code requirements concerning impact assessments, public information and consultation, the regulations governing the transport of hazardous materials or the regulations governing pressure equipment. The applicability of some of these rules to nuclear activities is mentioned during the course of this report.

Diagram 2: various levels of regulation in the field of small-scale nuclear activities in France (orientations, recommendations): legally binding or non-binding nature



1|2 The regulations applicable to the various categories of individuals and the various situations involving exposure to ionising radiation

The appendix to this chapter gives the various levels and exposure limits set by the regulations.

1|2|1 General protection of workers

The Labour Code contains a number of requirements specific to the protection of workers, whether or not salaried, exposed to ionising radiation. It transposes into French law two Euratom directives, namely 90/641/Euratom of 4 December 1990 on the operational protection of outside workers exposed to the risk of ionising radiation during their activities in controlled areas, and the above-mentioned directive 96/29/Euratom.

The Labour Code establishes a link with the three radiation protection principles contained in the Public Health Code. The regulatory articles of this code concerning radiation protection were reclassified by decree 2010-750 of 2nd July 2010 relative to the protection of workers against risks due to artificial optical radiation.

A General Directorate for Labour/ASN joint Circular no. 4 of 21st April 2010 indicates the conditions of application of the provisions of the Labour Code concerning the radiation protection of workers.

Articles R. 4451-1 to R. 4451-144 of the Labour Code create a single radiation protection system for all workers (whether or not salaried) liable to be exposed to ionising radiation during the course of their professional activities.

Of these requirements, the following should be mentioned:
– application of the optimisation principle to the equipment, processes and work organisation (Articles R. 4451-7 to 11), which leads to clarification of where responsibilities lie and how information is circulated between the head of the facility, the employer, in particular when he or she is not the head of the facility, and the person with competence for radiation protection;

TO BE NOTED

The Euratom directive setting the basic radiation protection standards

The new Euratom directive proposal, setting the basic radiation protection standards, currently being discussed at the European level, sets an effective dose limit of 20 mSv per year, in place of the value of 100 mSv for five consecutive years (provided that this effective dose does not exceed 50 mSv in any one year). The Labour Code anticipated this change as early as 2003 and, as it stands, it is already in compliance with this future European requirement.

Moreover, and in accordance with the latest recommendations from the International Commission on Radiological Protection (ICRP), dating from 21st April 2011, this new draft European text proposes a significant reduction in the equivalent dose limit for the lens of the eye, to 20 mSv over a one-year period. French regulations currently state an equivalent dose limit for workers of 150 mSv over 12 consecutive months for the lens of the eye.

– the annual dose limit (articles R. 4451-12 to 15) set at 20 mSv for 12 consecutive months, barring waivers resulting from exceptional exposure levels justified in advance, or emergency occupational exposure levels;
– the dose limits for pregnant women (article D. 4152-5) or more accurately for the unborn child (1mSv for the period from the declaration of pregnancy up until birth).

Zoning

Provisions concerning the boundaries of supervised areas, controlled areas and specially regulated areas (subject to special checks) were issued, regardless of the activity sector, by the order of 15th May 2006 (O.G. of 15th June 2006). This order also defines the health, safety and maintenance rules to be observed in these zones.

When defining the regulated zones, different levels of protection are taken into account: the effective dose for external exposure and, as applicable, internal exposure of the whole body; the equivalent doses for external exposure of the extremities and, as applicable, the dose rates for the whole body. A General Directorate for Labour/ASN joint circular of 18th January 2008 specifies the implementation procedures.



Check on zoning signage during an inspection of the nuclear medicine unit of the Oscar Lambret centre in Lille – November 2011

The person with competence for radiation protection (PCR)

The duties of the person with competence for radiation protection (PCR) were extended to delineating the areas in which radiation work is being carried out, to assessing the exposed workstations and to taking measures such as to reduce exposure (optimisation). For the performance of these duties, the PCR will have access to passive dosimetry and operational dosimetry data (article R. 4451-112 of the Labour Code).

The order of 26th October 2005 concerning training of the person with competence for radiation protection and certification of the instructor distinguishes between three different activity sectors:
– the "medical" sector, comprising nuclear and radiological activities intended for preventive and curative medicine - including forensic examinations - dentistry, medical biology and biomedical research, as well as veterinary medicine;
– the "Basic nuclear installation – BNI / Installation classified on environment protection grounds – ICPE" sector, comprising establishments containing one or more BNIs, as well as those comprising a facility requiring licensing as a classified installation, with the exception of medical sector nuclear activities as defined above;
– the "industry and research" sector, covering the nuclear activities defined in article R. 4451-1 of the Labour Code, with the exception of the activities in the "medical" and "BNI - ICPE" sectors defined above.

The instructor must be certified by an organisation accredited by the French accreditation committee (COFRAC).

ASN decision 2009-DC-0147 of 16th July 2009 defines the conditions to be met by a PCR who is not an employee of the company in which the nuclear activity is carried out. This option of calling on an outside PCR is limited to those nuclear activities that require notification to ASN. On the basis of the opinion issued by the Advisory Committee for radiation protection (GPRAD), an update of the order of 26th October 2005 is currently being examined, with publication scheduled in 2012.

UNDERSTAND

The role of the "Radiation Protection Expert"

On the basis of the work done by EUTERP (European Training and Education on Radiation Protection Platform), the proposed Euratom directive currently being examined at the European level, intends to change the concept of "qualified expert" stipulated by directive 96/29 (PCR in France), by introducing an advisory function for the RPE (radiation protection expert) and a more operational role for the RPO (radiation protection officer).

The RPE will be responsible for issuing an opinion to the head of the company or the employer on questions concerning exposure of the workers and the general public. This opinion will in particular concern new facilities, the delineation of regulated zones, worker classifications, the content of monitoring and inspection programmes, the optimisation and definition of appropriate dose constraints, training programmes for exposed workers, and so on.

Operational radiation protection tasks will be entrusted to the RPO: they include monitoring the effective implementation of the inspection programme, individual dosimetric surveillance and the creation of adequate source registers.

Dosimetry

The approval procedures for organisations tasked with worker dosimetry are defined by the order of 6th December 2003 as amended; the procedures for medical monitoring of workers and the transmission of individual dosimetry data are specified in the order of 30th December 2004 (the order of 30th December 2004 is currently being updated and should be completed in 2012). ASN is in charge of examining the approval applications submitted by the dosimetry organisations and laboratories.

Radiation protection checks

Technical controls on of sources and devices emitting ionising radiation, protection and alarm devices and measuring instruments, as well as ambient environment checks, can be entrusted to the French institute for radiation protection and nuclear safety (IRSN), to the department with competence for radiation protection or to organisations approved under application of Article R. 1333-97 of the Public Health Code. The nature and frequency of the radiation protection technical controls are defined by ASN decision no. 2010-DC-0175 of 4th February 2010.

These technical controls concern sources and devices emitting ionising radiation, the ambient environment, measuring instruments and protection and alarm devices, management of sources and of any waste and effluents produced. Some of these controls are carried out as part of the licensee's in-house inspection processes and some by outside organisations (the outside checks must be performed by IRSN or an organisation approved under article R. 1333-97 of the Public Health Code – see point 2|1|2).

Radon in the workplace

(see point 2|3|1).

1|2|2 General protection of the general public

Apart from the special radiation protection measures included in individual nuclear activity licences for the benefit of the general public and the workers, a number of general measures included in the Public Health Code help to protect the public against the dangers of ionising radiation.

Public dose limits

The annual effective dose limit (article R. 1333-8 of the Public Health Code) received by a member of the public as a result of nuclear activities, is set at 1mSv; the equivalent dose limits for the lens of the eye and the skin are set at 15mSv/year and 50 mSv/year respectively. The calculation method for the effective and equivalent dose rates and the methods used to estimate the dosimetric impact on a population are defined by ministerial order of 1st September 2003.

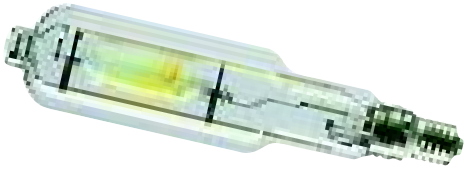
Radioactivity in consumer goods and construction materials

The intentional addition of natural or artificial radionuclides in all consumer goods and construction materials is prohibited (article R. 1333-2 of the Public Health Code). Waivers may however be granted by the minister for health after receiving the opinion of the French high public health council (HCSP) and ASN, except with respect to foodstuffs and materials placed in contact with them, cosmetic products, toys and personal ornaments. The Government order of 5th May 2009 specifies the content of the waiver application file and the consumer information procedures stipulated in Article R. 1333-5 of the Public Health Code. This waiver arrangement was used for the first time in 2011 to cover the gradual phase-out of ionization smoke detectors (see chapter 10). This prohibition principle does not concern the radionuclides naturally present in the initial components or in the additives used to prepare foodstuffs (for example potassium 40 in milk) or for the manufacture of materials used in the production of consumer goods or construction materials.

Furthermore, the use of materials or waste from a nuclear activity is also prohibited, when they are contaminated or likely to have been contaminated by radionuclides as a result of this activity.

At present, there are no regulations limiting the natural radioactivity of construction materials, when this is naturally present in the components used in their manufacture.

The proposed Euratom directive currently being examined at European level introduces a new regulatory framework to limit natural radioactivity in construction materials. Regulations such as these do not exist in France. It will require that manufacturers carry out tests to measure the potential emissions of gamma radiation.



Very high-intensity gas discharge lamp

Radioactivity and the environment

A national network for the collection of environmental radioactivity measurements was set up in 2009 (Article R. 1333-11 of the Public Health Code) and the data collected will help estimate the doses received by the general public. The network's orientations are defined by ASN and it is managed by IRSN (order of 27th June 2005 on the organisation of a national network for the measurement of environmental radioactivity and setting the conditions for laboratory approval).

To guarantee the quality of the measurements, the laboratories in this network must meet approval criteria, which in particular include intercomparison benchmarking tests.



New-generation IRSN Téléray network monitor designed to monitor ambient gamma radiation in France, installed on the roof of the Navy headquarters in Paris.

A detailed presentation of the national measurement network is given in chapter 5.

The radiological quality of water intended for human consumption

Pursuant to article R. 1321-3 of the Public Health Code, water intended for human consumption is subject to radiological quality inspection. The inspection procedures are specified in the order of 12th May 2004. They form part of the sanitary inspections carried out by the Regional Health Agencies (ARS). The order of 11th January 2007 concerning water quality limits and benchmarks introduces four radiological quality indicators for water intended for human consumption. These indicators and the corresponding limits are the total alpha activity (0.1Bq/L), the total residual beta activity (1Bq/L), the tritium activity (100Bq/L) and the total indicative dose – TID (0.1mSv/year). The circular from the General Directorate for Health (DGS) dated 13th June 2007, accompanied by recommendations from ASN, specifies the policy underpinning this regulation.

Radiological quality of foodstuffs

Restrictions on the consumption or sale of foodstuffs may be necessary in the event of an accident or of any other radiological emergency situation.

In Europe, these restrictions are determined by Council Regulation 3959/87/Euratom of 22nd December 1987, modified by Council Regulation no.2219/89/EEC of 18th July 1989, laying down maximum permitted levels of radioactive contamination of foodstuffs and of feeding-stuffs. The maximum permitted levels were defined to "safeguard the health of the population while maintaining the unified nature of the market".

In the event of a confirmed nuclear accident, "automatic"application of this regulation cannot exceed a period of three months, after which it will be superseded by specific measures (see the regulation specific to the Chernobyl accident, the values of which are given in the appendix.

Following the events which affected the Fukushima nuclear power plant, as of 11th March 2011, contamination analyses on certain foodstuffs produced around the plant have revealed radioactive contamination levels higher than those accepted by commercial sale standards. European regulation (EU) 297/2011, amended by regulations 351/2011, 506/2011 and 657/2011, stipulated harmonised implementation of contamination checks on food products imported from Japan. These European provisions stipulate a two-level process, with the first checks prior to export being conducted under the responsibility of the Japanese authorities, and then further checks being performed on arrival in European territory, in all the Member States of the European Union. Two inspection levels were defined by the European regulation, depending on the geographical proximity of the area of origin of the foodstuffs to the Fukushima plant.

This measure enables each Member State to adapt the level of control to that it wishes to use. To maximise consumer safety, the French authorities decided first of all to run 100% checks on all foodstuffs of animal origin produced after 11th March and all fresh produce. This level of inspection is changing in line with the clearer picture being obtained of the contamination of foodstuffs in Japan.

The results of these checks should be compared first of all with the MPL set by regulation 3459/87/Euratom and, since 11th April, with the MPL set by appendix II to regulation 351/2011 (these levels correspond to the MPL applied by the Japanese authorities and are more restrictive than those set by regulation 3954/87/Euratom). The radioactive substances measured are iodine 131 and radioactive caesium. The analyses are carried out by the network of laboratories of the Ministry responsible for agriculture (nine laboratories reporting to the General Councils) and by the laboratories reporting to the customs and consumer affairs services (joint laboratories service).

Radioactive waste and effluents

Management of waste and effluents from BNIs and ICPEs is subject to the provisions of the special regulations concerning these installations (for BNIs, see point 3|5 of this chapter). For the management of waste and effluents from other establishments, including hospitals (article R. 1333-12 of the Public Health Code), general rules are established in an ASN decision 2008-DC-0095 of 29th January 2008. These waste and effluents must be disposed of in duly authorised facilities, unless there are special provisions for on-site organisation and monitoring of their radioactive decay (this concerns radionuclides with a radioactive half-life of less than 100 days).

Although above-mentioned Directive 96/29/Euratom so allows, French regulations have not adopted the notion of discharge threshold, in other words, the generic level of radioactivity below which the effluents and waste from a nuclear activity can be disposed of without supervision. In practice, the disposal of waste and effluents is regulated on a case by case basis when the activities that produce them are subject to licensing (the case of BNIs and ICPEs) or can be covered by technical requirements when these activities simply require notification. Similarly, French regulations do not use the notion of "trivial dose" as contained in Directive 96/29/Euratom, in other words, a dose below which no radiation protection action is considered to be necessary (10µSv/year).

1|2|3 Protection of persons in a radiological emergency situation

The general public are protected against the hazards of ionising radiation in the event of an accident or of radiological emergency situations through the implementation of specific actions (or countermeasures) appropriate to the nature and scale of the exposure. In the particular case of nuclear accidents, these actions were defined in the government circular of 10th March 2000 which amended the off-site emergency plans (PPI) applicable to BNIs, by expressing intervention levels in terms of doses. These levels constitute reference points for the public authorities (*préfets*[1]) who have to decide locally, on a case by case basis, on what action is to be taken.

Reference and intervention levels

The intervention levels were updated in 2009 by ASN regulatory decision 2009-DC-0153 of 18th August 2009, with a reduction of the level concerning exposure of the thyroid. Henceforth, the protection measures to be taken in an emergency situation, and the corresponding intervention levels, are:
– sheltering, if the predicted effective dose exceeds 10mSv;
– evacuation, if the predicted effective dose exceeds 50mSv;
– administration of stable iodine, when the predicted thyroid dose is liable to exceed 50 mSv.

The reference exposure levels for persons intervening in a radiological emergency situation are also defined in the regulations (Articles R. 1333-84 and 86 of the Public Health Code) and two groups of response personnel are thus defined:
– the first group comprises the personnel making up the special technical or medical response teams set up to deal with a radiological emergency. These personnel benefit from radiological surveillance, a medical aptitude check-up, special training and equipment appropriate to the nature of the radiological risk;
– the second group comprises personnel who are not members of the special response teams but who are called in on the basis of their expertise. They are given appropriate information.

The reference individual exposure levels for the participants, expressed in terms of effective dose, should be set as follows:
– the effective dose which may be received by personnel in group 1 is 100 mSv. It is set at 300 millisieverts when the intervention measure is aimed at protecting other people;
– the effective dose which may be received by personnel in group 2 is 10 millisieverts. In exceptional circumstances, volunteers informed of the risks involved in their acts may exceed the reference levels, in order to save human life.



Emergency exercise in the off-site emergency plan zone of the Chinon nuclear power plant – June 2011

Public information in a radiological emergency

The ways in which the general public is informed in a radiological emergency situation are covered by a specific EU directive (Directive 89/618/Euratom of 27th November 1989 on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency). This directive was transposed into French law by decree 2005-1158 of 13th September 2005 concerning the off-site emergency plans for certain fixed structures or installations, implementing article 15 of Act 2004-811 of 13th August 2004 on the modernisation of civil security.

Two implementing orders were published:
– the order of 4th November 2005 concerning public information in the event of a radiological emergency situation;
– the order of 8th December 2005 concerning the medical aptitude check-up, radiological surveillance and training or information to the personnel involved in managing a radiological emergency situation.

1|2|4 Protection of the general public in a long-term exposure situation

Sites contaminated by radioactive materials are sites which have been contaminated by a nuclear activity in the recent or more distant past (use of unsealed sources, radium industry, etc.) or an industrial activity using raw materials containing significant quantities of natural radionuclides (uranium and thorium families). Most of these sites are listed in the inventory distributed and periodically updated by ANDRA.

A new guide for the management of potentially contaminated sites, which was drafted under the supervision of ASN and the Ministry for ecology has, since December 2011, replaced the IRSN guide published in October 2000. It describes how to deal with the various situations liable to be encountered when rehabilitating sites (potentially) contaminated by radioactive substances.

2. In a *département*, representative of the State appointed by the President.

2 REGULATORY REQUIREMENTS APPLICABLE TO SMALL-SCALE NUCLEAR ACTIVITIES

2|1 The small-scale nuclear activities licensing and notification system

2|1|1 Licensing and declaration procedures for sources of ionising radiation

The system of licensing or notification, which covers all sources of ionising radiation, is described in section 3 of chapter III of part III of book III of the first part of the Public Health Code. Licences are issued by ASN and notifications are filed with the ASN regional divisions. Medical, industrial and research applications which do not benefit from a waiver are concerned by these procedures. This more specifically concerns the manufacture, possession, distribution – including import and export – and use of radionuclides or products and devices containing them.

The licensing system applies both to companies or facilities which have radionuclides on-site, and to those which trade in them or use them without directly possessing them. However, the licences issued under the licensing system for industries covered by the mining code, BNIs and ICPEs, constitute authorisation to produce or possess sources of ionising radiation.

Finally, the X-ray facilities used for forensic procedures (for example, radiological examination to determine the age of an individual, use of X-rays to detect objects hidden within the human body, etc.), are regulated by the licensing or notification system applicable to facilities designed for medical uses, given that individuals will be intentionally exposed to ionising radiation (see point 2|2).



Licence application form updated in 2011, available from *www.asn.fr*

The renewable ASN licence is delivered for a period that cannot exceed 10 years. The licence application or notification is made with a form that can be downloaded from the *www.asn.fr* website or obtained from the ASN regional divisions. The conditions for filing licence applications, established by Articles R. 1333-23 and following of the Public Health Code, are set out by ASN decision 10-DC-192 of 22nd July 2010, which establishes the content of the dossiers enclosed with the licence application. During the preparation of these texts, the requirements applicable to the various medical and non-medical fields were harmonised. The new forms integrating the above decisions will be available in the course of 2011.

Activities requiring notification

The list of activities requiring notification pursuant to article R.1333-19-1 of the Public Health Code was updated in 2009 by ASN decision 2009-DC-0146 of 16th July 2009, supplemented by ASN decision 2009-DC-0162 of 20th October 2009. As in low-intensity medical radiology, radiology in veterinary practices is now included in the activities requiring notification. It is added to the list of non-medical activities requiring notification, pursuant to Article R.1333-19-3 of the Public Health Code.

When the dossier is considered by ASN to be complete, an acknowledgement of receipt of notification of the installations is sent by ASN to the notifying party. As the maximum validity period for a notification has been abolished, a new notification for regularly notified activities only becomes necessary if significant changes have been made to the installation (replacement or addition of an appliance, transfer or substantial modification of the premises or change in the licence holder).

Licensing of medical applications and biomedical research

ASN issues licences for the use of radionuclides, or products and devices containing them, used in nuclear medicine and brachytherapy, for the use of particle accelerators in external radiotherapy, tomography appliances and blood product irradiators. For medical and biomedical research applications, the licensing system contains no exemptions.

Licensing of non-medical activities

ASN is responsible for issuing licences for industrial and non-medical research applications. This concerns:
– the import, export and distribution of radionuclides and products or devices containing them;
– the manufacture, possession and use of radionuclides, products or devices containing them, devices emitting ionising radiation or radioactive sources, the use of accelerators other than electron microscopes and the irradiation of products of whatsoever nature, including foodstuffs, with the exception of

activities which are licensed under the terms of the mining code, the BNI system or that applicable to ICPEs.

The license exemption criteria adopted by directive 96/29/Euratom (Annex 1, table A) are appended to the Public Health Code (table A, annex 13-8).

Exemption will be possible if one of the following conditions is met:
– the total quantity of radionuclides possessed is less than the exemption values in Bq;
– the radionuclide concentrations are less than the exemption values in Bq/kg.

2|1|2 Approval of radiation protection technical supervision organisations

Technical monitoring of the radiation protection organisation, including monitoring of the management of radioactive sources and any associated waste, is entrusted to approved organisations (article R. 1333-97 to of the Public Health Code). The conditions and procedures for approval of these organisations are set by ASN decision 2010-DC-0191 of 22nd July 2010. ASN is responsible for issuing these approvals. The list of approved organisations is available on the ASN website (*www.asn.fr*). The nature and frequency of the radiation protection technical checks are defined in ASN decision 2010-DC-0175 mentioned in point 1|2|1.

2|1|3 Licensing the suppliers of ionising radiation sources

ASN decision 2008-DC-0109 of 19th August 2008 concerns the licensing system for the distribution, import and/or export of radionuclides and products or devices containing them. This decision covers products intended for industrial and research purposes, but also health products: drugs containing radionuclides (radiopharmaceutical drugs, precursors and generators), medical devices (gamma-ray teletherapy devices, brachytherapy sources and associated applicators, blood product irradiators, etc.) and *in vitro* diagnosis medical devices (for radioimmunology assay).

ASN decision 2008-DC-0108 of 19th August 2008 in particular concerns the licence to possess and use a particle accelerator (cyclotron) and the manufacture of radiopharmaceuticals containing a positron emitter.

During the preparation of these texts, the requirements applicable to the various medical and non-medical fields were harmonised. The new forms incorporating the above decisions reflect this harmonisation. They are available on the ASN website, along with guides to help applicants put together their dossiers.

2|1|4 Radioactive source management rules

The general radioactive source management rules are contained in section 4 of chapter III of part III of book III of the first part of the Public Health Code. Responsibility for keeping the national inventory of sources is given to IRSN (Article L. 1333-9 of the Public Health Code).



Packaging of sealed sources, nuclear medicine unit in Nancy university hospital

The national table of financial guarantees required from source suppliers, and the implementation and payment procedures, must be defined in an order from the ministers responsible for Health and for Finance (Articles R. 1333.53 and R. 1333-54-2 of the Public Health Code). Pending publication of this order, the particular licensing conditions established by the CIREA (French Interministerial Commission for Artificial Radionuclides) in 1990 are reiterated as requirements in the licences, which allows their validity to be extended.

2|2 Protection of persons exposed for medical and forensic purposes

Radiation protection for individuals exposed for medical purposes is now based on two regulatory principles: justification of the procedures and optimisation of exposure, which are under the responsibility of both the practitioners prescribing medical imaging examinations entailing exposure to ionising radiation and the practitioners carrying out these procedures. Ultimate responsibility for exposure lies with the practitioners carrying out the procedures. These principles cover all the diagnostic and therapeutic applications of ionising radiation, including radiological examinations requested for screening, occupational health, sports medicine and forensic purposes.

2|2|1 Justification of practices

A written exchange of information between the prescribing practitioner and the practitioner carrying out the procedure

exposing the patient should provide justification of the benefit of the exposure for each procedure. This "individual" justification is required for each procedure. Articles R. 1333-70 and R. 1333-71 of the Public Health Code respectively require the publication of "prescription of routine procedures and examinations" guides (also called "referral criteria for imaging guides") and "performance of procedures" guides (called "procedure guides").

2|2|2 Optimisation of exposure

Optimisation in medical imaging (radiology and nuclear medicine) consists in delivering the lowest possible dose compatible with obtaining a quality image that provides the diagnostic information sought for. Optimisation in therapy (external radiotherapy, brachytherapy and nuclear medicine) consists in delivering the prescribed dose to the tumour to destroy cancerous cells while limiting the dose to healthy tissues to the strict minimum.

Standardised guides for conducting procedures using ionising radiation have been prepared and are regularly updated by health professionals, or are currently being prepared, to facilitate optimisation in practice (table 1).

Diagnostic reference levels

The diagnostic reference levels (DRL) are one of the tools used for dose optimisation. As required in article R. 1333-68 of the Public Health Code, the DRL are defined in the order of 24th October concerning diagnostic reference levels in radiology and nuclear medicine. For radiology, this consists of dose values, while for nuclear medicine it consists of activity levels administered in the course of the most common or most heavily irradiating examinations. Depending on the type of examination, periodic measurements or readings shall be taken in each radiology and nuclear medicine unit.

Dose constraints

In the field of biomedical research, where exposure to ionising radiation is of no direct benefit to the persons exposed, dose constraints designed to limit the doses delivered must be established by the physician.

Medical radiation physics

The safety of radiotherapy and optimisation of the doses delivered to the patients in medical imaging require particular expertise in the field of medical physics. The employment of a specialised medical radiation physicist (PSRPM), formerly called a "radiophysicist", has been extended to radiology, having already been compulsory in radiotherapy and nuclear medicine.

The duties of the PSRPM were clarified and broadened by the order of 19th November 2004. Thus medical radiation physics specialists must ensure the appropriateness of the equipment, data and computing processes for determining and delivering the doses and activity levels administered to the patient in any procedure involving ionising radiation. In the field of radiotherapy, they guarantee that the radiation dose received by the tissues due to be irradiated matches that prescribed by the prescribing physician.

Furthermore, they estimate the dose received by the patient during diagnostic procedures and play a part in quality assurance including inspecting the quality of the medical devices.

Temporary criteria determining the conditions for the presence of radiation physicists in radiotherapy centres have been defined by decree (decree no.2009-959 of 29th July 2009. They are applicable until the end of the interim period provided for in the health-care activities licensing system (decree no.2007-388 of 21st March 2007), i.e. May 2012 at the latest.

Since 2005, heads of facilities have had to draw up plans for medical radiation physics, defining the resources allocated, primarily in terms of staffing, in the light of the medical procedures carried out in the establishment, the actual or probable patient numbers, existing dosimetry skills and resources allocated to quality assurance and control.

The PSRPM training procedures were updated by an order of 28th February 2011 and a further update is expected in early 2012.

Radiotherapy quality assurance

The quality assurance obligations of radiotherapy centres, provided for in article R.1333-59 of the Public Health Code, were specified by decision 2008-DC-0103 dated 1st July 2008, which mainly concerns the quality management system (SMQ), the management's commitments as stipulated in the SMQ, the documentary system, staff responsibility, the analysis of the risks run by the patients during the radiotherapy process, and the identification and handling of undesirable situations or malfunctions, whether organisational, human or equipment-related.

These obligations entered into force in September 2011.



Quality control of a CT installation by a medical physicist at the Pitié Salpêtrière Hospital in Paris

Table 1 : list of Referral Criteria for Imaging and Procedure Guides for the performance of medical procedures entailing exposure to ionising radiation

Specialty	Medical radiology		Nuclear medicine	Radiology	Dental Radiology
Documents	Procedure guide	Referral criteria for imaging guide	Referral criteria for imaging and procedure guide	External radiotherapy procedure guide	Referral criteria for imaging and procedure guide
Availability	www.sfrnet.org www.irsn.org	www.sfrnet.org www.irsn.org	www.sfmm.org	www.sfro.org	www.adf.asso.fr www.has-sante.fr

TO BE NOTED

The proposed Euratom directive currently being examined at European level makes it mandatory to carry out a risk analysis and record and analyse undesirable events, along with their notification to the authorities (already required in France).

Maintenance and quality control of medical devices

Maintenance and quality control, both internal and external, of medical devices using ionising radiation (Articles R. 5211-5 to R. 5211-35 of the Public Health Code) have been mandatory since publication of the order of 3rd March 2003. External quality control is entrusted to organisations approved by the Director General of the AFSSAPS (French Health Product Safety Agency) who is responsible for issuing a decision defining the acceptability criteria, the monitoring parameters and the frequency of the inspections on the medical devices concerned. The published decisions are posted on the AFSSAPS web site.

Training and information

Additional major factors in the optimisation approach are the training of health professionals and the information of patients.

Thus the objectives and content of training programmes for practitioners conducting procedures using ionising radiation, or who assist in these procedures, were defined in the order of 18th May 2004. To ensure the traceability of the data on application of the justification and optimisation principles, the report on the procedure, written by the medical practitioner carrying out the examination, must provide information justifying the procedures and the operations carried out as well as the data used to estimate the dose received by the patient (order of 22nd September 2006).

Finally, before carrying out a diagnostic or therapeutic procedure using radionuclides (nuclear medicine), the physician must give the patient oral and written guidelines on radiation protection that are of use to him/herself, his/her relations, the public and the environment. In the event of a nuclear medicine procedure for therapeutic purposes, this information, issued in a written document, provides lifestyle hints to enable potential contamination to be minimised and states, for example, for how many days contacts with the spouse and children should be reduced. Recommendations (French High Public Health Council, learned societies) were distributed by ASN (January 2007) to enable the content of the information already sent out to be harmonised.

The proposed Euratom directive currently under review at European level introduces a new regime concerning forensic applications of ionising radiation. It in particular clarifies the conditions for identification and authorisation of these practices, thus improving the existing "forensic exposure" situation (directive 97/34/Euratom).

TO BE NOTED

2|2|3 Forensic applications of ionising radiation

In the forensic field, ionising radiation is used in a wide variety of sectors such as occupational medicine, sports medicine or for investigative procedures required by the courts or insurance companies. The principles of justification and optimisation defined apply both to the person requesting the examinations and to the person performing them.

In occupational medicine, ionising radiation is used for medical supervision of workers (whether or not professionally exposed to ionising radiation, for example workers exposed to asbestos). ASN transmitted proposals in early 2010 to the General Labour Directorate, to the French Agency for Environmental and Occupational Health Safety (AFSSET), and to the French National Authority for Health (HAS), to have the examinations

that today are considered unjustified removed from the regulations in force. In 2012, ASN will be consulting the stakeholders in order to reach a final decision on this subject.

2|3 Protection of persons exposed to "enhanced" natural radiation

2|3|1 Protection of persons exposed to radon

The regulations applicable to management of the radon-related risk in premises open to the public (Article R. 1333-15 of the Public Health Code) introduce the following clarifications:
– the radon monitoring obligation applies in geographical areas in which radon of natural origin is likely to be measured in high concentrations and in premises in which the public is likely to stay for extended periods;
– the measurements are made by organisations approved by ASN, these measurements being repeated every 10 years and whenever work is carried out to modify the ventilation or the radon tightness of the building.

In addition to introducing action trigger levels of 400 and 1,000 Bq/m^3, the implementing order of 22nd July 2004 concerning management of the radon risk in premises open to the public defined geographical zones and premises open to the public for which radon measurements are now mandatory:
– the geographical areas correspond to the 31 *départements* classified as having priority for radon measurement (see map p. 81);



2011-2015 national action plan for management of the radon risk

Map of 31 priority *départements* for radon monitoring



– the categories of premises open to the public cover teaching institutions, health and social institutions, spas and prisons.

The obligations of the owner of the facility are also specified when the action levels are found to have been exceeded. The order of 22nd July 2004 was accompanied by the publication in the *Official Gazette* of a notice defining the action and work to be carried out if the action trigger levels of 400 and 1,000 Bq/m^3 were to be exceeded (O.G. of 22nd February 2005). The conditions for approval of organisations qualified to measure an activity concentration, and the measurement conditions, were updated by three ASN decisions:
– decision 2009-DC-0134 of 7th April 2009, amended by decision 2010-DC-0181 of 15th April 2010, sets the approval criteria, provides the detailed list of information to be enclosed with the approval application, and specifies the conditions of issue, verification and withdrawal of approval;
– decision 2009-DC-0135 specifies the conditions in which the radon activity concentration is measured;
– decision 2009-DC-0136 concerns the objectives, duration and content of the training programmes for the individuals carrying out radon activity concentration measurements.

The list of approved organisations is published in the ASN Official Bulletin on *www.asn.fr*.

Act 2009-879 of 21st July 2009 reforming the hospital system and concerning patients, health and the regions, introduced new requirements concerning radon into the Public Health Code (Article L.1333-10). A radon measurement will therefore be taken in residential buildings every 10 years. The corresponding implementing decree is currently being prepared.

Finally, in the workplace, Article R. 4451-136 of the Labour Code requires the employer to carry out radon activity measurements and take the necessary steps to reduce exposure when the results of the measurements reveal an average radon concentration higher than the levels set in an ASN decision. The order of 7th August 2008 defined the workplaces in which these measurements are required and ASN decision 2008-DC-0110, approved by the order of 8th December 2008, specifies the reference levels above which the radon concentration must be reduced.

2|3|2 Other sources of exposure to "enhanced" natural radiation

Professional activities which use materials which naturally contain radionuclides not used for their intrinsic radioactive properties but which are likely to create exposure such as to harm the health of workers and the public ("enhanced" natural exposure) are subject to the provisions of the Labour Code (Articles R. 4451-131 to 135) and the Public Health Code (Article R. 1333-13).

The order of 25th May 2005 defines the list of professional activities using raw materials naturally containing radionuclides, the handling of which can lead to significant exposure of the general public or of workers.

For these activities, the Public Health Code requires an estimation of the doses to which the general public is exposed owing to the installation, or owing to the production of consumer goods or construction products by these activities (see chapter 1). In addition, and if protection of the public so warrants, it is also possible to set radioactivity limits for the construction materials and consumer goods produced by some of these industries (Article R. 1333-14 of the Public Health Code). This latter measure complements the ban on the intentional addition of radioactive materials to consumer goods.

For the occupational exposure resulting from these activities, the Labour Code requires a dose assessment to be carried out under the responsibility of the employer. Should the dose limit of 1 mSv/year be exceeded, steps to reduce exposure should be taken. The above-mentioned order of 25 May 2005

TO BE NOTED

The proposed Euratom directive currently under review at European level defines the list of industries and activities concerned by exposure to enhanced natural radioactivity (in force in France) and introduces exemption values.

TO BE NOTED

The proposed Euratom directive currently under review at European level requires that the Member States define a national action plan to reduce radon exposure and introduce a maximum reference level for the general public of 300 Bq/m. The second national action plan for radon was published on 15th December 2011.



Aircrew

offers clarification of the technical measurement procedures for evaluating the doses received by the workers[2].

Finally, the Labour Code (Article R. 4451-140) stipulates that for aircrews likely to be exposed to more than 1 mSv/year, the employer must evaluate the exposure, take steps to reduce it (particularly in the event of a declared pregnancy) and inform the personnel of the health risks. The order of 7th February 2004 defines the procedures for implementing these measures.

3 THE LEGAL SYSTEM APPLICABLE TO BASIC NUCLEAR INSTALLATIONS (BNIs)

Basic nuclear installations (BNI) are installations which, due to their nature or to the quantity or activity of the radioactive substances they contain, are subject to particular provisions in order to protect the general public and the environment.

3|1 The legal bases

3|1|1 International conventions and standards

IAEA publishes reference texts, called "Basic Safety Standards", which describe safety principles and practices. They concern installation safety and radiation protection, the safety of waste management and the safety of radioactive materials transportation. Although these documents are not binding, they do nonetheless constitute references which are widely drawn on in the drafting of national regulations.

Several legislative and regulatory provisions relative to BNIs are derived from or take up international conventions and standards, and notably those of the IAEA.

The Convention on Nuclear Safety (see chapter 7, point 4|1) concerns civil nuclear power generating reactors. It aims to propose binding international obligations concerning nuclear safety. France has voluntarily decided to include the steps taken with regard to research reactors.

The counterpart of the Convention on Nuclear Safety in the field of spent fuel and radioactive waste management is the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management (see chapter 7, point 4|2).

For France, these conventions are a tool to be used to reinforce nuclear safety, periodically presenting the international community with the status of the facilities concerned and the steps taken to ensure their safety.

3|1|2 European texts

Several European community texts apply to BNIs. The more important ones are described below.

The Euratom Treaty

The Euratom Treaty, which was signed in 1957 and came into force in 1958, aimed to develop nuclear power while protecting the general public and workers from the harmful effects of ionising radiation.

Chapter III of part II of the Euratom Treaty deals with health protection as linked to ionising radiation.

Articles 35 (implementation of means for checking compliance with standards), 36 (information to the Commission on environmental radioactivity levels) and 37 (information to the Commission on planned effluent discharges) deal with the issues of discharges and environmental protection.

Requirements regarding information of the Commission were incorporated into the decree n°2007-1557 of 2 November 2007. The BNI creation authorisation or final shutdown decrees, as well as significant modifications to the facilities leading to an increase in discharge limit values, are only issued once the opinion of the Commission has been obtained.

The Directive of 25 June 2009

Directive 2009/71/Euratom of 25th June 2009 creates an EU framework for nuclear safety and paves the way for the creation of common legal requirements for nuclear safety among all Member States.

This directive defines basic obligations and general principles in this field. It strengthens the role of the national regulatory organisations, contributes to harmonising the safety requirements between the Member States in order to develop a high level of safety in the installations and guarantees a high level of transparency on these issues.

2. This concerns: the combustion of coal in coal-fired power stations; the treatment of tin, aluminium, copper, titanium, niobium, bismuth and thorium ores; the production of refractory ceramics and the glassworks, foundries, iron and steel and metallurgy plants that use them; the production or use of compounds containing thorium; the production of zircon and baddaleyite, and the foundry and metallurgy activities that use them; the production of phosphated fertilizers and phosphoric acid; the treatment of titanium dioxide; the treatment of rare earths and the production of pigments containing them; the treatment of underground water by filtration for the production of water for human consumption and mineral waters and spas.

The directive comprises stipulations regarding cooperation between nuclear regulators, in particular the creation of a peer review mechanism, personnel training, regulation and inspection of nuclear installations and public transparency. In this respect, it reinforces cooperation between the Member States.

Finally, it creates a framework for the harmonisation work carried out by the Western European Nuclear Regulators' Association (WENRA) (see chapter 7, point 2|1|5).

France transposed this directive (22nd July 2011) within the allotted time. Certain provisions were already applied in France, for example the requirements of the TSN Act 2006-686 of 13th June 2006, decree 2007-1557 of 2nd November 2007 concerning BNIs and the regulation of the nuclear safety of the transport of radioactive materials, decree 2007-831 of 11th May 2007 determining the designation and qualification of nuclear safety inspectors, and the orders of 10/08/84 on the quality of the design, construction and operation of BNIs, the order of 31/12/99 setting out the general technical regulations for preventing and limiting detrimental effects and off-site hazards arising from the operation of BNIs, the order of 26/11/99 setting out the general technical requirements concerning the limits and procedures for BNI water intake and discharge subject to licensing and, with regard to pressure equipment, the order of 10/11/99 concerning surveillance of the operation of the main primary system and the main secondary systems of pressurised water reactors, plus the order of 12/12/2005 concerning nuclear pressure equipment.

The signing of the order setting the general rules concerning basic nuclear installations (see point 3|2|2) constitutes an improvement of the national frameworkconcerning the safety of nuclear facilities, as stipulated in the directive.

The directive of 19th July 2011

Directive 2011/70/Euratom of 19th July 2011 establishes a European framework for the safe and responsible management of spent fuel and radioactive waste. It applies to the management of spent fuel and the management of radioactive waste, from production to disposal, when this waste is the result of civil activities. In a manner similar to the directive of 25th June 2009, it calls for each Member State to set up a coherent and appropriate national framework and sets various requirements for the States, the safety regulators and the licensees. Several of the requirements of this directive, which should in any case be fully transposed before August 2013, are already in force in France, for example through the provisions of the Environment Code concerning waste, the waste Act 2006-739 of 28th June 2006 and the TSN Act 2006-686 of 13th June 2006. ASN took part in the work involved in the transposition of this directive.

3|1|3 National texts

The TSN Act (now codified in books I and V of the Environment Code) and its implementing degrees

The provisions of chapters III and V of part IX of book V of the Environment Code (previously section IV of the TSN Act) underpin the BNI authorisation and regulation regime.

The legal regime applicable to BNIs is said to be "integrated" because it aims to cover the prevention or control of all the risks and detrimental effects, whether radioactive or not, that a BNI could create for man and the environment.

About fifteen decrees implement the legislative provisions of book V of the Environment Code, in particular decree 2007-830 of11th May 2007 concerning the list of BNIs and decree 2007-1557 of 2nd November 2007 as amended, concerning BNIs and the regulation of the nuclear safety of the transport of radioactive materials, known as the "BNI procedures" decree (see below).

The "Waste" Act and its implementing decrees

Act 2006-739 of 28th June 2006 on the Sustainable Management of Radioactive Materials and Wastes, known as the "Waste" Act, creates a coherent, exhaustive legislative framework for managing all radioactive waste. It is now codified in chapter II of part IV of book V of the Environment Code.

TO BE NOTED IN 2011

The codification of the "Nuclear Acts"

Pursuant to the authorisation granted by the 10th July 2010 Act constituting the national environmental undertaking, referred to as the "Grenelle II" Act, the Government - with the assistance of ASN - undertook to codify the TSN Act, the "Waste" Act and Act 68-943 of 30th October 1968 on civil liability in the field of nuclear energy, in the Environment Code, but without changing the legislative content. Certain provisions of Act 571 of 28th October 1943 as amended, concerning steam pressure equipment employed on land and gas pressure equipment employed on land and on board seagoing vessels are also codified, with regard to the monitoring and inspection of equipment in a BNI by ASN inspectors. The codification of these provisions, since the publication of ordinance 2012-6 of 5th January 2012 amending books I and V of the Environment Code, leads in particular to the creation of a part IX within book V of the Environment Code, entitled "Nuclear security and basic nuclear installations". Additions have also been made to chapter V of part II of book I, to include provisions specific to information and transparency with regard to nuclear activities.

The "BNI procedures" decree

Decree 2007-1557 of 2nd November 2007 concerning BNIs and the regulation of the nuclear safety of the transport of radioactive materials, known as the "BNI procedures" degree, implements article L. 593-38 of the Environment Code.

It defines the requirements applicable to BNI procedures and deals with the entire lifecycle of a BNI, from its authorisation decree to commissioning, to final shutdown and decommissioning. Finally, it explains the relations between the ministers responsible for nuclear safety and ASN in the field of BNI safety.

The decree clarifies the applicable procedures for adoption of the general regulations and for taking individual decisions concerning BNIs. It defines how the Act is implemented with regard to inspections and administrative or criminal sanctions. Finally, it defines the particular conditions for application of certain regimes within a BNI.

3|2 General technical regulations

The general technical regulations stipulated by Article L.593-4 of the Environment Code, comprise all the general texts laying down the technical rules concerning nuclear safety, whether binding (ministerial orders and ASN regulatory decisions) or non-binding (circulars, basic safety rules, ASN guides).

3|2|1 Ministerial and government orders

Quality organisation

The order of 10th August 1984 concerning the quality of the design, construction and operation of BNIs, known as the "quality order", specifies the steps to be taken by a BNI licensee for defining, obtaining and maintaining the quality of its installations and the conditions necessary to guarantee its operational safety.

It thus stipulates that the licensee must define quality requirements for each activity concerned, employ the appropriate skills and methods for meeting these quality requirements and finally, guarantee quality by checking compliance with these requirements.

It also specifies:
– that detected discrepancies and incidents be thoroughly corrected and that preventive action be taken;
– that suitable documents testify to the results obtained;
– that the licensee supervise the service companies used and check satisfactory operation of the procedures adopted to guarantee quality.

Operating experience feedback from events that have occurred in BNIs, plus the observations made during inspections, enable ASN to assess the application of the "quality" order.

This order is one of the texts undergoing revision, as described in point 3|2|2 of this chapter.

Prevention of off-site detrimental effects and hazards resulting from BNI operation

BNI operation can entail detrimental effects and risks for the environment, that is to say for the surrounding installations and their workers, but also for the general public and the environment off the site.

The order of 31st December 1999 amended by the order of 31st January 2006 contains the general technical regulations intended, except for water intake and discharge of effluents, to prevent and mitigate off-site detrimental effects and risks resulting from BNI operation. More specifically, and in addition to the general incident and accident prevention rules (staff training,

UNDERSTAND

The planned overhaul of the general technical regulations applicable to BNIs

The planned overhaul of the general technical regulations applicable to BNIs aims to publish several texts implementing the TSN Act and some of its application decrees; one order and about twenty regulatory decisions, as well as guides. The draft texts are written and reviewed by all the ASN entities concerned and its technical support organisation (IRSN). For the draft order, ASN proposed a preliminary version of the text to the Ministry for Ecology, Sustainable Development, Transport and Housing (MEDDTL). In 2010, the draft order and ten decisions were submitted to the stakeholders and made available for consultation by the general public.

This broad consultation was addressed to licensees, experts, environmental protection associations, union organisations and European safety authorities. The draft order was also placed on-line on the MEDDTL and ASN websites for three months, in order to obtain comments from all interested parties. Similarly, ASN also posted the drafts of the ten decisions mentioned above on its own website.

The stakeholders expressed particularly keen interest in the draft order, for which several hundred comments were processed. As a result, the draft was extensively modified. Following a further public consultation of this new version, the draft order was submitted in January 2012 to the high council for the prevention of technological risks (CSPRT). The ASN issued its opinion on the draft on 24th January 2012. The order was signed on 7th February 2012.

safety instructions, maintenance of installations, etc.), the order specifies objectives for protection against fire, lightning, noise, or the risks of accidental pollution of the environment. It introduces principles concerning waste management, prevention of accidental pollution, fire, lightning, criticality and radiolysis applicable to all nuclear equipment, including that which is situated outside the sensitive parts of the BNIs.

The various provisions of the order are detailed in point 3|4 of this chapter.

Regulation of BNI water intake and effluent discharges

The 26th November 1999 order lays out the general technical requirements concerning the limits and procedures applicable to BNI water intake and effluent discharges requiring licensing.

This order also introduced improvements:
– concerning the regulation of issues regarding water intake, effluents discharge, environmental monitoring and information of the public and of the Government departments responsible for oversight;
– concerning the incorporation of the regulatory principles applicable to ICPEs, in particular setting discharge limits based on the use of the best available techniques at an economically acceptable cost.

3|2|2 Overhaul of the general technical regulations

Pursuant to the publication of the TSN Act in 2006 and its implementing decrees, ASN wished to completely revise the general technical regulations applicable to BNIs. This initiative moreover ties in with a drive for European harmonisation of nuclear safety, by integrating in the new regulations the principles ("reference levels") developed by WENRA, the Western European Nuclear Regulators' Association, which has worked for several years on defining a baseline of common requirements. WENRA's work results from a review of existing reactors and experience feedback on their operation and inspection.

The order of 7th February 2012 setting out the general rules for BNIs

An order setting out the general rules for BNIs reuses the basic provisions in force and incorporates the "reference levels" developed by the Western European Nuclear Regulators' Association (WENRA). Most of the provisions of this order, published in the Official Gazette on 8th February 2012, will come into force on 1st July 2013, on which date the orders of 10th August 1984, 26th November 1999 and 31st December 1999 previously mentioned will be abrogated.

This order represents a significant reinforcement of the regulatory framework applicable to BNIs, as it specifies numerous requirements and formalises a number of ASN practices which hitherto had no regulatory underpinning. It also offers a solid basis for several requirements expressed by ASN, following the analysis of the complementary safety assessments (CSA) requested in the wake of the Fukushima accident.

Regulatory decisions

Pursuant to Article L.592-19 of the Environment Code, ASN may issue regulatory decisions to clarify decrees and orders in the field of nuclear safety or radiation protection, which have to be approved by the Government.

ASN defined a programme of regulatory decisions which will clarify decree 2007-1557 of 2nd November 2007 and the order of 7th February 2012 setting out the general rules applicable to BNIs.

The first ASN decision issued for application of the decree of 2nd November 2007 was decision 2008-DC-106 of 11th July 2008 relating to the implementation of the BNI internal authorisations system. Several decisions should be issued in 2012 following the publication of the order setting out the general rules applicable to BNIs. They will need to be approved by the ministers responsible for nuclear safety.

3|2|3 Basic safety rules and ASN guides

ASN has drafted basic safety rules (BSR) on a variety of technical subjects concerning BNIs. These are recommendations which specify safety objectives and describe practices ASN considers satisfactory. As part of the ongoing reorganisation of the general technical regulations, the BSRs are gradually being replaced by "ASN guides".

The "ASN guides" collection was created as an educational tool for professionals. In 2011, it comprises 17 purely advisory guides. These documents present ASN doctrine, stipulate recommendations, propose methods for achieving the objectives presented in the texts and share methods and good practices derived from experience feedback from significant events.

3|2|4 French nuclear industry professional codes and standards

The nuclear industry produces detailed rules dealing with the state of the art and industrial practices. It groups these rules in "Industrial codes". These rules allow concrete transposition of the requirements of the general technical regulations, while reflecting good industrial practice. They thus facilitate contractual relations between customers and suppliers.

In the particular field of nuclear safety, the industrial codes are drafted by the French association for NSSS equipment construction rules (Association française pour les règles de conception, de construction, et de surveillance en exploitation des matériels des chaudières électronucléaires - AFCEN), of which EDF and AREVA are members. The RCC codes of design and construction rules were drafted for the design, manufacture and commissioning of electrical equipment (RCC-E), civil engineering (RCC-G) and mechanical equipment (RCC-M). A code of mechanical equipment in-service monitoring rules (RSE-M) was drafted to deal with this subject.

Production of these documents is the responsibility of industry rather than ASN, which is nonetheless tasked with examining them to ensure their conformity with the general technical

regulations, in most cases leading to drafting of a BSR, a guide or a decision, recognising the overall acceptability on the date of the edition concerned.

3|3 Plant authorisation decree and commissioning licence

Chapter III of part IX of book V of the Environment Code contains a creation authorisation procedure, which may be followed by a number of licensing operations throughout the life of a BNI, from its commissioning up to final shutdown and decommissioning, including any modifications made to the facility.

3|3|1 Siting

Well before applying for a BNI authorisation decree, the licensee informs the administration of the site(s) on which it plans to build this installation. For its part, ASN analyses the safety-related characteristics of the sites: seismicity, hydrogeology, industrial environment, cold water sources, etc.

Construction of a BNI requires issue of a building permit by the préfet, according to procedures specified in Articles R.421-1 and following and Article R.422-2 of the Town Planning Code.

3|3|2 Safety options

Any industrial concern intending to operate a BNI may, even before starting the licensing procedure, ask ASN for an opinion on all or part of the safety options it intends to adopt for its installation. The applicant is notified of the ASN opinion and will produce any additional studies and justifications as necessary for a possible authorisation decree application. ASN generally asks a competent Advisory Committee to review the project.

The safety options must then be presented in the authorisation application dossier in the form of a preliminary safety analysis report (PSAR).

This preparatory procedure in no way exempts the applicant from the subsequent regulatory examinations but simply facilitates them.

3|3|3 Public debate

Pursuant to articles L.121-1 and following of the Environment Code, creation of a BNI must be preceded by a public debate when dealing with a new nuclear power plant site or a new site with a cost in excess of €300 million and, in certain cases, when dealing with a new site costing between €150 million and €300 million.

The public debate looks at the suitability, objectives and characteristics of the project.

For example, a public debate was held in 2010 prior to the decision to build an EPR type nuclear reactor in Penly. Smaller-scale projects can also give rise to a "local debate" initiative. This was the case for example in 2005 for the Jules Horowitz reactor project on the CEA (French Atomic Energy and Alternative Energy Commission) site at Cadarache.

3|3|4 Plant authorisation decrees

A BNI authorisation decree application is submitted to the ministers responsible for nuclear safety by the industrial concern intending to operate the facility, which thus acquires the status of licensee. The application is accompanied by a dossier comprising several items, including the detailed drawing of the installation, the impact assessment, the preliminary safety analysis report, the risk management study and the decommissioning plan.

ASN is responsible for reviewing the dossier, jointly with the ministers responsible for nuclear safety. This is followed by a period of parallel consultation of the public and technical experts.

The impact assessment is submitted for its opinion to the environmental authority created within the Departmental Council for the Environment and Sustainable Development (CGEDD).

TO BE NOTED

The WENRA reference levels

The Western European Nuclear Regulator's Association (WENRA) was created with the following aims:
- *to establish and coordinate a network of the chief nuclear safety regulators in Europe;*
- *to promote the sharing of experience and take mutual advantage of best practices;*
- *to develop a harmonised approach to subjects relating to nuclear safety and radiation protection, and to their regulation, particularly within the European Union;*
- *to give the European Union an independent capability for examining nuclear safety and its regulation in candidate countries for EU membership.*

WENRA has produced some 300 common "reference levels" concerning the safety of nuclear reactors, the safety of decommissioning operations and the safety of radioactive waste and irradiated fuel management facilities. These "reference levels", which are agreed upon at European level, cover subjects such as safety management, installation design and operation, the verification of safety, and emergency situations.

The collection of ASN guides

No.1	Disposal of radioactive waste in deep geological formations
No.2	Transport of radioactive materials in airports
No.3	Recommendations for drafting annual information reports for the public concerning basic nuclear installations
No.4	Auto-assessment of potential risks to patients receiving external radiotherapy
No.5	Management of radiotherapy safety and quality of treatment
No.6	Final shutdown, decommissioning and delicensing of basic nuclear installations in France
No.7	Applications for shipment authorisation and approval of package models or radioactive materials for civil use transported on the public highway
No.8	Assessment of nuclear pressure equipment conformity
No.9	Definition of a BNI perimeter (to be published in 2012)
No.10	Local involvement of CLIs in the 3rd ten-year inspections of the 900 MWe reactors
No.11	Notification and codification of criteria related to significant radiation protection events (excluding BNIs and radioactive material transport operations)
No.12	Notification and codification of criteria related to significant safety, radiation protection or environmental events applicable to BNIs and radioactive material transport operations
No.13	Protection of BNIs against off-site flooding
No.14	Acceptable complete clean-out methodologies in basic nuclear installations in France
No.15	Safety management policy within BNIs
No.16	Significant radiation protection event affecting a radiotherapy patient: declaration and classification on the ASN-SFRO scale
No.17	Studying hazards in transport infrastructures concerned by the transport of radioactive material
No.18	Disposal of effluents and waste contaminated by radionuclides, produced in facilities licensed under the Public Health Code

The public inquiry

The authorisation can only be granted after a public inquiry, as stipulated in Article L. 593-8 of the Environment Code. Publication of decree 2011-2018 of 29th December 2011 reforming the public inquiry process for operations liable to affect the environment, led to harmonisation of the public inquiry regime, which meant that the procedure applicable to BNIs was no longer an exception but was incorporated into the general regime. The purpose of the inquiry is to inform the public and collect their opinions, suggestions and counter-proposals, in such a way as to provide the competent authority with all the elements necessary for it then to make an informed decision.

The inquiry is carried out in accordance with the provisions of Articles L. 123-1 to L. 123-19 and R. 123-1 to R. 123-27 of this code. The préfet opens the public inquiry at least in each of the communes which is situated, at least in part, less than five kilometres from the perimeter of the installation. This inquiry lasts between a minimum of one month and a maximum of two months. The dossier submitted by the licensee in support of its authorisation application is made available in the public inquiry dossier. However, the safety analysis report (document containing the inventory of installation risks, an analysis of the measures taken to prevent these risks and a description of the measures designed to limit the probability and effects of accidents) is a large document that is difficult for non-specialists to understand, therefore it is supplemented by a risk control study.

Furthermore, the procedures concerning BNIs subject to an inquiry are concerned by decree 2011-2021 of 29th December, determining the list of projects, plans and programmes to be communicated electronically to the general public under the experiment specified in II of article L. 123-10 of the Environment Code. This states that the Authority responsible for opening and holding the public inquiry shall communicate the main documents in the inquiry dossier to the general public in electronic format. This approach aims to make it easier for the public to understand the projects, in particular those who do not live where the inquiry is being held. Using this means of providing access to information and the possibility of also submitting observations in electronic format, as stipulated in article R. 123-9 of the Environment Code, since the publication of decree 2011-2018 of 29th December 2011 reforming the public inquiry process for operations liable to affect the environment, should make it considerably easier for the public to express their opinions. These provisions will enter into force for those projects for which the order opening the public inquiry is published as of 1st June 2012.

Creation of a local information committee

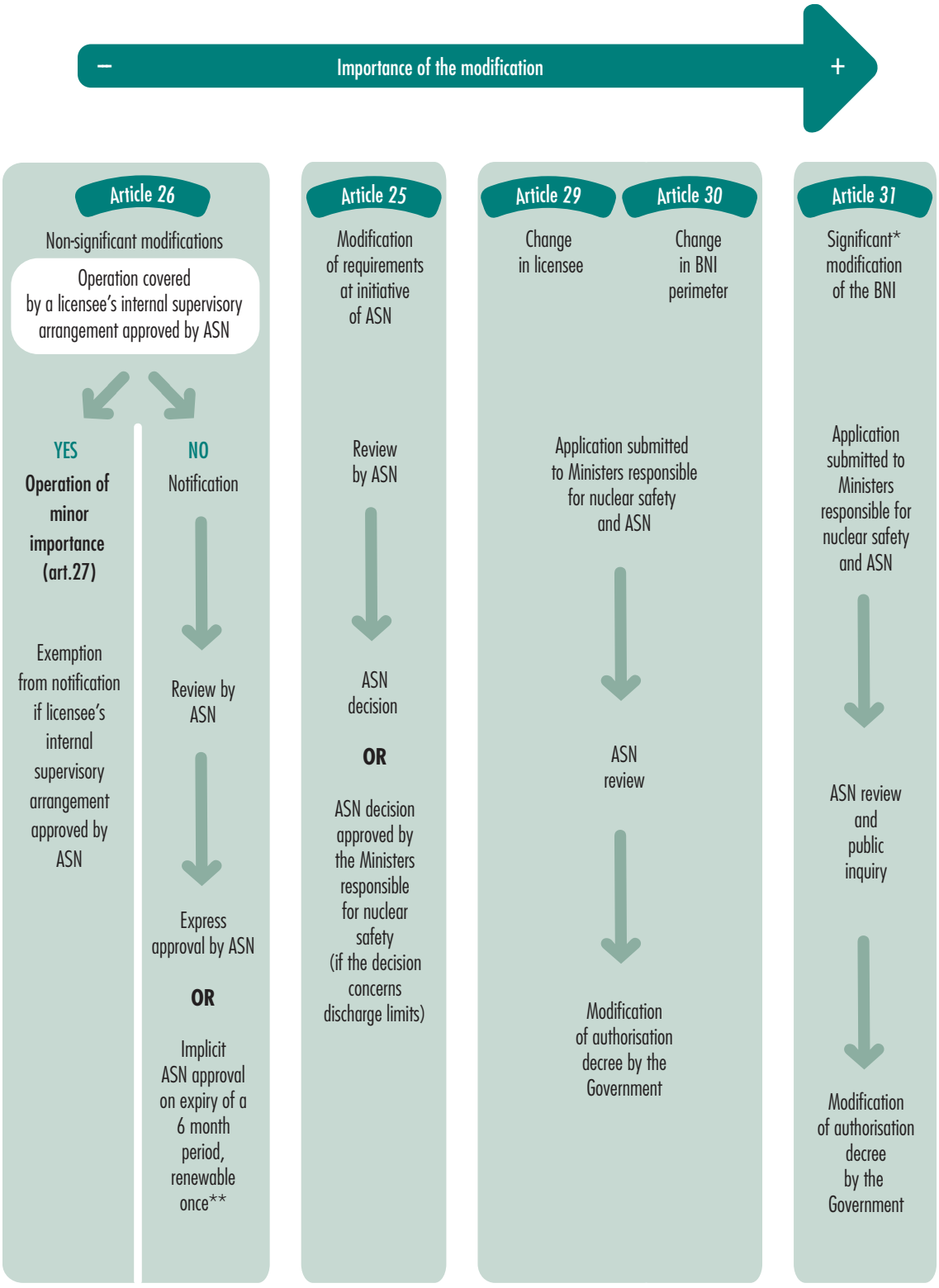
The TSN Act formally defined the status of the BNI local information committees (CLI). The corresponding provisions can be found in sub-section 3 of section 2 of chapter V of part II of book 1 of the Environment Code. The CLI can be created as soon as the BNI authorisation decree application is made. Whatever the case, it must be constituted once the authorisation decree has been issued.

The CLIs are presented in chapter 6.

Consultation of other European Union countries

Pursuant to article 37 of the treaty instituting the European atomic energy community and the TSN Act, it is only possible to authorise the creation of a facility liable to discharge radioactive effluent into the environment after consulting the European Commission.

Diagram 3: types of BNI modification provided for by the "BNI procedures" decree



* Definition of significant modification of a BNI: a change in its nature or rise in its capacity, a change in the key aspects regarding the protection of public health and safety, nature and the environment, the addition of a new BNI within the perimeter of the initial BNI.
** This time allows ASN to proceed with a new review or issue additional requirements.

Consultation of technical organisations

The preliminary safety analysis report appended to the authorisation decree application is transmitted to ASN, which submits it for examination to one of the Advisory Committees reporting to it, following a report from IRSN.

Further to its investigation and the results of the consultations, ASN sends the ministers responsible for nuclear safety a draft decree proposal authorising or rejecting creation of the installation.

The authorisation decree (DAC, see diagram 4)

The ministers responsible for nuclear safety send the licensee a draft decree granting or rejecting authorisation. The licensee has a period of two months in which to present its observations. The ministers then solicit the opinion of the ASN. Decision 2010-DC-0179 of 13th April 2010, which came into force in July 2010, gives licensees and the CLIs the possibility of being heard by the ASN college before it gives its opinion.

The authorisation decree for a BNI is delivered by a decree from the Prime Minister and countersigned by the ministers responsible for nuclear safety.

The DAC establishes the perimeter and characteristics of the facility. It also specifies the duration of the authorisation, if applicable, and the installation commissioning deadline. It also specifies the essential elements required to protect public health and safety, or to protect nature and the environment.

The requirements defined by ASN for application of the authorisation decree

For application of the authorisation decree, ASN defines the requirements regarding the design, construction and operation of the BNI that it considers to be necessary for nuclear safety.

ASN defines the requirements regarding the BNI water intakes and effluent discharges. The specific requirements setting limits on the discharges from the BNI into the environment are subject to approval by the ministers responsible for nuclear safety. In application of Article L.593-15 of the Environment Code (previously paragraph IIbis of Article 29 of the TSN Act) created by the "Grenelle II" Act 2010-788 of 12th July 2010 constituting the French environmental commitment), information on BNI modification projects that could lead to a significant increase in water intake or effluent discharge into the environment will now be made available to the public. This arrangement will enter into force on 1st July 2012 (6 months after publication of the decree specified in Article L. 122-3 of the Environment Code, which stipulates certain legislative requirements concerning the impact assessments). ASN has nonetheless required this of the licensees since 2008 and it has been implemented on several occasions, for example the revision of the discharge license provisions for the Cadarache site in 2010.

Modification of a BNI

Any significant modification to an installation is subject to a procedure similar to the authorisation decree application.

A modification is considered to be significant in the cases mentioned in article 31 of decree 2007-1557 of 2nd November 2007, known as the "procedures" decree:
– a change in the nature of the installation or an increase in its maximum capacity;
– a modification of the key elements protecting the interests mentioned in the first paragraph of article L. 593-1 of the environment code, which appear in the authorisation decree;
– the addition, within the perimeter of the facility, of a new BNI, the operation of which is linked to that of the facility in question.

Furthermore, if a BNI licensee envisages making modifications to its operating arrangements or to its installation that would not be considered significant under the above criteria, it must declare them to the ASN beforehand. It cannot make the modifications until a renewable period of at least six months has expired, unless ASN gives its express agreement. If it so considers necessary, ASN may stipulate requirements so that the envisaged modifications are reviewed or accompanied by additional measures to guarantee the protection of the interests mentioned in the 1st paragraph of article L. 593-1 of the Environment Code.

The other installations located within a BNI perimeter

The following co-exist within the perimeter of a BNI:
– equipment and installations which are part of a BNI: these are elements of this installation which are necessary for it to operate; depending on their type, they can in technical terms be compared to classified installations but, as a part of the BNI, they are subject to the regulations applicable to BNIs;
– classified equipment and installations which are not necessarily linked to the BNI.

The equipment necessary for BNI operation is fully covered by the BNI system specified in the "BNI procedures" decree. The other equipment subject to another regime (water or ICPE) but located within the perimeter of the BNI remains subject to this regime, but with a change in competent party, as individual measures are no longer taken by the préfet, but by ASN.

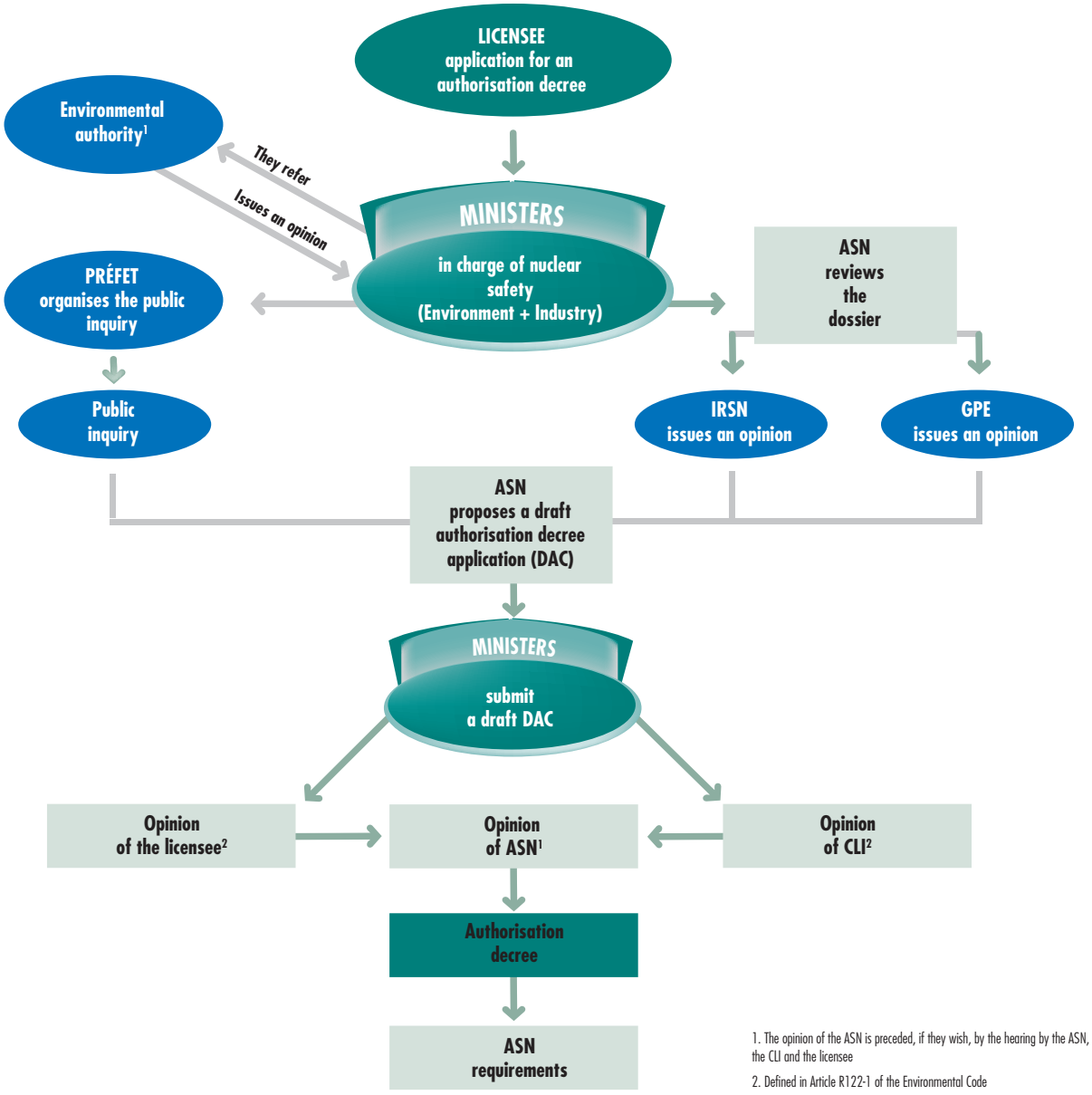
3|3|5 Commissioning licences

Commissioning corresponds to first utilisation of radioactive materials in the installation or the first operation of a particle beam.

Prior to commissioning, the licensee sends ASN a dossier comprising the updated safety analysis report of the "as-built" installation, the general operating rules, a waste management study, the on-site emergency plan and the decommissioning plan.

After checking that the installation complies with the objectives and rules defined by the TSN Act and its implementing texts, ASN authorises commissioning of the installation and communicates this decision to the ministers responsible for nuclear safety and to the préfet. It also forwards it to the CLI.

Diagram 4: basic nuclear installation authorisation decree in accordance with the Act of 13 June 2006



1. The opinion of the ASN is preceded, if they wish, by the hearing by the ASN, the CLI and the licensee

2. Defined in Article R122-1 of the Environmental Code

3|4 Particular requirements for the prevention of pollution and detrimental effects

3|4|1 The OSPAR convention

The international OSPAR Convention (the result of the merger between the Oslo and Paris conventions) is the mechanism whereby the European Commission and fifteen States, including France, cooperate to protect the marine environment of the North-East Atlantic. In 2010, through the Bergen declaration, the ministers of each contracting party renewed and reaffirmed their commitments with respect to OSPAR. They approved the general report on the quality of the environment and adopted the new strategic orientations. With regard to radioactive materials, the strategic objectives are to "prevent pollution of the maritime area by ionising radiation through progressive and substantial reductions in discharges, emissions and losses of radioactive substances, with the

ultimate aim of achieving concentrations in the environment approaching the background values for naturally occurring radioactive substances and approaching zero for artificial radioactive substances". To achieve these objectives, the following are taken into account:
– the radiological impacts on man and biota;
– the legitimate uses of the sea;
– technical feasibility.

Within the French delegation, ASN takes part in the work of the committee tasked with assessing application of this strategy.

3|4|2 Discharges from basic nuclear installations

BNI discharges management policy

Like all industries, nuclear activities (nuclear industry, nuclear medicine, research installations, etc.) create by-products, which may or may not be radioactive. Steps are being taken to reduce their quantity through reduction at source.

The radioactivity discharged in effluents represents a marginal fraction of that which is confined in the waste.

Opting for discharge of effluents (liquid or gaseous) is part of a more general approach aimed at minimising the overall impact of the installation.

ASN makes sure that the BNI authorisation decree application explains the licensee's choices, in particular the reduction at source measures, the decisions taken between confinement, treatment or dispersal of substances, based on safety and radiation protection considerations.

The optimisation efforts required by the authorities and made by the licensees have - for "equivalent operation" - resulted in these emissions being constantly and sometimes considerably reduced. ASN hopes that setting discharge limit values will encourage the licensees to maintain their discharge optimisation and management efforts. It ensures that discharges are kept to the minimum possible by using the best techniques available, and has undertaken a revision of the discharge limits in recent years.

The impact of BNI chemical discharges

The substances discharged can have an impact on the environment and the population owing to their chemical characteristics.

ASN considers that BNI discharges should be regulated in the same way as those of other industrial facilities. The TSN Act, now codified in the Environment Code, and more broadly the general technical regulations concerning discharges and the environment, takes account of this issue. This integrated approach is little used abroad, where chemical discharges are often regulated by an authority different from that in charge of radiological issues.

ASN wants to ensure that the impact of chemical discharges on the populations and the environment is as low as possible, in the same way as for radioactive materials.



ASN "environmental" inspection at the Flamanville nuclear power plant – November 2011

The impact of BNI thermal discharges

Some BNIs, especially nuclear power plants, discharge cooling water into watercourses or the sea, either directly or after cooling in cooling towers. Thermal discharges lead to a temperature rise in the watercourse around and downstream of the discharge point, which can reach several degrees.

The regulatory limits aim to prevent a modification of the receiving environment, in particular fish life, and to ensure acceptable health conditions if water is taken for human consumption downstream. These limits can thus differ according to the environment and the technical characteristics of each installation.

3|4|3 Prevention of accidental pollution

The order of 31 December 1999 sets measures designed to prevent or, in the event of an accident, to minimise direct or indirect release of toxic, radioactive, flammable, corrosive or explosive liquids into the natural environment and the sewers.

On the occasion of the overhaul of the general regulations applicable to BNIs, the requirements of the order of 31st December 1999 are taken up by the order of 7th February 2012 setting the general rules for BNIs, some of which will be subsequently clarified in the relevant ASN regulatory decisions, for example the "detrimental effects and impact" decision.

3|4|4 Protection against noise

The 31 December 1999 order sets allowable limits for noise and requires verification of compliance with the stipulated noise limits. Protection against noise is among the requirements of the order of 7th February 2012 setting the general rules applicable to BNIs.

3|4|5 Protection against the microbiological risk (legionella, amoebae)

Most natural surface waters (lakes, rivers) naturally contain high levels of bacteria, whose presence is linked to the existence of the nutrients and minerals essential for their growth and to temperature conditions conducive to this growth.

Micro-organisms can therefore be found in various installations: sanitary installations, air-conditioning installations and cooling systems (cooling towers, industrial cooling circuits), ponds and fountains, spa waters and medical equipment producing aerosols.

Some of these bacteria are pathogenic, which is why special measures are required. This is in particular the case with legionella and amoebae such as Naegleria Fowleri.

The requirements relative to the prevention and limitation of the risks of development of legionella are similar to those adopted for ICPEs, while taking into account the specifics of BNIs. The characteristics of the cooling towers and nuclear power plant cooling systems justified the adoption of particular measures. They are presented in chapter 12.

3|5 Requirements concerning radioactive waste and decommissioning

3|5|1 Radioactive waste management in basic nuclear installations

The regulations, whether the requirements of the order of 31st December 1999 setting the general technical regulations designed to prevent and limit off-site detrimental effects and hazards resulting from the operation of basic nuclear installations, or the order of 7th February 2012 setting the general rules concerning basic nuclear installations and applicable in 2013, determine requirements concerning waste management in BNIs, whether conventional or radioactive.

The licensees must for example conduct a study comprising an analysis of the waste produced or to be produced in the facility, as well as of the waste zoning plan, which specifies the measures taken by the licensee for waste management. An ASN decision will supplement the requirements concerning management of the waste produced in BNIs. ASN submitted the draft decision to public consultation from 26th May to 31st August 2010. Following incorporation of the comments and observations received, it will be published in 2012 after publication of the order of 7th February 2012 setting the general rules applicable to BNIs and it will enter into force in 2013.

3|5|2 Decommissioning

The technical provisions applicable to installations a licensee wishes to shut down and decommission must be in compliance with general safety and radiation protection regulations, notably regarding worker external and internal exposure to ionising radiation, the production of radioactive waste, discharge of effluents to the environment and measures designed to reduce the risk of accidents and mitigate their consequences. Safety issues can be significant during active clean-out or dismantling operations and must never be neglected, including during passive surveillance phases.

Once the licensee has decided to cease operations in its installation in order to proceed with final shutdown and decommissioning, it is no longer covered by the framework set by the licensing decree nor the safety reference system associated with the operating phase. In accordance with the provisions of chapter III of section IX of book V of the Environment Code, final shutdown and then decommissioning of a nuclear facility are authorised by a further decree, issued on the advice of ASN.

ASN has specified the regulations for BNI decommissioning operations in a guide, following major work designed to clarify and simplify the administrative procedures while at the same time improving the importance given to safety and radiation protection. A completely revised version of this guide, produced to include the regulatory changes resulting from the publication of the TSN Act and decree 2007-1557 of 2nd November 2007, as well as the work done by WENRA, was finalised in 2009.

The final shutdown and decommissioning authorisation procedure

At least one year before the date scheduled for final shutdown, the licensee submits the authorisation request to the ministers responsible for nuclear safety. The licensee sends ASN a copy of its application along with the dossier necessary for its examination.

The final shutdown and decommissioning authorisation application is in the same way subject to the consultations and inquiries applicable to the BNI authorisation decree applications.

Two licensing systems coexist, one for general cases and one for radioactive waste disposal facilities:

General case:
– the licence application contains requirements concerning the shutdown conditions, the decommissioning and fuel management procedures, and the surveillance and subsequent maintenance of the installation site;



Bugey 1 dismantling worksite – UNGG gas-cooled reactor fuel loading zone – August 2011

– the licence is granted by decree, subject to the opinion of ASN, setting the decommissioning characteristics, the time allotted for decommissioning and the types of operations for which the licensee is responsible after decommissioning.

Radioactive waste disposal facilities:
– the licence application contains requirements concerning final shutdown and the subsequent maintenance and surveillance of the site;
– the licence is issued by decree, subject to the opinion of ASN, setting the types of operations for which the licensee is responsible after final shutdown.

Performance of final shutdown and decommissioning operations

In order to avoid fragmentation of the decommissioning projects and improve their overall consistency, the dossier submitted to support the final shutdown and decommissioning application must explicitly describe all the planned work, from final shutdown to attainment of the target final condition and, for each step, must explain the nature and scale of the risks presented by the installation as well as the envisaged means of managing these risks. The final shutdown and decommissioning phase may be preceded by a final shutdown preparation stage, provided for in the initial operating licence. This preparatory phase in particular allows removal of all or part of the source term, as well as preparation for the decommissioning operations (readying of premises, preparation of worksites, training of staff, etc.). It is also during this preparatory phase that installation characterisation operations can be carried out: production of radiological maps, collection of pertinent data (operating history) with a view to decommissioning, etc.

Installation delicensing

Following decommissioning, a nuclear installation can be delicensed. It is then removed from the list of BNIs and no longer has BNI status. To support its delicensing application, the licensee must provide a dossier demonstrating that the envisaged final state has indeed been reached and describing the state of the site after decommissioning (analysis of the state of the soil and remaining buildings or equipment, etc.). Depending on the final state reached, public protection restrictions may be implemented, depending on the intended subsequent use of the site and/or buildings. These may contain a certain number of restrictions on use (only to be used for industrial applications for example) or precautionary measures (radiological measurements to be taken in the event of excavation, etc.). ASN may make delicensing of a BNI dependent on the implementation of such restrictions.

3|5|3 The financing of decommissioning and radioactive waste management

Sections 1 and 2 of chapter IV of part IX of book V of the Environment Code (previously Article 20 of the "Waste" Act) create an arrangement for ring-fencing funds to meet the costs of decommissioning nuclear facilities and managing radioactive waste. These arrangements are clarified by decree 2007-243 of 23rd February 2007 and the order of 21st March 2007 concerning the secure financing of nuclear costs. The legal system created by these texts aims to secure the financing of nuclear costs, through implementation of the "polluter-pays" principle. It is therefore up to the nuclear licensees to ensure this financing, by setting up a portfolio of assets dedicated to the expected costs. This is done under the direct control of the State, which analyses the situation of the licensees and can prescribe measures, should it be seen to be insufficient or inadequate. In any case, the nuclear licensees remain responsible for the satisfactory financing of their long-term costs.

It stipulates that the licensees must make a prudent assessment of the cost of decommissioning their installations or, for radioactive waste disposal installations, their final shutdown, maintenance and monitoring costs. They also evaluate the cost of managing their spent fuel and radioactive waste, according to Article L. 594-1 of the Environment Code. Pursuant to the decree of 23 February 2007, ASN issues an opinion on the consistency of the decommissioning and spent fuel and radioactive waste management strategy presented by the licensee with regard to nuclear safety.

3|6 Particular requirements for pressure equipment

Pressure equipment is subject to the requirements of Act 571 of 28th October 1943 as amended, concerning steam pressure equipment used on land and gas pressure equipment used on land or on-board seagoing ships, and those of the decree of 2nd April 1926 as amended regulating steam pressure equipment other than that installed on-board ships, decree 63 of 18th January 1943 as amended, regulating gas pressure equipment, or decree 99-1046 of 13th December 1999 concerning pressure equipment.

Pressure equipment specifically designed for BNIs is subject to special requirements entailing monitoring and inspection by ASN. These requirements are covered by both the BNI system and that applicable to pressure equipment. They are in particular defined in the decree of 13th December 1999 and specific orders.

The principles of these regulations are those of the new approach pursuant to the European pressure equipment directive. The equipment is designed and produced by the manufacturer under its own responsibility. It is required to comply with the main safety and radiation protection requirements and to have the conformity of its equipment assessed by an independent, competent third-party organisation approved by ASN. The equipment in operation must be monitored and maintained by the licensee under ASN control and must undergo periodic technical inspections by ASN-approved organisations.

ASN will monitor the organisations.

Article 50 of Act 2009-526 of 12th May 2009 simplifying and clarifying the law and relaxing procedures, modified the Act of 28th October 1943, giving ASN additional competence for regulation of the other ("conventional") pressure equipment present in a BNI.

Table 2 summarises the texts applicable to the pressure equipment present in BNIs.

Table 2 : regulations applicable to pressure equipment

	Nuclear			Conventional
	Main primary system of pressurised water reactors	Main secondary systems of pressurised water reactors	Other equipment	
Construction	• Decree of 2nd April 1926; • Order of 26th February 1974(1)	• Decree of 2nd April 1926; • RFS II.3.8 of 8th June 1990(1)	• Decree of 2nd April 1926; • Decree of 18th January 1943(1) or; • Decree 99-1046 of 13th December 1999	• Decree 99-1046 of 13th December 1999
	or Order of 12th December 2005			
Operation	• Order of 10th November 1999		• Decree of 2nd April 1926 • Decree of 18th January 1943(1)	• Decree 99-1046 of 13th December 1999 • Order of 30th March 2005

(1) Since 2011, the order of 12th December 2005 applies to the construction and operation of nuclear pressure equipment, except for the operational aspects of the main primary and main secondary systems of pressurised water reactors.

4 REGULATIONS GOVERNING THE TRANSPORT OF RADIOACTIVE MATERIALS

4|1 International regulations

For the safe transport of radioactive materials, the International Atomic Energy Agency (IAEA) has issued basic rules called "Regulations for the Safe Transport of Radioactive Material" (TS-R-1). ASN is a participant in IAEA's work.

This basis specific to radioactive materials is used in the drafting of the "modal" transport safety regulations in force for dangerous goods: the ADR agreement (European agreement on the international transport of dangerous goods by road) for road transport, the regulations concerning international rail transport of dangerous goods (RID) for rail transport, the regulations for the transport of dangerous goods on the Rhine (ADNR) for river transport, the international maritime dangerous goods code (IMDG) for maritime transport and the technical instructions of the ICAO (International Civil Aviation Organisation) for air transport.

Directive 2008/68/EC of 24th September 2008 sets out a common framework for all aspects of goods transport by road, rail and inland waterway, within the European Union.

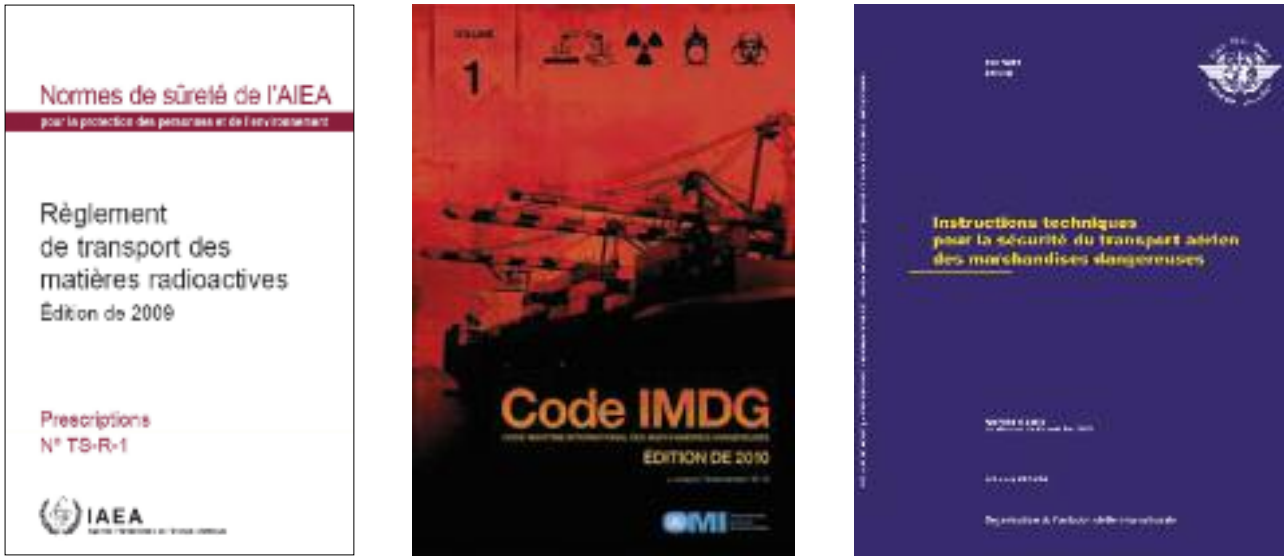
The regulations derived from IAEA recommendations specify the package performance criteria. The safety functions to be assured are containment, radiation protection, prevention of thermal hazards and criticality.

The degree of safety of the packages is adapted to the potential harmfulness of the material transported. For each type of package, the regulations define the scope of intervention of the public authorities, the associated safety requirements and the criteria to be met for successful testing (see chapter 11, point 2).

4|2 National regulations

The "modal" regulations are transposed in full into French law and are made applicable by interministerial orders based on the provisions of the transport code, especially its Articles L. 1252-1 and following. ASN is in direct contact with the Administrations responsible for the various modes of transport (General Directorate for Infrastructure, Transport and the Sea (DGITM), General Directorate for Risk Prevention (DGPR) and General Directorate for Civil Aviation (DGAC)) and attends the French Interministerial Commission for the Carriage of Dangerous Goods (CITMD).

The directive of 24th September 2008 is transposed into French law by a single order covering all land transport on the national territory. This is the order of 29th May 2009 concerning the transport of dangerous goods by land, known as the "TMD order". This text replaced the previous "ADR", "RID" and "ADNR" modal orders as of 1st July 2009.



IAEA TS-R-1 regulations and maritime (IMDG) and air (IT ICAO) transport regulations

Other orders specific to a mode of transport apply to the transport of radioactive materials:

– the order of 12th May 1997 as modified, concerning the technical conditions for the operation of aircraft by a public air transport operator (OPS1);
– the order of 23rd November 1987 as modified, division 411 of the regulation concerning the safety of ships (RSN);
– the order of 18th July 2000 as modified, regulating the transport and handling of dangerous goods in sea ports.

The regulations in particular require approval of the package models for certain radioactive material transport operations (see chapter 11). These approvals are issued by ASN.

Article R. 1333-44 of the Public Health Code also requires that companies transporting radioactive materials in France be subject to either notification of or licensing by ASN. The procedures for implementation of this requirement are to be clarified by an ASN regulatory decision, publication of which is currently suspended pending a possible European regulation covering these activities.

Implementation of the regulations on the safe transport of radioactive materials is checked by nuclear safety inspectors duly appointed by ASN.



ADR and RID regulations

5 REQUIREMENTS APPLICABLE TO CERTAIN RISKS OR CERTAIN PARTICULAR ACTIVITIES

5|1 Installations classified on environmental protection grounds (ICPE) using radioactive materials

The ICPE regime comprises objectives that are similar to those for BNIs, but it is not specialised and applies to a large number of installations involving risks or detrimental effects of all types.

Depending on the scale of the hazards they represent, ICPEs require authorisation by the préfet, or registration, or simple notification.

For installations requiring licensing, this licence is issued by order of the préfet following a public inquiry. The licence comprises requirements which may be subsequently modified by a further order.

The list of ICPEs is given in column A of the appendix to Article R. 511-9 of the Environment Code. It defines the types of installations subject to the system and the applicable thresholds.

Two headings in the list of ICPEs concern radioactive materials:
– heading 1715 concerns the preparation, fabrication, transformation, packaging, utilisation, deposit, storage or disposal of radioactive materials. These activities require notification or authorisation, depending on the quantity of radionuclides used. However, these activities are only subject to the ICPE regime if the establishment in which they take place is subject to authorisation under the terms of this regime for another of its activities;
– heading 1735 requires licensing of repositories, storage or disposal facilities for solid residues of uranium, thorium or radium ore, as well as their by-products not containing uranium enriched with isotope 235 and for which the total quantity exceeds one ton.

Pursuant to article L.593-3 of the Environment Code, an installation covered by the list of ICPEs which is also covered by the BNI regime would in fact only be subject to the latter regime.

Similarly, by virtue of Article L. 1333-4 of the Public Health Code, the authorisations issued to ICPEs under the Environment Code for the possession or utilisation of radioactive sources take the place of the authorisation required under the Public Health Code. However, except for the provisions concerning procedures, the regulatory provisions of the Public Health Code apply to them.

5|2 The regulations designed to combat malicious acts in nuclear activities

The regimes mentioned above often take account of the fight against malicious acts, at least in part. For example, in the BNI regime, the licensee must in its safety analysis report present an analysis of the accidents liable to occur in the installation, regardless of the cause of the accident, including in the event of a malicious act. This analysis mentions the effects of the accidents and the steps taken to prevent or minimise these effects. It is taken into account when assessing whether or not the authorisation decree can be issued. The most important risk prevention or mitigation measures can be the subject of ASN requirements.

The threats to be considered when examining malicious acts are defined by the Government (General Secretariat for Defence and National Security).

There are also procedures specific to the fight against malicious acts. Two systems created by the Defence Code concern certain nuclear activities:
– chapter III of part III of book III of the first part of the Defence Code defines the measures to protect and monitor nuclear materials. This concerns the following fusible, fissile or fertile materials: plutonium, uranium, thorium, deuterium, tritium, lithium 6, as well as chemical compounds comprising one of these elements, except ores. To prevent the dissemination of these nuclear materials, their import, export, production, possession, transfer, use and transport are subject to licensing;
– chapter II of part III of book III of the first part of the Defence Code defines a system for protection of establishments which "if unavailable, would risk significantly compromising the nation's combat or economic potential, its security or its capacity for survival". The TSN Act, particularly its article 2, supplemented Article L. 1333-2 of the Defence Code in order to enable the administrative authority to apply this system to establishments comprising a BNI "when the destruction of or damage to (this BNI) could constitute a serious danger for the general public". This protection system requires that the licensees take the protective measures stipulated in a particular protection plan prepared by itself and approved by the administrative authority. These measures in particular include effective surveillance, alarm and material protection measures. If the plan is not approved and in the event of a persistent disagreement, the decision is taken by the administrative authority.

With regard to nuclear activities outside the scope of national defence, these systems are monitored at national level by the Defence High Official at the Ministry responsible for Energy.

5|3 The particular system applicable to defence-related nuclear activities and installations

Defence-related nuclear installations and activities are mentioned in point III of Article 2 of the TSN Act. Pursuant to Article R. 1333-37 of the Defence Code, these are:
– secret basic nuclear installations (INBS);
– military nuclear systems;
– defence-related nuclear experimentation sites and installations;
– the former nuclear experimentation sites in the Pacific;
– transport of fissile or radioactive materials involved in the nuclear weapons and naval nuclear propulsion activities.

A large number of the requirements applicable to nuclear activities governed by ordinary law also apply to defence-related nuclear activities and installations; for example, they are subject to the same general principles as all nuclear activities and the requirements of the Public Health Code, including the system of licensing and notification of small-scale nuclear activities, and they concern defence-related nuclear activities in the same conditions as the ordinary law activities, except for the fact that the licences are granted by the Delegate for Nuclear Safety and Radiation Protection for National Defence Installations and Activities (DSND), reporting to the Minister for Defence and the Minister for Industry. These activities and installations are regulated and inspected by the personnel of the Defence Nuclear Safety Authority (ASND) headed by the Delegate.

Pursuant to point III of article 2 of the TSN Act, other provisions are specific to defence-related nuclear activities and facilities. They are subject to particular information rules in order to comply with specific defence requirements. Similarly, the installations on the list of BNIs, but which are classified as INBS by order of the Prime Minister, are not subject to the BNI system but to a special system defined by the Defence Code and implemented by the ASND (see section 2 of chapter III of book III of the first part of the Defence Code).

ASN and ASND maintain very close relations to ensure consistency between the systems for which they are responsible.

6 OUTLOOK

ASN is continuing with the publication of technical regulatory decisions required by the Public Health Code and the Labour Code. A number of decisions should therefore be issued in 2012, including those concerning the design and operating rules for medical facilities using ionising radiation, the minimum technical design rules applicable to facilities using X-rays, the design rules applicable to electrical devices emitting X-rays, the registration, monitoring, recovery and disposal of sources, and the identification and marking of high-level sealed sources.

ASN will also be assisting the Government with coming work on the transposition into French law of the new Euratom directives, whether the directive concerning radiation protection, or that concerning the management of waste and spent fuel.

With regard to the new radiation protection directive and in order to prepare for the transposition, ASN will in 2012 be conducting an analysis of the legislative modifications that will probably be necessary and will then start specific work on medical physics, the radiation protection expert (RPE), the radiological emergency and post-accident response teams and natural radioactivity in construction materials.

With regard to BNIs, ASN will in 2012 continue its work to overhaul the general technical regulations. The order setting out the BNI general rules has already been issued on 7th February 2012 (published on 8th February 2012). 2012 should also be marked by the publication of regulatory decisions, some of which have already been through the public consultation process. The publication of these texts is a new and significant step in the project to overhaul the regulations. The order of 7th February 2012 supplements and clarifies the framework created by the TSN Act and the "BNI procedures" decree, by formally stipulating the requirements based on experience feedback from several years of regulating nuclear facilities, thus giving them an appropriate legal underpinning. The publication of the order of 7th February 2012 is also a means of ensuring that the requirements ASN considers to be essential, and which were generally specified individually subsequent to periodic safety reviews, can now be applied clearly and uniformly to all facilities. Entry into force of regulatory decisions will mark the completion of the transposition into French law of the "reference levels" adopted by WENRA. As this entry into force is scheduled for 1st July 2013, 2012 could be devoted to disseminating and assimilating the provisions of the order of 7th February 2012, for instance by the licensees.

ASN will propose to the ministers responsible for nuclear safety modifications to decree 2007-1557 of 2nd November 2007 concerning BNIs and the regulation of the nuclear safety of the transport of radioactive materials, known as the "BNI procedures" decree, on the basis of the feedback gathered with respect to its implementation.

ASN will assist the Ministry for Ecology, Sustainable Development, Transport and Housing with integrating the regulatory requirements in force into the Environment Code.

Working groups will continue their work on drafting the next revision of the regulations concerning the transport of radioactive materials. They will in particular deal with fissile exceptions, the acceleration levels to be considered for package tie-down, and the interim measures and requirements.

Lastly, ASN hopes in 2012 to see the completion of the study into setting up a system to control "source security", which began several months ago. This control system will aim to guarantee the application of measures to protect the most dangerous sources of ionising radiation against malicious acts, from production through to disposal. ASN is thus working on drafting the corresponding legislative and regulatory requirements to be included in the bill ratifying ordinance 2012-6 of 5th January 2012 amending books I and V of the Environment Code. Following discussion by the Cabinet on 21st March 2012, this bill was tabled before the Senate. If adopted, these requirements should be incorporated into the Public Health Code.

APPENDIX 1
REGULATION EXPOSURE LIMITS AND DOSE LEVELS

Annual exposure limits contained in the Public Health Code (CSP) and in the Labour Code (CT)

References	Definition	Values	Observation
	Annual limits for the general public		
Art. R.1333-8 of the CSP	• Effective doses for the body • Equivalent doses for the lens of the eye • Equivalent doses for the skin (average dose over any area of 1 cm^2 of skin, regardless of the area exposed)	1 mSv/year 15 mSv/year 50 mSv/year	☞ These limits comprise the sum of effective or equivalent doses received as a result of nuclear activities. These are limits that must not be exceeded.
	Worker limits for 12 consecutive months		
Art. R. 4451-13 of the CT	Adults: • Effective doses for the body • Equivalent doses for the hands, forearms, feet and ankles • Equivalent doses for the skin (average dose over any area of 1 cm^2 of skin, regardless of the area exposed) • Equivalent doses for the lens of the eye Pregnant women • Exposure of the child to be born Young people from 16 to 18 years old*: • Effective doses for the body • Equivalent doses for the hands, forearms, feet and ankles • Equivalent doses for the skin • Equivalent doses for the lens of the eye	 20 mSv 500 mSv 500 mSv 150 mSv 1 mSv 6 mSv 150 mSv 150 mSv 50 mSv	☞ These limits comprise the sum of effective or equivalent doses received. These are limits that must not be exceeded. ☞ Exceptional waivers are accepted: • when justified beforehand, they are scheduled in certain working areas and for a limited period, subject to special authorisation. These individual exposure levels are planned according to a ceiling limit which is no more than twice the annual exposure limit value; • emergency occupational exposure is possible in an emergency situation, in particular to save human life.

* Only if covered by waivers, such as for apprentices.

Optimisation levels for patient protection (Public Health Code)

References	Definition	Values	Observation
Diagnostic examinations			
Diagnostic reference levels Art. R.1333-68, order of 16 February 2004	Dose levels for standard diagnostic examinations	E.g. : entry level of 0.3 mGy for an X-ray of the thorax	☞ The diagnostic reference levels, the dose constraints and the dose target levels are used by applying the principle of optimisation. They are simply guidelines. ☞ The reference levels are defined for standard patients by dose levels for standard radiological examinations and by radioactivity levels for radiopharmaceutical products used in diagnostic nuclear medicine.
Dose constraint Art. R.1333-65, order expected in 2006	Used when exposure offers no direct medical benefit to the person exposed		☞ The dose constraint can be a fraction of a diagnostic reference level, in particular for exposure in the context of biomedical research or forensic procedures.
Radiology			
Target dose level Art. R.1333-63	Dose necessary for the target organ or tissue (target organ or target-tissue) during radiotherapy (experimentation)		☞ The target dose level (specialists talk of a target volume in radiotherapy) is used to adjust the equipment.

Intervention levels in cases of radiological emergencies

References	Definition	Values	Observation
Protection of the general public			
Intervention levels Art. R.1333-80, order of 14th October 2003, circular of 10th March 2000	Expressed in effective dose (except for iodine), these levels are designed to assist with the relevant response decision to protect the general public: • sheltering • evacuation • administration of a stable iodine tablet (equivalent dose for the thyroid)	10 mSv 50 mSv 50 mSv	☞ The *préfet* can make adjustments to take account of local factors.
Protection of participants			
Reference levels Art. R.1333-86	These levels are expressed as effective dose: • for the special teams for technical or medical intervention • for the other participants	100 mSv 10 mSv	☞ This level is raised to 300 mSv when the intervention is designed to prevent or reduce exposure of a large number of people.

Source: The Public Health Code

Action levels (Public Health Code and Labour Code) and activity or dose levels above which steps must be taken to reduce exposure

References	Definition	Values	Observation
Lasting exposure (contaminated sites)			
Art. R.1333-89 of the CSP IRSN Guide 2000	Selection level: individual dose above which the need for rehabilitation must be examined	Not defined	☞ The notion of selection level is introduced by the IRSN guide for management of industrial sites potentially contaminated by radioactive materials.
Exposure to radon			
Protection of the general public Art. R.1333-15 and R.1333-16 of the CSP, order of 22 July 2004	Premises open to the public	400 Bq/m³ 1,000 Bq/m³	☞ See recommendation published in Official Gazette of 11 August 2004 defining the radon measurement methods. ☞ See recommendation published in Official Gazette of 22 February 2005 defining corrective action to be taken in the event of an overexposure.
Lasting exposure (contaminated sites)			
Worker protection	Working environments	400 Bq/m³	
Enhanced natural exposure (other than radon)			
Protection of the general public Art. R.1333-13 and R.1333-16 of the CSP	Effective dose	None	☞ Any population protection action to be taken will be defined on a case-by-case basis.
Worker protection Art. R.4457-6 to 9 Order of 7 August 2008		1 mSv/year	
Water intended for human consumption			
Order of 11 January 2007	Annual total indicative dose (TID), calculated based on the radionuclides present in the water, except for tritium, potassium 40, radon and daughter products Tritium Total alpha activity Total residual beta activity	0.1 mSv/an 100 Bq/L 0.1 Bq/L 1 Bq/L	☞ The TID can be used to estimate the exposure attributable to the radiological quality of the water. Any corrective measures to be taken if the TID is exceeded depend on the value of the TID and the radionuclides in question. ☞ Tritium is a contamination indicator.
Foodstuffs (emergency situation)			
European regulations *Codex alimentarius,* etc.	Sale restrictions (MAL and GL)	See following table	

Limit values for the consumption and sale of foodstuffs contaminated in the event of a nuclear accident

MAXIMUM PERMITTED LEVELS OF RADIOACTIVE CONTAMINATION FOR FOODSTUFFS (Bq/kg or Bq/L)		Baby food	Other foodstuffs except those of lesser importance	Liquids intended for consumption
Isotopes of strontium, in particular ^{90}Sr	75	125	750	125
Isotopes of iodine, in particular ^{131}I	150	500	2,000	500
Isotopes of plutonium and alpha-emitting transuranic elements, especially ^{239}Pu and ^{241}Am	1	20	80	20
Any other element with a half-life of more than 10 days, in particular ^{134}Cs and ^{137}Cs	400	1,000	1,250	1,000

Source: Council Regulation 2218/89/Euratom of 18th July 1989 amending Regulation 3954/87/Euratom of 22nd December 1987

Maximum permitted levels of radioactive contamination in feedingstuffs (caesium 134 and caesium 137)

Animal categories	Bq/kg
Pork	1,250
Poultry, lamb, veal	2,500
Others	5,000

Source: Regulation 770/90/Euratom of 29th March 1990

Guideline levels in Bq/kg

Radionuclides	Foodstuffs intended for general consumption	Baby food
Plutonium 238, plutonium 239, plutonium 240, americium 241	10	1
Strontium 90, ruthenium 106, iodine 129, iodine 131, uranium 235	100	100
Sulphur 35, cobalt 60, strontium 89, ruthenium 103, caesium 134, caesium 137, cerium 144, iridium 192	1,000	1,000
Tritium, carbon 14, technetium 99	10,000	1,000

Source: Codex alimentarius, July 2006

REGULATION OF NUCLEAR ACTIVITIES AND EXPOSURE TO IONISING RADIATION

1 **VERIFYING THAT THE LICENSEE ASSUMES ITS RESPONSIBILITIES** 105

1|1 **The principles underpinning the regulatory role**

1|2 **Regulating nuclear activities: a vast area**

1|2|1 Regulating safety

1|2|2 Regulating activities entailing a risk of exposure to ionising radiation

1|2|3 Regulating the enforcement of labour law in nuclear power plants (NPPs)

2 **REGULATION THAT IS PROPORTIONATE TO THE ISSUES INVOLVED IN THE ACTIVITIES** 108

2|1 **Defining the issues**

2|2 **Applying the principle of licensee prime responsibility**

2|2|1 Operations subject to a licensee internal authorisations procedure

2|2|2 Internal monitoring of radiation protection by the users of ionising radiation sources

2|2|3 Packages not requiring approval

2|3 **Increasing ASN regulation resources by approving organisations and laboratories**

3 **DEPLOYING THE MOST EFFICIENT REGULATION AND INSPECTION MEANS** 111

3|1 **Assessing the supporting documents submitted by the licensee**

3|1|1 Analysing the information supplied by basic nuclear installation (BNI) licensees

3|1|2 Reviewing the procedures laid down by the Public Health Code

3|2 **Inspection of installations and activities**

3|2|1 Inspection objectives and principles

3|2|2 Inspection resources

3|2|3 Inspection of basic nuclear installations (BNIs) and pressure equipment in 2011

3|2|4 Inspection of radioactive material transport (RMT) in 2011

3|2|5 Inspection of small-scale nuclear activities in 2011

3|2|6 Inspection of ASN approved organisations and laboratories in 2011

3|2|7 Checks on exposure to radon and Naturally Occurring Radioactive Materials (NORM) in 2011

3|3 **Regulating the impact of nuclear activities on the environment**

3|3|1 Regulating basic nuclear installation (BNI) discharges

3|3|2 Assessing the radiological impact of nuclear activities

3|4 **Learning the lessons from significant events**

3|4|1 Anomaly detection and analysis

3|4|2 Implementation of the approach

3|4|3 Conducting a technical inquiry in the event of an incident or accident concerning a nuclear activity

3|4|4 Public information

3|4|5 Statistical summary of events in 2011

3|5 **Raising awareness**

CHAPTER 4

4 **MONITORING ENVIRONMENTAL RADIOACTIVITY** 125

4|1 **European context**

4|1|1 The purpose of environmental monitoring

4|1|2 Content of monitoring

4|2 **Environmental monitoring nationwide**

4|3 **Guaranteeing measurement quality**

4|3|1 Laboratory approval procedure

4|3|2 The approval commission

4|3|3 Approval conditions

5 **IDENTIFYING AND PENALISING INFRINGEMENTS** 131

5|1 **Ensuring that licensee penalty decisions are proportionate, fair and consistent**

5|2 **Implementing a policy of penalties**

5|2|1 For the BNI and RMT licensees

5|2|2 For persons in charge of small-scale nuclear activities, approved organisations and laboratories

5|2|3 For noncompliance with labour law

5|2|4 2011 results concerning enforcement and penalties

5|3 **Information about ASN's inspections**

6 **OUTLOOK** 133

In France, nuclear activity licensees hold prime responsibility for the safety of their activity. They cannot delegate this responsibility, and must ensure permanent surveillance of their installations. In view of the risks that ionising radiation present for persons and the environment, the State exercises its own independent control over the nuclear activities through ASN, which it has empowered for this task.

Control and regulation of nuclear activities is thus a fundamental responsibility of ASN. The aim is to verify that all licensees fully assume their responsibility and comply with the requirements of the regulations relative to radiation protection and safety, in order to protect workers, patients, the public and the environment against the risks associated with nuclear activities.

Inspection is the key means of control available to ASN. Its purpose is to verify on the sites and the facilities of licensees and their suppliers, that the provisions relative to safety and radiation protection are applied, and to detect any deviations leading to a reduction in the safety of the installations or the protection of persons.

ASN has a broad vision of control and regulation, encompassing material, organisational and human aspects. Its actions take the tangible form of decisions, requirements, inspection follow-up documents and assessments of safety and radiation protection in each sector of activity.

1 VERIFYING THAT THE LICENSEE ASSUMES ITS RESPONSIBILITIES

1|1 The principles underpinning the regulatory role

ASN aims to ensure that the principle of prime responsibility of the licensee for safety and radiation protection is respected.

ASN applies the principle of proportionality when determining its actions, so that the scope, conditions and extent of its regulatory action is commensurate with the health and environmental safety implications involved.

Regulation is part of a multi-level approach and is carried out with the support of the Institute for Radiation Protection and Nuclear Safety (IRSN). It applies to all phases in the life of the installation, including operation, shutdown and decommissioning:
– before the licensee exercises an activity subject to authorisation, by reviewing and analysing the files, documents and information provided by the licensee to justify its project with regard to safety and radiation protection. This verification aims to ensure that the information supplied is both relevant and sufficient;
– during exercise of the activity, by site visits, inspections on all or part of the installation, verification of high-risk operations performed by the licensee, review of operating reports and analysis of significant events. This verification comprises sampling and the analysis of justifications provided by the licensee with regard to the performance of its activities.

To consolidate the effectiveness and quality of its actions, ASN is adopting an approach involving continuous improvement of its regulatory practices. It uses the experience feedback from more than thirty years of nuclear activity inspections and the sharing of good practices with its foreign counterparts.

1|2 Regulating nuclear activities: a vast area

Article L.592-21 of the Environment Code states that ASN must regulate compliance with the general rules and particular requirements of safety and radiation protection, applicable to:
– licensees of BNIs;
– those in charge of the construction and operation of pressure equipment in BNIs;
– those in charge of RMT;
– those in charge of activities entailing a risk of exposure of individuals and workers to ionising radiation;



Post-Fukushima inspection of the Cattenom NPP in the presence of experts from Luxembourg and Germany – August 2011

– those in charge of implementing ionising radiation exposure monitoring measures.

In this chapter, these entities are called the "licensees". ASN also regulates the organisations and laboratories it approves, in order to take part in the inspections and in guaranteeing safety and radiation protection, as well as carrying out labour inspection duties in the NPPs (see chapter 12).

Although historically based on verifying the technical conformity of facilities and activities with regulations or standards, regulation today also covers a broader field incorporating social, human and organisational factors. It takes account of individual and collective behaviour and attitudes, management, organisation and procedures, relying on a variety of sources: significant events, inspections, relations with the stakeholders (personnel, licensees, outside contractors, trade unions, occupational physicians, inspection services, approved organisations, and so on).

1|2|1 Regulating safety

Safety covers all technical and organisational measures taken at all stages in the life cycle of nuclear installations (design, creation, commissioning, operation, final shutdown, decommissioning) to prevent or mitigate the risks for safety, public health, the environment, and so on. This notion thus includes the measures taken to optimise waste and effluent management.

The International Atomic Energy Agency (IAEA) defined the following principles in its safety fundamentals for nuclear facilities (safety collection no.110), taken up to a large extent by the European Directive on nuclear safety of 25th June 2009:
– prime responsibility for safety must lie with the licensee organisation;
– the regulatory body must be effectively independent of the organisation in charge of promoting or using nuclear energy. It must have responsibility for licensing, inspection, and formal notices, and must have the authority, expertise and resources necessary for performance of the responsibilities entrusted to it. No other responsibility shall compromise or conflict with its responsibility for safety.

In France, pursuant to the Environment Code, ASN is the regulatory body meeting these criteria.

Regulating BNIs

In its regulatory duties, ASN is required to look at the equipment and hardware in the installations, the individuals in charge of operating it, the working methods and the organisation, from the start of the design process up to decommissioning. It reviews the steps taken concerning nuclear safety and the monitoring and limitation of the doses received by the individuals working in the facilities, and the waste management, effluents discharge monitoring and environmental protection procedures.

Regulating pressure equipment

Numerous systems in nuclear facilities contain or carry pressurised fluids. They are therefore subject to pressure equipment regulations (see chapter 3, point 2|2|1).

Article L.592-21 of the Environment Code states that ASN "monitors compliance with the general rules and special prescriptions as regards nuclear safety and radiation protection to which are subject […] the manufacture and use of BNI pressurised equipment". Furthermore, so that the BNI licensees only have to deal with a single point of contact, article 50 of Act 2009-526 of 12th May 2009, on the simplification and clarification of the law and relaxation of procedures, entrusts ASN with the verification of application of the regulations for all pressure equipment in a facility comprising a BNI.

Of the BNI pressure equipment regulated by ASN, the main primary and secondary systems of EDF's pressurised water reactors (PWRs) are particularly important. Since under normal conditions they operate at high temperature and pressure, their in-service behaviour is one of the keys to nuclear power plant (NPP) safety (see chapter 12, point 1|1|3). ASN thus pays particularly close attention to the regulation of these systems.

Pressure equipment operation is regulated. This regulation in particular applies to the in-service surveillance programmes, non-destructive testing, maintenance work, handling of deviations affecting the systems and periodic post-maintenance testing of the systems. The principal PWR files currently being dealt with are presented in chapter 12.

Regulating the transport of radioactive materials

Transport comprises all operations and conditions associated with radioactive material movements, such as packaging design, manufacture, maintenance and repair, as well as the preparation, shipment, loading, carriage, including transit storage, unloading and reception at the final destination of radioactive material consignments and packages (see chapter 11).

The safety of RMT is guaranteed by three main factors:
– primarily, the robustness of package design and the quality of package construction;
– the reliability of transport and of certain special vehicle equipment;
– an efficient emergency response in the event of an accident.

ASN is responsible for drafting the regulations pertaining to the safe transport of radioactive and fissile materials for civil use and for verifying their implementation.

In terms of regulations and practices, good coordination with the other regulatory transport authorities is sought, particularly those responsible for inspecting means of transport, conventional safety inspection in the transport sector and protection of nuclear materials.

1|2|2 Regulating activities entailing a risk of exposure to ionising radiation

The "International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources" issued by IAEA define the general functions of the regulatory body.

In France, ASN fulfils this role of regulatory body by drafting and monitoring technical regulations in the field of radiation protection (see chapter 3, point 1).

The scope of ASN's regulatory role in radiation protection covers all the activities that use ionising radiation. This duty is exercised, where applicable, jointly with other State services such as occupational health and safety, the inspectorate for installations classified on environmental protection grounds (ICPE), the departments of the ministry responsible for health and the French Health Product Safety Agency (AFSSAPS).

ASN's regulatory action takes the form of reviews of files, pre-commissioning visits, inspections, and discussions with professional organisations (trade unions, professional orders, learned societies, etc.). This action directly concerns either the users of ionising radiation sources, or organisations approved to carry out technical inspections on these users.

These actions are summarised in table 1.

Table 1: methods of ASN regulation of the various radiation protection players

	Review/authorisation	Inspection	Openness and cooperation
Users of ionising radiation sources	Files produced in accordance with the procedures laid down in the Public Health Code (Articles R. 1333-1 to R. 1333-54). Review of the file and visit prior to commissioning. Leads to registration of the notification or to issue of an authorisation.	Radiation protection inspectorate (Article L. 1333-17 of the Public Health Code).	Jointly with the professional organisations, drafting of a guide of good practices for users of ionising radiation.
Approved inspection bodies for radiation protection	Application file for approval to perform the inspections specified in Article R. 1333-95 of the Public Health Code and Articles R. 4451-29 to R. 4451-34 of the Labour Code. Review of the file and audit of the organisation. Leads to issue of approval. (48 organisations approved as at 31/12/2011).	Second-level inspection through: - audits, - in-depth inspections at head office and in the branches of the organisations, - unannounced field inspections.	Jointly with the professional organisations, drafting of guides of good practices for performance of radiation protection inspections.

1|2|3 Regulating the enforcement of labour law in nuclear power plants (NPPs)

In NPPs, the regulation of safety, radiation protection and the occupational health and safety aspects very often covers common topics, such as worksite organisation or the conditions in which outside contractors are called in. The legislator therefore assigned labour inspector duties to engineers or technicians specifically designated for this purpose by the ASN Chairman from among ASN staff (article R. 8111-11 of the Labour Code). They operate under the authority of the minister responsible for labour.

There are three main conventional safety inspection duties: regulation, information and advice.

They concern working conditions and worker protection. Their legitimacy is underpinned not only by international standards, particularly convention No. 81 of the International Labour Organisation (ILO), but also by national texts regulating the inspection departments.

The six main issues identified by ASN in 2007 and related to the labour inspection responsibility in NPPs are:

1. exercise closer regulation of contractor working conditions and of EDF's surveillance of subcontracted activities;
2. deal with the growing problems of construction/dismantling;
3. take full account of social, organisational and human factors;
4. encourage EDF to include the goal of security in addition to safety and radiation protection;
5. ensure effective and uniform application nationwide of the Labour Code and collective agreements;
6. highlight ASN's expanded labour inspection responsibility.

ASN implemented changes to its organisation in order to clarify:

– the organisation, among the divisions, of labour inspection duties in NPPs;
– relations with the other Government departments concerned, mainly the departments of the ministry responsible for labour;
– relations with the regional health insurance funds (CRAM) for technical appraisal, recommendations, inquiries into health and safety conditions, etc.;

– relations with the Occupational Risk Prevention Organisation for the Building and Civil Engineering Industries (OPPBTP) to promote the prevention of industrial accidents and occupational diseases, as well as to improve working conditions of building and civil engineering contractors, in particular for construction and dismantling activities;
– relations with the General Directorate for Energy and Climate (DGEC), for statutory and social issues concerning companies and organisations involved in providing the public gas and electricity service.

Since 2009, ASN has devoted particular efforts to setting up centralised support for the labour inspectors in the divisions, by recruiting an experienced civil servant from the Ministry for Labour, given responsibility for overseeing and coordinating ASN's labour inspection duties.

2 REGULATION THAT IS PROPORTIONATE TO THE ISSUES INVOLVED IN THE ACTIVITIES

ASN organises its regulatory work in a way that is proportionate to the issues involved in the activities. The licensee remains the key player in the regulation of its activities. The performance of certain inspections by organisations and laboratories offering the necessary guarantees as validated by ASN approval, contributes to this action.

2|1 Defining the issues

In order to consider both the health and environmental issues and licensee safety and radiation protection performance, and the large number of activities it regulates, ASN periodically identifies those activities and topics with significant implications so that it can regulate them directly.

In order to identify these activities and topics, ASN relies on current scientific and technical knowledge and uses the information collected by both itself and IRSN: results of inspections, frequency and nature of incidents, major modifications made to facilities, review of files, feedback of data concerning doses received by workers, information resulting from checks by approved organisations. It can revise its priorities further to significant events that have occurred in France or elsewhere in the world.

Activities in 2011 with significant implications are presented in table 2.

TO BE NOTED IN 2011

Targeted inspections

Following the nuclear accident that struck the Fukushima NPP in Japan on 11th March 2011, ASN adapted its inspection programme to reinforce checks on all the French nuclear facilities considered to be high-priority.

38 targeted inspections, representing 110 days in the field, involved spot checks on the conformity of the licensee's equipment and organisation with the existing baseline safety standards. They concerned the following topics:
– protection against off-site hazards, in particular ability to withstand earthquakes and protection against flooding,
– loss of electrical power supplies,
– loss of heat sinks,
– operational management of radiological emergency situations.

ASN aimed to involve representatives of civil society in its inspections and proposed that the local information committees (CLI) of the nuclear facilities and the French High Committee for Transparency and Information on Nuclear Security (HCTISN) take part in targeted inspections as observers, subject to the licensee's approval. ASN also invited inspectors from the regulatory authorities of Germany, Switzerland, Belgium and Luxembourg to attend these inspections. In total, 51 outside observers took part in the targeted inspections carried out by ASN, mainly on NPPs.

Table 2: significant activities in 2011

Field	Topics or activities with significant implications
BNIs including: – NPPs – Research reactors – Laboratories and plants – Installations undergoing decommissioning	– Reactor outages – Social, organisational and human factors – Operation of the installation – Condition of barriers – Condition of systems – Prevention and management of risks, emergency situations – Radiation protection – Environment and waste
Small-scale nuclear activities	– Industrial radiography activities – External radiotherapy – Interventional medical radiology – Brachytherapy – Suppliers of ionising radiation sources – Nuclear medicine units performing therapeutic and/or in vivo diagnostic procedures – Holders of unsealed source licences – Industrial or research irradiation facilities or particle accelerators – Thin layer thickness measurement – Gammadensimetry – Use of neutron sources – Implementation of high-activity sealed sources
Radioactive material transport	– Emergency plan for approved package consignors – Packages not requiring approval – Internal transport

2|2 Applying the principle of licensee prime responsibility

ASN considers that operations taking place in BNIs with the greatest implications in terms of safety and radiation protection must obtain prior authorisation from it (see chapter 3). Those for which the safety and radioprotection implications are limited must remain under the responsibility and control of the licensee.

2|2|1 Operations subject to a licensee internal authorisations procedure

For intermediate operations, with safety and radiation protection implications that are significant but that do not compromise the safety scenarios used in BNI operation or decommissioning, ASN allows the licensee to assume direct responsibility for them provided that it sets up a system of enhanced, systematic internal checks, offering sufficient guarantees of quality, independence and transparency. The decision on whether or not to carry out the operations must be the subject of a formal authorisation issued by the licensee's duly qualified staff. This organisation is called the "internal authorisations system". It is presented to the competent CLI.

This internal authorisations system is regulated by the decree of 2nd November 2007 and by ASN decision 2008-DC-106 of 11th July 2008, which clarifies ASN's requirements.

ASN verifies correct application of the internal checks arrangements by various means: inspections, review of the periodic reports forwarded by the licensees, cross-checking of the dossiers, etc. It can at all times either terminate or temporarily suspend an "internal authorisations system" if it considers it to be unsatisfactorily implemented, in which case the corresponding operations must be referred to ASN for prior authorisation.

2|2|2 Internal monitoring of radiation protection by the users of ionising radiation sources

The aim of internal monitoring of radiation protection is to ensure regular assessment of the radiological safety of the facilities using sources of ionising radiation. This monitoring is performed under the responsibility of the licensees. It may be carried out by the person competent in radiation protection (PCR), appointed and mandated by the employer, or be entrusted to IRSN or to organisations approved by ASN. It does not replace either the periodic checks required by the regulations, or the inspections conducted by ASN. It for example concerns the performance of the protection systems, monitoring of the ambient atmosphere in regulated areas, checks on medical appliances before they enter service or after modification.

2|2|3 Packages not requiring approval

The package models with the highest safety implications require approval from ASN. This includes those intended for the transport of high activity radioactive materials, or those in which the contents entail a criticality risk (see chapter 11). However, for the other types of packages, in particular those for which destruction can lead to exposure of up to 50 mSv in 30 minutes at a distance of 1 metre, the consignor is responsible for demonstrating that the package model used does indeed meet the safety requirements set by the regulations and that it is appropriate for the contents to be transported. ASN regularly conducts inspections to check the measures adopted by the consignors of these packages, referred to as "packages not requiring approval".

2|3 Increasing ASN regulation resources by approving organisations and laboratories

Article L. 592-21 of the Environment Code states that ASN must issue the necessary approvals to the organisations taking part in the inspections and in ensuring nuclear safety and radiation protection. Depending on the health or safety implications of a nuclear activity or a facility category, ASN may rely on the results of checks carried out by independent organisations and laboratories it has approved and which it monitors via second level checks.

ASN thus approves organisations to perform the technical inspections required by the regulations in the fields within its scope of competence. The organisations approved in this way carry out:
– radiation protection checks;
– measurement of radon activity concentration in premises open to the public;
– evaluations of nuclear pressure equipment conformity and inspection of operational equipment.

The checks carried out by these organisations contribute to ASN's overview of all nuclear activities.

In order to approve the applicant organisations, ASN ensures that they perform the inspections in accordance with their technical, organisational and ethical obligations and in compliance with the rules of professional good practice. Compliance with these provisions should enable the required level of quality to be obtained and maintained.

ASN ensures that maximum benefit is gained from the approval issued, in particular through regular exchanges with the organisations it has approved and the mandatory transmission of an annual report, in order to:
– turn operating experience feedback to good account;
– improve the approval process;
– improve intervention conditions.

ASN also approves laboratories to conduct analyses requiring a high level of measurement quality if the results are to be usable. It thus approves laboratories:
– for monitoring environmental radioactivity (see point 4);
– for worker dosimetry (see chapter 1).

The list of approvals issued by ASN is kept up to date on its website (*"bulletin officiel de l'ASN/agréments d'organismes"* section, available in French only).

In 2011, ASN issued:
– 12 new or renewed approvals for organisations responsible for radiation protection inspections;
– 25 new or renewed approvals for organisations responsible for radon activity concentration measurements;
– 4 approvals for worker dosimetry (3 for internal monitoring of workers and 1 for external monitoring of workers);
– 130 approvals for measurement of environmental radioactivity.

ASN sends the General Directorate for Health (DGS) an opinion on the approval of the laboratories analysing radioactivity in water intended for human consumption.

It sends the ministers responsible for nuclear safety and/or transport an opinion on approval of the organisations responsible for:
– training the drivers of vehicles transporting radioactive materials (class 7 hazardous materials);
– organising safety adviser examinations for transport of dangerous goods by road, rail or navigable waterway;
– certifying the conformity of packagings designed to contain 0.1 kg or more of uranium hexafluoride (initial and periodic checks);
– issuing type approval for tank-containers and mobile tanker units intended for transport of class 7 hazardous materials by road;
– the initial and periodic checks of tankers for transport of class 7 hazardous materials by road.

3 DEPLOYING THE MOST EFFICIENT REGULATION AND INSPECTION MEANS

The licensee is required to provide ASN with the information it needs to meet its regulatory responsibilities. The volume and quality of this data should enable the technical demonstrations presented by the licensee to be analysed and the inspections to be targeted. It should also allow identification and monitoring of the milestones in the operation of a nuclear activity. The actions specific to the inspection of RMT are described in detail in chapter 11.

3|1 Assessing the supporting documents submitted by the licensee

The purpose of the documents supplied by the licensee is to demonstrate compliance with the objectives set by the general regulations, as well as those that it has set for itself. ASN is required to check the completeness of the data and the quality of the demonstration.

Review of this data may lead ASN to accept or on the contrary reject the licensee's proposals, to ask for additional information or studies or to ask for work to bring the relevant items into conformity. ASN's requirements are expressed as decisions.

3|1|1 Analysing the information supplied by basic nuclear installation (BNI) licensees

Reviewing the supporting documents produced by the licensees and the technical meetings organised with them are one of the forms of control carried out by ASN.

Whenever it deems necessary, ASN seeks the advice of technical support organisations, primarily IRSN. The safety review implies cooperation by numerous specialists, as well as efficient coordination, in order to identify the essential points relating to safety and radiation protection.

The IRSN assessment relies on research and development programmes and studies focused on risk prevention and improving our knowledge of accidents. It is also based on in-depth technical discussions with the licensee teams responsible for designing and operating the plants.

For major issues, ASN requests the opinion of the competent Advisory Committee. For other matters, IRSN examines the safety analyses and gives its opinion directly to ASN. ASN procedures for requesting the opinion of a technical support organisation and, where required, of an Advisory Committee, are described in chapter 2.

At the design and construction stage, ASN - aided by its technical support organisation - examines the safety analysis reports describing and justifying basic design data, equipment design calculations, utilisation rules and test procedures, and quality organisation provisions made by the prime contractor and its suppliers. ASN also checks the construction and manufacture of structures and equipment, in particular PWR main primary systems (MPS) and main secondary systems (MSS). In accordance with the same principles, it checks the packages intended for the transport of radioactive materials.



Documentary examination by the ASN inspectors during the inspection of the nuclear medicine unit of the Oscar Lambret centre in Lille – November 2011

Once the nuclear facility has been commissioned, following ASN authorisation, all changes made by the licensee that could affect security, public health and safety, or protection of nature and the environment, are notified to ASN. In addition to these procedures, made necessary by changes to the facilities or how they operate, the licensee must, pursuant to the Environment Code, carry out periodic safety reviews in order to update the evaluation of the facility in the light of changing techniques and regulations and on the basis of operating experience feedback. The conclusions of these reviews are submitted to ASN, which can issue new provisions in order to tighten the safety requirements (see chapter 12 point 2|2|3).

Other data submitted by BNI licensees

The licensee submits routine activity reports and summary reports on water intake, liquid and gaseous discharges and the waste produced.

Similarly, there is a considerable volume of data on specific topics such as fire protection, PWR fuel management strategies, relations with subcontractors, and so on.

3|1|2 Reviewing the procedures laid down by the Public Health Code

ASN is responsible for reviewing applications to possess and use ionising radiation for medicine, dentistry, human biology and biomedical research, as well as for any other nuclear activity. ASN also deals with the specified procedures for the acquisition, distribution, import, export, transfer, recovery and disposal of radioactive sources. It in particular relies on the inspection reports from the approved organisations and the reports on the steps taken to remedy inadequacies detected during these inspections.

In addition to the internal inspections carried out under the responsibility of the establishments and the periodic checks required by the regulations, ASN carries out its own

verifications. In this respect it directly carries out checks during the procedures for issue (pre-commissioning inspections) or renewal (periodic inspections) of the authorisations to possess and use radiation sources granted on the basis of article R. 1333-23 of the Public Health Code. The authorisation notifications can only be issued if any actions demanded by ASN further to the checks have been carried out. These checks are in particular designed to compare the data contained in the files with the actual physical reality (sources inventory, check on the conditions of production, distribution and utilisation of the sources and the devices containing them). They also enable ASN to ask the establishments to improve their in-house provisions for source management and radiation protection.

3|2 Inspection of installations and activities

3|2|1 Inspection objectives and principles

The inspection carried out by ASN is based on the following principles:

1. the inspection aims to detect any deviations indicative of a possible deterioration in facility safety or the protection of individuals and any non-compliance with the legislative and regulatory requirements the licensee is bound to apply;
2. the inspection is proportionate to the level of risk presented by the facility or activity;
3. the inspection is neither systematic nor exhaustive, is based on sampling and focuses on subjects with the greatest implications.

3|2|2 Inspection resources

To ensure greater efficiency, ASN's action is organised on the following basis:



ASN inspection of the nuclear medicine unit of the Oscar Lambret centre in Lille – November 2011

– inspections, according to a predetermined frequency, of the nuclear activities and topics of particular health and environmental significance;
- inspections on a sample of installations representative of the other nuclear activities;
- systematic technical inspections of all facilities by approved organisations.

As mentioned earlier, the activities with the least implications are checked by the approved organisations, but can also be the subject of targeted inspections by ASN.

The inspections may be unannounced or notified to the licensee a few weeks before the visit. They take place mainly on the site or during the course of the relevant activities (work, transport operation). They may also concern the head office departments or design and engineering departments at the major licensees, the workshops or engineering offices of the subcontractors, the construction sites, plants or workshops manufacturing the various safety-related components.

ASN uses various types of inspections:
– standard inspections;
– in-depth inspections, which take place over several days and mobilise about ten inspectors. Their purpose is to carry out detailed examinations and they are overseen by senior inspectors (see chapter 2);
– inspections with sampling and measurements. These are designed to check discharges by means of samples that are independent of those taken by the licensee;
– inspections carried out further to a particularly significant event;
– worksite inspections, ensuring a significant ASN presence on the sites on the occasion of reactor outages or particular work, especially in the decommissioning phase.

These inspections give rise to records, made available to the licensee. They concern:
– anomalies in the facility or aspects warranting additional justifications;
– deviations between the situation observed during the inspection and the regulations or documents produced by the licensee pursuant to the regulations.

Some inspections are carried out with the support of an IRSN representative specialised in the facility visited or the topic of the inspection.

a) To achieve its objectives, ASN employs inspectors chosen for their professional experience and for their legal and technical expertise. It gives them the practical tools they need to carry out their inspections.

The inspectors carry out their inspection duties under the authority of the ASN Director General. They are sworn-in and bound by professional secrecy. They are appointed and qualified once they have acquired the necessary competence through their professional experience, tutoring and appropriate training. To ensure constant progress, ASN:
– has defined a system of qualification for its inspectors, based on recognition of their technical competence, in the same way as the leading foreign safety authorities.
– has adopted a number of foreign practices identified during the course of inspector exchanges between regulatory authorities. These exchanges are organised either for a particular inspection

or for a longer period, via a secondment of up to 3 years. Thus, after having observed its advantages, ASN has adopted the concept of in-depth inspections described earlier. However, it has not opted for the system involving a resident inspector on a nuclear site: ASN considers that its inspectors must work within a structure large enough to allow the sharing of experience and that they must take part in inspections on different licensees and facilities in order to acquire a broader view of this field of activity. This also avoids confusion of responsibilities;

– encourages an open-minded attitude to other regulatory practices on the part of its inspectors. ASN encourages its departments to take on inspectors from other regulatory bodies (ICPE inspectorate, AFSSAPS, ARS (Regional Health Agencies), etc.). It also proposes organising joint inspections with these bodies concerning the activities falling within its scope of expertise. In order to identify other methods for risk management by the licensees, the ASN inspectors may also observe inspections on specialised subjects in facilities which do not fall within their field of expertise;

– aims to ensure the uniformity of its practices. It encourages participation by its staff in inspections on different subjects, in different regions and sectors.

The ASN Chairman appoints the inspectors as defined by decree 2007-831 of 11th May 2007 which determines the procedures for the appointment and qualification of nuclear safety inspectors (formerly known as BNI inspectors) and the staff responsible for checking pressure equipment specifically designed for BNIs and by articles R. 1333-100 to R. 1333-108 of the Public Health Code (radiation protection inspectors).

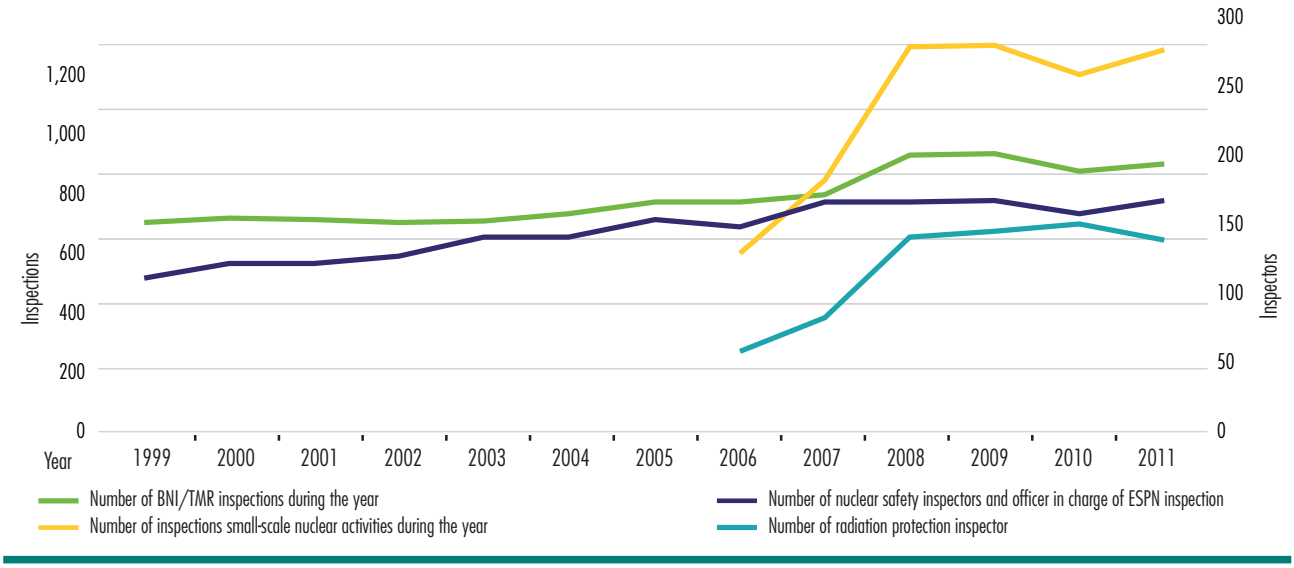
To help them with the performance of their duties, ASN provides its inspectors with inspection guides and tools to help them to decide the follow-up to the deviations observed. These guides are regularly updated to take account of changes to the regulations and to techniques.

Table 3 presents the inspector staffing levels on 31st December 2011. Some inspectors are qualified in several inspection domains.

Table 3: number of inspectors per inspection domain (as at 31.12.2011)

Type of inspector	Departments	Divisions	Total
Nuclear safety inspector (BNI)	65	92	**157**
Pressure equipment inspector	10	34	**44**
Nuclear safety inspector (transport)	14	29	**43**
Radiation protection inspector	38	103	**141**
Labour inspector	2	10	**12**
Number of inspectors (all fields included)	95	155	**250**

Graph 1 : evolution of number of ASN inspectors and inspections



In 2011, ASN carried out 256 days of labour inspections and 2,061 inspections on BNIs, RMT operations, activities using ionising radiation, organisations and laboratories it has approved and activities involving pressure equipment.

b) To guarantee an adequate distribution of the inspection resources, proportionate to the safety and radiation protection implications of the various facilities and activities, ASN each year drafts an inspections forecast schedule.

This schedule identifies the facilities, activities and subjects targeted. This is not known beforehand to those in charge of nuclear activities. ASN performs qualitative and quantitative supervision of the inspection programme and the actions taken subsequent to the inspections. Reports are issued on compliance with the forecast schedule of inspections and enable the activities checked to be evaluated in terms of both the licensee and the sector or particular topic concerned. These reports contribute to the process of continuous improvement of the inspection system.

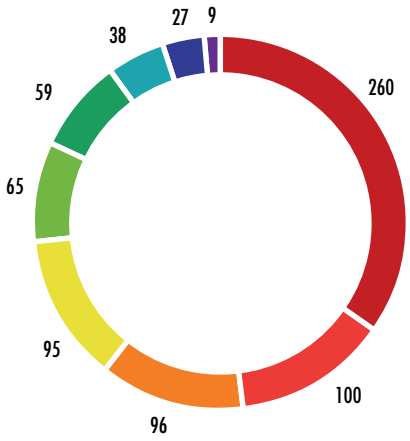
c) With regard to these inspections, ASN informs the public by posting the inspection follow-up letters on-line on its website. This subject is developed in greater detail in chapter 6.

3|2|3 Inspection of basic nuclear installations (BNIs) and pressure equipment in 2011

In 2011, 749 BNI inspections were carried out, of which 157 (21%) were unannounced. The breakdown according to the various installation categories is described in the graphs 2 to 4. All the NPP reactors and 18 laboratories and plants of the fuel cycle underwent 38 specific post-Fukushima inspections concerning five topics: earthquake, flooding, electrical power supplies, cooling and management of accident situations. These inspections each mobilised several inspectors for several days of inspections and required specific preparation. To take account of the extra work generated by these inspections, on top of the routine inspections, they were weighted and counted in the following way:
– a targeted inspection in the PWRs counts for three routine inspections,
– a targeted inspection in the LUDD (Laboratories, Plants, Waste and Decommissioning) sites counts for two routine inspections.

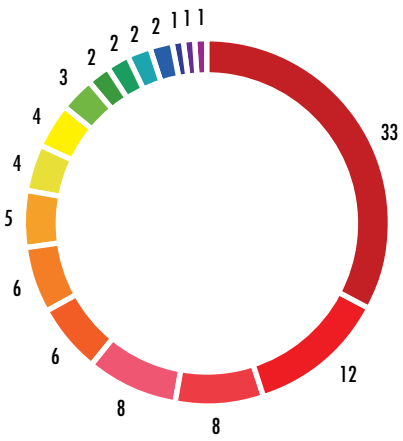
ASN and the organisations it has approved also performed more than 400 inspections to assess the conformity of the nuclear pressure equipment.

Graph 2: breakdown per topic of BNI inspections in 2011



- Nuclear safety
- Effluent, waste and environmental monitoring
- Staff and organisation
- Post-Fukushima targeted inspection
- Pressure equipment
- General inspection and others
- Radiation protection
- Prevention of risks including fire
- Emergency management

Graph 3: breakdown by topic of RMT inspections in 2011



- Shipment - organisation of transport operations
- General inspection
- Non-approved packages
- Road transport
- Maintenance
- Air transport
- Gamma radiography
- Gammadensimetry
- Transport of F18
- Manufacture
- Transit storage
- Tests
- Rail transport
- Internal transport
- Approved packages
- Sea transport
- Others

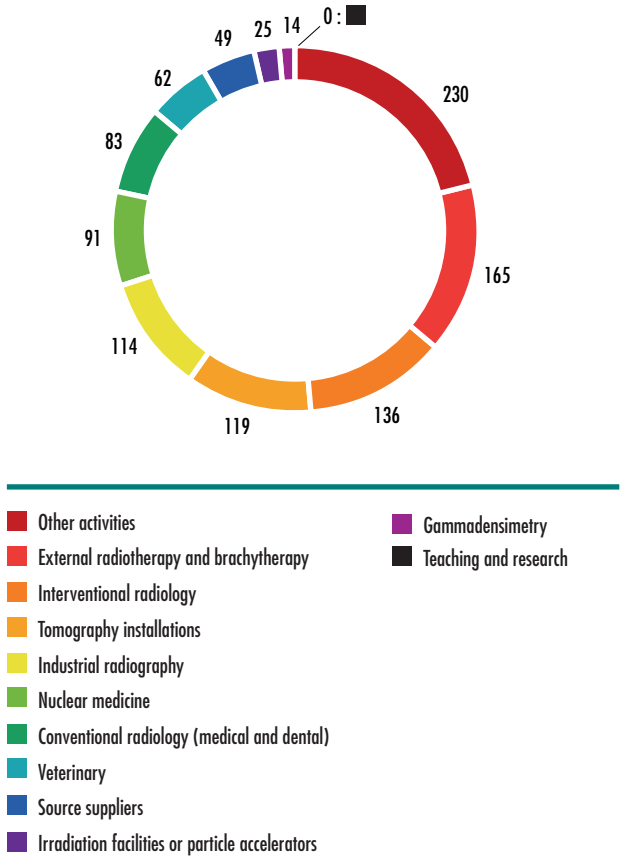
3|2|4 Inspection of radioactive material transport (RMT) in 2011

The 100 inspections on transport activities in 2011 can be broken down according to topic as shown in graph 3.

3|2|5 Inspection of small-scale nuclear activities in 2011

ASN organises its regulation so that it is proportionate to the radiological issues involved in the use of ionising radiation, and consistent with the actions of the other inspection services. ASN carried out 1,088 inspections in 2011 on the 50,000 or so nuclear facilities and activities in the sector, including 617 in the medical sector, 452 in industry or research and 19 on landfills, mines and spoil heaps, polluted sites or companies not exercising a nuclear activity but exposing their staff to ionising radiation. The breakdown according to the various activity categories is described in graph 4.

Graph 4: breakdown of small-scale nuclear activity inspections in 2011 according to nature of activity



3|2|6 Inspection of ASN approved organisations and laboratories in 2011

ASN carries out a second level of inspection on approved organisations and laboratories. In addition to reviewing the application file and issuing the approval, this comprises surveillance such as the following:
– approval follow-up or renewal audits;
– checks to ensure that the organisation and operation of the entity concerned comply with the applicable requirements;
– checks, which are usually unannounced, to ensure that the organisation's staff work in satisfactory conditions.

In 2011, ASN carried out 124 inspections of approved organisations and laboratories, broken down as follows:
– organisations carrying out radiation protection technical checks: 87 inspections;
– organisations evaluating nuclear pressure equipment conformity and inspecting operational equipment: 15 inspections;
– organisations measuring radon activity concentration: 11 inspections;
– laboratories approved for environmental radioactivity measurements: 11 inspections.

3|2|7 Checks on exposure to radon and Naturally Occurring Radioactive Materials (NORM) in 2011

ASN also monitors radiation protection in premises where exposure of individuals to natural ionising radiation can be enhanced owing to the underlying geological context (radon in premises open to the public) or the characteristics of the materials used in industrial processes (non-nuclear industries).

Monitoring exposure to radon

Article R.1333-15 of the Public Health Code and article R.4451-136 of the Labour Code provide for the radon activity concentration to be measured either by IRSN or by ASN-approved organisations. These measurements are to be taken between 15th September and 30th April of the following year.

For the 2011-2012 measurement campaign, the number of approved organisations is indicated in table 4.

Monitoring exposure to natural ionising radiation in non-nuclear industries

The order of 25th May 2005 provides the list of professional activities (industries, spas and drinking water treatment plants) requiring monitoring of human exposure to natural ionising radiation, owing to the fact that the materials used contain natural radionuclides and are likely to generate doses that are significant from the radiation protection standpoint.

Verification of application of these provisions over the 2007-2011 period confirmed that certain industries using enhanced natural ionising radiation came within the scope of application of the regulatory radiation protection provisions. These include facilities for zircon production and for processing of titanium ore and rare earths, to which the worker radiation protection regulations apply in accordance with articles R.4451-143 and R.4451-144 of the Labour Code.

Table 4: number of organisations approved for measuring radon levels

	Approval until 15th september 2012	Approval until 15th september 2013	Approval until 15th september 2014	Approval until 15th september 2015	Approval until 15th september 2016
Level 1 or Level 1 option A*	19	0	0	8	18
Level 1 option B**	8				
Level 2***	1			1	5

* Workplace and premises open to the public for all types of buildings

** Workplace, cavities and underground structures (except buildings)

*** Corresponds to complementary investigations

The inspection and evaluation actions taken in collaboration with the conventional safety inspectorate and the ICPE inspectorate were carried out over the period 2008-2011. These actions completed the results obtained and improved understanding of the issues in these industrial sectors, as well as in spas and groundwater extraction facilities.

Monitoring natural radioactivity in water intended for human consumption

Since 1st January 2005 (order of 12th May 2004), monitoring of natural radioactivity in water intended for human consumption is an integral part of the health monitoring carried out by the Regional Health Agencies (ARS). The procedures for these checks take account of the recommendations issued by ASN and taken up in the DGS circular of 13th June 2008. The results of the checks are jointly analysed and utilised by ASN and the services of the ministry for health. A summary of these results is presented in chapter 1.

3|3 Regulating the impact of nuclear activities on the environment

3|3|1 Regulating basic nuclear installation (BNI) discharges

Monitoring of discharges

The monitoring of discharges from an installation is essentially the responsibility of the licensee. The provisions regulating discharges stipulate the minimum checks that the licensee is required to carry out. These checks for example concern effluents (monitoring of the activity of discharges, characterisation of certain effluents prior to discharge, etc.) and environmental monitoring (checks during discharge, samples of air, milk, grass, etc.). Lastly, the measurement of environmental - particularly meteorological - parameters is imposed when necessary.

The results of the regulatory measurements must be stored in registers which, in the case of BNIs, are forwarded on a monthly basis to ASN, which checks them.

BNI licensees are also required regularly to transmit a number of discharge samples to an independent laboratory for analysis. The results of these "cross-checks" are communicated to ASN. This programme of cross-checks defined by ASN is a way of ensuring that the accuracy of the laboratory measurements is maintained over time.

Finally, ASN uses a system of unannounced inspections to ensure that the licensees abide by the regulations. During the course of these inspections, inspectors – assisted when necessary by technicians from a specialised, independent laboratory – check compliance with the regulation requirements, take samples from the effluents or the environment, and have them analysed by this laboratory. Since 2000, ASN has carried out 10 to 30 inspections - with sampling - every year (23 in 2011).

Accounting rules for BNI discharges

The lowering of the activity level of the radioactive effluents discharged by BNIs, the changes made to the categories of radionuclides regulated in the discharge licence orders and the need to be able to calculate the dosimetric impact of the discharges on the population, led ASN to change the radioactive discharge accounting rules in 2002, based on the following principles:

– for each category of radionuclides regulated, the activity levels discharged are based on a specific analysis of the radionuclides rather than on total measurements;
– applicable decision thresholds are defined for each type of measurement;
– for each BNI and for each type of effluent, a "reference" spectrum is defined, in other words a list of radionuclides whose activity must be systematically considered, whether or not higher than the decision threshold.

UNDERSTAND

With regard to the measurements

– *The decision threshold (SD) is the value above which the measurement technique guarantees that a radionuclide is present.*

– *The detection limit (LD) is the value above which the measurement technique gives a reliable result.*

In practice LD ≈ 2 x SD.



ASN "environmental" inspection at the Nogent-sur-Seine NPP – December 2011

These evolving reference spectra are based on operating experience feedback from the analyses carried out. When the activity is lower than the decision threshold, then the latter value is used;

– other radionuclides, which are occasionally present, are considered if their activity concentration is higher than the decision threshold.

These rules are applied in all BNIs. The rules for chemical discharges are identical to those in force for ICPEs. These rules will be put down in writing in the general regulations applicable to BNIs, which are currently being revised.

As other countries use different accounting methods, it is hard to compare the results published by the various national nuclear regulators.

Quality of measurement is a precondition if the results obtained and published are to be conclusive. In the area of effluent measurement, in view of the shortcomings in the available body of standards, ASN supported the creation of a working group by the French nuclear equipment standardisation office (BNEN). This programme will eventually produce a set of high-quality methods that are standardised and therefore comparable.

3|3|2 Assessing the radiological impact of nuclear activities

Under the optimisation principle, the licensee is required to reduce the radiological impact of its facility to values as low as reasonably achievable based on economic and social factors.

The licensee is required to assess the dosimetric impact of its activity. Depending on the case, this obligation arises from article L. 1333-8 of the Public Health Code, or from the regulations concerning BNI discharges. The result must be compared with the annual dose limit for the public (1 mSv per year) defined in article R.1333-8 of the Public Health Code. This regulation limit corresponds to the sum of the effective doses received by the public as a result of nuclear activities.

It must be pointed out that in practice, only traces of artificial radioactivity are detectable in the vicinity of the nuclear facilities and that most measurements taken during routine surveillance are below the decision threshold or reflect the natural radioactivity. Consequently, these measurements cannot be used for estimating doses. It then becomes necessary to use models of radioactivity transfer to man, for which the input is the facility discharge measurement data.

UNDERSTAND

Reference spectra used for NPPs

The reference spectra selected for NPP radioactive discharges are as follows:

- *Liquid:*
  - *^{3}H,*
  - *^{14}C,*
  - *Iodines: ^{131}I,*
  - *Other fission and activation products: ^{54}Mn, ^{58}Co, ^{60}Co, ^{110m}Ag, ^{123m}Te, ^{124}Sb, ^{125}Sb, ^{134}Cs, ^{137}Cs.*
- *Gaseous:*
  - *^{3}H,*
  - *^{14}C,*
  - *Rare gases:*
    - *ventilation (permanent discharges): ^{133}Xe, ^{135}Xe*
    - *"RS" tank drainage: ^{85}Kr, ^{131m}Xe, ^{133}Xe*
    - *decompression of reactor buildings: ^{41}Ar, ^{133}Xe, ^{135}Xe.*
  - *Iodines: ^{131}I, ^{133}I,*
  - *Other fission and activation products: ^{58}Co, ^{60}Co, ^{134}Cs, ^{137}Cs.*

These models are specific to each licensee. ASN aims for optimum harmonisation of the methods used and in 2009 initiated an examination of this subject with IRSN.

Nonetheless, programmes to monitor the radioactivity present in the environment (water, air, earth, milk, grass, agricultural produce, etc.) are imposed on the licensees in order to check compliance with the scenarios postulated in the impact assessment. The laboratories carrying out these measurements must be approved by ASN (see 4 | 3).

An estimation of the doses from BNIs is presented in table 5. For each site and per year, this table gives the effective doses received by the most exposed reference population groups.

Table 5: radiological impact of BNIs since 2005 calculated by the licensees on the basis of the actual discharges from the installations and for the most exposed reference groups (data provided by the licensees)

Licensee/Site	Most exposed reference group [population/distance from site in km][a]	Estimation of received doses, in mSv					
		2005	2006	2007	2008	2009	2010
AREVA/La Hague	Digulleville (Child/2.6) Fisherman Goury [Adult (2008. 2009: child)/7.5]	1.10^{-2} 6.10^{-3}	1.10^{-2} 6.10^{-3}	1.10^{-2} 6.10^{-3}	8.10^{-3} 5.10^{-3}	8.10^{-3} 4.10^{-3}	1.10^{-2} 5.10^{-3}
GANIL/Caen	IUT (Adult/0.6)	2.10^{-3}	3.10^{-3}	$< 6.10^{-3}$	$< 9.10^{-3}$ [b]	3.10^{-3}	$< 3.10^{-3}$
EDF/Cattenom	Garche nord, Warpich (2009. 2010) [Adult/2.15] [2009. 2010: baby/1.5]	2.10^{-3}	3.10^{-3}	3.10^{-3}	3.10^{-3}	3.10^{-3}	3.10^{-3}
CEA/Cadarache	Saint-Paul-Lez-Durance [Adult/2]	8.10^{-3}	3.10^{-4}	2.10^{-3}	2.10^{-3}	2.10^{-3}	2.10^{-3}
AREVA/FBFC	Ferme Riffard [Adult/0.2]	*	*	*	6.10^{-4}	8.10^{-4}	1.10^{-3}
EDF/Chooz	Les Pirettes (gymnasium) [Adult (2009: infant)/0.75]	*	*	*	2.10^{-3}	1.10^{-3}	1.10^{-3}
EDF/Civaux	Ervaux sud [Adult/0.7]	*	*	*	8.10^{-4}	7.10^{-4}	1.10^{-3}
EDF/Dampierre-en-Burly	La Maison Neuve, Les Serres (2009. 2010) [Adult/0.9 (2009. 2010: adult/0,7)]	*	*	*	8.10^{-4}	1.10^{-3}	1.10^{-3}
EDF/Gravelines	Petit-Fort-Philippe, Esp. Cult. Decaestecker (2009. 2010) [Adult/1.45] [2009. 2010: fisherman/1.1]	2.10^{-4}	3.10^{-4}	3.10^{-4}	3.10^{-4}	1.10^{-3}	1.10^{-3}
EDF/Penly	Saint-Martin Plage,Vassonville (2009. 2010) [Adult/1.05] [2009. 2010: fisherman/0.7]	9.10^{-4}	5.10^{-4}	6.10^{-4}	3.10^{-3}	9.10^{-4}	1.10^{-3}
EDF/Flamanville	La Berquerie, Hameau es Louis (2009. 2010) [Adult/0.8] [2009. 2010: fisherman/0.8]	5.10^{-3}	5.10^{-3}	1.10^{-3}	7.10^{-4}	9.10^{-4}	9.10^{-4}
EDF/Golfech	Pascalet, Labaquière (2009. 2010) [Adult/0.85] [2009. 2010: adult/1]	2.10^{-4}	2.10^{-4}	5.10^{-4}	8.10^{-4}	8.10^{-4}	9.10^{-4}
EDF/Nogent-sur-Seine	Port Saint-Nicolas, lock-keeper's house (2009. 2010) [Adult/2.25] [2009. 2010: adult: 1]	7.10^{-4}	8.10^{-4}	9.10^{-4}	7.10^{-4}	6.10^{-4}	9.10^{-4}
EDF/Tricastin	Clos du Bonneau, Le Trop Long (2009. 2010) [Adult/1.25] [2009. 2010: infant/1.25]	7.10^{-5}	6.10^{-5}	7.10^{-5}	4.10^{-4}	7.10^{-4}	9.10^{-4}
AREVA/Tricastin (AREVA NC, COMURHEX, EURODIF, SOCATRI, SET)	Les Prés Guérinés [Adult (2005: child)/3; 3.1; 2.16; 1.3; 1.5]	2.10^{-3}	1.10^{-3}	1.10^{-3}	5.10^{-4}	5.10^{-4}	*
	Clos de Bonnot [Adult/2.2; 2.3; 1.3; 0.6; 0.8)]	*	*	*	7.10^{-4}	8.10^{-4}	7.10^{-4}
CEA/Saclay	Fisherman, Christ de Saclay [Adult/1] Farmer, Christ de Saclay [Adult/1]	4.10^{-3} 5.10^{-4}	5.10^{-3} 5.10^{-4}	9.10^{-4} 4.10^{-4}	7.10^{-4} 4.10^{-4}	4.10^{-4} *	7.10^{-4} *
EDF/Paluel	Le Tôt [Adult (2009. 2010: fisherman)/1.45]	2.10^{-3}	2.10^{-3}	2.10^{-3}	2.10^{-3}	6.10^{-4}	7.10^{-4}
EDF/Belleville-sur-Loire	Neuvy-sur-Loire [Adult/1.3]	2.10^{-4}	2.10^{-4}	2.10^{-4}	6.10^{-4}	7.10^{-4}	6.10^{-4}
EDF/Blayais	Le Bastion [Adult (2009. 2010: fisherman)/1.1]	4.10^{-4}	4.10^{-4}	4.10^{-4}	5.10^{-4}	5.10^{-4}	6.10^{-4}
EDF/Cruas-Meysse	Ferme de Grimaud, Serres (2009. 2010) [Adult/1.25] [2009. 2010: infant/1.1]	2.10^{-4}	2.10^{-4}	8.10^{-5}	4.10^{-4}	5.10^{-4}	5.10^{-4}

Table continued

Licensee/Site	Most exposed reference group (population/distance from site in km)[a]	Estimation of received doses, in mSv					
		2005	2006	2007	2008	2009	2010
ANDRA/Manche	Hameau de La Fosse [Adult/2.5] Fisherman Goury [Adult/8]	8.10^{-4} 7.10^{-7}	8.10^{-4} 8.10^{-8}	7.10^{-4} 9.10^{-8}	7.10^{-4} 5.10^{-8}	6.10^{-4} 8.10^{-8}	4.10^{-4} 8.10^{-8}
EDF/Bugey	St Etienne d'Hières sud [Adult/0.45]	*	*	*	5.10^{-4}	5.10^{-4}	4.10^{-4}
EDF/Chinon	Le Neman [Adult/1.25]	3.10^{-4}	3.10^{-4}	2.10^{-4}	4.10^{-4}	4.10^{-4}	4.10^{-4}
EDF/St-Alban	Les Crès [Adulte / 1.45]	2.10^{-4}	2.10^{-4}	7.10^{-5}	3.10^{-4}	4.10^{-4}	4.10^{-4}
CEA/Marcoule (ATALANTE, CENTRACO, PHÉNIX, MÉLOX, CIS-Bio)	Codolet [Adult/2]	4.10^{-4}	4.10^{-4}	5.10^{-4}	4.10^{-4}	4.10^{-4}	3.10^{-4}
EDF/St-Laurent-des-Eaux	Port au Vin [Adult/0.75]	7.10^{-5}	9.10^{-5}	2.10^{-4}	4.10^{-4}	3.10^{-4}	3.10^{-4}
EDF/Fessenheim	Cité EDF (Koechlin) [Adult (2010: infant)/1.2]	*	*	*	8.10^{-5}	8.10^{-5}	1.10^{-4}
ILL/Grenoble	Fontaine (gaseous discharges); Saint-Egrève (liquid discharges) [infant/1 (Fontaine); 1.4 (Saint-Egrève)]	*	*	*	*	1.10^{-4}	1.10^{-4}
EDF/Creys-Malville	Ferme de Chancillon [Adult (2010: infant)/0.85]	*	*	1.10^{-5}	2.10^{-5}	8.10^{-6}	6.10^{-5}
CEA/Fontenay-aux-Roses	Fontenay-aux-Roses [Child/1.5]	2.10^{-5}	2.10^{-5}	9.10^{-6}	1.10^{-5}	5.10^{-6}	4.10^{-6}
ANDRA/CSA	CD24 road bridge [Child/2.1]	6.10^{-6}	5.10^{-6}	3.10^{-6}	2.10^{-6}	5.10^{-6}	2.10^{-6}
CEA/Grenoble [c]	Fontaine (gaseous discharges); Saint-Egrève (liquid discharges) [infant (2004. 2008: adult)/1 (Fontaine); 1.4 (Saint-Egrève)]	7.10^{-7}	2.10^{-6}	7.10^{-7}	1.10^{-6}	3.10^{-7}	3.10^{-7}
	Saint-Egrève [infant (2004. 2007: adult)/ 1.4 (liquids); 3.9 (gaseous)]	4.10^{-7}	8.10^{-7}	3.10^{-7}	6.10^{-7}	*	*

a : For installations operated by EDF, only "adult" figures are calculated. Since 2009, the dose of the most exposed reference group of each site for the two age classes (adult or infant) is mentioned.
b : value measured at site perimeter by means of passive dosimeters. Several dosimeters showed contamination readings, even when the facility was shut down. The value is thus highly over-estimated, according to the licensee.
c : Because the outfall for the liquid discharges is geographically distant from the stack, two impact calculations are performed. One reflects the aggregate of maximum impact of gaseous discharges plus maximum impact of liquid discharges. The other corresponds to an actual reference group.
* Information not supplied by the licensees.

The doses from BNIs for a given year are determined on the basis of the actual discharges from each installation for the year in question. This assessment takes account of the discharges through the identified outlets (stack, discharge pipe to river or seawater). It also includes diffuse emissions and sources of radiological exposure to the ionising radiation present in the facilities. These elements are the "source term".

The estimate is made in relation to one or more identified reference groups. These are homogeneous groups of individuals receiving the highest average dose from among the population exposed to a given installation according to realistic scenarios. This population category (adults, infants, children) differs from one site to another and from one year to another, as does the group's distance from the site.

Finally, the estimate is made according to modelling parameters, such as meteorological data (locally observed wind rose). All of these parameters, specific to each site, explain most of the differences observed between sites and from one year to another.

For each of the nuclear sites presented, the radiological impact remains far below 1% of the limit for the public of 1mSv per year. ASN is therefore of the opinion that in France, the discharges produced by the nuclear industry have an extremely small radiological impact.

3|4 Learning the lessons from significant events

3|4|1 Anomaly detection and analysis

History

The international conventions ratified by France (Article 9v of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management of 5th September 1997; Article 19vi of the Convention on Nuclear Safety of 20th September 1994) require that BNI licensees implement a reliable system for detecting any anomalies that may occur, such as equipment failures or errors in the application of operating rules. This system should allow early detection of any abnormal operation and is a factor in defence in depth. These anomalies must be notified to ASN.

Based on twenty years of experience, ASN felt that it would be useful to transpose this approach, which was initially limited to nuclear safety, to radiation protection and protection of the environment. ASN thus drafted two guides defining the

The ASN tritium action plan

Further to questions as to what becomes of tritium in the environment and its impact on man, ASN created two pluralistic think-tanks in 2008, one examining the sources of tritium, the other examining its impact on health and the environment. The chairmen of the groups, Dr Patrick Smeesters of the Belgian Federal Agency for Nuclear Control (FANC) and Mr Roland Masse of the Academy of Technologies, submitted their conclusions and the recommendations of the two think-tanks to ASN in April 2010.

The work confirmed the low impact of tritium discharges in France, but also evidenced the need for further studies and research to consolidate existing data and knowledge on the behaviour of tritium in the environment.

On the basis of the conclusions and recommendations of the think-tanks, ASN proposed a plan of action for standardising tritium measurement, for the management of tritiated discharges, and for improvements to environmental monitoring and estimation of the impact of tritium. It has asked the research organisations to further research into the evaluation of the impact of tritium, its effects on the foetus and embryo, and the potential induction of hereditary effects.

The entire Tritium White Paper, including the ASN action plan, is available on the http://livre-blanc-tritium.asn.fr website.

ASN has set up a pluralistic committee to monitor the action plans, which met for the first time on 6th July 2011. Certain aspects of the action plans are already under way:
- *ASN has initiated a review of tritium emissions form all French nuclear sites, which are published on the White Paper website. This review also includes the dosimetric impact of each site and the tritium contribution to the total dose;*
- *ASN asked the BNEN to begin work to standardise the measurement of organically bound tritium: a special working group was created in 2011 and is tasked with drafting a standard;*
- *ASN asked the licensees to initiate work to improve characterisation of their discharges;*
- *with regard to radiological impact, ASN referred the question of impact assessment to the International Commission on Radiological Protection (ICRP) and also asked the licensees to supplement their impact assessments with a critical study using w_R =2 (weighting factor for tritium).*

principles and reiterating the obligations binding on the licensees with regard to notification of incidents and accidents:
- the 21st October 2005 guide contains the requirements applicable to BNI licensees and to carriers. It concerns significant events affecting nuclear safety of BNIs and RMTs, radiation protection and protection of the environment;
- guide No. 11 of 15th June 2007 (modified on 7th October 2009) is intended for those in charge of nuclear activities as defined in L. 1333-1 of the Public Health Code and the heads of the facilities in which ionising radiation is used (medical, industrial and research activities). It has been used since 1st June 2007, in order to familiarise the professionals with this approach and take account of any problems they could encounter, while enabling them to meet their legal obligations straight away.

These guides can be consulted on the ASN website, *www.asn.fr.* They are currently being revised by ASN.

What is a significant event?

Detection of events (deviations, anomalies, incidents, etc.) by those in charge of the activities using ionising radiation, and implementation of corrective measures highlighted after analysis, play a fundamental role in accident prevention. To give an idea of what this entails, the licensees detect and analyse 100 to 300 anomalies a year for each EDF reactor and about 50 a year for a research facility.

Rating the anomalies should enable priority to be given to addressing the most important ones. ASN has defined a category of anomalies called "significant events". These are events that are sufficiently important in terms of safety or radiation protection to justify rapid notification of ASN, followed by a subsequent and more complete analysis. Significant events must be notified to it, as specified in the Environment Code (article L.591-5), the Public Health Code (Articles L. 1333-3 and R. 1333-109 to R. 1333-111) and the Labour Code (Article R. 4451-99). The criteria for notifying the public authorities of events considered to be "significant" take account of the following:
- the actual or potential consequences for workers, the public, patients or the environment, of events that could occur and affect nuclear safety or radiation protection;
- the main technical, human or organisational causes that led to the occurrence of such an event.

This notification process is part of the continuous safety improvement approach. It requires the active participation of all licensees (users of ionising radiation, carriers, etc.) in the detection and analysis of deviations. It enables the authorities:
- to ensure that the individual in charge of the activity has carried out a relevant analysis of the event and taken appropriate measures to remedy the situation and prevent it happening again;
- to analyse the event in the light of the experience available to other parties in charge of similar activities.

The purpose of this system is not to identify or penalise any individual person or party (see point 4).

3|4|2 Implementation of the approach

Event notification

In the event of an incident or accident, whether or not nuclear, with a real or potential risk of significant consequences for the safety of the facility or transport, or liable to constitute a risk for people, property or the environment through significant exposure to ionising radiation, the person in charge of a nuclear activity is obliged to notify ASN and the State representative in the *département*[1] without delay.

According to the provisions of the Labour Code, employers are obliged to declare significant events affecting their workers. When the head of a facility carrying out a nuclear activity calls in an external contractor or non-salaried worker, the significant events affecting salaried or non-salaried workers are notified in accordance with the prevention plans and the agreements concluded pursuant to article R. 4451-8 of the Labour Code.

The declaring party determines the urgency of the notification in the light of the actual or potential severity of the event and the speed of response necessary to prevent the situation from getting worse or to mitigate the consequences of the event. The notification time of two working days tolerated in the ASN notification guides is not applicable if the consequences of the event necessitate intervention by the public authorities.

ASN analysis of the notification

ASN analyses the initial notification to check the implementation of immediate corrective measures, decide whether to conduct an on-site inspection to analyse the event in depth, and to prepare for informing of the public if necessary.

Within two months of the notification, it is followed by a report indicating the conclusions the licensee has drawn from analysis of the events and the steps it intends to take to improve safety or radiation protection. This information is extremely valuable for ASN and its technical support organisation, IRSN, in particular for the periodic safety reviews conducted on BNIs.

ASN ensures that the licensee has analysed the event pertinently, has taken appropriate steps to remedy the situation and prevent it from recurring, and has circulated the operating experience feedback.

ASN's review focuses on compliance with the applicable rules for detecting and notifying significant events, the immediate technical measures taken by the licensee to maintain or bring the installation into a safe condition, and the pertinence of the licensee's analysis.

ASN and IRSN subsequently examine the operating feedback from the events. The assessment by ASN, the significant event reports and the periodic results sent by the licensees constitute the organisational basis of operating experience feedback. This experience feedback can lead to requests for improvement of the condition of the facilities and the organisation adopted by the licensee, as well as for changes to the regulations.

Operating experience feedback encompasses events occurring both in France and abroad, whenever relevant to enhancing nuclear safety or radiation protection.

3|4|3 Conducting a technical inquiry in the event of an incident or accident concerning a nuclear activity

ASN has the authority to carry out an immediate technical inquiry in the event of an incident or accident in a nuclear activity. This inquiry, carried out for events that justify it, consists in collecting and analysing all useful information, without prejudice to the judicial inquiry, in order to determine the circumstances and the identified or possible causes of the event, and drawing up recommendations if necessary. The inquiry is conducted by an inquiry team which, in addition to ASN staff, can comprise specifically designated outside individuals.

This arrangement covers incidents and accidents associated with both BNIs and RMT as well as those which can occur during activities entailing a risk of human exposure to ionising radiation, in particular activities carried out for medical purposes.

Articles L. 592-35 and following of the Environment Code give ASN powers to set up a commission of inquiry, determine its composition, define the subject and scope of the investigations and gain access to all necessary elements in the event of a judicial inquiry.

However, unlike the investigation bureaus set up in other fields[2], whose sole purpose is to conduct inquiries, disseminate information gleaned from operating experience feedback and conduct research into accidents and their causes, ASN's main responsibility is the inspection of nuclear activities and the drafting of the regulations. This entails certain particularities in how the investigators and ASN work together.

This primarily concerns three aspects:
– for inquiries concerning a nuclear activity, it is necessary to differentiate between the inquiry duty, the aim of which is to determine the circumstances and causes of the event, and the ASN's regulation duty, the aim of which is to protect workers, patients, the public and the environment from risks related to nuclear activities.

1. Administrative region headed by a *préfet*
2. The maritime accidents investigation bureau (BEAmer), the land transports accident investigation bureau (BEA TT), the civil aircraft accident investigation bureau (BEA), and their counterparts for events affecting defence-related transport.

– the accident investigation bureau (BEA) officers whose duty is to take part in the inquiries, receive permanent commissions as technical investigators. As the responsibility of the ASN officers is primarily one of inspection, they are temporarily commissioned on a case-by-case basis;
– the investigators must offer guarantees of independence and impartiality. This requirement applies to ASN officers, who must not have taken part in the inspection of the activity which is the subject of the inquiry for which they are commissioned.

Decree 2007-1572 of 6th November 2007 on technical inquiries into accidents or incidents concerning a nuclear activity specifies the procedure to be followed. It is based on the practices established for the other investigation bureaus and takes account of the specific characteristics of ASN, particularly its independence, its ability to impose requirements or penalties if necessary and the concurrence of its investigative and other duties.

3|4|4 Public information

Independently of this process, the public must be informed of those events whose importance so warrants (see chapter 6).

3|4|5 Statistical summary of events in 2011

In 2011, ASN was notified of:
– 1,092 significant events for the BNIs, concerning nuclear safety, radiation protection and the environment, 938 of which were classified on the INES scale;
– 29 significant events concerning the transport of radioactive materials; 27 of which were classified on the INES scale;
– 534 significant events concerning radiation protection in small-scale nuclear activities, 97 of which were rated on the INES scale.

By comparison with 2010, the number of significant events is up by about 6% for BNIs and 8% for small-scale nuclear activities, but significantly down for RMT operations. The overall rise in the number of significant events stems from the rise in notifications, in particular from those in charge of small-scale nuclear activities.

The distribution of significant events rated on the INES scale is specified in table 6. The INES scale is not applicable to patients, which are rated on the ASN-SFRO scale of significant events affecting one or more radiotherapy patients, and is described in chapter 9.

3|5 Raising awareness

Regulation is supplemented by awareness programmes designed to ensure familiarity with the regulations and their application in practical terms appropriate to the various professions. ASN aims to encourage and support initiatives by the professional organisations who implement this approach by issuing good practice and professional information guides. Initiatives such as these, initiated in the medical field, are mentioned in chapter 9.

Raising awareness also involves joint action with other administrations and organisations that carry out regulatory duties on the same facilities, but with different prerogatives, such as the state labour inspectorate, inspection of medical appliances by AFSSAPS or health inspection as entrusted to the technical divisions of the Ministry for Health.

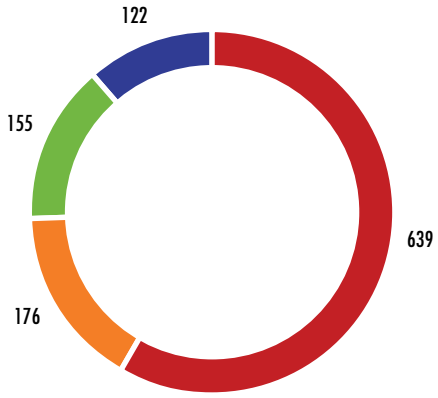
ASN and the General Directorate for Labour (DGT) for example signed an agreement in 2011 to coordinate the labour inspection and radiation protection inspection duties. This includes information exchanges, both local and national, joint inspections and cross-training courses.

Graphs 5 to 11 describe in detail the significant events notified to ASN in 2011, differentiating between the various notification criteria for each domain.

Table 6: rating of significant events on the INES scale in 2011

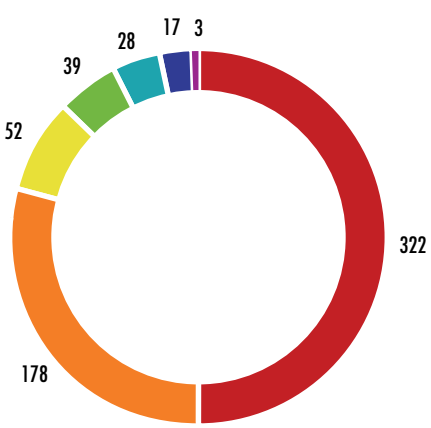
Level	Water reactors	Other pressurised facilities	Basic nuclear transport operations	Small-scale nuclear activities	Total
3 and +	0	0	0	0	**0**
2	1	0	0	1	**2**
1	66	23	2	15	**106**
0	680	168	25	81	**954**
Total	747	191	27	97	**1,062**

Graph 5 : breakdown per type of event for BNIs in 2011



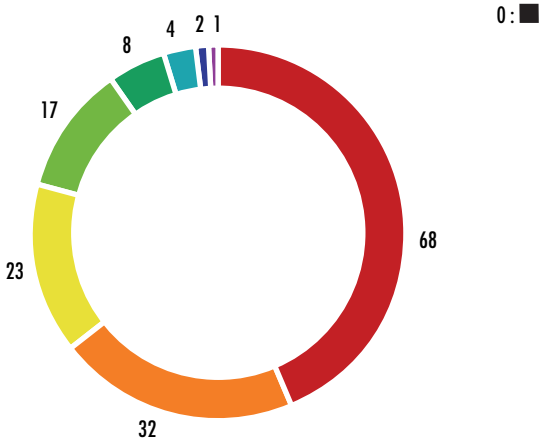
- Safety related events for NPPs
- Environmental events for BNIs
- Safety related events for BNIs other than NPPs
- Events involving radiation protection in BNIs

Graph 6 : events involving safety in NPPs in 2011



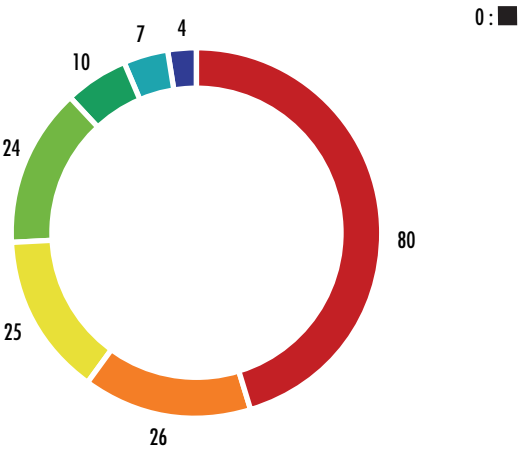
- Deviation from Operational Technical Specifications (STE) or event which could lead to a deviation
- Other significant events which could affect safety
- Automatic reactor trip
- Design, manufacturing or assembly anomaly
- Transition to shutdown state according to the STE or accident procedures
- Inadvertent start-up of a protection or safeguard system
- Event or anomaly specific to the primary or secondary system
- On-site or off-site hazard affecting the availability of important equipment
- Actual or attempted malicious act
- Event which caused or could cause multiple failures

Graph 7 : events involving safety for BNIs other than NPPs in 2011



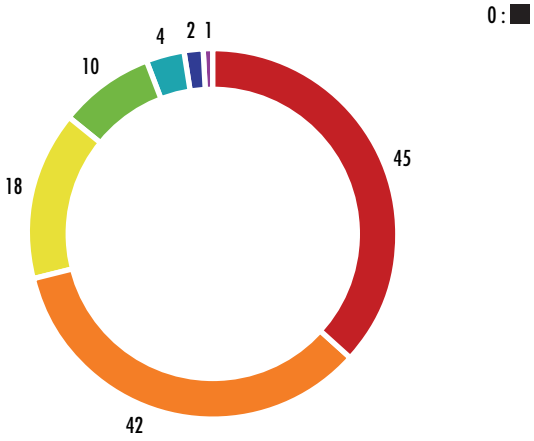
- Event which led to safety limit(s) being exceeded
- Event actually or potentially affecting the containment of hazardous materials
- Other significant events which could affect safety
- Fault, deterioration or failure which affected a safety function
- Inadvertent start-up of a protection or safeguard system
- On-site or off-site hazard affecting the availability of important equipment
- Event which caused or could cause multiple failures
- Equipment failure causing an event leading to injury or death
- Actual or attempted malicious act
- Events affecting a safety function which could subsequently lead to an accident

Graph 8 : significant environmental events for BNIs in 2011



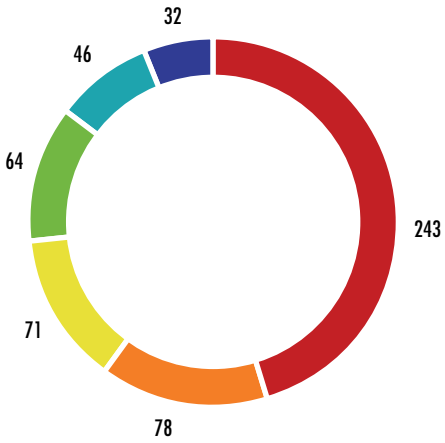
- Non-compliance with the order of 31st December 1999
- Bypassing of normal discharge channels, with a significant chemical impact
- Other significant events which could affect the environment
- Confirmed overshoot of a discharge or concentration limit
- Bypassing of normal discharge channels, with a significant radioactive impact
- Non-compliance with an operational requirement which could lead to a significant impact
- Non-compliance with the site or facility waste study
- Actual or attempted malicious act
- Discovery of a site polluted by chemical or radioactive contamination

Graph 9 : events involving radiation protection for BNIs in 2011



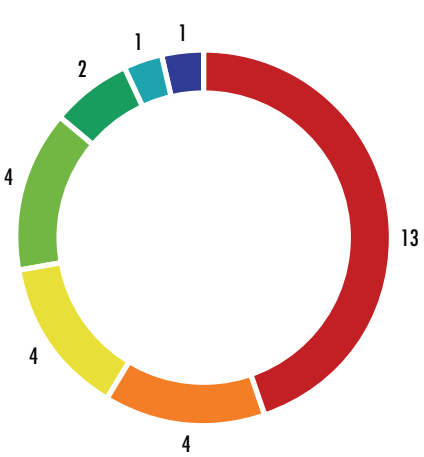
- Other significant events which could affect radiation protection
- Signage anomaly or failure to comply with zone access conditions
- Any significant deviation concerning radiological cleanness
- Abnormal situation affecting a source with activity higher than the exemption threshold
- Radiological monitoring device inspection interval exceeded
- Operation with a radiological risk performed without analysis or ignoring the findings of the analysis
- One quarter of the annual dose limit exceeded or event capable of leading to such a situation
- Annual dose limit exceeded or event capable of leading to such a situation
- Actual or attempted malicious act liable to affect the protection of the workers or general public
- Uncompensated failure of radiological monitoring systems

Graph 10 : events involving radiation protection (other than BNIs and RMT) in 2011



- Concerning one or more patients (therapeutic purposes)
- Concerning the general public
- Concerning one or more patients (diagnostic purposes)
- Loss, theft or discovery of radioactive sources or substances
- Other event concerning radiation protection
- Concerning one or more workers

Graph 11 : events involving the transport of radioactive materials (RMT) in 2011



- Non-compliance with regulations applicable to RMT operations
- Non-compliance with a radiation intensity or contamination limit
- Fault, deterioration or failure which affected a safety function
- Other significant events which could affect the transport operation
- Actual or potential hazard affecting the safety of a transport operation
- Repetitive event of unknown cause affecting a safety function
- Event open to misinterpretation in the media or by the general public
- Loss or theft of a radioactive material package during transport
- Shipment of a package even though the consignee is not in a position to receive the shipment
- Accidental discovery of a transport package not declared as having been stolen or lost
- Actual or attempted malicious act
- Nuclear or other event leading to injury or death
- Event having affected at least one barrier, with actual or potential consequences

4 MONITORING ENVIRONMENTAL RADIOACTIVITY

Within a European regulatory context, the monitoring of the environment is in particular based on:
– monitoring around the nuclear facilities by the licensees in accordance with the terms of their discharge licences;
– monitoring of environmental radioactivity by IRSN;
– the French National Network for the Measurement of Environmental Radioactivity (RNM), the aim of which is to collate and make available to the public all the environmental measurements taken nationwide as required by the regulations. The quality of these measurements is guaranteed by subjecting the measuring laboratories to an approval procedure.

4|1 European context

Article 35 of the Euratom Treaty requires the Member States to establish the facilities necessary to carry out continuous monitoring of the level of radioactivity in the air, water and soil and to ensure compliance with the basic standards of health protection for the general public and workers against the hazards of ionising radiation. All Member States, whether or not they have nuclear facilities, are therefore required to implement environmental monitoring arrangements throughout their territory.

By virtue of the provisions of this same article 35, the European Commission also has the right of access to these monitoring facilities, in order to check their operation and effectiveness. Following these checks, the European Commission issues an opinion on the resources put in place by the Member States to monitor:
– radioactive liquid and gaseous discharges into the environment;
– the levels of radioactivity in the land and aquatic environment around nuclear sites and nationwide.

It gives its opinion more particularly on:
– the operation of the measuring instruments;
– the representativeness of the samples and the sampling methods;
– the relevance of the analytical methods;
– management and archiving of results;
– reports and procedures;
– quality control of measurements.

Since 1994, the Commission has carried out the following inspections:
– the La Hague reprocessing plant and ANDRA's Manche repository in 1996;
– Chooz NPP in 1999;
– Belleville-sur-Loire NPP in 1994 and 2003;
– the La Hague reprocessing plant in 2005;
– the Pierrelatte nuclear site in 2008;
– the old uranium mines in the Limousin *département* in 2010;
– the CEA site at Cadarache in 2011.

During the course of this latest verification, in June 2011, the Commission's experts concluded that France was in conformity with the requirements of article 35 of the Euratom Treaty.

4|1|1 The purpose of environmental monitoring

Licensee prime responsibility includes monitoring the environment around nuclear sites in accordance with individual requirements (creation authorisation decree, discharge license or ASN decision) defining the steps to be taken and their frequency, regardless of any additional arrangements made by the licensees for their own monitoring.

This environmental monitoring:
– helps gives a picture of the condition of the radiological and radio-ecological state of the facility's environment through measurement of regulated parameters and substances, whether or not radioactive, in the various compartments of the environment (air, water, soil) as well as in the various biotopes and the food chain (milk, vegetables, etc.): a zero reference point is identified before the creation of the facility and environmental monitoring enables any changes to be tracked;
– helps verify that the impact of the facility on health and the environment is in conformity with the impact assessment provided for in 6° of I of article 8 of the decree of 2nd November 2007;



ASN inspection on the topic "sampling and measurement of effluents" discharged from the Flamanville NPP – November 2011

Table 7: example of radiological monitoring of the environment around BNIs

Environment monitored type of inspection	Nuclear power plant	Research laboratory or plant
Air at ground level	• 4 stations continuously sampling atmospheric dust on a fixed filter, with daily measurements of the total β activity (β_G) spectrometry γ if $\beta_G > 2$ mBq/m^3 • 1 continuous sampling under the prevailing winds with weekly tritium measurement (^{3}H)	
Ambient γ radiation	• 4 detectors at 1 km with continuous measurement • 10 detectors with continuous measurement at the site limits (monthly recording) • 4 detectors at 5 km with continuous measurement	• 4 detectors with continuous measurement and recording • 10 integrating dosimeters at the site limits (monthly recording)
Rain	• 1 station under the prevailing wind (monthly collector) with measurement of β_G and ^{3}H on a monthly mixture	• 2 continuous sampling stations including one under the prevailing wind with weekly measurement of β_G and ^{3}H
Liquid discharge receiving environment	• Sampling in the river upstream and at mid-discharge, for each discharge (riverside plant) or sampling after dilution in the cooling water and bi-monthly sampling at sea (coastal plant): Measurement of β_G, of potassium (K) Continuous sampling of ^{3}H (daily average mixture) • Annual sampling in sediments, aquatic fauna and flora with measurement of β_G, du K and ^{3}H	• At least weekly sampling of water in the receiving environment with measurement of the total α activity, β_G, K and ^{3}H • Annual sampling in sediments, aquatic fauna and flora for γ spectrometrie
Groundwater	• 5 sampling points (monthly check) with measurement of β_G, K and ^{3}H	• 5 sampling points (monthly check) with measurement of β_G, K and ^{3}H • Measurement of total α activity
Soil	• 1 annual sample of topsoil with γ spectrometry	
Vegetation	• 2 grass sampling points (monthly check) with measurement of β_G, K and γ spectrometrie. Measurement of carbon 14 (^{14}C) and total carbon (quarterly) • Annual campaign on the main agricultural produce with measurement of β_G, K,^{14}C and total carbon, and γ spectrometrie	• 4 grass sampling points (monthly check) with measurement of β_G, K and γ spectrometrie • Annual campaign on the main agricultural produce with measurement of β_G, K, ^{14}C et du carbone total, and total carbon, and γ spectrometrie
Milk	• 2 sampling points (monthly check) with measurement of β activity (except ^{40}K), K and annually ^{14}C	• 1 sampling point (monthly check) with measurement of β activity and γ spectrometrie (+ ^{3}H and ^{14}C periodically)

β_G = total β

– detects any abnormal increase in radioactivity as early as possible;
– ensures there are no facility malfunctions, including by analysing the ground water and checking compliance with the regulations by the licensees;
– contributes to transparency and informing the public by transmitting monitoring data to the RNM.

4|1|2 Content of monitoring

Virtually all nuclear sites in France carry out systematic environmental monitoring. The nature of this monitoring is proportionate to the potential environmental risks or drawbacks of the facility, as presented in the authorisation file, particularly the impact assessment.

The regulation monitoring of the BNIs environment is tailored to each type of installation, depending on whether it is a power reactor, a plant or a research facility. The nature of the environmental monitoring associated with liquid discharges, which must be stipulated in the authorisation order, is defined in articles 14, 22 and 23 of the ministerial order of 26th November 1999. To bring it into line with the progress achieved with the Environment Code, ASN has initiated an update of the general technical regulations applicable to BNIs.

Depending on specific local features, monitoring may vary from one site to another. Table 7 gives examples of the monitoring performed by a NPP and by a research centre or plant.

When several facilities (whether or not BNIs) are present on the same site, joint monitoring of all these installations is possible,

TO BE NOTED IN 2011

Special monitoring plan during the Fukushima accident

To estimate radioactivity levels across French territory following releases from the Fukushima Daiichi nuclear power plant, ASN asked operators to demonstrate particular vigilance regarding the results of measurements made and to step up monitoring. Additional analyses were requested by ASN on 22nd March 2011 relative to monitoring the air, entailing measurement of the radioactivity levels of aerosols and gaseous iodines.

The first phase of this additional monitoring (22nd March – 18th April 2011) consisted in grouped daily gamma spectrometry measurement of aerosol filters, as well as gamma spectrometry measurement of iodine gases on a cartridge, at intervals of 24h to 72h. Depending on the specificities of each site, the licensees were able to adapt this mechanism. To take account of changing contamination levels, a second phase was initiated as of 18th April, with a weekly gamma spectrometry measurement of the 7 daily aerosol filters and a weekly gamma spectrometry measurement of the iodine gases on a cartridge.

Faced with the very low concentrations of artificial radionuclides in early May and, as of the second week of April 2011, the consistent decline as of the second week of April 2011 of traces detected in air masses that reached France at the end of March 2011, ASN has therefore asked operators to lift the special monitoring implemented.

During this period, the nuclear licensees continued to monitor the environment in accordance with the regulations applicable to them. The results of these measurements are transmitted monthly to the RNM and are published on this network's website www.mesure-radioactivite.fr.

A total of 30 sites took part in this complementary monitoring. More than 600 gamma spectrometry measurements of filter groups (4 to 28 filters) and more than 250 gamma spectrometry measurements of cartridges to measure gaseous iodine, were taken.

The summary report on these measurement results has been integrated into the information notes published on the IRSN website since 24th March 2011 [1].

Everyone involved in monitoring the environment, especially university laboratories and associations, has also played a crucial role in assessing the very long-range impact of the releases from Fukushima thanks to their specific and independent measurements.



Post-Fukushima inspection of the Flamanville NPP – July 2011

1. ww.irsn.fr/FR/Actualites_presse/Actualites/Documents/IRSN_Bulletin14_Bilan-surveillance-environnement-France_22042011.pdf

as has been the case on the Cadarache and Pierrelatte sites since 2006, for example.

These monitoring principles are supplemented in the individual requirements applicable to the facilities by monitoring measures specific to the risks inherent in the industrial processes they use.

Each year, in addition to forwarding the monitoring results to ASN, as required by the regulations, the operators send some 120,000 measurements to the RNM.

4|2 Environmental monitoring nationwide

IRSN ensures the environmental monitoring of the French territory through a measurement and sampling network dedicated to:
– air monitoring (aerosols, rainwater, ambient gamma activity);
– monitoring of surface water (watercourses) and groundwater (aquifers);
– monitoring of the human food chain (milk, cereals, food intake);

– terrestrial continental monitoring (reference stations located far from all industrial facilities).

It uses two approaches for this:
– continuous on-site monitoring using independent systems (remote-monitoring networks) providing real-time transmission of results. This includes:
  • the Téléray network (ambient gamma radioactivity of the air) which uses 164 measurement detectors;
  • the atmospheric aerosols radioactivity measurement network;
  • the Hydrotéléray network (monitoring of the main water courses downstream of all nuclear facilities and before they cross national boundaries);
  • the Téléhydro network (monitoring of waste water in the sewerage treatment plants in the main French cities);
– processing and measurement in a laboratory of samples taken from the various compartments of the environment, whether or not close to facilities liable to discharge radionuclides.

Every year, IRSN takes more than 25,000 samples in all compartments of the environment (excluding the remote-measurement networks).

The radioactivity levels measured in France are stable and situated at very low levels, generally at the detection sensitivity threshold of the measuring instruments. The artificial radioactivity detected in the environment results essentially from fallout from the atmospheric tests of nuclear weapons carried out in the 1960's, and from the Chernobyl accident. Traces of artificial radioactivity associated with discharges can sometimes be detected near installations. To this can be added very local contaminations resulting from past industrial incidents or activities, and which do not represent a health risk.

4|3 Guaranteeing measurement quality

Articles R.1333-11 and R.1333-11-1 of the Public Health Code make provision for the creation of a National Network for the Measurement of Environmental Radioactivity (RNM) and a procedure for having the radioactivity measurement laboratories approved by ASN. The RNM procedures were defined by an ASN decision (approved decision 2008-DC-0099 of 29th April 2008).

This network is being deployed for two main reasons:
– to ensure the transparency of information on environmental radioactivity by making the results of this environmental monitoring and information about the radiological impact of nuclear activities in France available to the public;
– to continue a quality assurance policy for environmental radioactivity measurements by setting up a system of laboratory approvals granted by ASN decision, pursuant to article L.592-21 of the Environment Code.

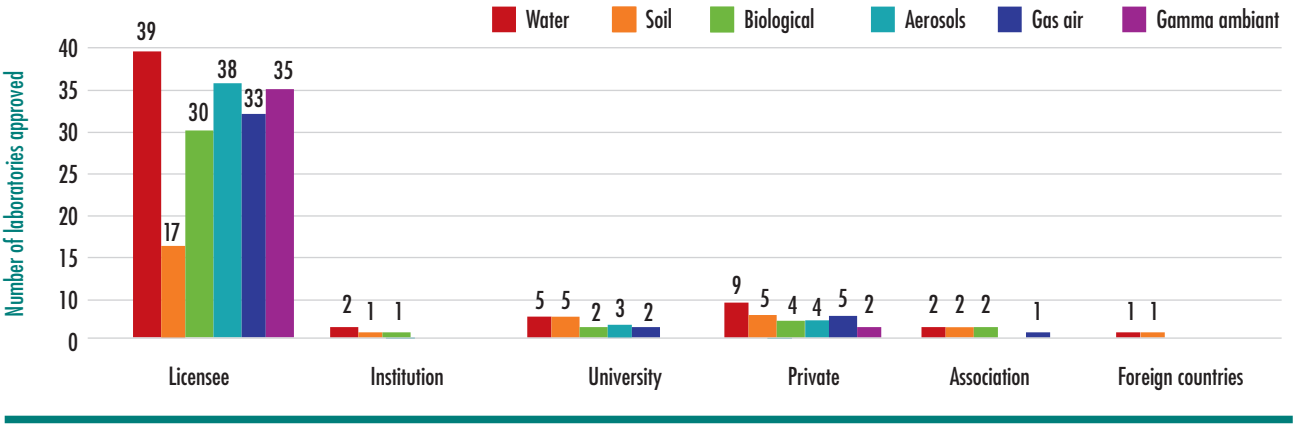
Table 8: approval chart and forecast five-year programme of inter-laboratory tests

		Type 1		Type 2		Type 3		Type 4		Type 5		Type 6	
Code	Radioactive measurements category	Water		Soil matrices		Biological matrices		Aerosols on filter		Gas air		Ambient environment (soil /air)	
.. -01	Gamma emitters $\gamma > 100$ keV	2	1_01	1	2_01	2	3_01	2	4_01	1	5_01		-
.. -02	Gamma emitters $\gamma < 100$ keV	2	1_02	1	2_02	2	3_02		4_02	1	5_02		-
.. - 03	Total alpha	1	1_03		-		-	2	4_03		-		-
.. -04	Total beta	1 1**	1_04		-		-	2	4_04		-		-
.. -05	H-3	1 1**	1_05		2_05	2	3_05		-		See water		-
.. -06	C-14	1	1_06		2_06	2	3_06		-	1	5_06		-
.. -07	Sr-90/Y-90	1	1_07	1	2_07	2	3_07	2	4_07		-		-
.. -08	Other pure beta emitters (Tc99,...)		1_08	2	2_08	1	3_08		-		-		-
.. -09	U isotopes	2	1_09	1	2_09	2	3_09	2	4_09		-		-
.. -10	Th isotopes		1_10	1	2_10	2	3_10		4_10		-		-
.. -11	Ra-226 + daughters	2	1_11	1	2_11	2	3_11		-		Rn 222: 5_11		-
.. -12	Ra-228 + daughters	2	1_12	1	2_12	2	3_12		-		Rn 220: 5_12		-
.. -13	Isotopes Pu, Am, (Cm, Np)	*	1_13*	2 2	2_13*	1	3_13	2	4_13		-		-
.. -14	Halogenated gases		-		-		-		-	1	5_14		-
.. -15	Rare gases		-		-		-		-	1	5_15		-
.. -16	Gamma dosimetry		-		-		-		-		-	1	6_16
.. -17	Total uranium	2	1_17	1	2_17	1	3_17	2	4_17		-		-

2011 2012 2013 2014 2015

The number of stars corresponds to the half year period during which the inter-comparison test is organised :
* 1_13* and 2_13* in the second half of 2010 and scheduled for the second half of 2016.
** 1**: 1_04 and 1_05 in seawater in the first half of 2014

Graph 12: breakdown of number of approved laboratories as at 1st January 2012



The approvals cover all components of the environment, water, soils or sediments, all biological matrices (fauna, flora, milk), aerosols and atmospheric gases. The measurements concern the main artificial or natural, gamma, beta or alpha emitting radionuclides, as well as the ambient gamma dosimetry (see p. 130 approval chart below in table 8).

In total, about fifty types of measurements are covered by approvals. There are just as many corresponding inter-laboratory comparison tests. These tests are organised by IRSN according to a 5-year cycle, which corresponds to the maximum approval validity period.

4|3|1 Laboratory approval procedure

ASN decision 2008-DC-0099 of 29th April 2008 specifies the organisation of the national network and sets new approval arrangements for the environmental radioactivity measurement laboratories. This ASN decision, which replaced the ministerial order of 27th June 2005, takes account of the changes to the Public Health Code, the ASN prerogatives defined by the Environment Code and the operating experience feedback acquired since 2003.



ASN inspection on the topic "sampling and measurement of effluents" discharged from the Flamanville NPP – November 2011

The approval procedure includes:
– presentation of an application file by the laboratory concerned, after participation in an inter-laboratory test (ILT);
– review of it by ASN;
– review of the application files - which are made anonymous - by a pluralistic approval commission which delivers an opinion on them.

The laboratories are approved by ASN decision, published in its Official Bulletin.

This decision obliges BNI licensees to have approved laboratories take the environmental radioactivity monitoring measurements required by regulations.

4|3|2 The approval commission

The approval commission is the body which, for the RNM, is tasked with ensuring that the measurement laboratories have adequate organisational and technical competence to provide the network with quality measurement results. The commission is responsible for giving ASN its proposed approval, refusal, revocation or suspension of approval. It decides on the basis of an application file submitted by the candidate laboratory and its results in the ILTs organised by IRSN.

The commission presided over by ASN comprises qualified persons and representatives of the State services, laboratories, standardising authorities and the IRSN. ASN decision 2008-DC-0117 of 4th November 2008 renewed the mandates of the commission's members for a further 5 years.

4|3|3 Approval conditions

Laboratories seeking approval must set up an organisation meeting the requirements of standard NF EN ISO/IEC 17025 concerning the general requirements for the competence of calibration and test laboratories.

In order to demonstrate their technical competence, they must take part in ILTs organised by IRSN. The ILT programme, which now operates on a five-yearly basis, is updated annually. It is reviewed by the approval commission and published on the national network's website *(www.mesure-radioactivite.fr)*.

The French National Network for the Measurement of Environmental Radioactivity Monitoring (RNM) website

In order to meet this transparency goal, the Network launched a website on 2nd February 2010 to present the environmental radioactivity monitoring results and information on the health impact of nuclear activities in France. In order to guarantee the quality of the measurements, only those taken by an approved laboratory or by IRSN may be communicated to the Network.

The website is organised around three topics (radioactivity, the national network and the measurements map) and can be used to obtain information about radioactivity (what is radioactivity? how is it measured? what are its biological effects?), about the national monitoring network (operation, network participants, laboratory approval procedure), plus access to a database containing all the radioactivity measurements taken nationwide (almost 600,000 measurements). The RNM management report is also available on the website. The next summary of the radiological situation in France, including notable findings will also be available on-line.

At the time of the Fukushima events, the site experienced a traffic peak, with 150,000 visits in March.

ASN considers that the launch of the RNM website is a decisive step forward in terms of transparency. It also considers this to be just a first step in providing the public with environmental radioactivity monitoring information, and will ensure that the general public and web users are consulted about how they would like this website to develop. A panel of users will thus be set up in 2012 so that functions and information can be gradually added to the site, enabling the public to understand and interpret the environmental radioactivity measurement results transmitted to the national monitoring network.

The ILTs organised by IRSN can cover up to 70 laboratories in each test, including a few foreign laboratories.

To ensure that the laboratory approval conditions are fully transparent, precise assessment criteria are used by the approval commission. These criteria are published on the national network's website.

In 2011, IRSN organised 5 intercomparison tests, which means 39 ILT since 2003 covering 44 types of approvals. Most of the approved laboratories specialise in water monitoring, with 58 laboratories holding up to 13 different approvals for monitoring of this medium. About forty laboratories are approved for measurement of biological matrices (food chain), atmospheric dust, air, or ambient gamma dosimetry. About 30 laboratories deal with soils. Although most of the laboratories are competent to measure gamma emitters in all environmental matrices, only about ten of them are approved to measure carbon 14, trans-uranium elements or radionuclides of the natural chains of uranium and thorium in water, soil and biological matrices.

In 2011, ASN issued 130 approvals and extended a further hundred. On 1st January 2012, the total number of approved laboratories stood at 63, which represents 788 approvals of all types currently valid.

The detailed list of approved laboratories and their scope of technical competence is available on ASN's website *www.asn.fr.*

5 IDENTIFYING AND PENALISING INFRINGEMENTS

5|1 Ensuring that licensee penalty decisions are proportionate, fair and consistent

In certain situations in which the licensee fails to conform to the regulations or legislation, or when it is important that appropriate action be taken by it to remedy the most serious risks immediately, ASN may impose the penalties provided for by law. The principles of ASN's actions in this respect are:

1. penalties that are impartial, justified and appropriate to the level of risk presented by the situation concerned. Their scale is proportionate to the health and environmental consequences associated with the anomaly detected and also takes account of intrinsic factors relating to the behaviour of the party at fault and external factors relating to the context of the infringement;
2. administrative action initiated on proposals from the inspectors and decided on by ASN in order to remedy risk situations and non-compliance with the legislative and regulatory requirements as observed during its inspections.

ASN has a range of tools at its disposal, in particular:
– remarks made by the inspector to the licensee;
– the official letter from the ASN departments to the licensee (follow-up letters);
– formal notice from ASN to the licensee to regularise its administrative situation or meet certain specified conditions, within a given time-frame;
– administrative penalties applied after formal notice.

In parallel with ASN's administrative action, reports can be drafted by the inspector and sent to the Public Prosecutor's Office.

To provide the inspectors with the tools they need to assess the seriousness of the anomalies observed and impose appropriate penalties, ASN has drawn up procedures and decision-making tools regarding the position to be adopted. These documents provide a structured framework enabling an impartial decision to be reached that is proportionate to the anomaly detected, coherent between all the inspectors and in conformity with ASN policy. They also constitute a learning aid for the less experienced inspectors.

The decision to issue demands is based on the observed risk for people or the environment and takes account of factors specific to the licensee (history, behaviour, repeated nature of the problem), contextual factors and the nature of the infringements observed (regulations, standards, "rules of good practice", etc.).

5|2 Implementing a policy of penalties

5|2|1 For the BNI and RMT licensees

When ASN's regulatory actions reveal failures to comply with safety requirements, penalties can be imposed on the licensees concerned, after serving formal notice if necessary. Penalties in such cases may consist in prohibiting restart of a plant or suspending operation until the requisite corrective measures have been taken.

If an infringement is observed, the Environment Code comprises graduated administrative penalties that become applicable after formal notice, as defined in its articles L. 596-14 to L. 596-22:
– deposit in the hands of a public accountant of a sum covering the total cost of the work to be performed;
– have the work or prescribed measures carried out without consulting the licensee and at its expense (any sums deposited beforehand can be used to pay for this work);
– suspension of operation of the installation or of performance of an operation until the licensee has brought it into conformity.

If the licensee has any observations concerning the penalties it shall present them to the ASN Commission before they are applied.

The Act also makes provision for interim measures to safeguard public health and safety or protect the environment. ASN can therefore:
– provisionally suspend operation of a BNI, immediately notifying the ministers responsible for nuclear safety, in the event of any serious and imminent risk;
– at all times require assessments and implementation of the necessary measures in the event of a threat to the above-mentioned interests.

Infringements are written up in reports by the nuclear safety inspectors and transmitted to the Public Prosecutor's Office, which decides on what subsequent action, if any, is to be taken. The Environment Code makes provision for criminal penalties, detailed in articles L. 596-27 to L. 596-30; these penalties comprise fines of from €7,500 to €150,000 plus a possible prison term of from 1 to 3 years, depending on the nature of the infringement. For legal persons found to be criminally liable, the amount of the fine can reach €1,500,000.

Decree 2007-1557 of 2nd November 2007 concerning BNIs and the regulation of the transport of radioactive materials with respect to nuclear safety, also imposes class 5 fines for infringements as detailed in its article 56.

5|2|2 For persons in charge of small-scale nuclear activities, approved organisations and laboratories

The Public Health Code makes provision for administrative and criminal sanctions in the event of a breach of the radiation protection requirements.

Administrative decision-making powers lie with ASN and can entail:
– temporary or definitive authorisation withdrawals (after receiving formal notice);
– interim suspension of an activity (whether licensed or notified) if urgent measures are required to safeguard human health;
– revocation or suspension of any approvals it has issued.

The formal notice prior to revocation of a licence (based on article L.1333-5 of the Public Health Code) concerns implementation of all the requirements of the "ionising radiation" chapter of the legislative part of the Public Health Code (articles L.1333-1 to L.1333-20), regulatory requirements and the stipulations of the licence. Temporary or final revocation of the licence by ASN must be fully explained in a decision within one month following serving of formal notice.

The formal notices prior to criminal sanctions (based on article L.1337-6 of the Public Health code) are served by ASN. They concern the requirements of articles L.1333-2, L.1333-8 (human exposure monitoring, protection and information measures), L.1333-10 (monitoring of exposure to enhanced natural radioactivity and in premises open to the public) and L.1333-20 (certain implementations of the chapter of the Public Health Code relating to ionising radiation, as determined by decrees).

Infringements are written up in reports by the radiation protection inspectors and transmitted to the Public Prosecutor's Office, which decides on what subsequent action, if any, is to be taken. The Public Health Code makes provision for criminal sanctions as detailed in articles L.1337-5 to L.1337-9 and range from a fine of €3,750 to one year of imprisonment and a fine of €15,000.

5|2|3 For noncompliance with labour law

In the performance of their duties in NPPs, the ASN's labour inspectors have at their disposal all the inspection, decision-making and enforcement resources of ordinary law inspectors. Observation, formal notice, report, injunction (to obtain immediate cessation of the risks) or even shutdown of the worksite, offer a range of enforcement and constraining measures for the ASN labour inspectors that is broader than that available to the nuclear safety or radiation protection inspectors.

The labour inspector has special decision-making powers enabling him to check the employer's disciplinary capability, to protect the general interests from an economic standpoint and to act as arbitrator, if necessary by delegation from the Regional Directorate for Enterprises, Competition, Consumption, Labour and Employment (DIRECCTE). He is also tasked with examining approval applications by the occupational health departments, jointly with the occupational physicians.

The labour inspector is in contact with many parties from different EDF entities. Management of these internal interfaces is an integral part of his duties. The labour inspector is first of all in contact with the unit senior management, the risk prevention departments and the occupational health departments. He is also in direct contact with the members of the Health, Safety and Working Conditions Committees (CHSCT) and the trade union representatives. The members of the CHSCT are a vital means of transmitting information for the labour inspector, in the light of their knowledge of the facility, the operating procedures, working conditions and accidents that occur in the facility. The members of the CHSCT are informed of the inspector's visits and of his observations during the inspections.

The inspector is notified of the ordinary meetings of the CHSCT (one every quarter) and the Inter-Company Working Conditions and Safety Committee (CIESCT) meetings held on the power plant sites, and can attend them. He takes part in extraordinary meetings held following an industrial accident, and in issuing an alert in the event of serious and imminent danger.

The mandatory posting of the contact details of the inspector with competence for each NPP leads to him being frequently contacted both by EDF personnel and by the personnel of the contractors working in the NPPs. The main subjects concern performance of their employment contract (working times, rest periods, travel, leave, etc.), but also notification of degraded working conditions.

The labour inspector is in contact with the occupational health departments. He may be required to validate (or invalidate) a decision by the occupational physician. Close relations with the occupational physician may enable him to gain a relatively clear picture of the "health" of the facility, in particular with regard to the organisational and human factors to be monitored.

Relations on the site can also concern EDF entities from outside the plant, which have their own staff consultation and medical supervision structures. The entities most concerned are the National Electricity Generating Equipment Centre (CNEPE) which is in charge of carrying out and supervising major non-nuclear works, the Nuclear Equipment Engineering Department (CIPN) for major operations on the nuclear island (in particular steam generator replacement), the Nuclear Environmental and Decommissioning Engineering Centre (CIDEN) for all work relating to the decommissioning of retired NPPs, and which on some sites has a separate structure, the workforce of which will rise as the decommissioning phases progress.

In 2011, the ASN labour inspectorate carried out 256 days of inspection and 580 interventions. It ordered two temporary shutdowns of building sites and issued four formal notices. In terms of criminal sanctions, the labour inspectorate issued six official reports on three NPPs.

5|2|4 2011 results concerning enforcement and penalties

ASN took administrative action (formal notice, suspension, etc.) against 12 licensees and managers of nuclear activities. Further to the observed infringements, it sent 33 reports to the Public Prosecutors, four of which were on account of labour inspections in NPPs.

The report drawn up by the ASN inspectors in 2008 concerning the SOCATRI company, led to the Court of first instance of Carpentras sentencing the company in July 2010, in respect of the event which took place on the SOCATRI facility in the night of 7th to 8th July 2008, finding it guilty of having failed to notify the incident without delay. The Public Prosecutor's office appealed this sentence.

On 30th September 2011, the Nimes court of appeal ruled on the appeal brought by the Public Prosecutor's Office. Concerning liability, the court partially reversed the appealed sentence regarding the acquittal in respect of the release of

substances into groundwater, surface water or the sea leading to effects harmful to health or to flora or fauna. The Court requalified the offence and declared the SOCATRI company guilty. Finally, with respect to enforcement and the civil suit, the court also reversed the appealed sentences.

5|3 Information about ASN's inspections

ASN attaches importance to coordinating Government departments and informs the other departments concerned of its inspection programme, the follow-up to its inspections, the penalties imposed on the licensees and any significant events.

To ensure that its inspection work is transparent, ASN informs the public (both general and specialised) by placing the following on its website:
– inspection follow-up letters for all the activities it inspects;
– approval authorisations or rejections;
– incident notifications;
– the results of reactor outages;
– its publications on specific subjects (*Contrôle* magazine, etc.).

Message ordered by the Court to be published in the regional and national daily newspapers, at the expense of the SOCATRI company

By order of 30th September 2011, the court of appeal of Nimes found the SOCATRI company guilty of the offence of releasing substances into the groundwater, surface water or the sea leading, even temporarily, to significant modifications to the normal water supply and to restrictions on the use of bathing waters, and of a failure to notify without delay the incident that occurred in its premises on the night of 7th to 8th July 2008, pursuant to articles 48 and 54 of the 13th June 2006 Act on transparency and security in the nuclear field (TSN Act), and ruled on damages for the civil plaintiffs.

6 OUTLOOK

In 2012, ASN scheduled 1,846 inspections on BNIs, radioactive material transport, activities using ionising radiation, organisations and laboratories it has approved and activities involving pressure equipment. As in 2011, ASN will give priority to the inspection of activities with significant implications, as defined in point 2|1.

Other activities, such as services in BNIs, the supply of electrical generators of ionising radiation and computer tomography will also receive particular attention.

ASN is currently revising the conditions for notification of significant events, which will take into account the experimentation of the events notification guide in small-scale nuclear activities and the changes in regulations in the BNIs sector. The notification criteria and conditions shall be detailed and harmonised between the different sectors.

In the environmental field, ASN will continue to implement its tritium action plan, for example with the assistance of the pluralistic committee responsible for monitoring the action plan. With regard to monitoring of environmental radioactivity, ASN will finalise the work initiated on the monitoring strategy, both nationwide and around the nuclear sites. Together with the ministry responsible for the environment, ASN will also be reinforcing monitoring and inspection of the arrangements made for environmental protection around the BNIs.

Lastly, ASN is preparing to inspect a new field, namely the security of radioactive sources (see chapter 10). While broadening its area of competence, ASN will call on the experience feedback from previous years in order to improve the organisation and accounting of its inspection activities.

RADIOLOGICAL EMERGENCIES

1 **ANTICIPATING** 137

1|1 **Looking ahead and planning**

1|1|1 The emergency plans for basic nuclear installations (BNIs)

1|1|2 The ORSEC-TMR plan

1|1|3 Responding to any other radiological emergency situation

1|1|4 Role of ASN in the preparation and follow-up of emergency plans

1|2 **Controlling urban development around nuclear sites**

1|3 **Organising a collective response**

1|3|1 Local response organisation

1|3|2 National response organisation

1|4 **Protecting the public**

1|4|1 General protective actions

1|4|2 Iodine tablets

1|4|3 Care and treatment of contaminated persons

1|5 **Understanding the long-term consequences**

2 **RESPONDING TO AN EMERGENCY SITUATION** 143

2|1 **Assisting the Government**

2|1|1 ASN's duties in emergency situations

2|1|2 Organisation of ASN

2|1|3 ASN's emergency response centre

2|2 **Ensuring efficient coordination with international authorities**

2|2|1 Bilateral relations

2|2|2 Multilateral relations

2|2|3 International assistance

3 **LEARNING FROM EXPERIENCE** 149

3|1 **Carrying out exercises**

3|1|1 Nuclear alert tests and mobilisation exercises

3|1|2 National nuclear and radiological emergency exercises

3|1|3 Other emergency exercises

3|2 **Assessing with a view to improvement**

4 **OUTLOOK** 152

CHAPTER 5

The Fukushima Daiichi nuclear power plant (NPP) disaster confirms that in spite of the precautions taken in the design, construction and operation of nuclear facilities, the possibility of an accident can never be ruled out. To cope with such an accident, however unlikely, it is necessary to provide for and regularly test specific material and organisational measures to manage emergency situations as effectively as possible.

Two types of emergency situations can occur on basic nuclear installations (BNIs):
– emergency situations, arising from an incident or accident which risk leading to an emission of radioactive materials or a level of radioactivity, liable to affect public health[1] and which include:
  • emergency situations occurring on a BNI, also called nuclear emergencies;
  • accidents involving radioactive material transports (RMT);
  • emergency situations occurring in the field of small-scale nuclear activities;
– non-radiological emergency situations (fire, explosion, release of toxic substances).

The emergency requirements comprise specific organisational measures and emergency plans involving both the licensee and the public authorities. These arrangements, which are regularly tested and assessed, are also subject to regular revision to integrate experience feedback from exercises and from the management of real-life situations.

1 ANTICIPATING

1|1 Looking ahead and planning

1|1|1 The emergency plans for basic nuclear installations (BNIs)

The emergency plans relative to accidents occurring at a BNI define the measures necessary to protect the site personnel, the general public and the environment, and to control the accident.

The on-site emergency plan (PUI), prepared by the licensee, is designed to restore the plant to a safe condition and mitigate the consequences of an accident. It defines the organisational actions and the resources to be implemented on the site. It also comprises arrangements for informing the public authorities rapidly.

The off-site emergency plan (PPI) is established by the *Préfet*[2] in application of decree 2005-1158 of 13th September 2005, "to protect the populations, property and the environment, and to cope with the specific risks associated with the existence of structures and facilities whose coverage area is localised and fixed. They implement the orientations of the policy of emergency preparedness and civil protection in terms of mobilisation of resources, information, alert, exercises and training". This decree also precises the characteristics of the facilities or structures for which the *Préfet* is required to define a PPI.

The PPI specifies the initial actions to be taken to protect the general public, the roles of the various services concerned, the systems for giving the alert, and the human and material resources likely to be engaged in order to protect the general public.

The PPI falls within the framework of the ORSEC plan (Disaster and Emergency Response Organisation) that specifies the protective measures implemented in large-scale emergencies. Consequently, beyond the perimeter established by the PPI, the modular and progressive *departemental* or zonal ORSEC plan applies in full.

More broadly, the interministerial directive of 7th April 2005 on the public authorities response in an event leading to a radiological emergency situation sets the framework for the response by the public authorities and the actions they must take if an event could result in a radiological emergency situation leading to activation of the ORSEC or PPI-ORSEC plan, or one of the "PIRATE[3]" plans.

1|1|2 The ORSEC-TMR plan

The ORSEC-TMR plan is a specific plan of the ORSEC system designed to deal with an RMT accident.

Faced with the diversity of possible types of transport operation, the ORSEC-TMR plans define the criteria and simple measures enabling the first responders (SDIS - *Départemental* Fire and Emergency Response Department - and services in charge of public security in particular) to initiate the first "reflex" response actions to protect the general public, based on their findings on the site of the accident.

1|1|3 Responding to any other radiological emergency situation

Apart from incidents affecting nuclear installations or RMT, radiological emergency situations can also occur:

1. Article R.1333-76 of the Public Health Code.
2. In a *départements*, representative of the State appointed by the President.
3. Plans which are part of a larger system of vigilance, prevention, protection and counter-terrorism.

– during performance of a nuclear activity, whether for medical, research or industrial purposes;
– in the event of intentional or inadvertent dispersal of radioactive substances into the environment;
– if radioactive sources are discovered in places where they are not supposed to be.

In such cases, intervention is necessary to put an end to any risk of human exposure to ionising radiation.

ASN together with the ministries and stakeholders concerned, drafted government circular DGSNR/DHOS/DDSC 2005/1390 of 23rd December 2005. This supplements the provisions of the directive of 7th April 2005 and defines the organisation of the State services for radiological emergency situations not covered by an ORSEC, PPI-ORSEC or PIRATE-CBRN plan.

ASN is tasked with controlling the actions decided on by the head of the establishment or the owner of the site, with advising the competent police authority with respect to the steps to be taken to prevent or mitigate the effects of ionising radiation on the health of individuals, and with taking part in disseminating information. In the same way as in a normal situation, ASN can call on the expertise of the Institute for Radiation Protection and Nuclear Safety (IRSN) when taking these steps.

Faced with the many possible originators of an alert and the associated alert-raising channels, it was deemed necessary to designate a one-stop shop to centralise all the alerts and then forward them to the other stakeholders. This one-stop shop is the *Départemental* Fire and Emergency Response Operational Centre – Alert Processing Centre (CODIS-CTA) which can be reached by dialling 18 or 112.

1|1|4 Role of ASN in the preparation and follow-up of emergency plans

The on-site emergency plan (PUI)

Pursuant to decree 2007-1557 of 2nd November 2007, a BNI licensee is required to send ASN a file containing the PUI before commissioning the installation.

The PUI must specify the organisational measures, response methods and necessary resources the licensee implements in the event of an emergency situation in order to protect its personnel, the public and the environment and to preserve or restore the safety of the installation.

During the course of 2011, ASN helped draft the texts of the regulations in order to clarify new requirements, in particular concerning the management of an emergency situation.

Participation in drafting the off-site emergency plans

Pursuant to the 13 September 2005 orders concerning the PPI and the ORSEC plan, the *Préfet* is responsible for preparing and approving the PPI. ASN assists the *Préfet* by analysing the technical data to be provided by the licensees, with the help of its technical support organisation, IRSN, in order to determine the nature and scope of the consequences of an accident.

ASN and IRSN carry out this analysis taking account of the knowledge acquired from severe accidents and radioactive material dispersion phenomena.

Population protective actions

The off-site emergency plans identify the general public protective actions such as to limit the consequences of any accident. The *Préfet* decides whether or not to deploy these measures on the basis of intervention levels according to the predicted dose that would be received by a person situated in the open air at the time of the accident.

The intervention levels are defined on the basis of the most recent international recommendations and, since 2003, have been included in regulatory requirements. The intervention levels are thus defined by ASN decision 2009-DC-0153 of 18th August 2009, which modified the intervention level with regard to the administration of stable iodine. The intervention levels associated with the implementation of population protective measures in a radiological emergency situation, mentioned in article R. 1333-80 of the public health Code, are therefore as follows:
– an effective dose of 10 mSv for sheltering;
– an effective dose of 50 mSv for evacuation;
– an equivalent dose to the thyroid of 50 mSv for the administration of stable iodine.

The PPI perimeter must protect the general public in the first hours following the accident, without ruling out any subsequent actions to be taken. As the accident situation develops, and depending on the weather conditions on the day of the accident, the disaster and emergency services may implement general public protective actions beyond the PPI perimeter, as required by the ORSEC plan.

For example, the off-site emergency plans defined for the vicinity of a PWR reactor recommends sheltering of the population and the absorption of stable iodine tablets within a 10-kilometre radius, plus evacuation of the population within a 5-kilometre radius.

As of 2012, additions to the PPIs are envisaged, in order to take account of the new post-accident management doctrine (see point 1|5).

1|2 Controlling urban development around nuclear sites

Four main principles underpin the protection of the general public against technological risks:
– reducing risks at source;
– implementing off-site emergency plans;
– controlling urban development;
– informing the general public.

The aim of controlling urban development is to limit the consequences of a severe accident for the population and property. Since 1987, this type of approach has been implemented around non-nuclear industrial facilities and it has been reinforced since the AZF utility accident that occurred in Toulouse (South of France) in 2001. The TSN Act (now codified in books I and V of the Environment Code by ordinance no.2012-6 of 5th January 2012) now enables the public authorities to control urban development around BNIs, by issuing public protection restrictions limiting or prohibiting any further construction in the vicinity of these facilities.

The urban development control actions entail a division of responsibilities between the licensee, the mayors and the State:
– the licensee is responsible for its activities and the related risks;
– the mayor is responsible for producing the town planning documents and issuing building permits;
– the *Préfet* informs the mayors of the risks that exist and ensures the legality of the acts of the municipalities;
– ASN supplies the technical data in its possession, in order to characterise the risk, and offers the *Préfet* its assistance in the urban development control process.

In recent years, urban development pressure in the vicinity of nuclear sites has increased. It is therefore important to incorporate the control of urban development into the management of the nuclear risk. ASN's current doctrine for controlling activities around nuclear facilities only concerns those facilities requiring a PPI and primarily aims to avoid compromising the feasibility of the protective measures mentioned in the PPI with regard to sheltering and evacuation. It focuses on the "reflex" zones of the PPIs, established in accordance with the circular of 10th March 2000 and in which automatic measures to protect the general public are taken in the event of a rapidly developing accident. Since 2006, ASN has asked to be consulted with regard to building permit applications made in the immediate vicinity of nuclear installations. ASN has so far issued about 15% of reserved or unfavourable opinions on some 300 projects submitted.

A circular from the Ministry of the Environment dated 17th February 2010 has asked the *Préfets* to exercise greater vigilance over urban development near nuclear installations. This circular states that the greatest possible attention must be paid to projects that are sensitive owing to their size, their purpose, or the difficulties they could entail in terms of protection of the general public in the so-called "reflex" zone. This circular tasks ASN and the DGPR (General Directorate for Risk Prevention) with leading a pluralistic working group to determine the ways and means of controlling activities around nuclear installations.

In the years 2010 and 2011, the DGPR and ASN thus chaired a debate with the administrations, elected officials, the National Association of Local Information Commissions and Committees (ANCCLI) and the licensees concerned. These discussions led to the drafting of a guide for controlling activities around BNIs, which presents the general principles applicable to controlling urban development, the main ones being as follows:



Aerial view of the Golfech NPP and its environs

– preserve the operability of the off-site emergency plans;
– favour urban development outside the zone in which the risk could rapidly develop;
– allow controlled development that meets the needs of the resident population.

This guide was extensively opened to public consultation on the Ministry of the Environment and ASN websites, between 17th October and 17th December 2011. The purpose of this guide is to offer a uniform national framework to promote the consideration of risk at the local level.

1|3 Organising a collective response

The response by the authorities to an incident or accident is determined by a number of texts concerning nuclear safety, radiation protection, public order and emergency preparedness and civil protection, as well as by the emergency plans.

Act 2004-811 of 13th August 2004 on the modernisation of civil security, makes provision for an updated inventory of risks, an overhaul of operational planning, performance of exercises involving the general public, information and training of the general public, an operational watching brief and alert procedures. A number of decrees implementing this act were passed during the course of 2005 and include:
– decree 2005-1158 of 13th September 2005 concerning off-site emergency plans (PPI);
– decree 2005-1157 of 13th September 2005 concerning the ORSEC plan;
– decree 2005-1156 of 13th September 2005 concerning the local safeguard plan.

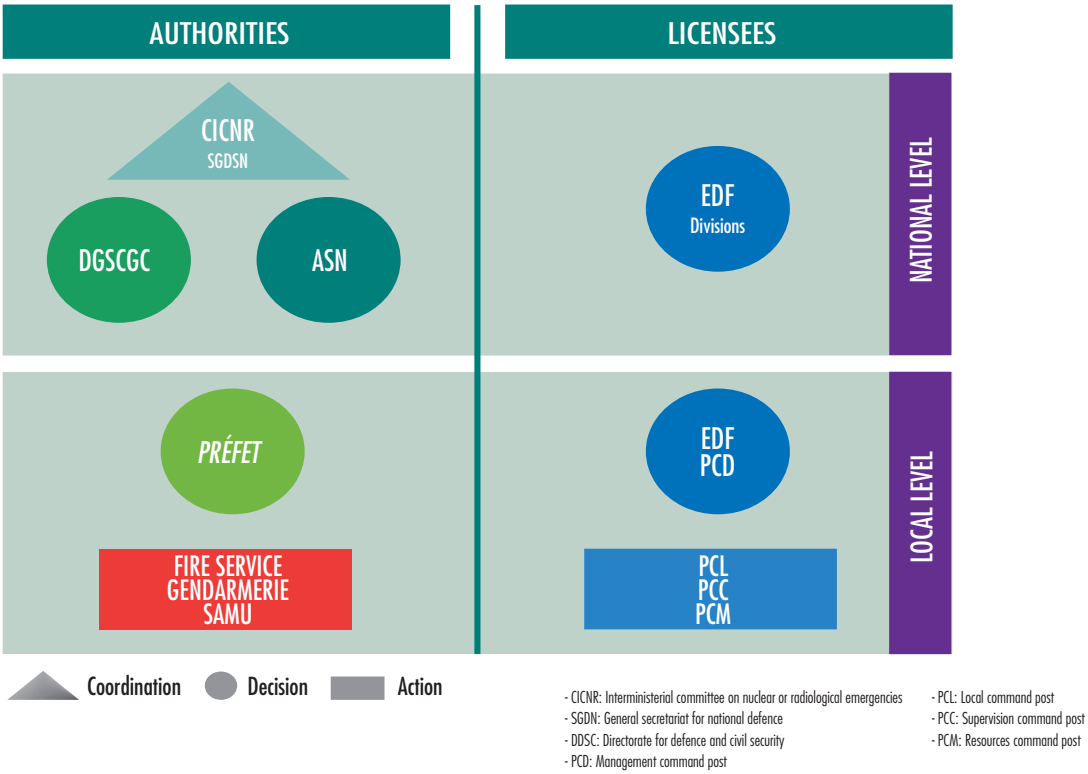
The radiological emergency field is clarified in the government directive of 7th April 2005. The response organisation of the public authorities and that of the licensee are presented in diagram 1.

ASN is participating in all the ongoing national and international work related to the public authorities' response, following the Fukushima Daiichi nuclear accident. At the national level, ASN is thus taking part in the ministerial work on experience feedback with regard to management of a nuclear emergency. At the international level, ASN is taking part in the experience feedback work being done by international bodies such as the International Atomic Energy Agency (IAEA), the Nuclear Energy Agency (NEA), and within authority networks such as HERCA (Heads of the European Radiological Protection Competent Authorities Association).

1|3|1 Local response organisation

In an emergency situation, several parties have the authority to take decisions:
– the licensee of the affected nuclear installation, which implements the organisational provisions and the means needed to bring the accident under control, to assess and mitigate its consequences, to protect persons on the site and to alert and regularly inform the authorities. This arrangement is defined beforehand in the licensee's PUI;
– ASN has authority over and controls the actions of the licensee. In an emergency situation, aided by the IRSN's

Diagram 1: emergency organisation in an accident situation affecting a nuclear reactor operated by EDF



assessments, it can at any time ask the licensee to perform assessments and take the necessary actions;
– the *Préfet* of the *département* (Administrative region headed by a *Préfet*) in which the installation is located, who takes the necessary decisions to protect the population, the environment and the property threatened by the accident. He takes action according to the PPI and the ORSEC plans. Hence, he is responsible for ensuring coordination of all the resources engaged by the PPI, whether both public and private, material and human He keeps the population and the mayors informed of events. Through its regional office, ASN assists the *Préfet* in drafting the plans and managing the situation;
– owing to his or her role in the local community, the mayor has an important part to play in anticipating and supporting the protective measures. To this end, the mayor of a town included within the scope of application of an off-site emergency plan must draw up and implement a local safeguard plan to provide for, organise and structure the actions to accompany the *Préfet's* decisions. The mayor also plays a role in passing on information and heightening population awareness during iodine tablet distribution campaigns (see chapter 6).

1|3|2 National response organisation

The relevant ministries and the ASN jointly advise the *Préfet* with regard to the protective measures to be taken. They provide the information and advice necessary for the *Préfet* to assess the state of the facility, the seriousness of the incident or accident, its possible developments, and the measures required to protect the general public and the environment.

The main bodies concerned are as follows:
– Ministry of the Interior: the General Directorate for Civil Security and Crisis Management (DGSCGC) houses the Government Emergency Management Operational Centre (COGIC) and the Nuclear Risk Management Support Team (MARN). It provides the *Préfet* with material and human resources for the protection of individuals and property;
– Ministry of Health: responsible for human health protection against the effects of ionising radiation;
– Ministry of the Environment: the Nuclear Safety and Radiation Protection Mission (MSNR) takes part in the State's nuclear safety and radiation protection responsibilities, jointly with the other competent administrations, especially the civil protection services;
– Ministry of Defence: the Defence Nuclear Safety Authority (ASND) is the Competent Authority for regulating the safety of secret basic nuclear installations (INBS), military nuclear systems and defence-related transport operations. A protocol was signed by ASN and the ASND on 26th October 2009 to ensure coordination between these two entities in the event of an accident affecting an activity under the supervision of the ASND, to facilitate the transition from the emergency phase managed by the ASND to the post-accident phase for which ASN is competent;
– General Secretariat for Defence and National Security

(SGDSN:) the SGDSN is tasked with ensuring interministerial consistency of the actions planned in the event of an accident and in scheduling and evaluating exercises. It is in charge of the secretariat for the French Interministerial Committee for Nuclear or Radiological Emergencies (CICNR). The CICNR is convened at the initiative of the Prime Minister. Its role is to coordinate governmental action in the event of a radiological or nuclear emergency situation;
– ASN is involved in the management of radiological emergency situations. It verifies the steps taken by the licensee, assists the Government with all questions within the scope of its competence and informs the general public about the safety of the facility in which the emergency situation originated. ASN's responsibilities in an emergency situation are detailed in point 2 | 1 | 1.

1 | 4 Protecting the public

1 | 4 | 1 General protective actions

The general public protection actions that can be taken during the emergency phase are described in the PPI. The steps taken are designed to protect the general public and prevent affections attributable to exposure to ionising radiation and to any chemical and toxic substances present in the releases.

In the event of a serious accident, a number of preventive measures can be envisaged by the *Préfet* in order to protect the general public:
– sheltering and listening: the individuals concerned, alerted by a siren, take shelter at home or in a building, with all openings carefully closed, and wait for instructions from the *Préfet* broadcast by radio;
– administration of stable iodine tablets: when ordered by the *Préfet*, the individuals liable to be exposed to releases of radioactive iodine are urged to take the prescribed dose of potassium iodide tablets;
– evacuation: in the event of an imminent risk of large-scale radioactive releases, the *Préfet* may order evacuation. The populations concerned are asked to prepare a bag of essential personal effects, secure and leave their homes and go to the nearest assembly point.

In the event of effective release of radioactive substances into the environment, the first steps to be decided on for preparation of post-accident phase management for example include the definition of the area zoning to be implemented at the end of the emergency phase. This should comprise:
– a public protection zone (ZPP) within which contamination reduction actions will be rapidly undertaken;
– a tightened surveillance zone (ZSR) within which the consumption and sale of foodstuffs produced will be prohibited, based on the maximum permissible radioactivity levels set by the European Commission;
– if necessary, a population clearing zone (ZEP) within the ZPP if external exposure levels due to deposition so justify.

The *Préfet* ensures that the population is regularly informed of developments in the situation and its consequences.

1 | 4 | 2 Iodine tablets

The circular of 27th May 2009 defines the principles governing the responsibilities of a BNI licensee and of the State with regard to the distribution of iodine tablets. The licensee has prime responsibility for the safety of its facilities. The licensee is involved in the measures to protect the members of the public living within the perimeter of the PPI, finances public information campaigns and ensures permanent, free, preventive distribution of stable iodine tablets via the network of pharmacies.

In 2009, in collaboration with other government departments and EDF, ASN coordinated the 4th campaign of iodine tablet distribution to the population located in the vicinity of NPPs, within the zone covered by the off-site emergency plan (PPI). Distribution was organised in three phases: people were first invited to collect their stable iodine tablets from the pharmacy, then boxes of tablets were posted to those households that had not collected them, and lastly the tablets were made permanently available in the pharmacies.

At the end of the first phase of distribution, nearly 50% of the persons concerned nationwide had collected their boxes of tablets from the pharmacy. This low figure underlines a lack of "risk culture" and shows the pressing need for better information and communication (see chapter 6). In early 2010, the boxes were therefore sent by mail to those persons who had not collected them from a pharmacy. After this second phase, the overall coverage of the populations residing near the NPPs was approximately 93%.

The government circular of 27th May 2009 provides for a third phase in which blank withdrawal slips are provided in pharmacies. This system means that stable iodine tablets are available for distribution at all times and free of charge to persons newly arrived in the area, whether as permanent or temporary residents, or in the event of loss or omission.

For the rest of the country outside the zones covered by PPIs, stocks of tablets are held in each *département*. In this respect, the ministries responsible for public health and civil protection drafted a circular dated 11th July 2011, which defines the new procedures for stockpiling potassium iodide tablets and the conditions regarding their distribution to the population outside the zones covered by the PPI. The stocks of iodine tablets are thus created, positioned and managed by the Health emergency preparation and response organisation (EPRUS) and in his own *département*, each *Préfet* organises the distribution of tablets to the population, in particular via the mayors. The Ministry of Health has undertaken to create a new stockpile of 110 million 65 mg tablets, which will be sent to the various zonal platforms managed by the EPRUS.

1 | 4 | 3 Care and treatment of contaminated persons

In the event of a nuclear or radiological accident, a significant number of people could be contaminated by radionuclides. This contamination could pose problems for care and treatment by the emergency response teams.

Circular 800/SGDN/PSE/PPS of 18th February 2011 specifies the national doctrine concerning the use of emergency and care resources in the event of a terrorist act involving radioactive

materials. These provisions, which also apply to an accident, aim to implement a unified nationwide methodology for the use of resources, in order to optimise efficiency. They will have to be adapted to the situations encountered by the director of emergency operations (the *Préfet*) and by the commander of emergency operations.

The "Medical intervention following a nuclear or radiological event" guide, coordinated by ASN and published in 2008, accompanies circular DHOS/HFD/DGSNR no.2002/277 of 2nd May 2002 concerning the organisation of medical care in the event of a nuclear or radiological accident, giving all information of use to the medical response teams in charge of collecting and transporting the injured, as well as to the hospital staff admitting them to health care establishments.



Radioactivity protective measures during an emergency exercise on the Chinon NPP – June 2011

1|5 Understanding the long-term consequences

The post-accident phase deals with the consequences of the event. It covers the handling of varied consequences (economic, health, social), that should be considered in the short, medium or even long term, with a view to returning to an acceptable situation. Pursuant to the interministerial directive of 7th April 2005, ASN, in association with the ministerial departments concerned, is responsible for "establishing the framework, for defining, preparing and implementing the steps necessary to deal with the post-accident situation".

To produce a doctrine and after testing post-accident management during national and international exercises, ASN convened all the stakeholders around a steering committee responsible for post-accident aspects, the CODIRPA (Steering committee for managing the post-accident phase of a nuclear accident or radiological emergency situation). This committee comprises ASN, as coordinator, and representatives of the various ministerial departments concerned by the subject, health agencies, associations, as well as Local Information Committees (CLIs) and IRSN representatives.

The CODIRPA has addressed a large number of subjects, such as the lifting of population sheltering orders and the return of evacuated populations, the strategy for measuring environmental radioactivity, contamination reduction, waste management, restrictions on the consumption and export of foodstuffs, water, population health monitoring, persons intervening in situations of lasting exposure and compensation. It has also addressed cross-disciplinary subjects such as the organisation of the public authorities, governance and public information, and examined - where applicable - regulatory questions specific to them. Reports on all these subjects have been drawn up jointly with the stakeholders and published on the ASN website.

CODIRPA set up a new organisation in 2009, creating two commissions, one to study the transition phase and one to study the longer-term picture.

The first CODIRPA commission has prepared a guide on the management plans for exiting the emergency phase. This operational guide provides the local authorities with useful elements for preparing their local plan for exiting the emergency phase (action to be taken during the first week). A first draft of this guide has been trialled in a number of pilot *départements* which are home to an NPP, but also in a number of communes[4] involved in preparing the radiological part of the local safeguard plan. This commission has also prepared guidelines for management of the transition phase (which can range from a few weeks to a few months after the accident).

The second commission has prepared guidelines for the management of the transition phase and the long-term phase, integrating the international work carried out in Belarus (CORE[5], COREX[6]) after the Chernobyl accident.

In 2010 and 2011, the first elements of the post-accident doctrine were tested during national nuclear or radiological emergency exercises. For example, the exercise held on 18th October 2011 in the Cruas NPP, was able to test some of the post-accident measures contained in the guide for exiting the emergency phase.

Post-nuclear accident management doctrine which, in a single document, combines the specific recommendations for exiting the emergency phase and guidelines for the transition and long-term phases, should be approved by the CODIRPA in early 2012. This doctrine should be incorporated into the PPIs as of 2012.

ASN will also be continuing the work started on the post-accident phase, to take account of experience feedback from the Fukushima Daiichi NPP accident.

4. Smallest administrative subdivision administered by a mayor and a municipal council
5. Cooperation for rehabilitation of living conditions in the contaminated Belarus territories.
6. Follow-up to the CORE programme; analysis of experience feedback from actions taken in Belarus by the French teams.

TO BE NOTED IN 2011



CODIRPA seminar – May 2011

CODIRPA seminar on 5th and 6th May 2011

On 5th and 6th May 2011, the post-nuclear accident seminar organised by ASN was attended in the premises of the French National Assembly by 300 national emergency bodies and experts from 20 foreign countries. It was preceded by a public presentation before the Parliamentary mission chaired by the OPECST (Parliamentary Office for the Evaluation of Scientific and Technological Choices).

The seminar was an opportunity to review progress in French doctrine, for which the first baseline requirements should be published in 2012:
1. the guide for exiting the emergency phase ;
2. guidelines for the transition and long-term phases.

To conclude, the ASN Chairman called for initiatives from the European Commission and HERCA, the association of Heads of European radiological protection competent Authorities, for improved European coordination and harmonisation of post-accident zoning, exports from a "European country in which an accident has occurred", sharing of radioactivity measurements and compensation.

2 RESPONDING TO AN EMERGENCY SITUATION

2|1 Assisting the Government

2|1|1 ASN's duties in emergency situations

In an emergency situation, the responsibilities of ASN, with the support of IRSN, are as follows:

1) to ensure that judicious provisions are made by the licensee;
2) to advise the Government;
3) to contribute to the dissemination of information;
4) to act as Competent Authority within the framework of the international Conventions on early notification and assistance.

Overseeing of actions taken by the licensee

As in a normal situation, ASN exercises its roles as the authority controlling the licensee of an accident-stricken facility. In this particular context, ASN ensures that the licensee exercises in full its responsibility for keeping the accident under control, mitigating the consequences, and rapidly and regularly informing the authorities. On the basis of IRSN's assessments, ASN can at any time ask the licensee to perform assessments and take the necessary actions, without substituting itself for the licensee in the technical operations carried out to cope with the accident.

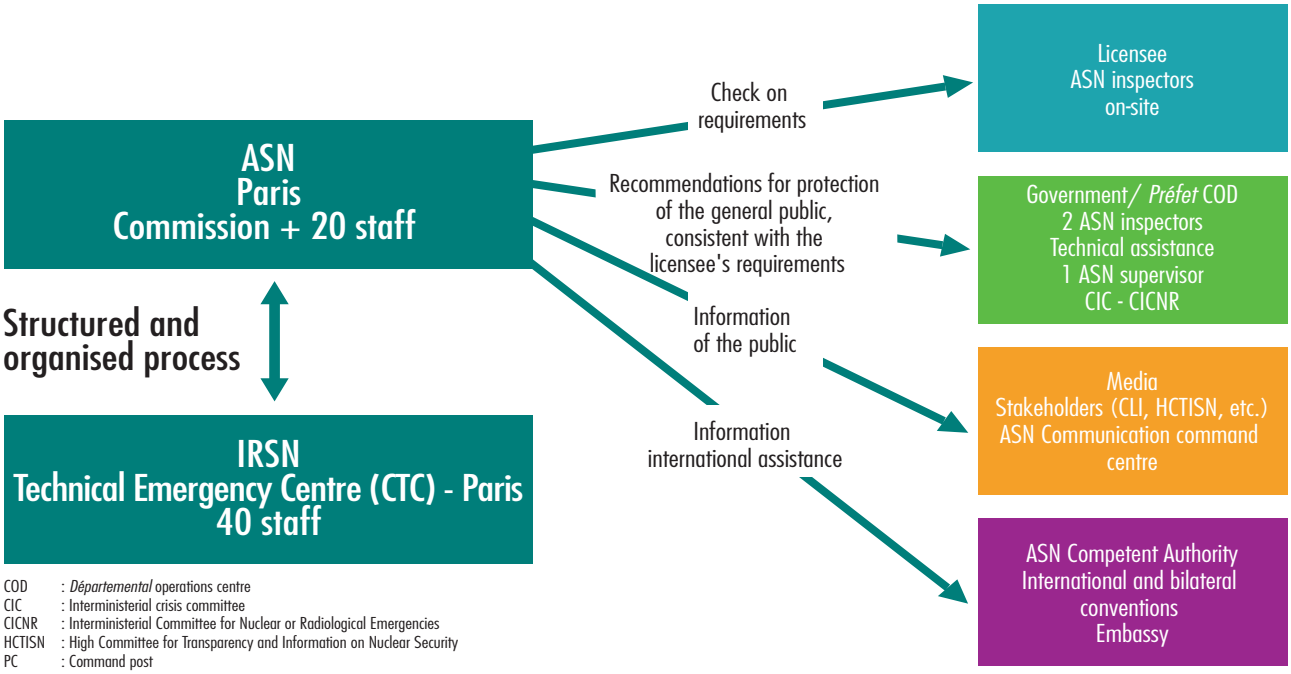
Advising the Government

The decision by the *Préfet* concerning the general public protective mesaures to be taken depends on the actual or foreseeable consequences of the accident around the site. It is the role of ASN to make recommendations to the Government or the *Préfet* in this respect, integrating the IRSN's analysis. This analysis combines diagnosis (understanding of the situation at the installation concerned) and prognosis (assessment of possible short-term developments, notably radioactive releases). This advice also concerns the steps to be taken to protect the health of the general public.

Circulation of information

ASN is involved in information circulation in a number of ways:
– informing the media and the public: ASN contributes to informing both the media and the general public in different ways (press releases, press conferences). It is important that this should be done in close collaboration with the other entities which are themselves involved in communication (*Préfet*, local and national licensee, etc.);

Diagram 2: the role of ASN in a nuclear emergency situation



COD : *Départemental* operations centre
CIC : Interministerial crisis committee
CICNR : Interministerial Committee for Nuclear or Radiological Emergencies
HCTISN : High Committee for Transparency and Information on Nuclear Security
PC : Command post

– institutional information: ASN keeps the Government informed, along with the SGDSN, which is responsible for informing the President of the Republic and the Prime Minister.
– informing foreign nuclear safety authorities.

Function of Competent Authority as defined by international conventions

The TSN Act provides for ASN to fulfil the role of Competent Authority under the international Conventions on early notification and assistance. As such it collates and summarises information for the purpose of sending or receiving notifications and for transmitting the information required by these conventions to the international organisations (IAEA and European Union) and to the countries possibly affected by radiological consequences on their own territory.

2|1|2 Organisation of ASN

Organising the response to accidents occurring on BNIs

In the event of an incident or accident occurring in a BNI, ASN, with the help of its technical support organisation IRSN, sets up an organisation comprising the following:
– at the national level:
  • a decision-making level or strategic management command post (PCD), located in the ASN response emergency centre in Paris and in constant contact with the ASN Commission. Its role is to adopt a stance or make decisions to advise the *Préfet*, who acts as the director of emergency operations;
  • a communication level supported by a communication unit located near the ASN's PCD, run by an ASN representative. The ASN Chairman or his representative acts as spokesperson, a role which is distinct from that of the head of the PCD;
– at the local level:
  • ASN representatives working with and advising the *Préfet* in his decisions and communications;
  • ASN inspectors on the damaged site, forwarding the positions adopted at the national level and controlling the decisions taken by the licensee.

ASN is supported by an analysis team working at the IRSN's Technical Emergency Centre (CTC). ASN and IRSN have signed draft agreements with the main nuclear licensees regarding the organisational setup in an emergency situation. These protocols designate those who will be responsible in the event of an emergency and define their respective roles and the communication methods to be employed.

Diagram 2 summarises the role of ASN in a radiological emergency situation

The following two diagrams show the relations between the public authorities, the Government and ASN, the licensees and the technical experts in a radiological emergency situation. Diagram 3 presents the exchanges leading to decisions and orientations concerning the safety of the facility and the protection of the general public.

Diagram 4 describes the relations between the communication committees and the strategic management command post spokespersons, who are responsible for ensuring that the information sent out to the public and the media is consistent.

Diagram 3: planned safety response

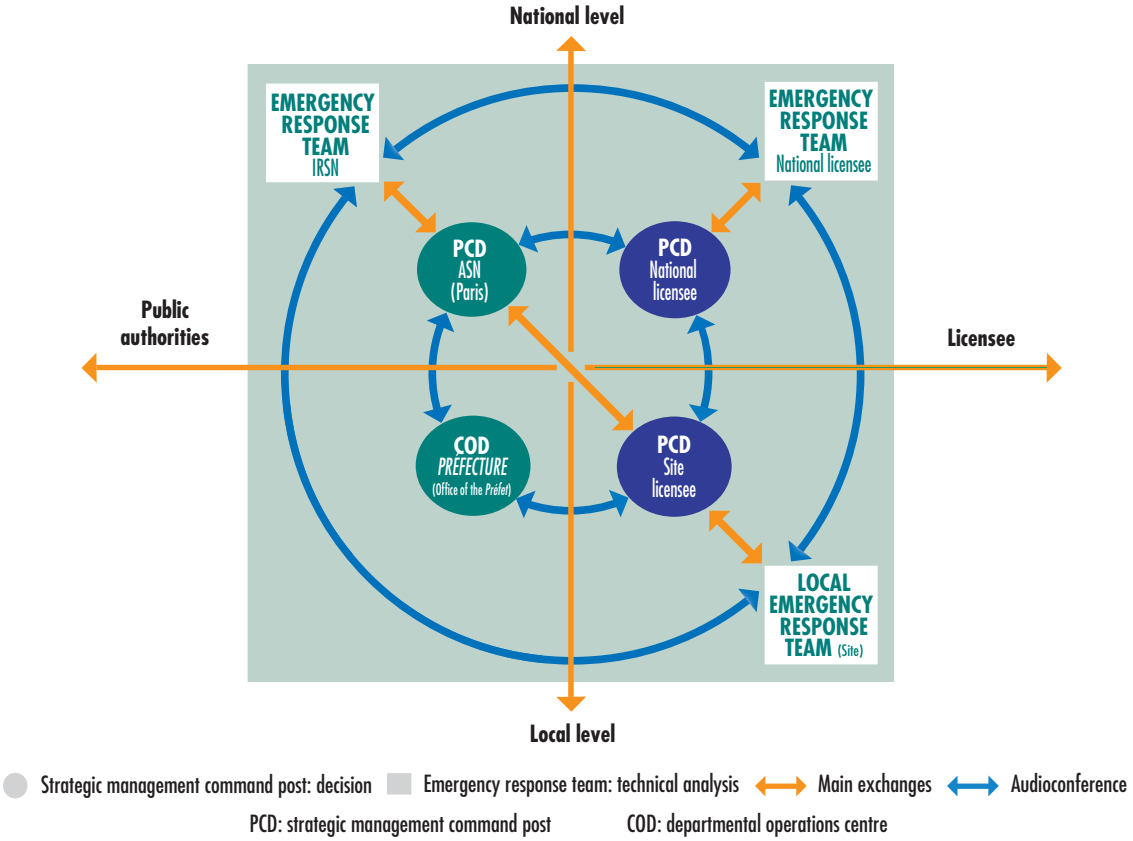
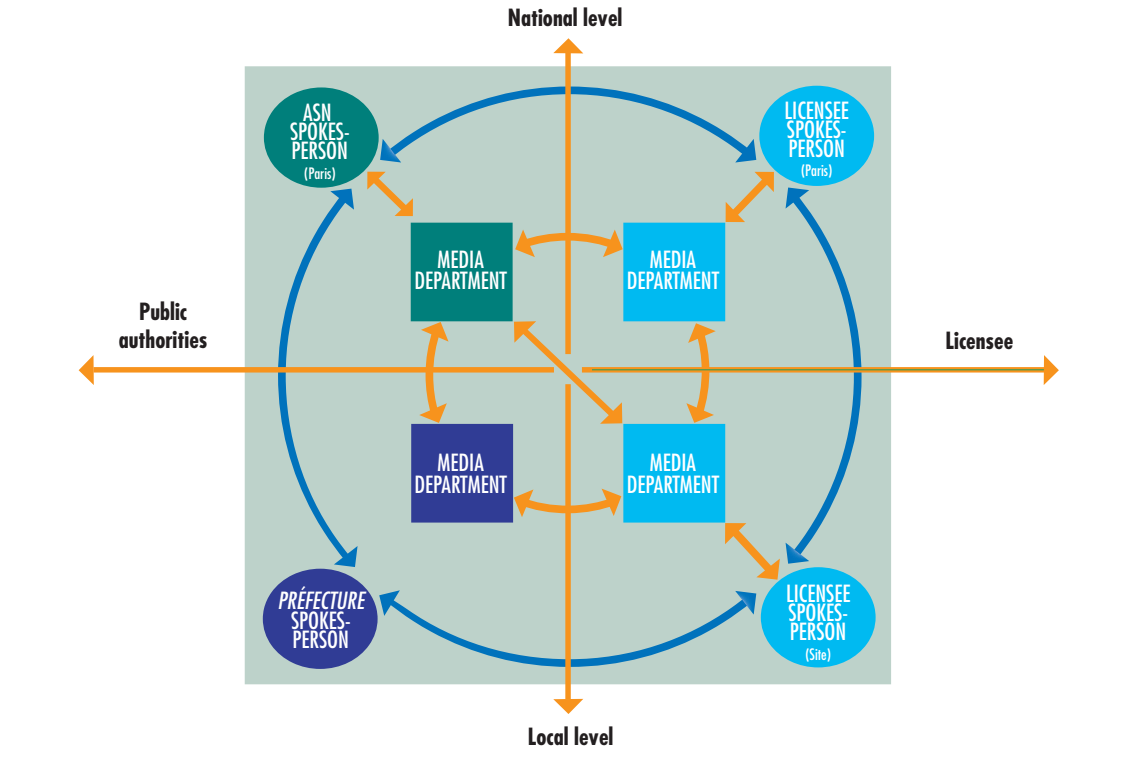
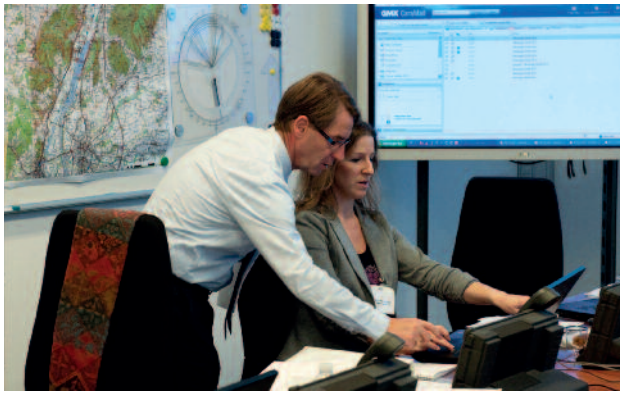


Diagram 4: planned communication response







ASN emergency response centre during an emergency exercise – October 2011

Organising a response to any other radiological emergency situation

A dedicated hotline enables ASN to receive calls notifying incidents involving non-BNI or non-RMT sources of ionising radiation 24 hours a day, 7 days a week. The information given during the call is transmitted to an ASN official who will act accordingly. Depending on the seriousness of the accident, ASN may decide to activate its emergency response centre in Paris.

Once the authorities have been alerted, the response generally consists of four main phases: care for the individuals involved, confirmation of the radiological nature of the event, securing the zone and reducing the emission and, finally, clean-out.

The *Préfet* or the mayor coordinates the intervention response teams, taking account of their technical competence, and decides on the protective measures to be taken, on the basis of the plans they have drawn up (ORSEC and PPI for the *Préfets*, local safeguard plans for the mayors). At the local level, the mayors can also call on the mobile radiological intervention units of the fire and emergency services (CMIR).

In these situations, responsibility for the decision and for implementing protective measures lies with:
- the head of the establishment carrying out a nuclear activity (hospital, research laboratory, etc.) who implements the PUI specified in Article L. 1333-6 of the Public Health Code (if the risks inherent to the installation so justify) or the owner of the site, with regard to the safety of the persons on the site;
- the mayor or *Préfet* concerning public safety outside nuclear installations.

2|1|3 ASN's emergency response centre

In order to be able to carry out its responsibilities, ASN has its own emergency response centre, equipped with communication and data processing tools enabling:
- swift mobilisation of ASN staff;
- reliable exchange of information between the many stakeholders concerned.

The fact of activating the emergency response centre in no way constitutes a judgement of the gravity of the situation. In the event of an alert, activating this centre provides ASN with technical management and communication resources readily accessible to all the players.

This emergency response centre has been activated in real-life situations in the event of incidents or accidents. In 2011, it was activated for one month during the nuclear accident that struck the Fukushima Daiichi NPP in Japan in March, for the 12th September 2011 accident on the CENTRACO facility (Gard) and on 16th December 2011 owing to the meteorological phenomena that were threatening the Le Blayais NPP (Gironde). The CENTRACO event is described in greater detail in chapter 16.

ASN's alert system allows swift mobilisation of ASN and IRSN staff. This automatic system sends out an alert signal to all staff carrying radio pagers or mobile phones, as soon as the alert is triggered remotely by the licensee of the nuclear installation in which the alert originated. It also sends out the alert to staff of the DGSCGC, the SGDSN and Météo-France. This system is regularly tested during exercises or when real-life emergency situations arise.

In addition to the public telephone network, the emergency response centre is connected to several autonomous restricted access networks providing secure direct or dedicated lines to the main nuclear sites. ASN's PCD also has a video-conferencing system which is the preferred means of contact with IRSN's CTC. The PCD also uses dedicated computer systems for alerts and information exchanges with the European Commission, the IAEA and the member states (ECURIE[7], USIE[8]).

2|2 Ensuring efficient coordination with international authorities

Considering the potential repercussions that an accident can induce in other countries, it is important for the various

7. The ECURIE system, created in 1987, enables the Member States of the European union to inform their counterparts of any nuclear event taking place on their territory and liable to entail radioactive releases, so that they can if necessary take steps to protect their populations.
8. USIE (Unified System for Information Exchange in Incidents and Emergencies) is a tool proposed by the IAEA to the member states for notification of a nuclear event occurring in their territory.

ASN mobilisation for one month during the accident at Fukushima Daiichi NPP

Starting on 11th March, and for a period of one month, ASN activated its emergency response centre and its Commission sat daily, as would have been the case if the event had occurred in France. ASN adapted its response organisation to the exceptional context of this accident - exceptional in its remoteness, its scale, the concatenation of events and the considerable social and media interest that came with it.

The essential mission of ASN was to regularly inform the Government, the media and the French population, and to advise the Government and the French embassy in Tokyo on the population protective measures to be taken (protection of French citizens in Japan, screening of imported goods for contamination, etc.).

ASN was rapidly alerted of the accident, as Competent Authority under the international agreements on notification and assistance of 26th September 1986, and pursuant to the Euratom decision of 14th December 1987. It then regularly monitored the situation in Japan on the basis of information provided firstly by the IAEA's USIE tool, and secondly by daily audioconferences on the one hand with the French embassy in Japan and on the other with the American, Canadian and British nuclear safety authorities. ASN also used the European Commission's ECURIE network, in liaison with the NEA, to communicate with other countries and obtain an overall view of the decisions they were taking.

In terms of international assistance, ASN was approached by Japan (requests for information on certain specific tools that could be provided) and by the IAEA (requests for additional experts to man the IAEA emergency response centre and requests for satellite maps).

Nearly 200 ASN employees volunteered their services and were mobilised to perform duties at the emergency response centre. Their monitoring work and analyses helped understand and predict the development of the condition of the Fukushima Daiichi NPP reactors. This technical information was then reviewed and verified before being issued to the administrations, the media and the public.

ASN thus held 17 press briefings and issued more than 30 press releases, thereby providing regular information on the development of the accident and the nature of the risks involved.

ASN is now involved in analysing experience feedback on the organisation it deployed to respond to the numerous demands brought about by the management of this accident. What emerges in particular is that the long-term management of a large-scale nuclear emergency is particularly demanding in terms of deployment of human resources.



The media unit handling calls from journalists during the Fukushima emergency – March 2011

countries to be informed and to intervene in as coordinated a way as possible. This is why IAEA and the European Commission offer the member countries tools to help with notification, intervention and assistance. ASN made an active contribution to the preparation of these tools, in particular IAEA's new tool, USIE, which is present in the ASN emergency response centre.

Independently of any bilateral agreements on the exchange of information in the event of an incident or accident with possible radiological consequences, France is committed to applying the Convention on Early Notification of a Nuclear Accident adopted on 26th September 1986 by IAEA and the Euratom decision of 14th December 1987 concerning community procedures for an early exchange of information in the event of a radiological emergency. On 26th September 1986, France also signed the convention adopted by IAEA concerning assistance in the event of a nuclear accident or a radiological emergency situation.

Two interministerial directives of 30th May 2005 and 30th November 2005 specify the procedures for application of these texts in France and instate ASN as the competent national authority. It is therefore up to ASN to notify the event without delay to the international institutions and to the member States, to supply relevant information quickly in order to limit the radiological consequences and finally to provide the ministers concerned with a copy of the notifications and information transmitted or received.

2|2|1 Bilateral relations

Maintaining and strengthening bilateral relations with neighbouring countries is one of ASN's major priorities.

In 2011, ASN thus continued its regular exchanges with its Swiss, Belgian, Luxembourg and German counterparts, to examine emergency management aspects and clarify the transboundary alert and information exchange mechanisms in the event of an emergency situation. ASN representatives took part in inspections and in an emergency exercise in Great Britain, while representatives from the British Authority took part in a similar exercise in France. Finally, ASN was invited to an experience feedback seminar organised by Spain, to examine the Fukushima Daiichi NPP accident. During a bilateral meeting, the French and Spanish regulatory authorities agreed to hold a joint radiological emergency exercise.

2|2|2 Multilateral relations

ASN takes part in the IAEA's work to improve notification and information exchanges in radiological emergency situations. ASN is helping to define the strategy concerning international assistance requirements and resources and to set up the Assistance Response Network (RANET). Further to the Fukushima Daiichi NPP accident, ASN was asked to take part in an international think tank to consider whether it would be appropriate to amend the conventions relative to notification and assistance.

ASN is a member of the IAEA's National Competent Authorities' Coordinating Group (NCACG) and has represented the competent authorities of Western Europe since 2005. In this capacity, ASN hosted a meeting of the NCACG in its premises in early March 2011.

ASN also works with the NEA and participates in the Working Party on Nuclear Emergency Matters (WPNEM). Further to the Fukushima Daiichi NPP accident, ASN has been participating in and coordinating an expert group on aspects relating to the radiological protection of the general public.

Within HERCA association, ASN is participating in the new Working Group Emergencies. This group was tasked with proposing harmonised European actions to protect the general public, on the one hand in the event of an accident in Europe and, on the other, in the event of a more remote accident, in the light of the lessons learned from the Fukushima Daiichi NPP accident.

Finally, ASN coordinated French participation in the INEX 4[9] exercise, held in France on 17th November 2011 (see point 3|1|3). An international seminar to share experience feedback from this exercise, conducted in all the NEA member states, will be organised in 2012.



NCACG meeting in the ASN premises – March 2011

2|2|3 International assistance

The interministerial directive of 30th November 2005 defines the procedures for international assistance when France is called on or when it requires assistance itself in the event of a radiological emergency situation. For each ministry, it contains an obligation to keep an up-to-date inventory of its intervention capability in terms of experts, equipment, materials and medical resources, which must be forwarded to ASN. As coordinator of the national assistance resources (RANET[10] database), ASN takes part in the IAEA's work on the operational implementation of international assistance.

France has been called upon several times since 2008 to assist a foreign country in a radiological emergency situation. For example, in 2011, in its capacity as Competent Authority, ASN was approached by Bulgaria with a request for assistance following a radiological accident involving five workers accidentally exposed to a gammagraphy device radioactive source. An IRSN medical expert went to Bulgaria to examine the irradiated workers. The Percy hospital in Clamart then took charge of the irradiated workers so that they could be given appropriate treatment.

The international assistance procedures are currently being revised in the light of experience feedback from the Fukushima Daiichi NPP accident.

9. International Nuclear Emergency eXercice (run in particular by the NEA)

10. Response Assistance NETwork (network for responding to requests for assistance in the event of a radiological emergency - IAEA).

3 LEARNING FROM EXPERIENCE

3|1 Carrying out exercises

In order to be fully operational, the entire response system and organisation must be regularly tested. This is the purpose of the nuclear and radiological emergency exercises. These exercises, specified by an annual circular, involve the licensee, ministries, Prefectures, ASN and IRSN. They are a means of testing the off-site emergency plans, the response organisation and procedures and of helping with training the participating staff. The main objectives are defined at the beginning of the exercise. They are primarily to ensure a correct assessment of the situation, to bring the installation on which the accident occurred to a safe condition, to take appropriate measures to protect the general public and to ensure satisfactory communication with the media and the populations concerned. At the same time, the exercises are a means of testing the arrangements for alerting the national and international organisations.

3|1|1 Nuclear alert tests and mobilisation exercises

ASN periodically carries out tests to check the correct functioning of the system for alerting its staff. The system is also used for the exercises described below and undergoes unannounced tests.

3|1|2 National nuclear and radiological emergency exercises

In the same way as in previous years, and together with the SGDSN, the DGSCGC and the ASND, ASN has prepared a programme of national nuclear and radiological emergency exercises for 2011, concerning BNIs and RMT operations. This programme was announced to the *Préfets* in the circular of 7th October 2010. In this context, ASN coordinates the meetings to discuss good practices and possible areas for improvement. These meetings establish various objectives that are common to the national stakeholders.

These exercises are an opportunity to test the decision-making circuits at the highest level and most of these exercises include simulated media pressure on the main players, to test their communication skills and capabilities. The following table describes the key characteristics of the national exercises conducted in 2011.

Apart from the national exercises, the *Préfets* are asked to conduct local exercises with the sites that concern them, in order to improve preparations for a nuclear or radiological emergency situation, including testing of the time needed to mobilise all the parties concerned.

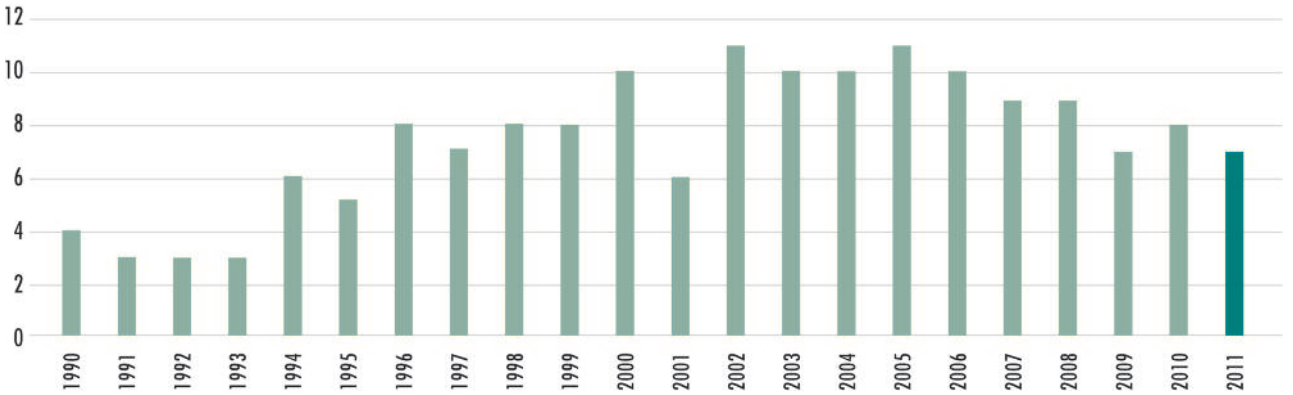
Carrying out a national nuclear and radiological emergency exercise every 3 to 5 years, depending on the complexity of the nuclear sites concerned, would seem to be a fair compromise between staff training and the time it takes for organisations to implement changes.

The number and scale of national exercises in France is high compared with foreign practices, as was underlined by the international audit conducted in 2006 by the IAEA's Integrated Regulatory Review Service (IRRS) mission, and the follow-up mission in 2009. This exercise programme enabled ASN staff and national stakeholders to accumulate a wealth of knowledge and experience in managing emergency situations. These exercises are also an opportunity to train field personnel, with about 300 staff being involved in each exercise.

Table 1: national civil nuclear and radiological emergency exercises conducted in 2011

Nuclear site	Date of exercice	Dominante of exercice	Main objectives of the exercice
Gravelines NPP	18th January 2011	Emergency preparedness and civil protection	Actual evacuation of a zone, ensuring neighbouring companies take account of the nuclear risk, testing of the alert system with the Belgian and British Authorities.
FBFC Romans	10th February 2011	Nuclear safety	Alert and regular information of the general public, implementation of the PPI, communication in an emergency situation.
Belleville-sur-Loire NPP	17th May 2011		Unannounced exercise.
Chinon NPP	30th June 2011	Nuclear safety	Minor accident, testing of the alert system, testing of the organisation and operation of the command structures, drafting of a plan for measurement of environmental radioactivity.
Paluel NPP	29th September 2011	Nuclear safety	Major fire, testing of alert and information systems.
Cruas NPP	18th October 2011	Emergency preparedness and civil protection	Evacuation and sheltering of a part of the population within the 2 and 5 km, perimeters, testing of inter-*département* zone communications, post-accident aspects.
AREVA / La Hague	8th December 2011	Emergency preparedness and civil protection	Testing of mobile alert resources, testing of radioactivity measurement devices; inclusion of a general public communication component.

Graph 1: number of national civil emergency exercises conducted from 1990 to 2011



For 2012, the objectives chosen in the annual circular of 20th December 2011 concerning the national nuclear or radiological emergency exercises are:
– to perform an exercise with safety and security components;
– to test certain elements of the emergency phase exit guide;
– widespread use of radioactivity measurement experiments;
– interfacing between the PPI and the other ORSEC plans;
– unannounced testing of activation aspects such as the operational command post and the *départemental* operations centre (COD);
– to simulate an accident affecting several facilities on the same site;
– to activate international links.

The experience feedback from the Fukushima Daiichi NPP accident was also taken into account in this circular, and thus led to the scheduling of exercises simulating accidents affecting several facilities simultaneously on a given site.



Simulated evacuation of a contaminated worker in an emergency exercise at Cadarache (CEA – Centre - South of France) – January 2012

3|1|3 Other emergency exercises

ASN is also heavily involved in the preparation and performance of other emergency exercises that have a nuclear safety component and are organised by other players such as:
– its counterparts for nuclear security (HFDS - Defence and Security High Official) or for the defence-related facilities (ASND);
– the international bodies (IAEA, European Commission, NEA);
– the ministries (Health, Interior, etc.).

The EPEES[11] nuclear security exercises are periodically held by the services of the HFDS on nuclear sites, in particular to test the interface between nuclear safety and security. ASN plays a full role in these exercises and carries out its duty of advising the *Préfet*. The last EPEES exercise took place in 2010 on the site of the French Alternative Energies and Atomic Energy Commission (CEA) in Saclay (Paris region).

During the course of 2011, three exercises run by the ASND were organised in accordance with the interministerial circular on nuclear and radiological emergency exercises. Pursuant to the ASN/ASND protocol of 26th October 2009, ASN takes part in these exercises:
– at the ASND national emergency centre: an ASN representative goes to the ASND's PCD to act as the interface between ASN and the ASND, to advise the ASND on aspects relating to the environmental impact of releases, and to prepare for post-accident management of the emergency by ASN;
– at the Prefecture: a representative of the ASN division concerned goes to the Prefecture to advise the *Préfet* pending the arrival of the ASND's representative.

INEX tabletop exercises are organised by NEA, together with the member States. ASN prepared and coordinated French participation in the INEX 4 exercise, held in at the ASN premises on 17th November 2011. The purpose of this exercise was to test the transition phase following the explosion of a "dirty" bomb in an urban environment. This exercise was an

11. Exercises related to protection and evaluation of security.

opportunity to identify good practices and the points to be improved in the French emergency management system.

ASN also takes part in exercises with a significant medical component, such as that held in October 2004 in the Necker hospital in Paris (exercise R53). This exercise was organised by the general directorate of Paris hospitals (AP-HP) and the Paris SAMU emergency services (French Emergency Medical Service), with the Paris police authorities, the DGSNR[12] and the IRSN.

The ASN personnel draws on the experience acquired during these numerous exercises in order to respond more effectively in real-life emergency situations.

3|2 Assessing with a view to improvement

Assessment meetings are organised in each emergency command centre immediately after each exercise. ASN, along with the other players in the emergency exercises, endeavours to identify the good practices and the areas for improvement brought to light during these exercises. These same feedback meetings are organised in order to learn the lessons from any real-life situations that have occurred.

ASN moreover brings together all the players twice a year to review the results of the good practices and areas for improvement identified at the debriefings organised following the exercises.

The exercises have, for example, enabled the following to be improved:
- procedures and doctrines: preventive distribution of iodine tablets in a radius of 10 km around the NPPs, to avoid having to expose those tasked with distributing them, sheltering in the "reflex" phase in the event of rapidly developing accidents;
- the decision channels: since 2007, the systematic use of audioconferences ensures the consistency of the workers and general public protective measures decided by the licensee and the public authorities;
- the general public alert system: the deployment around the NPPs of the "SAPPRE" telephone alerting system by EDF supplements the existing system of sirens;
- the environmental radioactivity measurement estimates: the circular of 12th October 2010 from the Minister of the Interior provides for the development of a measurements master programme to be appended to the PPI.

Finally, the real-life situations that occurred thus demonstrated the importance of communication in an emergency situation, in particular to inform the public sufficiently early and avoid the spread of rumours that could lead to panic among the general public. The accident of 12th September 2011 in the furnace of the Centraco facility on the Marcoule site provided a sharp reminder of the need to inform the neighbouring population, even if the PPI has not been initiated.

12. Former name of ASN.

4 OUTLOOK

The accident that struck the Fukushima Daiichi NPP raised a certain number of questions concerning the emergency response, both in Japan and more generally around the world:
– what should be the level of involvement and decision-making by the public authorities in the management of the emergency?
– are the various bodies involved in the emergency – licensees, public authorities, technical support organisations – sufficiently prepared for such extreme situations?
– are the protection and intervention perimeters around the sites extensive enough? Are all the populations concerned well-informed and prepared? Are the general public protective measures adequately identified and sufficiently well prepared?
– are the arrangements and the material resources necessary for checking the contamination of goods and persons appropriate to large-scale emergencies and available in sufficient numbers?
– what help could be provided by foreign countries or international organisations in the management of the technical and media emergency?
– etc.

ASN considers that these questions concern essential aspects of emergency management, in particular the organisation and training of the parties involved, the role of the safety regulator and the expertise, emergency planning, post-accident doctrine, notification and international assistance processes.

In accordance with the important nuclear emergency roles entrusted to it by the TSN Act, ASN will make a full contribution to the ongoing work being done by the public authorities, in close collaboration with the SGDSN, to integrate the experience feedback from the Fukushima Daiichi NPP accident.

In 2011, ASN identified some areas for internal improvements to its response to emergency situations. In 2012, ASN will deploy these improvements and will continue to work on the processes involved in the run-up to activating on-call arrangements. The change in ASN head offices will be an opportunity to modify the ASN emergency response centre, bringing it into line with the latest international standards.

ASN will also ensure that the annual programme of nuclear emergency exercises takes account of the initial lessons learned from the Fukushima Daiichi NPP accident. ASN considers that it would be advisable for these exercises to be able to closely involve the licensee and public authorities at the highest level and allow testing of the interface between the ORSEC and PPI plans.

ASN will clarify and reinforce its doctrine with respect to controlling urban development around the BNIs. ASN will take account of the observations arising from the public consultation and will finalise the nuclear risk information and communication support guide. With the help of the Ministry of the Environment, this guide will be transmitted to the Prefectures in order to provide a uniform overall framework for initiating discussions at the local level. ASN wants to better inform the local authorities of the risk generated by nuclear facilities so that this is considered to a greater extent in the development strategy adopted by the municipalities. This information will be provided coherently and systematically for all facilities with an PPI. In the longer term, ASN wishes to apply public protection restrictions to limit urban development and therefore the consequences of an accident affecting a facility.

In the field of post-accident situation management, ASN will continue the important work carried out over the past five years by the CODIRPA, supplementing it with feedback from the Fukushima Daiichi NPP accident. Jointly with the Ministry of the Interior, ASN will send elements of doctrine to the Prefectures so that they are taken into account and integrated into the PPIs.

Finally, at the international level, ASN will take part in the work being done by IAEA to revise the international conventions on assistance and early notification of a nuclear event. ASN will support the European initiatives taken with a view to transboundary harmonisation of actions to protect individuals in an emergency situation and to develop a coordinated response by the safety and radiation protection Authorities in the event of a near or remote accident.

PUBLIC INFORMATION AND TRANSPARENCY

1 **DEVELOPING RELATIONS BETWEEN ASN AND THE PUBLIC** 155

1|1 From public information to transparency

1|2 ASN's information media

1|2|1 ASN's website, *www.asn.fr*

1|2|2 The *French Nuclear Safety Authority's Newsletter*

1|2|3 *Contrôle* magazine

1|2|4 The *ASN Report on the state of nuclear safety and radiation protection in France*

1|2|5 ASN in-house publications

1|3 ASN's audiences

1|3|1 ASN and the general public

1|3|2 ASN and professionals

1|3|3 ASN and the media

1|3|4 ASN and elected representatives

1|4 ASN's international communication actions

2 **ENHANCING THE RIGHT TO NUCLEAR SAFETY AND RADIATION PROTECTION INFORMATION** 169

2|1 Information released by the licensees

2|1|1 Information circulated on the initiative of the licensees

2|1|2 Access to information in the possession of the licensees

2|2 Public consultation about projects

2|2|1 Public consultation procedures

2|2|2 Developing public consultation

2|3 The Local Information Committees and the National Association of Local Information Commissions and Committees

2|3|1 Local Information Committees for the Basic Nuclear Installations

2|3|2 The Federation of Local Information Committees: the National Association of Local Information Commissions and Committees

2|4 High Committee for Transparency and Information on Nuclear Security

2|5 Information released by the other stakeholders

2|5|1 Institute for Radiation Protection and Nuclear Safety (IRSN)

Selection of websites of the various stakeholders

3 **OUTLOOK** 179

CHAPTER 6

The TSN Act of 13th June 2006 constituted a significant innovation in that it defined transparency and the right to information in the nuclear field: *"Transparency in the nuclear field consists in the set of provisions adopted to ensure the public's right to reliable and accessible information on nuclear security"* (article L. 125-12 of the Environment Code, previously article 1 of the TSN Act). ASN is responsible for the correct implementation of the requirements of the TSN Act, particularly those concerning transparency.

ASN is intensifying its own actions with regard to transparency, through active communication with the general public, the media, the institutional public and professionals.

ASN ensures that the TSN Act is implemented by the stakeholders. It supports the measures taken by the Local Information Committees (CLIs) and the High Committee for Transparency and Information on Nuclear Security (HCTISN) to promote transparency.

In its nuclear licensee regulation and inspection activities, ASN intends to develop compliance with the transparency obligations stipulated by the TSN Act. The licensees are now required to release to anyone who so requests the information in their possession concerning the risks involved in their activities and the safety or radiation protection measures taken by them to prevent or mitigate these risks.

Each year ASN presents its report on the state of nuclear safety and radiation protection in France to Parliament. Discussions with its institutional, parliamentary and locally elected audiences enable ASN to be more effective in the fulfilment of its remit and the exercise of the independence conferred on it by the TSN Act.

The year 2011 was marked by the accident at the Fukushima Daiichi nuclear power plant in Japan, following a violent earthquake that triggered a tsunami. Right from the beginning of the emergency, ASN deployed significant resources to monitor the technical and radiological development of the situation and to inform the public and the media with the greatest possible transparency and clarity.

1 DEVELOPING RELATIONS BETWEEN ASN AND THE PUBLIC

1|1 From public information to transparency

Informing the public about nuclear safety and radiation protection is one of ASN's fundamental duties. In order to fulfil this role and meet the expectations of the general and professional public, ASN is looking to change its working methods and its information media.

Since 2002, ASN has published the follow-up letters for all inspections carried out in basic nuclear installations (BNI). ASN extended this publication to include radiotherapy inspection follow-up letters in 2008 and small-scale nuclear activity inspection follow-up letters in 2010. Each year ASN thus posts more than 1,500 inspection follow-up letters on *www.asn.fr* for all the activities it inspects.

Since 1st October 2008, ASN has published the opinions and recommendations of its Advisory Committees on its website (see chapter 2 - 2|5|2).

As part of its transparency and public information approach, ASN aims to include the general public more extensively in its decision-making process, by developing public consultation via the *www.asn.fr* website. Thirteen consultations were posted online between 2010 and 2011. The latest public consultation concerned a draft circular relative to controlling activities around BNIs (October – December 2011).

A specific section in French and English on the Complementary Safety Assessments (CSA) run by ASN following the Fukushima accident, in response to the request by the French and European regulators, was also created on *www.asn.fr*. On it, the public can consult the methodology, schedules and licensee reports about the CSAs submitted on 15th September 2011, the IRSN report submitted to ASN in early November, and the opinions of the Advisory Committees for reactors and for nuclear laboratories and plants. The ASN report on the CSAs and its opinion n° 2012-AV-0139 can also be consulted on the site.

1|2 ASN's information media

Convinced of the need to act with complete transparency, by producing reliable and accessible information, ASN has set up an information policy based on complementary media, so that information is made accessible to its various audiences.

1|2|1 ASN's website, *www.asn.fr*

Today, ASN's main channel for informing the public is its website *www.asn.fr*, which presents the current situation of nuclear safety and radiation protection in France, and the action and stances of ASN within its areas of competence. Website visitors are informed about subjects as varied as nuclear facilities, radiotherapy, radioactive waste, radon, emergency situation management, industrial uses of ionising radiation, etc.

The website gives access to a unique documentary database on the life of the nuclear installations.

In order to meet the expectations and demands of the public, ASN has since 2011 added video recordings to its website (press conferences, thematic reports, etc.). The media and the public now have permanent access to ASN's various position statements. The public can also access information that is more direct and informative.

Nuclear accident at Fukushima Daiichi: exceptional mobilisation by ASN to guarantee information of the public

As of the beginning of the Fukushima accident in Japan (11th March 2011), ASN activated its emergency system in order to handle the intense interest it aroused from both society and the media.

All the ASN teams provided the general public with information that was both responsive and comprehensible.

The ASN media relations services were operational 24/7 for the first month of the emergency.

Between 12th March and 14th April, 17 press briefings were held for journalists from the French and international media in the ASN documentation centre, which was converted into a media centre for the occasion. They were attended by large numbers of journalists from the national and international media. The efforts made to respond to media queries as rapidly as possible, combined with the availability of the spokespersons and their thematic specialisation, means that virtually all requests were satisfied. In total, ASN issued 36 press releases and received about 1,500 queries from the national and international media.

To help improve information of the general public, ASN decided to set up a telephone call centre to provide a clear and responsive answer to the most complex questions. More than 1,100 calls were received between 24th March and 1st April 2011.

An emergency website, http://japon.asn.fr, *was opened on 13th March 2011, offering complete (maps, drawings, computer graphics, etc.) and responsive information (information notices, video press conferences, press releases) about the condition of the power plant. In the weeks and months following the event, the site received between 70,000 and 80,000 visits per day, for example providing the media with access to the ASN opinions and position statements regarding the condition of the facilities, presented at its press conferences. The site proposes regularly updated reports on the radiological situation in Fukushima, press releases, answers to frequently asked questions from the public, information to help understand the accident and videos of the ASN press briefings. ASN also deployed tools enabling the public to give their own opinions (300 messages posted on* contact@asn.fr *or on* Facebook*).*

With a view to further enhancing information to its various audiences, ASN also created an electronic newsletter presenting events as they developed.

In order to provide regular information about the Complementary Safety Assessments (CSA) that the licensees of nuclear facilities were required to perform following the Fukushima Daiichi accident, ASN issued press releases to provide the latest news about the subject and keep journalists informed of the ongoing process.

On this point, it also opened a new section on www.asn.fr *proposing full information about the subject. With regard to its transparency role, all the reports drafted by the licensees regarding the CSAs were made available to the public on* www.asn.fr *as of 15th September 2011.*



ASN Briefing on 16th March 2011

With this informative approach in mind, ASN has developed on its website the topic of the transport of radioactive substances in France, with a presentation of the regulations applicable to this field, the risks, the safety principles and what is done by ASN accordingly. A video also presents how a radioactive material shipment is organised.

RSS web feeds are also available for real-time monitoring of the latest news and updates to the ASN *Official Bulletin*.

In 2010, ASN created pages on the main social networks (Facebook, Twitter, Dailymotion) as well as on Google+ in 2011, in order to ensure a broader and more reactive dissemination of its news to a more varied audience. More than 700,000 Internet users consulted 3.7 million pages online in 2011.

Interest from the English-speaking world, from institutions in particular, grew significantly in 2011. ASN thus developed the

English version of its site, *www.french-nuclear-safety.fr*, which proposes information notices, press releases and a variety of specific editorial content. In 2011, the majority of the section devoted to the CSA process was proposed in English. Several issues of Contrôle magazine were translated in full and posted on-line.

1|2|2 The *French Nuclear Safety Authority's Newsletter*

Since 2009, ASN has supplemented its editorial offering for its audiences (members of Parliament, local elected officials, senior civil servants, CLIs, licensees and journalists) with the launch of the *ASN Newsletter*. With its one-page format printed on both sides, the newsletter develops selected fundamental topics in the "Enjeu" section, and publishes the latest news in brief. Ten issues are published per year, proposing regular sections devoted to ASN decisions and actions, and to news from the regulated sectors. It directs readers towards other ASN publications should they wish to further their understanding of a particular subject.

The newsletter is sent by post to nearly 2,000 addressees each month, and since 2010 an electronic version can be consulted and downloaded at *www.asn.fr*, or sent by electronic-mail on subscription. As at 31st December 2011, there were more than 4,500 subscribers to the newsletter.

1|2|3 *Contrôle* Magazine

Three issues of *Contrôle* magazine, produced by ASN, were published in 2011 and sent out to more than 10,000 recipients in France (national and local elected officials, media, HCTISN, CLI, associations, licensees, administrations, private individuals) and abroad (nuclear safety regulators of the countries with which ASN enjoys close ties): no. 190, in February, on the topic of radioactive waste, no. 191, in March, concerning extracts from the ASN report on the *state of nuclear safety and radiation protection in 2010*, no. 192, in July, on medical imaging.

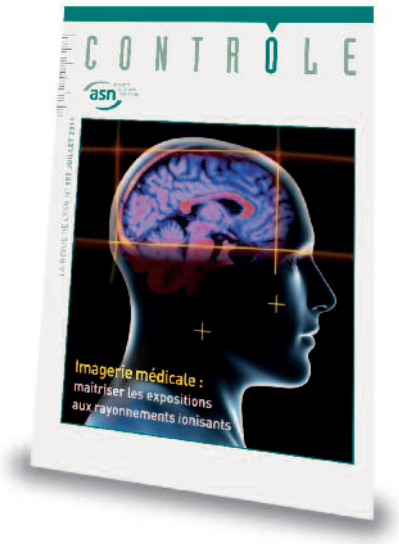
Contrôle comprises a detailed report on a specific subject concerning nuclear safety or radiation protection, entitled "Les dossiers de *Contrôle*", and a current affairs section entitled *"L'Essentiel"*, reporting on ASN activities, especially at regional level. The detailed report presents a given subject viewed from different angles so that readers can develop their own opinion. It presents the ASN viewpoint of the subject in question and gives various national and international players an opportunity to present their own views.

1|2|4 The ASN Report on the state of nuclear safety and radiation protection in France

The *ASN Report on the state of nuclear safety and radiation protection in France* is a reference document resulting from a collective analysis and synthesis of the status of the activities regulated by ASN in these two fields. It provides a means of extending the scope of reflection to projects and prospects relating on topical issues and to questions of particular importance at regional, national and international level.

Under the TSN Act, the annual *ASN Report on the state of nuclear safety and radiation protection in France* is presented each year to the President of the Republic, to the Government and to Parliament. It is also sent out to nearly 2,000 recipients: representatives of the administration, local elected officials, licensees and heads of regulated activities or facilities, associations, professional trades unions, learned societies, private individuals and so on.

ASN publications can be consulted and downloaded at www.asn.fr. *They are also available for consultation at the ASN's public information and documentation centre. It can also be sent free of charge, on request by letter to the following address: ASN Publications, 6, place du colonel Bourgoin, 75572 Paris Cedex 12.*



Contrôle **magazine issue 192 published in July 2011 about medical imaging (also available in English)**

1|2|5 ASN in-house publications

The second edition of *"Transparence"*, a magazine created in 2010 and more particularly aimed at ASN staff, was published this year. It is also issued three times a year to targeted external audiences such as operational partners, CLIs, members of Parliament and engineering schools. *Transparence* provides an informative analysis of ASN missions, its activities, its areas of professional expertise and its internal organisation. In March 2011, *Transparence* gave some first-hand accounts from inspectors in the field *("Dans les coulisses de l'inspection")*. In July, *Transparence* reviewed ASN's management of the emergency situation following the Fukushima disaster (Fukushima special report). Finally, in October, the magazine reviewed the situation regarding social dialogue within ASN, in the run-up to the 2011 trade union elections to be held throughout the civil service.

The third edition of the Activity Report was published in 2011. It is intended for all ASN staff, but can also be distributed to recruitment forums at which ASN is a participant. This report highlights information on subjects ranging from training or social dialogue to the quality management system and financial resources.

The ASN intranet, OASIS, is a prime channel for internal information, providing staff with documents about developments within the Authority and the performance of its occupational activities. OASIS is also the interface for the ASN information system, which provides a coherent organisation of the documentary base covering the main processes of the ASN sectors.

1|3 ASN's audiences

1|3|1 ASN and the general public

Nuclear safety and radiation protection concern the entire population.

ASN has a major role to play in access to information and compliance with the transparency principles laid out by the TSN Act. It aims to provide the citizens with information that is as clear, complete and accessible as possible.

ASN hopes to go further, by involving the public to a larger extent in the debate on nuclear safety and radiation protection issues, and in its own decisions. In this respect, ASN aims to initiate and take part in discussions with the public.

ASN actions aimed at the general public

The Public information and documentation centre

The Public information and documentation centre has been open to visitors in ASN's Paris premises since 2004 and manages queries and contacts from a variety of audiences: private individuals, professionals, students, associations, etc.

It offers more than 3,000 documents concerning nuclear safety and radiation protection for consultation.

It allows in-situ consultation of original administrative documents such as public inquiry files, impact assessments and the annual reports from the licensees which, pursuant to article L.125-16 of the Environment Code, deal with the environmental impact of each BNI.

The public has access to all ASN publications. It can also consult French and international publications on nuclear safety and radiation protection produced by the various stakeholders (CLIs, nuclear licensees, IRSN and other technical experts, radiology and radiation protection learned societies, professional associations, environmental protection associations and so on).

In 2011, the ASN's Public information and documentation centre answered more than 2,500 queries from various parties, a figure that was up on 2010, including requests for administrative documents, for environmental information, for transmission of publications, for documentary searches and for position statements on subjects with significant implications.

Exhibition: "Nuclear applications and society: from understanding to regulation"

ASN and the Institute for Radiation Protection and Nuclear Safety (IRSN) organise a travelling educational exhibition, which aims to provide students and the general public with an informative presentation of the assessment and management of risks linked to ionising radiation and the corresponding means of control. This 250 m² exhibition comprises seven modules containing interactive models, films, panels, computer games, plus explanations given by representatives from the IRSN.

To coincide with this exhibition, the ASN regional divisions provide help with the conferences and with distributing information to the stakeholders.

In 2011, the exhibition took up residence in the Euréka gallery in Chambery (CCSTI Savoie) for eight weeks. It received nearly



ASN's information and documentation centre – 6 place du colonel Bourgoin Paris 12e

Iodine tablet distribution campaign follow-up

The fourth campaign for the distribution of stable iodine tablets around EDF nuclear power plants ran between June 2009 and March 2010. It concerned some 500,000 people situated in a 10 kilometre radius around the 19 French nuclear power plants. Thanks to a large-scale communication effort, the campaign enjoyed a particularly high profile (88% of those questioned had heard about it). However the collection rate remained stable (one in two of those concerned actually collected their tablets from a pharmacy).

In order to better identify the potential obstacles to the collection of iodine tablets, ASN carried out two opinion surveys. They revealed that this apathy on the part of the population could be attributable to over-confidence in the safety of the facilities or, on the contrary, doubts as to the effectiveness of the tablets in the event of a nuclear accident. ASN is therefore convinced of the need to reinforce the "risk culture" by making each citizen feel involved in his or her own protection. ASN and its partners will submit proposals accordingly in 2012.

4,000 visitors. The debates and scientific round-tables associated with the exhibition attracted nearly 390 participants.

A study is currently in progress to examine ways of making this exhibition more appealing to a local audience.

The information sheets

These sheets are distributed among the general public and the teaching sector on the major issues of nuclear safety and radiation protection.

They are available at the exhibitions and symposia in which ASN participates and are sent out to various information providers such as CLIs and the documentation centres for teachers.

The information sheet collection includes:
"Administration of stable iodine in the event of a nuclear accident";
"Radiation protection principles";
"Nuclear or radiological: which term to use?";
"Radiation protection values and units";
"The French nuclear fuel cycle";
"Radiological emergencies";
"Radon".

1|3|2 ASN and professionals

The objective of ASN's relations with its professional audience is to enhance knowledge of the regulations and nuclear safety and radiation protection culture in its technical, organisational and human aspects.

Over and above its professional contacts with the main nuclear licensees, ASN develops relations with the users of ionising radiation in the industrial and health sectors.

In addition to its website *www.asn.fr*, ASN produces publications intended specifically for them and organises or takes part in many symposia, seminars and other events.

Seminars and publications intended for professionals

ASN develops its relations with professionals through the seminars and symposia it organises. In this respect, it produces publications aimed at a professional audience to:
– raise awareness concerning the responsibilities and implications of radiation protection
– disseminate the regulations and promote their implementation
– encourage the notification of significant events and experience feedback.

• Raising awareness concerning the responsibilities and implications of radiation protection

In 2011, seminars were organised by the ASN divisions in Orleans, Bordeaux, Marseilles and Nantes on the topic of industrial radiography. A brochure was given out to the participants. This is the third topic for which a brochure has been produced, after radiotherapy quality management and radioactive material transport operations.

ASN thus published thematic media to illustrate the radiation protection issues, summarise the regulatory fundamentals, as well as ASN's messages and actions.

In July 2011, ASN held a press conference warning about the rise in the doses of ionising radiation delivered by medical imaging (see point 1|3|3). A summary sheet was sent out to the professionals on this occasion, to remind them of the obligations and responsibilities of the various medical players. The conclusions of the medical imaging seminar of 16th September 2010 were also published, along with three papers on external beam radiotherapy, interventional radiology and the organisational plans in medical radiation physics (POPM).

The papers are sectorial reports on the state of radiation protection, trends, progress and difficulties encountered from the technical, organisational and human standpoints.

• Disseminate the regulations and promote their implementation

Disseminating, understanding and implementing nuclear safety and radiation protection regulations is one of ASN's key objectives.

ASN has placed two collections of radiation protection texts online for the professionals, on *www.asn.fr*. A list of texts applicable to industrial radiography was also distributed at the COFREND conference of May 2011.

In the medical field, ASN proposes an analysis of the applicable radiation protection requirements, in its medical and dental radiological guide. In the same way as every year, these baseline requirements were updated and in October 2011 were made available to the visitors to the French Radiology Days (JFR) conference.

Industrial radiography: spotlighting a key radiation protection issue

The purpose of industrial radiography is to detect defects in parts and structures, in particular in weld beads, either when they are manufactured or during the course of maintenance operations. This is a priority radiation protection issue, given the hazardous nature of the processes (dose rates of several grays per hour), the difficult conditions of intervention on worksites and the efforts still required to reduce the number of incidents and optimise human exposure.

Since 2005, the French Non-Destructive Testing Confederation (COFREND) has, at the request of ASN, been working on good practices for industrial radiological inspections and on justification for the use of ionising radiation.

A guide concerning the justification of industrial radiography was presented at the COFREND 2011 conference in Dunkerque (24th to 27th May), attended by more than 500 participants.

For the first time, ASN had a stand at this tri-yearly professional non-destructive testing fair. It was an opportunity for many exchanges with equipment suppliers, ordering customers and industrial radiology contractors.

ASN maintains a strong local presence through its industrial radiography inspection programme (more than 100 inspections/year). It also carries out preventive work alongside the Retirement and Occupational Health Insurance Fund (CARSAT) and the Regional Directorates for Enterprises, Competition, Consumption, Work and Employment (DIRECCTE).

The ASN divisions regularly organise regional meetings with radiography firms in order to encourage the adoption of good practices tailored to the specific local situation. In 2011, four professional meetings were arranged in Orleans (7th April), Bordeaux (16th June), Marseilles (3rd November) and Nantes (16th November). An information brochure was put together to make the participants aware of the radiation protection issues and to promote the principles of justification and dose limitation.

Regional charters in Provence-Alpes-Côte d'Azur, Haute-Normandie, Nord-Pas-de-Calais and Rhone-Alpes Auvergne, testify to the desire on the part of the firms to take greater account of radiation protection in their activities. A charter is also currently being prepared in the Pays de la Loire area.

In 2012, ASN will be continuing its work with the industrial firms concerned.



Control console of an unauthorised and nonconforming fixed industrial radiography installation – April 2011

The "ASN guides" collection was created as an educational tool for professionals. In 2011, it comprises 17 non-prescriptive guides. These documents clearly state ASN doctrine, specify its recommendations, propose methods for achieving the objectives presented in the texts and share methods and good practices derived from experience feedback from significant events.

- Encourage the notification of significant events and experience feedback

ASN promotes the notification of significant events, with the clear intention of reinforcing the safety culture.

With regard to radiotherapy, ASN and the AFSSAPS (French Health Products Safety Agency) together launched the *www.vigie-radiotherapie.fr* web portal in July 2011. This site can be used to meet the notification obligations regarding both radiation protection and equipment monitoring. It remedies the initial complexity of the notification process which could have put people off: access to the regulatory references and notification criteria, single notification form and identification of addressees of the notification according to the criteria identified.

ASN attaches considerable importance to sharing the lessons learned from significant events. In July 2011, together with the AFSSAPS, it published the second review of significant radiation protection events and equipment monitoring notifications in the field of radiotherapy, declared over the period 2008-2009.

The six-monthly electronic bulletin *"La sécurité des soins – Pour une dynamique de progrès"* (health care safety – building momentum for progress), co-signed by the radiotherapy learned

societies (SFRO / SFPM / AFPPE) and ASN, was launched in March 2011. The bulletin is an initiative of the working group looking at experience feedback from significant event notifications intended for health professionals. It presents the progress and experience sharing approach initiated by the radiotherapy centres to enhance health care safety. The first two issues, devoted to patient identification and the treatment preparation session, were published in March and November 2011.

The first lessons learned from significant radiation protection events in nuclear medicine were presented to the French Association of nuclear medicine technicians (AFTMN) conference in Toulouse, from 22nd to 24th May 2011. A double-sided sheet was published and also handed out to the participants at the regional seminars in Nantes, Chalons and Lyon.

Partnerships with institutions, associations and professional organisations

• ASN support for the PCR networks

The Labour Code requires the appointment of a Person Competent in Radiation protection (PCR) when the presence, handling, utilisation or storage of a radioactive source or electrical generator using ionising radiation creates a risk of exposure of the staff of an establishment or of outside contractors intervening in an establishment performing a nuclear activity.

ASN, together with the General Directorate for Labour, supports the PCR networks with a view to breaking down the barriers between industrial and medical PCRs. After an external audit in 2008 to evaluate the working of the PCR networks, ASN asked a consultant in early 2011 to examine ways of promoting the creation, management and coordination of the networks. At the meeting of 7th October 2011, the nine regional networks signed the founding coordination charter for the PCR networks. With the help of ASN, they produced a brochure designed to present the network approach to the PCRs and to the other radiation protection stakeholders. It was distributed for the first time on the ASN stand at the French Radiology Days annual conference in October 2011. Pages were also devoted to the PCR networks on *www.asn.fr*.

Table 1: the collection of ASN guides

Number	Title
1	Disposal of radioactive waste in deep geological formations
2	Transport of radioactive materials in airports
3	Recommendations for drafting annual information reports for the public concerning basic nuclear installations
4	Auto-assessment of risk exposure of patients receiving external radiotherapy
5	Management of radiotherapy safety and quality of treatment
6	Final shutdown, decommissioning and delicensing of basic nuclear installations in France
7	Requests for shipping authorisation and approval of package models or radioactive materials for civil use transported on the public highway
8	Evaluation of nuclear pressure vessel conformity
9	Definition of a BNI perimeter (to be published in 2012)
10	Local involvement of CLIs in the 3rd ten-year inspections of the 900 MWe reactors
11	Notification and codification of criteria related to significant radiation protection events (excluding BNIs and radioactive material transport operations)
12	Notification and codification of criteria related to significant safety, radiation protection or environmental events applicable to BNIs and radioactive material transport operations
13	Protection of BNIs against off-site flooding
14	Acceptable complete clean-out methodologies in BNIs in France
15	Safety management policy in BNIs
16	Significant radiation protection event affecting a radiotherapy patient: declaration and classification on the ASN-SFRO scale
17	Studying hazards in transport infrastructures concerned by the transport of radioactive materials
18	Disposal of effluents and waste contaminated by radionuclides, produced in facilities licensed under the public health code

• Collaboration with institutions and learned societies

ASN conducts an active policy of collaboration with institutions and learned societies, with a view to ensuring constant improvement of the radiation protection of patients and workers. This cooperation is given form by conventions or framework agreements and mainly concerns regulations, quality assurance, training, or experience feedback from radiation protection events.

With regard to radiation protection in the medical field, ASN has signed conventions with five institutions to make it easier for them to perform their respective duties and carry out joint or complementary work: the General Directorate for Labour (DGT), the General Directorate for Health (DGS), the High Authority for Health (HAS), the French Health Products Safety Agency (AFSSAPS) and the French Health Monitoring Institute (InVS).

Three medical learned societies have also signed framework agreements with ASN: the French Society for Radiation Oncology (SFRO), the French Nuclear Medicine and Molecular Imaging Society (SFMN) and the Professional Council of French Radiology (G4). In 2011, they were joined by the French Association of Electroradiology Paramedical Staff (AFPPE) and by the French Society of Medical Physics (SFPM). Joint ASN / SFPM work led to recommendations on the role, duties and staffing levels in medical radiation physics for imaging, as well as a guide for the organisational plans in medical radiation physics (POPM).

ASN is also working with the Commission for the radiation protection of veterinarians and, since 2011, with that for dentists.

More generally, the ASN regional divisions take part in professional meetings such as the regional seminars held by the Regional Union of private-practice physicians and the regional assemblies of health professionals (radiotherapists, radiation physicists, radiologists, oncologists, dental surgeons, stomatologists, etc.) and in continuing education training courses, in particular for biomedical engineers or radiology operators, and for Persons with Competence for Radiation protection (PCR) as defined by the regulations.

The presence and contributions of ASN at such events, both regional and national, are a valuable means of informing the professionals and ensuring closer relations with them - particularly in the small-scale nuclear sector - with a view to improving application of the safety and radiation protection principles.

Professional symposia

ASN is also developing relations with professionals through the symposia it organises and through its participation in the events they organise. These events are also opportunities for ASN to share ideas and experience with its foreign counterparts.

• The ASN divisions reaching out to the professionals in the small-scale nuclear sector

Twelve regional professional seminars were organised by the ASN divisions in 2011, or nearly twice as many as in 2010.
This figure is clear evidence of the commitment of ASN's divisions to four main topics:

– Nuclear Medicine in Nantes (7th October), Châlons (4th November) and Lyons (5th December) with three core messages: worker radiation protection, management of contaminated waste and effluents and notification of significant radiation protection events / experience feedback.
– Industrial radiography in Orleans (7th April), Bordeaux (16th June), Marseilles (3rd November) and Nantes (16th November) as part of the regional work on the good practices charters.
– Radiotherapy in Paris (17th May) and Marseilles (13th December) around two topics: sharing experience about health care safety and a review of ASN inspections.
– Organisation of radiation protection: conference of Persons Competent in Radiation protection (PCR) in Nantes (20th September) and of approved radiation protection organisations in Lyon (3rd November).

In 2011, ASN underlined its concerns regarding dose optimisation in medical imaging. In addition to holding a press conference, ASN devoted an issue of its Contrôle magazine to this subject and organised a first meeting of interventional radiology professionals in Marseilles on 17th June 2011.

• The main professional events in 2011

The Assises des déchets national waste conference (14th-15th September)

ASN is a long-standing partner of the Assises des déchets conference held every two years, under the aegis of the Ministry for Ecology, Sustainable Development, Transport and Housing.

On 15th September, together with ANDRA, ASN organised a round table on very low level (VLL) waste. The workshop was an opportunity to recall the fundamental principles applied in France, as enshrined in the national radioactive materials and waste management plan (PNGMDR), as well as the VLL waste management doctrine based on BNI zoning.

The participants (CEA, AREVA, the mayor of Soulaines, the FNE association and NEA) agreed that the system was functioning correctly but that there was a need to look for means of optimisation to avoid saturating the VLL waste repository too quickly. The subject of the possible recycling of waste within the nuclear industry was broached and its advantages and limitations discussed.

Meetings with radiation protection professionals

ASN took an active part in the events organised in 2011 by the French Radiation Protection Society (SFRP).
At the SFRP national conference (20th-23rd June), ASN co-chaired three sessions on the radiation protection of patients, in a professional environment and in an incident/accident or post-accident situation. It was present in the exhibitors area and presented three posters on the post-accident management of a nuclear accident, the "radon plan" and the radiological water survey. ASN was a member of the programme committees for the two SFRP days, devoted respectively to:

– a review of the use of ionising radiation sources and future prospects linked to technical and regulatory changes (15th -16th November);
– radiation protection of patients in medical imaging (13th December).

ASN was in contact with radiological physicists, medical radiation technologists and radiologists as an exhibitor at three fairs organised by the learned societies:

– the conference of the French Society of Medical Physics (8th-10th June) to coincide with its work on the organisation of medical physics;

– the conference of the French Association of Electroradiology Paramedical Staff (AFPPE, 17th-19th March);
– the French Radiology Days (JFR, 21st-25th October), with presentations focusing on risk management and dose optimisation in imaging and interventional radiology.

ASN was also present at the 13th International Hospital and Healthcare Quality Conference (JIQHS, 28th-29th November).

Industrial radiography

ASN had a stand at the COFREND conference in Dunkerque (24th to 27th May) to promote the principles of radiation protection and justification in industrial radiography.

1|3|3 ASN and the media

Press relations

ASN press relations help strengthen the organisation's credibility and legitimacy within its fields of competence.

ASN maintained close ties with the media throughout the year.

The year was marked by the Fukushima Daiichi accident in Japan. This ushered in a new era of ASN media relations, with a clear distinction between before and after Fukushima.

The ASN media service managed this lengthy media crisis and responded to the many queries from the media (see box on the Fukushima Daiichi accident).

The impact of this emergency was both visible and significant throughout 2011:
– numerous approaches on a variety of topics related to incidents that occurred in nuclear facilities, requests for explanations and clarifications about the ASN decisions, opinions and inspection follow-up letters, requests for ASN inspection follow-ups in the field.

ASN was subject to intense media pressure regarding topical and strategic subjects: the day-to-day safety of nuclear facilities, the EPR reactor construction site at Flamanville, the continued operation of the nuclear power plants, in particular Fessenheim, the level of safety of the new reactors being built around the world.

Since March 2011, many queries have concerned the complementary safety assessments (CSA) in France and the stress tests carried out on the nuclear facilities in Europe. ASN has provided explanations about the content of these topics, their schedule, how they are performed, the progress made and the outlook for 2012. The CSAs and the stress tests were also covered by specific press briefings to inform the journalists of how they were progressing. ASN held a press conference in mid-September to coincide with the submission to ASN of the licensee reports on the CSAs in the French nuclear facilities. In November, following the submission to ASN of the IRSN's analysis report on the post-Fukushima CSAs and the meetings of the Advisory Committees for reactors and for laboratories and plants, ASN held a press conference with the IRSN and the Chairman of the Advisory Committee to review the current situation regarding this subject. On 3rd January 2012, ASN submitted its report to the Prime Minister, for subsequent forwarding to the European Commission.
– a rise in the number of queries from international journalists contacting ASN on various subjects concerning nuclear safety in France, the steps taken to reinforce it, the complementary safety assessments, the stress tests and ASN safety initiatives around the world.

ASN welcomed journalists from Brazil, India and Eastern Europe and presented the institution and its policy of information to a variety of audiences.

It also held press conferences with international organisations (see point 1|4).



Briefing by Marie-Pierre Comets, Commissioner, and Olivier Gupta, Deputy Director General, during the Fukushima emergency – March 2011

In addition to the Fukushima accident, ASN kept journalists informed throughout the year by means of more than thirty national and regional press briefings on a variety of topics: nuclear waste management, post-accident management after a nuclear accident or radiological emergency (CODIRPA), the medical inspections report and management of exposure to ionising radiation.

With regard to the radiation protection of patients, the working of radiotherapy centres and the ASN recommendations to improve the quality of treatment safety were subjects that interested journalists.

In July, ASN held a press conference on the increased doses of ionising radiation delivered by medical imaging, primarily computed tomography and interventional radiology.

About twenty press releases, a hundred or so information notices and numerous interviews were an opportunity for ASN to inform the media and to clarify aspects of nuclear regulation and radiation protection in France, as part of its transparency approach.

ASN also held press conferences in which other institutions and working groups participated on various subjects. In November, with contributions from the pluralistic working group on leukaemia in children living near BNIs, it presented the recommendations of this working group, set up in 2008.

ASN also has regular institutional meetings with journalists to present the organisation, its development, and its priorities and strategic orientations:
– each January, ASN presents its New Year greetings to the journalists of the national and international press;
– at the end of March, when it presents its *Report on the safety of nuclear safety and radiation protection in France* to the OPECST (French Parliamentary Office for the Evaluation of Scientific and Technological Choices), with about twenty journalists present. The 2010 Report was presented to the OPECST on 30th March 2011 in the presence of both members of Parliament and journalists.

At the local level, the eleven regional divisions present the ASN report by organising 19 regional conferences. In 2011, they presented a summary of the activities of each division, discussed local issues and provided information about the Fukushima Daiichi accident.

The press expressed their interest in ASN's assessment of the state of the nuclear installations, the results of the inspections in radiology departments, and its status and powers of sanction. Field reporting assignments enabled the media to understand the various steps in ASN's regulation and inspection work and inform their audiences of the measures taken to guarantee treatment safety.

ASN and the media in emergency situations

Article L. 592-32 of the Environment Code assigns clear duties to ASN in emergency situations. It must "inform the public of the safety state of the installation that caused the emergency situation […] and of the possible releases into the environment and their risks for personal health and the environment".

ASN must in particular be capable of responding to media queries should a nuclear event occur. For this reason, some of the ten or so emergency response exercises organised each year include media pressure. This media pressure, simulated by journalists, is designed to assess and improve the responsiveness of ASN when faced with the media, as well as the consistency and quality of the messages put across by the various stakeholders, be they licensees or authorities, both nationally and locally.

TO BE NOTED IN 2011

The ASN barometer

In 2011, in collaboration with the TNS SOFRES institute, ASN repeated its survey (barometer) of the organisation's image and profile. This barometer is designed to measure ASN's recognition level and the degree of satisfaction of two sample populations of the public with regard to its information actions. It enables ASN to adapt its information policy to its various audiences.

The seventh wave of this opinion survey took place between October and December 2011 with a representative sample of the general public and a sample representing the more informed and professional public (in particular consisting of journalists, elected officials, association managers, administrators, CLI chairmen, health professionals and teachers).

Owing to its many declarations following the accident at the Fukushima nuclear power plant in March 2011, ASN is more visible and more well-known.

Among the general public, ASN's overall profile has risen 13 points in relation to 2010 (37%). The same applies to the more informed public. ASN's overall familiarity rating is 88% at the end of this year (+ 9 points in relation to 2010). 61% have heard about ASN's actions (+ 15 pts over 2010) and 72% have heard it talk about the Fukushima accident.

Among those who heard ASN talk about Fukushima, a majority (70% of the general public and 77% of the more informed public) are satisfied with what they heard.

Knowledge of ASN's roles is increasing among the general public. The vast majority of the French population is thus able to mention inspection and monitoring of nuclear facilities and activities in France (81%, + 2 pts in relation to 2010). The regulatory role is also better known (mentioned by 20%, + 8 pts in relation to 2010) as is that of information (10%, + 3 pts).

In 2011, much of the work done by the ASN media service was devoted to the nuclear accident at Fukushima.

Other emergencies entailing numerous international media queries also took place in 2011 requiring a ramp-up in resources so that the media could be informed in real-time. In September, ASN activated its emergency centre following the accident that occurred in the CENTRACO nuclear facility (low-level waste processing and packaging centre) in the *commune*[1] of Codolet near the Marcoule site (Gard). The licensee activated its on-site emergency plan following an explosion in a furnace used to melt low level and very low level radioactive metal waste. The accident led to the death of one person and injured 4 others (see chapter 16).

Training in communication and media relations

With the aim of issuing high-quality, clear and understandable information, stripped of any technical vocabulary, ASN offers all of its staff training in spoken and written communication and emergency management. This training is tailored to their various responsibilities. With a view to better responding to journalists' demands and expressing clear views, ASN spokespersons are trained in public speaking and communication with the media.

ASN inspectors receive training in written communication (drafting of information memos and press releases).

1. Smallest administrative subdivision administered by a mayor and a municipal council

1|3|4 ASN and elected representatives

ASN is also active in an institutional sector that comprises a large number of stakeholders: elected representatives, public authorities, HCTISN (French High Committee for Transparency and Information on Nuclear Security).

ASN organises discussions with this institutional audience in order to report on its activity and duties and to tie relations with the Government players in order to be more effective in carrying out its duties:

– on 2nd February 2011, the ASN Chairman was called before the Commission for Economic Affairs at the French Parliament's hearings devoted to the nuclear sector;
– On 30th March, ASN presented its Annual Report on the state of nuclear safety and radiation protection in France to the OPECST.
– on 7th July, ASN was called to one of the French Public Accounts Office (Cour des comptes) hearings concerning the cost of the nuclear sector.
– on 7th December, ASN was heard by the "Energies 2050" Commission.

Both nationally and regionally, ASN also took part in numerous debates with other institutional organisations on topics concerning nuclear safety and radiation protection and the notion of risk.

In a different context, ASN presented the national radioactive materials and waste management plan (PNGMDR) to the OPECST in June.



Presentation of the ASN 2010 annual report to the OPECST, Lamartine room of the National Assembly – April 2011

TO BE NOTED IN 2011

Parliamentary Mission on nuclear security, the current position and future of nuclear energy

After the Fukushima accident, the OPECST was, in March 2011, asked jointly by the Bureau of the National Assembly and by the Senate's Commission for the economy, sustainable development and planning, to undertake a study of "nuclear security, the current position and the future of nuclear energy".

ASN played a significant role and assisted this parliamentary mission. It was thus heard on a number of occasions by the OPECST:

– on 16th March: ASN took part in the hearing on "The nuclear emergency in Japan";

– on 5th May March: hearing open to the press on post-nuclear emergency management during the ASN seminar on this same subject,

– on 13th May: the ASN Douai division was called to the hearing on "nuclear accident emergency management";

– on 19th May: ASN hearing on incorporating natural hazards into the protection of nuclear facilities;

– on 24th May: the ASN was heard on "defence in depth mechanisms" as part of the hearing devoted to protection of the core and the vital systems of a reactor;

– on 31st May: public hearing on the organisation of nuclear safety, with a talk by the ASN Chairman, André-Claude Lacoste, who presented the specifications for the audit and the safety assessments of the European NPPs;

– on 16th June: the ASN spoke about transparency at a hearing devoted to the transparency of nuclear safety.

ASN also assisted the Parliamentary mission with its visits to the regions, at Nogent-sur-Seine (9th May), Gravelines (13th May), Flamanville - La Hague (20th May), Tricastin (27th May), Belleville-sur-Loire (10th June), and Fessenheim (10th June). The ASN regional divisions presented ASN's nuclear safety and radiation protection roles, informed the members of parliament about the safety of the nuclear facilities they were visiting and discussed subjects relating to nuclear control and monitoring (emergency management, transparency, etc.).

The OPECST mission's interim report on nuclear safety, the current position and future of nuclear energy was published on 30th June 2011.

At a regional level, the full ASN Commission, or some of its members, met members of the National Assembly and members of the Senate. The discussions focused essentially on improving transparency and the debate on nuclear questions.

ASN will continue to develop its relations with its institutional audiences in 2012.

1|4 ASN's international communication actions

The post-nuclear accident seminar (May)
On 5th and 6th May 2011, ASN organised the second edition of the international post-nuclear accident seminar, with the support of the OPECST. The seminar attracted 300 national players, experts from 20 foreign countries and numerous journalists in the premises of the National Assembly. It was preceded by a public hearing of the Parliamentary mission chaired by the OPECST, following the nuclear accident at Fukushima.

The seminar was an opportunity to review progress in French doctrine, for which the first baseline requirements should be published in 2012: the "emergency phase exit guide", currently being trialled in volunteer préfectures and communes and the guidelines of the "transition" and "long-term" phases (see chapter 7).

ENSREG European conference on nuclear safety (June)
ASN was heavily involved in organising the first European conference on nuclear safety. This event took place on 28th and 29th June 2011 in Brussels, at the initiative of ENSREG (European Nuclear Safety REgulators Group), which associates these regulators with the European Commission.

The event, which brought to light the emergence of a common vision of nuclear safety in Europe, built around the technical work done by WENRA, was a success, attracting more than 450 participants: safety regulators, nuclear licensees, international organisations, European Commission and NGOs.

A press conference was held with Mr Lacoste, his Spanish counterpart, Mrs Carmen Martinez Ten and the Chairs of ENSREG and WENRA, Andrej Stritar and Jukka Laaksonen. (see chapter 7).

The MDEP conference (September)
On 15th and 16th September, more than 120 experts from nuclear regulatory authorities and the nuclear industry met in Paris to discuss the progress made by the Multinational Design Evaluation Programme (MDEP) and the future of overall nuclear safety. This conference was held against the highly sensitive backdrop of the Fukushima Daiichi nuclear accident.

A press conference was held by André-Claude Lacoste, Chairman of ASN and of the MDEP Strategic committee, his American counterpart from the NRC, Gregory Jaczko, and with the participation of the NEA (Nuclear Energy Agency) and Mr Nakamura Koichiro, Deputy Director General of the Japanese nuclear safety regulator. It was an opportunity to review the MDEP, launched in 2007 to pool the resources and know-how of the safety regulators responsible for evaluating the design of new reactors (see chapter 7).

The rating scales for nuclear incidents and accidents and radiotherapy radiation protection events

The need to inform the public of the severity of nuclear events, especially following the Chernobyl accident (1986), led to the development of rating scales. The first scale was created in 1987 by the CSSIN (French High Council for Nuclear Safety and Information). ASN played a vital role in the creation in 1991 of the International Nuclear Event Scale (INES) published by the International Atomic Energy Agency (IAEA). In 2002, ASN proposed a new scale to take account of radiation protection events (irradiation, contamination), in particular those affecting workers, regardless of the location of the incident.

In July 2007, ASN - together with SFRO - produced a scale for rating radiation protection events affecting patients undergoing a radiotherapy procedure, which was published in 2008.

In July 2008, IAEA published a revised INES scale taking greater account of events occurring in the transport sector or entailing human exposure to radioactive sources.

In September 2008, ASN also invited HCTISN to take part in the task on which it has been working since 2007 with a view to creating an index for measuring radioactivity in the environment.

The INES scale

The INES scale is based on both objective and qualitative criteria. It is used by sixty countries and its purpose is to facilitate media and public perception of the scale of any nuclear incidents and accidents. It is not a tool for assessing or measuring nuclear safety and radiation protection and cannot constitute a basis for either compensation or sanction. The INES scale is not designed for international comparisons and in particular cannot be used to establish a cause-and-effect relationship between the number of incidents notified and the probability of a severe incident occurring on a given installation at a later date.

• Nature of the events rated on the INES scale
The INES scale enables ASN to rate all events occurring in civil basic nuclear installations and during radioactive material transport operations, according to their importance. It has also been possible, since 1st July 2008, for the INES scale to be used by the 60 member countries of IAEA to rate radiation protection events (excluding events affecting medical patients) resulting from the use of radioactive sources in medical, industrial or research installations.

• Use of the INES scale in France
All significant nuclear safety events must be notified to ASN by the licensees within 48 hours, with a proposed INES scale rating. ASN retains sole responsibility for the final rating decision.

Using the INES scale enables ASN to select those events and incidents which are sufficiently important for it to issue a communication:
– incidents rated level 0 are not the subject of an incident notification, unless they are of particular interest;
– events rated level 1 are systematically the subject of an incident notification published on www.asn.fr.

Incidents rated level 2 and above are also the subject of a press release and a notification to IAEA.

International transport incidents concerning a foreign country are also notified to IAEA as of level 1. In the event of loss of a radioactive source, this notification is made as of level 0.

The ASN-SFRO scale

The purpose of the ASN-SFRO scale is to inform the public about radiation protection events affecting patients undergoing a radiotherapy procedure.

The scale was drawn up in July 2007 by ASN, jointly with SFRO, and was tested over a 12-month period. After joint evaluation with SFRO and the SFPM (French Medical Physics Society), the final version of the scale was published on www.asn.fr, *in July 2008.*

• Presentation of the ASN-SFRO scale

Events are rated on eight levels on the ASN-SFRO scale:
– levels 0 and 1 are used to rate events with no clinical consequences for the patient(s) concerned;
– levels 2 and 3 correspond to events categorised as "incidents";
– levels 4 to 7 correspond to events categorised as "accidents".

The severity of the effects is assessed with reference to the international clinical classification (CTCAE[2] grades), already used by the practitioners.

2. CTCAE: *Cancer Therapy Evaluation Program*, August 2006, *http://ctep.cancer.gov*

The effects considered in the notification to ASN are unexpected or unforeseeable effects due to inappropriate doses or irradiated volumes. Side-effects are not taken into account, whatever their grade, when resulting from the treatment strategy adopted by the practitioner in consultation with the patient and which are unrelated to any error in the volume irradiated or the dose delivered (notion of accepted risk).

For patients affected by a radiotherapy event, the resulting appearance of effects or complications may not be immediate. An event may therefore be temporarily rated at a given level which can then be subsequently modified according to the changes in the patient's state of health.

Unlike the INES scale, the "defence in depth" criterion (assessment of the level of safety of the radiotherapy activity) is not used in this rating, in order to avoid any confusion between the seriousness of a medical condition and a failure of the installation or breakdown in the organisation of a department.

• Classification criteria

As with the INES scale, the criteria for rating an event on the ASN-SFRO scale concern not only the confirmed consequences but also the potential effects of events. When several patients are affected by the same event, the rating level adopted corresponds to the most severe observed or anticipated effects. In the case of confirmed effects, the number of patients exposed is generally taken into account.

Information of the public and international relations

ASN's Communication and Public Information Department (DCI) is running a 2 year cooperation mission (2011-2012) to help the Ukrainian safety regulator (SNRIU) to consolidate its public information policy, drawing on the best European practices. The Finnish (STUK) and Italian (ISPRA) representatives are also taking part in this project, financed by the European Commission.

In order to share their experience of information of the public, the communication teams from ASN and their Spanish counterparts from the CSN (Consejo de seguridad nuclear) held a bilateral meeting on 20th and 21st September 2011 in Madrid.

Finally, ASN is an active member of the NEA (OECD) WGPC (working group on public communication). This is a working group comprising communication heads from the nuclear safety regulators, to enable them to share their experience and their good practices, for example on topics related to nuclear safety and management of emergency situations. ASN takes part in the corresponding actions.

Table 2: rating of significant events on the INES scale in 2011 (see chapter 4)

Level	Pressurised water reactor	Other basic nuclear installations	Transport	Small-scale nuclear activities	Total
3 et +	0	0	0	0	0
2	1	0	0	1	2
1	66	23	2	15	106
0	680	168	25	81	954
Total	**747**	**191**	**27**	**97**	**1,062**

2 ENHANCING THE RIGHT TO NUCLEAR SAFETY AND RADIATION PROTECTION INFORMATION

The TSN Act contains a number of extremely important provisions with regard to public information. As information regarding nuclear matters is a component of environmental information, nuclear activities are now among those which require the highest level of transparency.

The law in particular guarantees the "public's right to reliable and accessible information on nuclear security as defined in article L. 591-1" (article L. 125-12 of the Environment Code previously paragraph 4 of I of article 1 of the TSN Act). The right to information on nuclear safety and radiation protection concerns all fields of ASN activity, in particular:
– informing the public about events occurring in BNIs or during the transport of radioactive materials, about discharges or releases from BNIs;
– informing workers about their individual radiological exposure;
– informing patients about the medical procedure, in particular its radiological aspect.

ASN is responsible for ensuring application of these measures, which apply not only to itself, but also to the licensees subject to its regulation and monitoring. As the applicable rules are still recent and questions regarding their implementation can arise, ASN endeavours to facilitate communication between all the stakeholders regarding any difficulties encountered and the best practices to adopt.



Examples of licensee reports

The environmental radioactivity index

Since 2008, ASN has been coordinating a pluralistic working group tasked with defining an environmental radioactivity index comparable with the pollution measurement scales. It is intended that this index should complement the INES scale of radiological incident or accident severity by providing information on environmental radioactivity levels independently of any situation occurring in a nuclear installation.

The following objectives have been set:
– qualify the information relative to the levels of radioactivity in the environment by enabling the information to be put into perspective, with a rating that depends on the required population protection actions;
– be rapidly determined on the basis of radioactivity measurements and estimates;
– must be usable everywhere and at all times, regardless of an incident or accident situation and the situations managed by the emergency plans.

The work continued in 2011 and led to a draft index comprising three levels, which can be determined by a simple calculation based on concentrations measured in the air and water.

This draft was presented to the steering committee of the national environmental radioactivity monitoring network (RNM) in May 2011 and to the HCTISN during its 16th June 2011 session, and was the subject of a paper at the International Conference on Radioecology and Environmental Radioactivity (ICRER) which was held in Hamilton (Canada) in late June 2011.

As a member of RNM's pluralistic working groups, ASN also undertook work to produce communication tools aimed at a variety of audiences (index presentation brochure, technical guide, etc.). These documents will enable trials of the index to be run in 2012, with a view to using it to support the measures specified in the RNM and during emergency exercises.

UNDERSTAND

2|1 Information released by the licensees

2|1|1 Information circulated on the initiative of the licensees

The main licensees of nuclear activities operate a proactive public information policy.

They are also subject to a number of legal obligations, either general (such as the environmental report required by the Commercial Code for joint stock companies), or specific, such as those pertaining to the nuclear sector.

All BNI licensees must therefore establish an annual report on their situation and the steps they take with respect to nuclear safety and radiation protection.

ASN produced a writing guide for these reports so that they conform to the objectives of the Act and deliver information to the general public that is as complete and as accessible as possible. After in-depth discussions with the CLIs, a new version of the guide was issued at the end of 2010.

Each year ASN analyses the licensees' reports, and the main conclusions for 2010 are summarized below.

As in the previous years, ASN considers the results of the analyses to be on the whole positive. The reports were produced on-time and comply with the obligations of the TSN Act with regard to the topics to be covered.

Efforts were continued in order to produce appropriate media for the general public and all the reports are now posted on-line (on the licensees' websites).

A certain number of shortcomings are still however apparent.

Generally speaking, the reports deal only with the topics explicitly mentioned in L. 125-15 of the Environment Code (previously paragraphs 1 to 5 and 8 of article 21 of the TSN Act) but without tackling related subjects that would be useful in providing the public with an overview of the impact of the site. Many of the reports contain few or no strategic orientations, long-term objectives or comparative data covering several years.

In general, the reports contain no qualitative or quantitative elements concerning public information (number of queries, types, response times, etc.).

Finally, ASN would like to see the licensees adopt a more instructive and informative approach in the reports they draft every year in accordance with articles L. 125-15 and L. 125-16 (previously article 21 of the TSN Act), on the public's right of access to information, in particular the right created by article L. 125-10 of the Environment Code (previously I of article 19 of the TSN Act).

ASN therefore aims to continue working with the licensees to share good practices and areas for progress.

In order to consolidate the position of these annual public information reports, and as part of the general process to overhaul the regulations applicable to BNIs, ASN plans to cancel a certain number of other reports required by the prior regulations, provided that the information they were to contain is from now on incorporated into the annual public information reports created by the TSN Act. This incorporation is not yet effective in the majority of cases, which means that the licensees still have to produce these various specific reports.

More precisely, the following observations concern the reports drafted by the main licensees.

ANDRA

The reports follow the standard layout recommended by ASN. The topics mentioned in article L. 125-15 of the Environment Code (previously paragraphs 1 to 5 and 8 of article 21 of the TSN Act) (nuclear safety & radiation protection, incidents & accidents, radioactive and non-radioactive discharges and radioactive waste) are on the whole dealt with satisfactorily.

The CHSCT recommendations are the subject of a separate opinion, positioned after the conclusion in the two reports. These opinions include the CHSCT's views of the annual report and underline the quality of these reports.

The reports all follow a common graphic charter and can be easily read by all publics (text, graphics, numerous illustrations, etc.). They are easily accessible and have been widely distributed, for example via the websites of ANDRA and the CLI concerned.

One possible improvement could be to add a presentation of the steps taken as a result of the requests and undertakings made further to the periodic safety reviews.

AREVA

As in previous years, ASN observes that the annual public information reports on the installations of the AREVA group are readily accessible and understandable. The report follows the standard layout recommended in the ASN guide, the graphic charter and the volume of the documents are uniform, and a chapter is dedicated to communication and informing the public.

The question of public access to information could however be given greater coverage. The presentation of subjects relating to transport could also be improved.

As a general rule, the data presented could be given greater perspective and objectives should be identified.

CEA

Just as in 2010, the annual public information reports on the facilities operated by CEA are on the whole good informative documents intended for the general public and deal with all the topics mentioned in article L. 125-15 of the Environment Code (previously paragraphs 1 to 5 and 8 of article 21 of the TSN Act). The language is understandable for the public and some explanations are included. The reports are organised according to the same layout, but without always fully adhering to that recommended by ASN.

Efforts must still be made to bring out the trends and performance of the BNIs by putting the data, experience feedback and objectives into perspective.

The risks and detrimental effects that are not specifically mentioned in article L.125-15 of said code (microbiological risk, noises, odours, etc.) are never addressed, even though they contribute to the overall impact of the installation.

Public information measures are presented infrequently and unequally.

EDF

As in previous years, the annual public information reports on EDF's nuclear facilities meet the requirements of article L. 125-15 of the Environment Code (previously paragraphs 1 to 5 and 8 of article 21 of the TSN Act).

These reports are clear and well-organised enough to be comprehensible to the general public. The data collection efforts accomplished make for easier comparisons between the sites.

Improvements could however be made to more clearly situate the information contained in the reports in a more general context, whether in terms of group strategy, its objectives or the rest of the NPP fleet. There is also a lack of perspective through historical comparisons (lack of multi-year data series). The reports could contain more graphics.

The annual reports for all the BNIs are available in the ASN public information and documentation centre.

2|1|2 Access to information in the possession of the licensees

With entry into force of the TSN Act, the nuclear field has a unique system of public access to information.

Hitherto, access to nuclear information had been regulated by two general texts:
– Act 78-753 of 17th July 1978 containing various measures to improve relations between the administration and the public and various administrative, social and fiscal measures, in particular institutes freedom of access to administrative documents: for instance, the administration must communicate to anyone who so requests the administrative documents in its possession, under certain conditions.
– chapter IV of part II of book I of the environment code stipulates that the public authorities and the persons responsible for a public service duty relating to the environment must communicate the information they have concerning the environment to whoever requests it.

These two general texts are obviously applicable to the nuclear field, with a few specific adaptations. Their common feature is that they place the obligation for communication on the shoulders of the public authorities mentioned in article L. 124-3 of the Environment Code or the organisations acting on their behalf.

The TSN Act innovated widely by creating a right of information concerning nuclear safety and radiation protection that is directly binding on the licensees. They are thus required to communicate to anyone who so requests, the information in their possession, whether it is produced by themselves or received from elsewhere, concerning risks linked to exposure to ionising radiation that could stem from this activity and concerning the safety and radiation protection steps taken to prevent or mitigate these risks or this exposure.

This arrangement is consistent with the principle of the prime responsibility of the licensee: as the licensee has overall responsibility for the safety of its facility, it is also responsible for communicating on the risks created by its facility and the steps it takes to prevent or mitigate their consequences.

In accordance with the general regime concerning the right of access to environmental information mentioned earlier, the TSN Act comprises provisions for protecting public safety or commercial and industrial secrecy.

The procedures governing disputes following a refusal to communicate information are similar to those applicable under the general regime: in the event of refusal by a licensee to communicate information, the applicant can refer the matter to the Committee for Access to Administrative Documents (CADA), an independent administrative authority, which gives its opinion on the justification for the refusal. Should the interested parties not follow the opinion of the CADA, the dispute would be taken before the administrative jurisdiction in order to rule on whether or not the information in question should be communicated.

The creation of this new right binding on the licensees represents a significant change to the legal framework of transparency. Currently, there is no equivalent applicable to other fields.

The right to information on nuclear safety and radiation protection is today enforceable both on BNI licensees and on those in charge of radioactive material transport operations, when the quantities involved are higher than thresholds, in accordance with article L. 125-10 of the Environment Code (previously I of article 19 of the TSN Act).

ASN is monitoring the implementation of this new right. The information collected shows that, as in previous years, it remains under-used. Some organisations have however had recourse to this right, in particular on the subject of the plants in the South-West or that at Fessenheim. ASN also contacted those licensees that had refused to communicate environmental information, to encourage them to adopt a more flexible interpretation of the notion of commercial and industrial secrecy. ASN also offered to provide CADA with technical opinions, as and when necessary, on whether or not the information referred to this Committee should be released. However, since this right came into force, only a very few cases have been referred to the CADA.

2|2 Public consultation about projects

2|2|1 Public consultation procedures
(also see chapter 3)

Article 7 of the Environment charter stipulates the principle of participation, by virtue of which everyone has the right of access to the environmental information in the possession of

the public authorities and everyone has the right to take part in the preparation of public decisions with an impact on the environment.

The TSN Act and its implementing decree 2007-2557 of 2nd November 2007 reinforced public information and participation concerning BNI-related procedures. The authorisation decree and the final shutdown and decommissioning authorisation for a BNI are therefore now always subject to a public inquiry. These procedures are also subject to the approval of the *Conseil général*[3], the municipal councils concerned and the CLI (Local Information Committee). The draft ASN prescriptions concerning water intake, effluent discharges into the ambient environment and the prevention or mitigation of detrimental effects of facilities on the public and the environment are also presented to the CLI and Departmental Council for the Environment and for Health and Technological Risks (CODERST).

ASN aims to ensure that these consultations enable the public and the associations concerned to express their views, in particular by verifying the quality of the licensee's files and by developing the CLI's resources so that they can express an independent opinion on the files (e.g. by consulting experts other than those of the licensee and ASN).

If this system is to work well, the public must obviously have as much information as possible. Although there are certain restrictions on the communication of environmental information legitimately provided for in articles L. 124-1 to L. 124-6 of the Environment Code, in particular to protect public security or commercial and industrial secrecy, ASN ensures that any rejection or refusal to communicate is effectively justified and notified to the applicant by a written decision giving full reasons and laying out the appeal procedures and deadlines.

2|2|2 Developing public consultation
(also see chapter 3)

Following a proposal from ASN, the Government included a new requirement in the 12th July 2010 Act constituting the national environment undertaking (article 243 of the "Grenelle 2" Act which supplements II of article 29 of the TSN Act) stipulating consultation of the public for any project to modify the facility or its operating conditions (without however constituting any significant modification of the facility) liable to lead to a significant rise in its water intakes or discharges into the environment. This procedure will become mandatory for projects submitted to ASN as of 1st July 2012.

Moreover, to enhance the participation of public representatives in the decision-making process, the ASN Commission has decided from now on to propose that representatives of the CLI come and present their committee's observations when it examines certain important files concerning a BNI.

Over and above the application of the legal and statutory public consultation procedures, ASN considers that information campaigns and suitable forms of public debate should be organised to help the public understand and assimilate certain important issues.

2|3 The Local Information Committees and the National Association of Local Information Commissions and Committees (ANCCLI)

2|3|1 Local Information Committees for the Basic Nuclear Installations

The CLI operating framework

Creation of the CLIs began in 1981 in application of a circular from the Prime Minister Pierre Mauroy, and was generalised by the TSN Act of 13th June 2006 (article 22). The broad role of the CLIs is to monitor, inform and be a channel for discussion on questions of nuclear safety, radiation protection and the impact on the populations and the environment of the nuclear activities of installations on the site(s) that concern(s) them.

The CLI operating rules and requirements are specified in decree 2008-251 of 12th March 2008 concerning BNI Local Information Committees.

The CLIs, whose creation is incumbent upon the President of the *Conseil général*[3], comprises various categories of members: representatives of *Conseils généraux*[4], of the municipal councils or representative bodies of groups of *communes*[5] and *Conseils régionaux* concerned, Parliament members elected in the département, representatives of associations for the protection of the environment or economic interests, representative employee and medical profession union organisations, and qualified personalities. The representatives of Government departments, including ASN, and of the licensee have an automatic right to participate in the work of a CLI, in an advisory capacity.

The CLIs are chaired by the President of the *Conseil général* or by an elected official from the *département* designated by him for this purpose.

The CLIs receive the information they need to function from the licensee, from ASN and from the other Government departments. They may request expert assessments or have measurements taken on the installation's discharges into the environment.

CLIs are financed by the regional authorities and by ASN. In 2011, ASN devoted about 600,000 euros to CLIs and the CLI association. Once again ASN suggested that the Government implement a provision of the TSN Act to top-up the budget of the CLIs with association status (there are about ten of them) with funds from the BNI tax, but this provision has not yet been implemented. The increased budgetary resources of ASN should however enable it to increase its CLI subsidies to a million euros in 2012, even if this does not meet the CLI's wishes in full.

ASN support for the CLIs is not restricted simply to financial aspects. ASN considers that correctly functioning CLIs contribute to safety by regularly questioning those in charge, and that this is an important factor in "ecological democracy". ASN also aims to ensure that the CLIs receive information that is as

3. *département*-level elected council
4. Regional–level elected council
5. Smallest administrative subdivision administered by a mayor and a municipal council

complete as possible. With the agreement of the licensees, it also invites CLI representatives to take part in inspections.

Apart from its direct support, ASN takes steps to ensure that a favourable environment is created for them. It encourages BNI licensees to facilitate CLI access - as early as possible - to the procedure files for which the opinion of the CLIs is required, so that they have sufficient time to produce a well-founded judgment. Similarly, ASN considers that the development of a diversified range of expertise in the nuclear field is essential if the CLIs are to be able to base their opinions, when needed, on the work of experts other than those called on by the licensee or ASN itself.

All BNI sites now have a CLI, except for IONISOS in Dagneux in the Ain département and GAMMASTER in Marseilles. A CLI should moreover be created in the near future for the COMURHEX site at Malvesi (Aude *département*), where part of the installation has been reclassified as a BNI (also see chapter 16).

At the end of 2011 there were 36 CLIs created under the TSN Act. To this must be added the local information and monitoring committee (CLIS) of the Bure underground laboratory (Meuse *département*), created pursuant to article L. 542-13 of the Environment Code, along with about fifteen information committees created around defence-related nuclear sites, pursuant to articles R.1333-38 and R.1333-9 of the Defence Code. For the Valduc site (Côte-d'Or *département*), there is also an advisory structure with association status: the Valduc information exchange structure (SEIVA).

CLI activity

The CLIs conduct their activity through plenary meetings, some of which are open to the public, and the specialised commissions they set up.

The annual public information report drawn up by the licensee was presented to the CLI in at least half of all cases. Significant events are also generally presented to the CLI.

Ten or so CLIs were consulted about licensees' projects in accordance with the procedures of the new BNI system. A similar number had appraisals carried out as provided for in the TSN Act, for example on the occasion of the third ten-year inspections of the 900 MWe reactors (for instance, the Fessenheim CLIS and the Gravelines CLI).

More than half of the CLIs have their own website or pages on the site of the local authority that supports them. Nearly twenty CLIs publish a newsletter (sometimes taking the form of an insert into the bulletin of a local authority) or published an information brochure in 2011.

The CLIs were particularly active in the wake of the Fukushima disaster. Some of them held specific meetings after the accident. At the invitation of ASN, 75 CLI members took part as observers in the targeted inspections carried out by ASN. Finally, the CLIs at Chinon, Civaux, Dampierre, Fessenheim, Golfech, Gravelines, Saint-Laurent and the three Cotentin CLIs sent observations to ASN on the complementary

TO BE NOTED IN 2011

23rd Conference of Local Information Committees



23rd CLI conference

The 23rd Conference of Local Information Committees brought together 225 participants on 14th December 2011 in Paris at the initiative of ASN and in partnership with ANCCLI.

CLI mobilisation was significant: 122 participants represented 34 different CLIs, a record level of participation.

As in previous years, the conference brought together CLI representatives, members of the HCTISN, representatives of the Conseils généraux *and the* préfectures *of* départements *with CLIs, the Government departments concerned, associations and licensees of nuclear installations.*

The conference debated the first lessons learned from the Fukushima accident, for example with regard to the safety of nuclear facilities and information and protection of the public in the event of an accident. As a preamble, ASN and ANCCLI touched on a few topical subjects and the President of the HCTISN presented the High Committee's activity for 2011.

The conference was preceded by an "inter-CLI meeting" organised by the ANCCLI, which included a debate between the representatives of the CLIs and ASN on the resources available to these committees.

12th December 2012 was set as the date for the 24th annual CLI conference.

safety assessment (CSA) reports produced by the licensees. These observations were incorporated by ASN into its opinion of 3rd January 2012.

The CLIs can have special advisers, generally on a part-time basis. They are members of staff of the local authorities or, for those CLIs with association status, employees of the association itself. If these special advisers are in place, this clearly helps the CLIs adopt a more proactive attitude.

More detailed information on the action of some of the CLIs is given in chapter 8.

2|3|2 The Federation of Local Information Committees: the National Association of Local Information Commissions and Committees

The TSN Act provides for the constitution of a federation of CLIs, and the decree of 12th March 2008 sets forth certain provisions that this federation must adhere to. This federation became the National Association of Local Information Commissions and Committees (ANCCLI). It is chaired by Mr Jean-Claude Delalonde.

The activity of ANCCLI in 2011

The ANCCLI is active in supporting the CLIs and in contacts with the CLI's institutional partners.

It has a website (*www.anccli.fr*) and an electronic newsletter sent out to about a thousand recipients.

As in 2010, the question of CLI financing occupied much of ANCCLI's time.

It took part in about twenty national, European and international events, to present CLI activities and their viewpoints on various topical subjects.

The ANCCLI authorities

The ANCCLI comprises a number of bodies, which continued their work in 2011.

• The ANCCLI Scientific Committee
This committee comprises independent unpaid experts from different backgrounds.

In 2011, it in particular focused on management of water resources by nuclear power plants in periods of drought, on epidemiological surveys conducted around nuclear sites (on which it drafted a summary report) and on the training of CLI members (for which it makes a number of proposals). It also examined a number of specific subjects.

It met six times in 2011.

• The ANCCLI permanent groups and consultative committee
ANCCLI has three "advisory committees":
– the "Radioactive materials and waste" advisory committee, which in 2011 worked on the topic of low-level, long-lived waste (LLW-LL);
– the "Territories – Post-nuclear accident" group which, together with IRSN, worked on defining a tool for raising the awareness of local stakeholders to the post-accident issue (OPAL); this tool was presented at the inter-CLI meeting preceding the 23rd annual CLI conference;
– the "Safety of nuclear facilities" advisory committee which, after focusing initially on the EPR reactor project, is to be reactivated in 2012.
The ANCCLI also has a "consultative committee" which examines the ANCCLI's strategic orientations for the coming years.

• The ANCCLI special advisers club
In 2010, ANCCLI created the CLI special advisers club to generate a dynamic current between the CLI coordinators and technicians, and provide a forum to discuss experiences, areas of progress and difficulties encountered by each CLI, in order to ensure common ground for work and reflection.

This group is working on the complete overhaul of the ANCCLI website and on training of the CLI members.

ANCCLI partnerships

ANCCLI enjoyed particularly regular discussions with ASN and takes part in several working groups set up by it (PNGMDR, CODIRPA, "tritium" action plan monitoring committee, working groups on the distribution of iodine tablets, on controlling urban development around BNIs, etc.).

The ANCCLI signed a cooperation agreement with the IRSN, under the terms of which it, for example, runs the OPAL project mentioned above. Two joint seminars were also held in the autumn to discuss safety issues related to the Fukushima accident.

At a European level, since it was created in 2007, the ANCCLI has played an active role in the European Nuclear energy Forum (ENEF). It for example intervened at the plenary session held in Prague in May 2011. The ANCCLI is a member of the "Transparency" working group set up following the first plenary session of the forum; this group held four meetings in 2011.

• The ACN initiative launched by ANCCLI
The Aarhus Convention and Nuclear (ACN) is an initiative launched by ANCCLI and the European Commission in 2008 with the aim of progressing with the practical implementation of the Aarhus Convention in the nuclear field. After an inaugural European workshop bringing together about a hundred participants from some fifteen member countries in June 2009, national round tables were set up in about ten countries.

Under the auspices of the HCTISN and ANCCLI, the French round table will in early 2012 make recommendations on the following themes: LLW-LL waste disposal site selection process, public access to information and participation in decision making, skills-building and access to the expertise necessary for truly active participation.

In parallel with the national work, thematic round-tables are organised at a European level; in January 2011, the ANCCLI and IRSN thus coordinated a meeting on the topic of access to expertise and skills-building. In February 2012, a new event will be organised with ASN on access to information and CLI participation in accident and post-accident situations.

The final conference of the ACN approach should be held in March 2013, under the aegis of the European Commission and the Secretariat of the Aarhus Convention.

2|4 High Committee for Transparency and Information on Nuclear Security

The High Committee for Transparency and Information on Nuclear Security (HCTISN) created by the TSN Act is a body that informs, discusses and debates on nuclear activities, their safety and their impact on health and the environment.

The High Committee is chaired by Mr Henri Revol, former senator for the Côte-d'Or *département* and former Chairman of the French Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST). It comprises forty members appointed for six years by decree, including:
– two MPs appointed by the National Assembly and two senators appointed by the Senate;
– six representatives of the CLIs (local information committees);
– six representatives of environmental protection associations and approved health system users associations;
– six representatives of persons in charge of nuclear activities;
– six representatives of representative employee labour organisations;
– six personalities chosen for their scientific, technical, economic or social competence, or for their information and communication expertise, including three appointed by OPECST, one by the Academy of Science and one by the Academy of Moral and Political Sciences;
– the ASN Chairman, a representative of the Institute for Radiation Protection and Nuclear Safety and four representatives from the ministries concerned.

The Chairman of the High Committee is appointed by decree from among members of Parliament, representatives of the local information committees and personalities chosen for their competence.

In 2011, the HCTISN held four ordinary plenary meetings and two extraordinary meetings concerning the Fukushima accident; it also ran several working groups.

It drafted a report entitled "Transparency and secrecy in the nuclear field" and another on the process to search for a disposal site for low level, long-lived waste (LLW-LL).

As requested by the Prime Minister, the High Committee is associated in all steps of the process, run by ASN, to assess the safety of nuclear facilities in the light of the Fukushima accident. The specifications for these Complementary Safety Assessments (CSA) were thus the subject of consultations with the High Committee, which issued a favourable opinion on 3rd May 2011. A working group, chaired by Mr Gilles Compagnat, was set up to examine various questions linked to experience feedback concerning the Fukushima accident, in particular with regard to the use of subcontracting.

The elements presented and debated at HCTISN meetings can be consulted on its website, *www.hctisn.fr.*

ASN considers that the HCTISN plays an important role in consultation and debate at national level, and contributes actively to its work.

2|5 Information released by the other stakeholders

Nuclear safety and radiation protection are complex areas in which many parties are involved.

Given the diversity of available information, the public can now make up its own mind, in particular by consulting the websites of the main organisations concerned. The information they make available varies in nature, from the most general to the most scientific, aimed at an audience ranging from the layman to the informed professional.

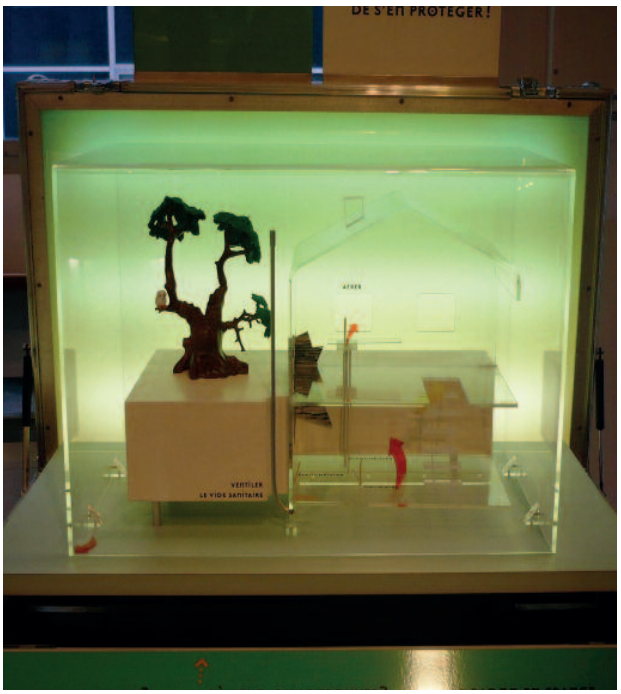
2|5|1 IRSN

IRSN produces an annual report of its activities, which it officially communicates to its supervisory Ministers and the HCTISN, the French High Public Health Council (HCSP) and the Working Conditions Guidance Council (COCT).

The 2010 version of this activity report is available in French and in English on the IRSN website and can be obtained on request, in paper format (French version) and/or on a CD-Rom (English version), from the Institute's communication department (IRSN, BP 17, 92262 Fontenay-aux-Roses Cedex).

In accordance with the requirements of the decree that created it, IRSN published the results of its R&D programmes, except for those concerning defence.

IRSN applies an information and communication policy that is consistent with the objectives defined in the objectives contract signed with the State. Some of its information actions are carried out jointly with ASN. This in particular concerns transparency and the "Nuclear applications and society" exhibition.



ASN-IRSN exhibition "nuclear applications and society: from understanding to regulation" at the *Ecole supérieure des mines in Saint-Etienne*

In line with its public information duty, the IRSN was extensively mobilised to answer questions from the media and the public during the Fukushima disaster in Japan.

As of 12th March, the Institute's website regularly published bulletins on the condition of the damaged plant and on the environmental and health consequences of the accident. Special arrangements were made for virtually real-time dissemination of the results of radioactivity monitoring in metropolitan France and overseas France.

Again in 2011, and continuing the transparency approach initiated in 2010 jointly with ASN, the IRSN also began publishing on its website certain technical opinions it produces at the request of the Authority.

In 2011, the "Nuclear applications and society" exhibition was presented at the Euréka gallery in Chambery (Savoie *département*) for 8 weeks, attracting nearly 4,000 visitors, plus 390 who attended debates and round-tables. Consideration is currently being given to possible changes to the existing exhibition, to make it more adaptable.

For all information concerning the travelling exhibitions: *http://expo.irsn.fr/expo/*

SELECTION OF WEBSITES OF THE VARIOUS STAKEHOLDERS

Below ASN provides a non-exhaustive list of the main websites dealing with nuclear matters:

- **International organisations and bodies**
  - http://ec.europa.eu (site of the European Commission);
  - www.iaea.org (site of the International Atomic Energy Agency);
  - www.icrp.org (site of ICRP, the International Commission on Radiological Protection);
  - www.nea.fr (site of the Nuclear Energy Agency);
  - www.unece.org (site of the UNECE Aarhus Convention on access to information, public participation in decision-making and access to justice in environmental matters);
  - www.unscear.org (site of UNSCEAR - *United Nations Scientific Committee on the Effects of Atomic Radiation*);
  - www.who.int/en (site of the WHO, the World Health Organisation).

- **Government sites**
  - www.debatpublic.fr (site of the National Public Debates Commission: "first off" EPR public debate, Cotentin-Maine VHV line, HLW-LL nuclear waste public debate);
  - www.developpement-durable.gouv.fr (site of the Ministry of Ecology, Sustainable Development, Transport and Housing);
  - www.toutsurlenvironnement.fr/ (Public services environmental information portal);
  - www.statistiques.developpement-durable.gouv.fr (site of the French Environment Institute, statistical department of the Ministry for the Environment);
  - www.industrie.gouv.fr (site of the Ministry for the Economy, Finance and Industry);
  - www.interieur.gouv.fr (site of the Ministry for the Interior, Overseas Territories, Territorial Collectivities and Immigration);
  - www.ladocumentationfrancaise.fr (site of La Documentation française, the reference public documents publishing house);
  - www.legifrance.gouv.fr (site of Légifrance, a public service for online legal publishing, under the editorial responsibility of the Government General Secretariat (SGG);
  - www.sante.gouv.fr (site of the Ministry for Health);
  - www.sites-pollues.developpement-durable.gouv.fr (Polluted sites portal of the Ministry for Ecology, Energy, Sustainable Development, Transport and Housing, dedicated to (potentially) polluted or radiation-contaminated sites and soils (MIMAUSA inventory);
  - www.vie-publique.fr (service provided by La Documentation française as part of its general duty to provide information and documentation about political, economic, social and international current affairs).

- **Parliamentary assemblies (report from the French Parliamentary Office for the evaluation of scientific and technological choices, bills, work done by committees, etc.)**
  - www.assemblee-nationale.fr (site of the National Assembly);
  - www.senat.fr (site of the Senate);
  - www.senat.fr/opecst/(section devoted to the Parliamentary Office for the Evaluation of Scientific and Technological Choices).

- **Health agencies, technical experts and authorities**
  - www.anses.fr (site of the French Agency for Food, Environmental and Occupational Health Safety);
  - www.afssaps.sante.fr (site of the French Health Product Safety agency);
  - www.curie.fr (site of the Institut Curie);
  - www.has-sante.fr (site of the French National Authority for Health);
  - www.ineris.fr (site of the French National Institute for the Study of Industrial Environments and Risks);
  - www.invs.sante.fr (site of the Health Monitoring institute);
  - www.irsn.fr (site of the Institute for Radiation Protection and Nuclear Safety);
  - www.mesure-radioactivite.fr (site of the French national network of environmental radioactivity monitoring: roles, operations, laboratories, etc.).

- **Learned societies and think tanks**
  - www.aidn-sf.org (site of the International Nuclear Law Association (INLA));
  - www.e-cancer.fr (site of the French Health and Scientific Agency for Cancerology);
  - www.sfpm.asso.fr (site of the French Society of Medical Physics);
  - www.sfro.org (site of the French Society for Radiation Oncology (INCa));
  - www.sfrp.asso.fr (site of the French Radiation Protection Society);
  - www.sfr-radiologie.asso.fr (site of the French Radiology Society).

- **Local Information Committees (CLIs), High Committee for transparency and information on nuclear security (HCTISN) and information committees**
  - www.hctisn.fr (site of HCTISN);
  - www.ancli.fr (site of the national association of local information commissions and committees (ANCCLI);
  - www.clis-bure.com (site of the Bure CLIS);
  - www.cli-cadarache.fr (site of the Cadarache CLI);
  - www.cligolfech.org (site of the Golfech CLI);
  - www.cli-gravelines.fr (site of the Gravelines CLI);
  - www.commission-hague.org (site of the La Hague CLI);
  - www.cli-gard-marcoule.fr (site of the Marcoule CLI);
  - www.seiva.fr (site of the Valduc Seiva).

• **Patients associations**
  – www.hesperios.org (site of Hesperios, an association for people who have lost someone close as a result of a medical accident);
  – www.leciss.org (site of the CISS, Collectif Inter associatif Sur la Santé (inter-associations health collective));
  – www.aviamfrance.org (Association for help to victims of medical accidents and their families);
  – www.ligue-cancer.net (The Ligue Contre le Cancer is a private and independent source of funding for cancer research in France).

• **Higher education establishments and research centres (engineering colleges, universities, university hospitals, etc.)**
  – www.ensi-bourges.fr (site of the Bourges École nationale supérieure, offering a specialised Masters' degree in nuclear safety and security);
  – http://graduateschool.paristech.org (site of the École Nationale Supérieure des Arts et Métiers ENSAM, offering a specialised Masters' degree in nuclear safety);
  – www.mines.net (site for the four engineering schools of Albi, Alès, Douai, Nantes with those of Nancy, Paris and Saint-Etienne, constituting the Groupe des écoles des mines (GEM);
  – www.polytechnique.fr (site of the École Polytechnique);
  – www.ujf-grenoble.fr (site of Joseph Fourier University in Grenoble, offering a Masters' degree in Engineering, Traceability, Sustainable Development, nuclear safety specialisation).

• **Professionals**
  – www.afppe.net (site of the French Association of Electroradiology paramedical staff);
  – http://aftmn.free.fr (site of the French Association of Nuclear Medicine Technicians AFTMN);
  – www.polenucleairebourgogne.fr (site of the Burgundy companies, research centres and training centres cluster).

• **Scientific popularisation**
  – www.laradioactivite.com (general public science information site produced by CNRS researchers and CEA engineers);
  – http://fr.wikipedia.org/wiki/Accueil (site of the Wikipedia on-line encyclopaedia, created in 2001. It is multilingual, freely accessible and written by web users).

• **Associations**
  – www.acro.eu.org (site of the Association for the Control of Radioactivity in the West, "ACRO");
  – www.cepn.asso.fr (site of the Nuclear Protection Evaluation Centre);
  – www.criirad.com (site of the Committee for Independent Research and Information on Radioactivity);
  – www.dissident-media.org/infonucleaire;
  – www.ecolo.org (site of the "Association of Ecologists for Nuclear Power", AEPN);
  – www.fne.asso.fr (site of the French federation of nature and environmental protection associations);
  – www.global-chance.org (site of the "Global Chance" association);
  – www.greenpeace.org/france (site of Greenpeace);
  – http://nucleaire-nonmerci.net;
  – http://resosol.org/Gazette (The GSIEN Gazette, a publication of the Group of Scientists for Information on Nuclear Energy);
  – www.robindesbois.org (site of the "Robin des bois" association);
  – www.sfen.fr (site of the French Nuclear Energy Society);
  – www.sortirdunucleaire.org (site of the "Sortir du nucléaire" association).
  – www.wise-paris.org (Wise site).

• **Licensees (industry and research organisations)**
  – www.andra.fr (site of the National Agency for Radioactive Waste Management);
  – www.dechets-radioactifs.com (educational site on radioactive waste published by ANDRA)
  – www.areva.com (official site of the AREVA group);
  – www.areva-nc.fr (formerly COGEMA);
  – www.areva-np.com (formerly Framatome-ANP, manufacturer of the French nuclear reactors);
  – www.cea.fr (site of CEA - the French Alternative Energies and Atomic Energy Commission);
  – http://france.edf.com (official site of EDF);
  – www.in2p3.fr (site of the National Institute for Nuclear Physics and Particle Physics);
  – www.iter.org (site of the international ITER project).

• **Trade union**
  – www.fnem-fo.org (site of the national energy and mines federation - FO).

3 OUTLOOK

Informing the public about nuclear safety and radiation protection is one of ASN's fundamental roles. This role was conferred on ASN from its inception, and was reinforced by the Act of 13th June 2006 relative to transparency and safety in the nuclear field. The Act, which makes it a duty for ASN to inform the public, defines transparency in the nuclear field as "all the measures taken to guarantee the public's right to reliable and understandable information concerning nuclear safety".

This duty to inform takes the form of numerous actions carried out at international, national and regional level. These actions are characterised by the multitude and diversity of the themes developed, of the audiences targeted (general public, media, institutional and professional audiences), and of the information means used (press relations, events, publications, Internet, etc.).

In 2012, ASN will continue to enhance transparency and information on the subjects under its responsibility, together with the other players and stakeholders.

It aims to make technical information more accessible and comprehensible to the general public.

It will improve its publications in order to more closely match the expectations of the audiences and will release more informative and educational videos on its website.

ASN will also continue to consult the public by means of online channels.

Developing exchanges with elected officials and stakeholders will also be one of the focal points of its public information actions.

In 2012, ASN will also continue actions to develop application of the requirements of the TSN Act concerning licensee transparency and procedures relating to nuclear activities.

It will contribute to the revision of the procedures for public consultation – where nuclear activities are concerned – provided for in the act on the national environment commitment ("Grenelle 2" Act): this chiefly concerns reforming the public inquiries and the institutionalisation, further to an ASN proposal, of a procedure for consulting the public about projects that could lead to a significant increase in water intake or discharges into the environment from a BNI, but which does not fall under the public inquiry procedure.

ASN will continue to ensure correct application of the provisions concerning access to the information in the possession of the BNI licensees, and the recent extension of these provisions to cover those in charge of the main radioactive material transport operations. It will initiate consultation with a view to applying these arrangements, as stipulated by the Act, to other nuclear activity categories with an impact on the public and the environment.

Finally, ASN will continue to support CLI activities. With ANCCLI and in agreement with the licensees, it will establish rules of good practice to make it easier for the CLIs to perform their duties. It will reiterate its proposals to the Government with a view to ensuring that the CLIs are given the resources they need.

INTERNATIONAL RELATIONS

1 **ASN OBJECTIVES IN EUROPE AND WORLDWIDE** 183

1|1 Action in Europe

1|2 Harmonisation of nuclear safety worldwide

1|3 Assistance requests

2 **EUROPEAN UNION AND MULTILATERAL RELATIONS** 185

2|1 European Union

2|1|1 The Euratom Treaty

2|1|2 The European Nuclear Safety Regulators Group (ENSREG)

2|1|3 The European Directive on the Safety of Nuclear Installations

2|1|4 The European directive on the management of waste and spent fuel

2|1|5 The European working groups

2|1|6 The Western European Nuclear Regulators Association

2|1|7 Association of the Heads of the European Radiological Protection Competent Authorities (HERCA)

2|1|8 ASN participation in the Euratom 7th framework R&D programme

2|1|9 Multilateral assistance actions

2|2 The International Atomic Energy Agency (IAEA)

2|3 OECD's Nuclear Energy Agency (NEA)

2|4 *Multinational Design Evaluation Program (MDEP)*

2|5 The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

2|6 The International Nuclear Regulators' Association (INRA)

2|7 The Association of Nuclear Regulators of Countries Operating French Designed Nuclear Power Plants (FRAREG)

2|8 The European ALARA Network and the European Radiation Protection Authorities Network

3 **BILATERAL RELATIONS** 195

3|1 Staff exchanges between ASN and its foreign counterparts

3|2 Bilateral cooperation between ASN and its foreign counterparts

3|3 ASN bilateral assistance

4 **INTERNATIONAL AGREEMENTS** 201

4|1 The Convention on Nuclear Safety (CNS)

4|2 The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

4|3 The Convention on Early Notification of a Nuclear Accident

4|4 The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency

4|5 Other conventions linked to nuclear safety and radiation protection

5 **INTERNATIONAL CONFERENCES** 203

6 **OUTLOOK** 204

CHAPTER 7

The range of nuclear installations regulated by ASN is one of the world's largest and most diverse. ASN therefore devotes considerable efforts to international relations with its foreign counterparts.

ASN's international actions are built around a clear legal framework. The TSN Act (now codified in parts 1 and V of the Environment Code by ordinance 2012-6 of 5th January 2012) states in article 9 that "*ASN sends the Government its proposals to define the French position in international negotiations in the fields of its competence*" and that "*it participates, on request by the Government, in the French representation in the bodies of international organisations and of the European Communities competent in these fields*". Finally, the article states that "*To implement international agreements or European Union regulations relative to radiological emergency situations, the Nuclear Safety Authority is empowered to warn and inform the authorities of third States or to receive their warnings and information*". These legislative arrangements underpin the legitimacy of ASN's international actions.

ASN is thus required to devote considerable resources to cooperative work, both within multilateral and EU bodies, and as part of bilateral relations with its foreign counterparts, with the aim of contributing to strengthening the culture of safety and radiation protection around the world and of becoming recognised as an "international benchmark".

2011 was naturally a particular year for ASN from this viewpoint, given the extent to which the Fukushima Daiichi disaster dominated the European and international scene from the moment it began on 11th March 2011, and subsequently dictated the agendas of the international organisations. As we will see in this chapter, ASN has devoted much time and effort to considering the changes to be made to the international safety and radiation protection framework and, within its areas of competence, played in full its role as consultant to the Government on these subjects.

1 ASN OBJECTIVES IN EUROPE AND WORLDWIDE

1|1 Action in Europe

Europe is the main focus of international action by ASN, which thus aims to contribute to building a Europe that is at the forefront of nuclear safety, the safe management of waste and spent fuel and radiation protection.

WENRA (Western European Nuclear Regulators' Association), an informal club created in 1999 at the initiative of the ASN Chairman, continued its work in 2011 to harmonise reactors and waste management facility safety rules. At the invitation of the European Council on 24th and 25th March 2011 and as part of the post-Fukushima actions, WENRA played a vital role in defining the specifications for the stress tests to be performed on the European nuclear reactors.

ENSREG (European Nuclear Safety Regulators' Group) which since 2008 has been a forum for the safety regulators of the European Union (EU) and the European Commission, also played its role in launching the European stress tests, in close collaboration with WENRA, fine-tuning the WENRA specifications and formally adopting them on 25th May 2011. ENSREG, which had worked hard to create a consensus on European nuclear safety directives and then on waste and spent fuel management, had the satisfaction of seeing these texts adopted by the EU Council of Ministers in June 2009 and July 2011 respectively.

In the field of radiation protection, the work done by the Heads of European Radiological Protection Competent Authorities (HERCA) continued. The progress achieved by this association, since it was created in 2007, is considerable and thus helps to ensure that this association is a key player in radiation protection in Europe. The repercussions of the Fukushima Daiichi accident were incorporated into the work done by HERCA (see point 2|1|7).

Within the European bilateral framework, ASN has maintained close relations with the main countries equipped with nuclear reactors or wishing to acquire them, but also devoted itself to relations with countries such as Ireland and Norway, who are interested in radiation protection and emergency management issues in particular. It also pays particularly close attention to relations with France's neighbours.

1|2 Harmonisation of nuclear safety worldwide

Outside Europe, a large number of initiatives have been taken to harmonise nuclear safety practices and regulation.

Within the International Atomic Energy Agency (IAEA), ASN plays an active part in the work of the Commission on Safety Standards (CSS) which drafts international standards for the safety of nuclear installations, waste management, the transport of radioactive materials and radiation protection. Although not legally binding, these standards do constitute an international reference, including in Europe. They are also the documentary reference standards for the international audits overseen by the Agency. These in particular include the safety regulator

Table 1: table of areas of competence of the main civil nuclear activity regulating authorities*

Country / Safety authority	Status			Activities						
	Administration	Government agency	Independent agency	Safety of civil installations	Radiation protection			Safety (protection against vandalism and malicious acts)		Transport safety
					BNI	Other installations	Patients	Sources	Nuclear materials	
Europe										
Germany/ BMU + Länder	•			•	•	•	•	•	•	•
Belgium/ AFCN		•		•	•	•	•	•	•	•
Spain/ CSN			•	•	•	•	•	•	•	•
Finland/ STUK		•		•	•	•	•	•		•
France/ ASN			•	•	•	•	•	•***		•
United Kingdom/ HSE/ND		•		•	•			•	•	•
Sweden/ SSM		•		•	•	•	•	•	•	•
Switzerland/ ENSI			•	•	•				•	•
Other countries										
Canada/ CCSN			•	•	•	•	•	•	•	•
China/ NNSA	•			•	•	•		•	•	•
Korea/ NSSC		•		•	•	•			•	•
United States/ NRC			•	•	•	•	•	•	•	•**
India/ AERB		•		•	•	•	•	•	•	•
Japan/ NISA + NSC + MEXT	•			•	•	•	•	•	•	
Russia/ Rostekhnadzor	•			•	•			•	•	•

* This table gives a schematic, simplified representation of ASN's current knowledge of the main areas of competence of the entities (administration, government agency or independent agency) responsible for regulating nuclear activities in the world's leading nuclear countries.

** Domestic transport only.

*** The certification process is underway.



Working session at the regional workshop organised at ASN from 14th to 18th November 2011, on the evaluation and effectiveness of regulatory bodies in preparation for hosting an IRRS mission

assessment missions (IRRS, Integrated Regulatory Review Service) the development of which is supported by ASN. In 2011, IAEA was the main forum for debate on the inclusion in international standards and practices of the first lessons learned from the Fukushima Daiichi accident.

The Multinational Design Evaluation Programme (MDEP) was launched several years ago by the U.S. Nuclear Regulatory Commission (NRC) and ASN, with the aim of joint evaluation of new reactor design. It then expanded its scope to take in numerous partners from around the world. The initiative eventually aims to harmonise the safety objectives, the codes and the standards associated with the safety analysis of a new reactor. Its secretariat was entrusted to the OECD's Nuclear Energy Agency (NEA) and it is chaired by the ASN Chairman.

1|3 Assistance requests

ASN analyses the nuclear safety situation in each country that contacts it for assistance with regulatory infrastructure and the regulation of safety.

In 2011, ASN continued to receive numerous requests from countries heavily engaged for the first time in a nuclear power programme as well as from countries simply wishing to know what actions would be necessary in the area of safety if they were to choose this energy source. These queries were however fewer in number than in previous years, owing to the Fukushima Daiichi accident, which focused attention on nuclear safety and how to reinforce international safety standards.

ASN, in line with its policy, responds to requests as part of its bilateral actions or via instruments that are either European (EU Instrument for Nuclear Safety Co-operation) or international (IAEA's Regulatory Cooperation Forum). The purpose of this cooperation is to enable the countries in question to acquire the safety and transparency culture essential to a national system of nuclear safety and radiation protection regulation that will guarantee effective protection of people and the environment.

2 EUROPEAN UNION AND MULTILATERAL RELATIONS

2|1 European Union

The Treaty setting up the European atomic energy community (Euratom) and the laws derived from it, together with the work of WENRA, ENSREG and HERCA, today place the European Union at the very heart of regulatory work on nuclear safety and radiation protection. It was the reactivity of WENRA and ENSREG that enabled the EU to launch the European nuclear power reactor stress tests rapidly and effectively. This exercise is the only one of its kind in the world.

2|1|1 The Euratom Treaty

The Euratom Treaty enabled harmonised European development of a strict system of regulation of nuclear safety (chapter 7) and radiation protection (chapter 3). In an Order of 10th December 2002 (aff. C-29/99 Commission of European Communities against Council of the European Union), the European Court of Justice, ruling that no artificial boundary could be established between radiation protection, covered by chapter 3, and nuclear safety, recognised the principle of the existence of community competence in the field of nuclear safety, as well as in that of management of radioactive waste and of spent fuel. ASN actions at the European level are aimed at developing this new field of community competence, although of course without forgetting radiation protection activities.

2|1|2 The European Nuclear Safety Regulators' Group (ENSREG)

At the invitation of the European Council in March 2007, a "High-Level Group" (HLG) on nuclear safety and waste management, subsequently renamed ENSREG, was created in 2008. ASN, which believes that nuclear safety principles and standards must be harmonised throughout Europe, is participating actively in this work in order to strengthen the extent to which nuclear safety and the safe management of radioactive waste and of spent fuel are taken into account in Europe. The ASN Chairman is a member of ENSREG. Three working groups were created, devoted to the safety of installations, to the safe management of radioactive waste and of spent fuel, and to transparency in the nuclear sector.

ENSREG was a key player in Europe's adoption of a first directive on the safety of nuclear installations. The consensus

arrived at by its members regarding the broad outlines of such legislation helped to relieve the tensions that arose from an initial Commission proposal in 2003 and to ensure that the directive was passed in June 2009.

In 2011, ENSREG observed that the work it had done to identify the main guidelines of a regulatory text on the safe management of radioactive waste and spent fuel had produced results, and in July 2011, a directive on this topic was formally adopted by the EU Council of Ministers (see chapter 16).

ENSREG also held its first European Conference on Nuclear Safety on 28th and 29th June 2011.

Of particular importance is that, at the request of the European Council on 24th and 25th March 2011, and together with WENRA, ENSREG on 25th May 2011 validated the specifications for the European stress tests. Through this agreement, the 14 European countries with nuclear reactors in operation undertook to examine these reactors in the light of the events that occurred at Fukushima Daiichi, using identical analysis criteria. On 11th October 2011, ENSREG also validated the second and essential phase of the European stress tests, in other words the peer review, which will run from January to April 2012. The members of ENSREG created a "Council" consisting of qualified personalities, to oversee this exercise, and appointed Philippe Jamet, a former director of nuclear safety at IAEA and now an ASN commissioner, as Chair.

2|1|3 The European Directive on the Safety of Nuclear Installations

The debate initiated in November 2008, under the French presidency of the EU, on a directive "establishing a Community framework for the nuclear safety of nuclear installations"(2009/71/EURATOM) continued until June 2009, when the Czech presidency of the EU concluded the debate on this important directive. The EU therefore now has a regulatory framework for nuclear safety enshrined in community law. In particular, the directive obliges all EU member States (present and future) to develop a legislative framework for nuclear safety (Article 4) and to set up an independent regulatory authority (Article 5). It also defines the obligations of nuclear installation licensees (Article 6), stresses the question of the availability of skills and expertise (Article 7) and public information (Article 8). It further makes provision for a "peer review" system (Article 9) which, in accordance with the principles of nuclear safety, allows "continuous improvement" of practices in this field.

This regulatory text is of great importance in that it finally puts an end to an absurd situation in which there was no European legislation on nuclear safety even though the EU, with the Euratom Treaty, has enjoyed the most advanced nuclear legislation for more than 50 years and counts nearly 150 nuclear reactors within the borders of its 27 member states. The text has the additional advantage of making its requirements legally binding under the legislation of the 27 member states.

This directive should also undergo a number of changes following the events at Fukushima. The European Council of 24th and 25th March 2011 did not only ask WENRA and ENSREG to set up the architecture for the European stress tests. It also asked the European Commission to consider the necessary changes to the European nuclear safety framework. In its communication of 23rd November 2011, the Commission gave an initial review of the safety assessments carried out in the EU member States and identified the first areas for improvement, in particular amendments to the "nuclear safety" directive. It in particular emphasises the possible improvements in terms of the independence of the safety regulators, transparency, the drafting of European safety standards, and so on. The Commission takes the opportunity to add that the "nuclear safety" directive, as adopted in June 2009, has still not been transposed by 13 member States of the EU, even though this transposition should have been completed no later than July 2011.

2|1|4 The European directive on the management of waste and spent fuel

On 19th July 2011, the Council of the European Union adopted a directive "establishing a community framework for the responsible and safe management of spent fuel and radioactive waste" (directive 2011/70/Euratom). Two years after the adoption of the directive on nuclear safety, the adoption of this directive is an important event and makes a contribution to reinforcing nuclear safety within the European Union, while enhancing the accountability of the member States with regard to the management of their radioactive waste and spent fuels.

This directive is legally binding and covers all aspects of the management of radioactive waste and spent fuel, from production up to long-term disposal. It recalls the prime responsibility of the producers and the ultimate responsibility of each Member State for ensuring the management of the waste produced on its territory, ensuring that the necessary steps are taken to guarantee a high level of safety and to protect the workers and the public from the dangers of ionising radiation.

It clearly defines obligations concerning the safe management of radioactive waste and spent fuel and requires each Member State to adopt a legal framework covering safety issues, stipulating:
- the creation of a competent regulatory authority with a status such as to guarantee its independence from the producers of waste;
- the creation of authorisation and licensing procedures, with authorisation applications being examined on the basis of safety demonstrations by the licensees.

The directive covers the drafting of national radioactive waste and spent fuel management policies to be adopted by each Member State, in particular specifying that each Member State must adopt a legislative and regulatory framework designed to implement national radioactive waste and spent fuel management programmes. The directive also contains requirements concerning transparency and the participation of the public, the financial resources for managing radioactive waste and spent fuel, training and regular self-assessments and peer-reviews. It officially determines the ultimate responsibility of each Member State for management of its radioactive waste and specifies the possibilities with regard to export for disposal of this waste.

These aspects therefore constitute significant steps forward in reinforcing the safe and responsible management of radioactive waste and spent fuel in the European Union.

TO BE NOTED IN 2011

First European Conference on nuclear safety

Nearly 400 people (safety regulators, nuclear licensees, international organisations, European Commission, NGOs, etc.) met in Brussels for the first European Conference on nuclear safety, organised by ENSREG on 28th and 29th June 2011. This event was an opportunity to review the efforts of WENRA and ENSREG to reinforce nuclear safety and waste management in Europe.

A round-table to discuss the follow-up to the Fukushima Daiichi accident, chaired by André-Claude Lacoste, vice-Chair of the conference and Chairman of ASN, provided an opportunity for the Chairman of the American NRC, Gregory Jaczko, the Director General for Energy of the European Commission, Philip Lowe, Jan Haverkamp of Greenpeace, and Laurent Stricker, the Chairman of the World Association of Nuclear Operators (WANO), to present their views of the lessons to be learned from this nuclear accident.

In concluding this conference, André-Claude Lacoste declared this first edition to be a success. He stated that he believed a common vision of nuclear safety is beginning to take shape in Europe. It is built around the technical work done by WENRA, its adoption by ENSREG, and its transposition into legislative proposals by the European Commission.

André-Claude Lacoste also stressed the challenges facing Europe in the coming months; after having defined European stress test specifications in a very short period of time, these safety assessments now have to be carried out within a time-frame compatible with public expectations.

The momentum thus created must lead to reform of the European regulatory framework for nuclear safety, as requested by the European council on 25th March 2011. Initiatives should be initiated for promotion of safety objectives for the new reactors, management of emergency situations, transparency, improvements to the nuclear safety directive and the independence of the safety regulators.

André-Claude Lacoste finally expressed his desire to see Europe become an audible and credible proactive source of ideas and proposals on the international stage.

2|1|5 The European working groups

ASN also participates in the work of the Euratom Treaty committees and working groups:
– scientific and technical committee (STC);
– Article 31 experts group (basic radiation protection standards);
– Article 35 experts group (checking and monitoring radioactivity in the environment);
– Article 36 experts group (information concerning regulation of radioactivity in the environment);
– Article 37 experts group (notifications concerning radioactive effluent discharges).

The activities of the article 31 Committee in the first half of 2011 concerned the allowable activity levels in foodstuffs and cosmetic products, as well as monitoring the contamination of containers and goods. The new dose limit for the lens of the eye published by the ICRP was also covered, with a view to preparation of a position statement aiming to include it in the Euratom BSS. In the second half of the year, a seminar was devoted to individual radiosensitivity.

In June 2011, ASN took part in a European Commission verification and examination mission to the CEA site in Cadarache. This purpose of this mission, conducted under article 35 of the Euratom Treaty, was to check the working and the efficiency of the installations necessary for permanent monitoring of the level of radioactivity in the atmosphere, water and soil, and to check compliance with the basic standards for health protection of the general public and workers against the hazards of ionising radiation. Following the verification and examination carried out, the Commission considered that France meets in full its obligations under article 35.

Among the European legislative proposals currently being examined in Brussels, one should also note the "drinking water" directive proposal, officially adopted by the European Commission on 27th June 2011. This proposal, which sets requirements for protection of the health of the general public with regard to radioactive substances in water intended for human consumption, is also being debated by the EU Council of Ministers and the European Parliament. Once again, with respect to this text, ASN is one of the Government's main advisers.

In 2011, even more so than in 2010, ASN enjoyed particularly close relations with the European institutions. ASN's Chairman, André-Claude Lacoste, had many contacts with the European Parliament in early 2011, to inform the Members of the European Parliament of the activities of WENRA, particularly with regard to the safety objectives for the new reactors, drafted by the association. After the Fukushima Daiichi accident, there were several contacts, jointly with other European safety regulators and with the Energy commissioner Günter Oettinger, in order to establish the European stress tests as efficiently and credibly as possible. The number of ENSREG meetings and exchanges with France's permanent Representation to the European institutions increased significantly.

2|1|6 The Western European Nuclear Regulators Association

WENRA was officially created in February 1999, the founding members being the heads of the nuclear regulatory bodies of Belgium, Finland, France, Germany, Italy, Netherlands, Spain, Sweden and the United Kingdom, joined a little later by Switzerland. The ASN Chairman was its first Chair for four years. Ms Judith Melin (Sweden) succeeded him from 2003 to 2006, followed by Ms Dana Drabova (Czech Republic) from 2006 to 2009.

Jukka Laaksonen (Finland), who was Chair until the end of 2011, was then replaced by Hans Wanner, Head of the Swiss regulatory body.

Since 2003, the heads of the regulatory bodies of Bulgaria, the Czech Republic, Hungary, Lithuania, Romania, Slovakia and Slovenia have become members of the association.

In 2009, the heads of the regulatory bodies of the ten countries which do not have a NPP were, at their request, invited to take part in the association's meetings, in the capacity of observers.

The objectives defined by the WENRA members when the association was created are:
– to provide the European Union with an independent appraisal capability for examining the issues of nuclear safety and its regulation in the countries applying for membership of the European Union;
– to develop a common approach to nuclear safety and regulation, in particular within the European Union.

The first of these tasks was successfully completed during the EU enlargements of 2004 and 2007.

With regard to the second task (harmonisation of national approaches to safety), WENRA has created two working groups:
– the nuclear power reactors group which, after being headed by an ASN Deputy Director General, is now chaired by Finland;
– the group dealing with spent fuel and radioactive waste management and decommissioning operations, which is chaired by a senior member of the Swiss regulatory body.

In each of these fields, the groups began by defining the reference levels for each technical topic, based on IAEA's most recent standards and on the most demanding approaches employed within the European Union and therefore, for all practical purposes, in the world.

In 2006, the members of WENRA developed national action plans for power generating reactors, designed to ensure that for all technical areas in which differences had been identified,

TO BE NOTED IN 2011

The European "basic standards" directive

On 20th September 2011, the Commission officially adopted a directive proposal setting out basic standards for health protection against the hazards resulting from exposure to ionising radiation. This is now being submitted to the Council of Ministers of the European Union and to the European Parliament.

This proposed directive incorporates five existing directives (transposed into national law) into the same text and updates the provisions of directive 96/29/Euratom, taking account of the current state of scientific and technical knowledge and the recommendations of the International Commission on Radiological Protection (ICRP) of December 2007. This draft text is also consistent with IAEA's new basic safety standards (BSS) adopted by the Board of Governors (publication in progress).

The community texts to be abrogated by the proposed directive are:
- *Directive 96/29/Euratom laying down basic standards for the protection of the health of workers and the general public against the dangers arising from ionising radiation;*
- *Directive 89/618/Euratom on informing the general public about health protection measures to be applied and steps to be taken in the event of a radiological emergency;*
- *Directive 90/641/Euratom concerning the operational protection of outside workers exposed to the risk of ionizing radiation during their activities in controlled areas;*
- *Directive 97/43/Euratom on health protection of individuals against the dangers of ionizing radiation in relation to medical exposure*
- *Directive 2003/122/Euratom on the control of high-activity sealed radioactive sources and orphan sources.*

The new proposed directive also includes new elements, in particular protection of the environment, protection from natural radiation (radon) and protection from radiation from building materials, and measures for emergency situations.

For information, ASN in 2010 initiated widespread consultation with stakeholders on a draft directive on basic safety standards for radiation protection (BSS Euratom), placed online on the European Commission's website. Following this consultation exercise, ASN forwarded proposals to the government with the aim of preparing the position that France would maintain within the Atomic Questions Group during the discussion to come in 2011. Since the beginning of the debates at the Council of Ministers on this new text, ASN, together with other French authorities, has been an active participant in the negotiations.



WENRA Publication – March 2011

national practices were brought into line with the reference levels defined in 2005. The members had set themselves the target of reaching a harmonised situation by 2010. A significant effort was made by the regulatory bodies of the countries concerned – in France, the BNI order published on 7th February 2012 extensively draws on the results of the work done by WENRA and the practices in force are therefore to a large extent in conformity with these reference levels – and the reference levels "transposition" work is continuing.

In 2008, in addition to continuing the work already under way, the association launched new work to harmonise safety objectives for new reactors. The resulting report was adopted by a consensus of WENRA members in November 2010. Discussions are continuing on the topic, to develop more detailed objectives.

WENRA has also begun to consider the issue of the safety of research reactors and the extension of reactor operation. In 2010, the association amended its statutes to take on an international role and to be able to better associate safety authorities from non-members of the EU. Thus, in 2011, the regulatory bodies of Russia and Ukraine took part in WENRA meetings, as observers.

However, in 2011, WENRA's major contribution will have been the drafting, as requested by the European Council of March, of the specifications for the stress tests to be run on the European nuclear power reactors. As early as its meeting on 22nd and 23rd March 2011, the ASN Chairman, jointly with all members of WENRA, stated that the association should become increasingly proactive in Europe. Specifications were drafted for assessing the safety margins of Europe's nuclear power reactors in the light of the events of Fukushima. WENRA followed the process defined for this by the European Council and forwarded these draft specifications to ENSREG, for discussion and adoption, in early May.

If WENRA had not been in operation for many years and if the level of trust created thanks to this association of European regulatory bodies had not been created, a result such as this – it is worth remembering that this entailed nothing less than running complementary safety assessments in 14 countries using the same methodology – would have been impossible.

Finally, it is worth noting that in 2011, as in the past, ASN used its network of WENRA and ENSREG correspondents to ensure rapid and harmonised information of all its European partners concerning the events that occurred in France, for example the accident at CENTRACO on 12th September 2011 (see chapter 16), which, in the post-Fukushima context, attracted considerable media interest from around the world.

2|1|7 Association of the Heads of the European Radiological Protection Competent Authorities (HERCA)

The existence of a European regulatory base for radiation protection, leaving each country a certain freedom of movement in interpreting and applying European rules in their national legislation, has led to differing transpositions in this field resulting, in certain cases, in significant discrepancies. For example, this has resulted in protection measures for the general public that differ between neighbouring countries in the event of a nuclear accident and in different protection measures for workers travelling between neighbouring countries.

ASN is convinced that if progress is to be made on harmonisation in Europe, in particular on the topic of radiation protection, close collaboration is needed between the heads of

European authorities regulating radiation protection, as is already the case for nuclear safety. This is why, in 2007, taking WENRA as an example, HERCA, the Heads of European Radiological Protection Competent Authorities, was created at the initiative of ASN. The association set itself the goal of increasing European cooperation on radiation protection matters. Four years later, the HERCA association has become a key radiation protection player in Europe, and can already claim tangible progress in the harmonisation of regulations and practices.

At present, 46 radiological protection competent authorities from 28 European countries are members of HERCA. In some countries, the regulation of radiation protection is entrusted to several Authorities. The association is working together with the European Commission on harmonising radiation protection practices.

Five working groups were set up to deal with the following topics:
– outside workers and the dosimetric passport;
– justification and optimisation of the use of sources in the non-medical field;
– medical applications;
– preparation and management of emergency situations;
– collective doses from medical exposures.

ASN is represented in all the working groups and chairs the WG on the use of sources in the non-medical field. ASN is also the general secretary of the association.

Following the Fukushima accident, a joint declaration reiterated the vital need for a common understanding and a common approach to emergency planning in Europe, as well as the importance of learning the immediate and long-term lessons of this accident. These lessons will be taken into account in future HERCA work in this field.

In 2011, the seventh and eighth meetings of the HERCA Board of Heads were held. On 30th June, the Belgian federal nuclear regulatory agency (AFCN) hosted the seventh meeting of the HERCA association under the chairmanship of Ole Harbitz (Director General of the Norwegian authority), and 42 representatives from 25 countries examined the results of the work done by the five HERCA working groups. A high-level representation from the European Commission was also present. The meeting was also an opportunity to discuss the association's role in the preparedness for and management of emergency situations, following the Fukushima Daiichi accident.

At this meeting, the following were approved:
– a practical guide to protection measures in the nuclear accident emergency phase;
– a new mandate for the emergency situations working group. This includes a search for practical and operational solutions for uniform management of a nuclear accident. This mandate also includes identification of the priority steps to be taken for improved harmonisation of actions and decisions taken in Europe in the event of an accident occurring in a non-European country;
– a joint declaration in favour of European harmonisation of regulations concerning light bulbs containing small quantities of radioactive material.

The eighth meeting of HERCA was held on 8th December 2011 in Berne, Switzerland, at the invitation of the Swiss federal office of public health. A new action plan for the emergency group was approved. It now focuses on two types of accidents: accidents occurring in a European country and accidents occurring in countries far from Europe. In this latter case, the aim is to identify the most pressing needs in order to increase the harmonisation of the reactions by the European countries and to propose practical solutions for meeting these objectives. The work should be completed by the end of 2012. At the same time, HERCA will aim to propose operational recommendations to provide the same level of protection for the general public around the site of a severe accident, whichever country is concerned. The European Commission intends to closely monitor this work, which could be incorporated into its future recommendations to improve preparedness for emergency situations in Europe. In this context, a communication system is currently being set up between the HERCA member countries and the European Commission. To avoid other bodies duplicating this work, HERCA took steps to boost coordination with other organisations (e.g. NEA) concerning post-Fukushima aspects.

This eighth meeting of HERCA was also an opportunity to approve a format for a European card to be used for patients who have undergone treatment with iodine 131 and to update the dosimetry passport model, taking account of the comments received by the stakeholders as a result of the 2010 consultation.

2|1|8 ASN participation in the Euratom 7th framework R&D programme

In 2011, and for the first time, ASN became a partner in a European project, the TRASNUSAFE project of the Euratom 7th framework research and development programme.

The purpose of this three-year project is to design, develop and test training programmes to develop the nuclear safety culture, including ALARA (As Low As Reasonably Achievable) aspects, within a European approach.

ASN, represented by the International Relations Department, took part in 2011 in Working Package no.2, entitled "Relationship between radiation protection and ALARA, and safety culture".

2|1|9 Multilateral assistance actions

After the Chernobyl disaster of 26th April 1986 and the fall of the Soviet bloc, the G7 Summit, held in Munich in July 1992, defined three priority areas for assistance with nuclear safety for eastern European countries:
– contribution to improving the operating safety of existing reactors;
– provision of funding for short-term improvements to the least safe reactors;
– improvement in the organisation of safety regulation, making a clear distinction between the responsibilities of the different entities concerned and reinforcing the role and scope of local nuclear regulatory bodies.

The assistance programmes introduced initially by the European Commission (PHARE and TACIS) were succeeded in 2007 by the Instrument for Pre-accession Assistance (IPA) and the Nuclear Safety Co-operation Instrument (NSCI), extending to all countries of the world without geographical limit.

The European Commission set up the Regulatory Assistance Management Group (RAMG) to collect opinions and advice concerning the assistance requests submitted by third party countries. The nuclear safety and radiation protection regulatory bodies of the countries of the European Union, including ASN, are members of the group. In 2011, the Commission proposed changes to this form of governance and asked ASN what it believed would be the most appropriate solution. In the same way as the other regulatory bodies, ASN supported an arrangement which would give greater weight to ENSREG, which is now clearly the most legitimate institutional representative within the EU on questions of nuclear safety.

As for the concrete assistance provided by ASN via the ICSN, this primarily took the form of help to national regulatory bodies with regard to nuclear safety. In 2011, it took part in regulatory assistance projects in Egypt, Jordan, Morocco, Ukraine and Vietnam.

These actions are supplemented by other international technical assistance programmes, in accordance with resolutions adopted by the G8 (G7 extended to include Russia), or those run by IAEA, to improve nuclear safety in third party countries, and which are financed by contributions from donor States and the European Union.

ASN is thus a participant in the expert groups reporting to the European Bank for Reconstruction and Development (EBRD), responsible for managing multilateral funds to finance the following actions:
– delicensing of nuclear reactors in Bulgaria (Kozloduy 1 to 4), Lithuania (Ignalina 1 & 2), and Slovakia (Bohunice V1 1 & 2);
– installation of a new containment dome for Chernobyl Reactor No. 4, the origin of the April 1986 disaster, and construction of interim storage and treatment installations for the spent fuel and waste still present on the site;
– dismantling of decommissioned Russian nuclear submarines and radiological clean-out of the White Sea naval bases.

Lastly in the area of nuclear safety, ASN advises the French delegation to the Nuclear Safety and Security Group (NSSG) of the G8[1], chaired in 2011 by France.

On this point, 2011 was for France a particular one because, during its Presidency of the G8 and G20, it had to deal with the events of Fukushima Daiichi. The debates during the first NSSG meeting, on 23rd and 24th March, were marked by the accident which had just happened in Japan. Two further meetings were held, still in Paris, on 2nd and 3rd May and again on 17th and 18th October.

Within this forum, ASN fully assumed its role as adviser to the Government, working with the Ministry for Ecology, Sustainable Development, Transport and Housing (MEDDTL) and the Ministry for Foreign and European Affairs (MAEE) on the drafting of an NSSG declaration, which subsequently constituted the basis of the Deauville declaration at the G8 meeting of 26th and 27th May 2011. This declaration, which stresses how important it is for the nuclear countries to carry out the complementary safety assessments, to submit them to peer review and to revise the international conventions on nuclear safety wherever necessary, was a clear political signal sent out by these eight countries to the international community and to the IAEA.

2|2 The International Atomic Energy Agency (IAEA)

The International Atomic Energy Agency (IAEA) is a United Nations organisation based in Vienna, Austria. In December 2011, it comprised 154 member States. IAEA activities fall into two main categories: on the one hand, monitoring of nuclear materials and non-proliferation and, on the other, civil nuclear energy. In this latter area, two aspects are covered, with one IAEA department in charge of developing and promoting nuclear energy and another department in charge of the safety and security of nuclear facilities, with 220 staff, run by a French representative, the deputy director general of the IAEA, Denis Flory, appointed in September 2010.

Against the backdrop of the Fukushima Daiichi accident, IAEA organised a ministerial level conference from 20th to 24th June. The first day of this conference brought together numerous ministers from the IAEA member countries, while the following four days saw meetings of the heads of the regulatory authorities of these countries. This event was organised into four sessions, one of which was chaired by the ASN Chairman. It defined the bases of the IAEA plan of action, approved by the Board of Governors in September 2011. Important recommendations were made to the IAEA member countries, so that they implement the various measures mentioned in this plan.

These include reinforcing IAEA's main activities with respect to maintaining a high level of nuclear safety around the world (definition of safety standards, use of peer review instruments such as IRRS, OSART, revision of international Conventions on nuclear safety, accident notification and assistance to countries affected by an accident, etc.), activities in which ASN has been extensively involved for many years.

Directly related to this plan of action and the events that occurred in Japan, was a fact-finding mission comprising representatives of regulatory bodies and members of IAEA, which went to Japan from 22nd May to 1st June, to the Fukushima Daiichi site in particular. Following this visit, the delegation, which included an ASN commissioner, submitted the first detailed report not to have been produced by the Japanese and which played an important part in the deliberations of the Ministerial Conference in June.

1. The member countries of the G8 are: France, Germany, United States, Japan, Canada, Italy, Russia, United Kingdom. The European Commission, the EBRD, the NEA and IAEA also took part in exchanges with the NSSG.

– Revision and consolidation of the Safety Standards, describing the safety principles and practices that the vast majority of member States use as the basis for their national regulations

This activity is supervised by the Commission on Safety Standards (CSS) set up in 1996. The CSS is made up of 24 representatives from the highest level of the safety authorities, appointed for 4 years. France is represented on this Commission by a Deputy Director General of ASN. At the beginning of 2008, the ASN Chairman was given a second term as Chair of the CSS. The 29th and 30th meetings of the CSS were held in 2011.

The CSS coordinates the activities of four committees tasked with supervising the drafting of documents in four areas: NUSSC (NUclear Safety Standards Committee) for installations safety, RASSC (RAdiation Safety Standards Committee) for radiation protection, TRANSSC (TRANsport Safety Standards Committee) for the safe transport of radioactive materials and WASSC (WAste Safety Standards Committee) for safe radioactive waste management. France, represented by ASN, is present on each of these committees, which meet twice a year. It should be noted that the ASN representative on the NUSSC was appointed chairman of this committee, with a three-year mandate. Representatives of the relevant French organisations also participate in the work of the technical groups drafting the documents.

The "Safety Standards", approved by the CSS and published under the responsibility of the Director General of IAEA, are contained in three types of documents: Safety Fundamentals, Safety Requirements and Safety Guides. In 2006, a single document laying out the fundamental principles for the four areas of safety was published, after approval by the CSS and adoption by the Board of Governors. For 2011, two points in particular should be mentioned: approval by the Board of Governors on 12th September 2011 of the radiation protection Basic Safety Standards (BSS) and the conclusions of the working group set up in 2009 to examine the optimum integration of aspects relating to nuclear security and safety. The short-term objective is to set up a committee for security, in the same way as those which already exist for safety and to create an official interface between the "safety" and "security" committees. In the longer term, extension of the scope of the CSS to "security" subjects which overlap the field of safety, is being envisaged.

– The rise in the number of audit missions requested from IAEA by the member States and their increased effectiveness

This category includes the OSART (Operational Safety Review Team) and IRRS (Integrated Regulatory Review Service) missions. These missions are carried out using the IAEA safety standards as the reference, thus making these standards a *de facto* international benchmark.

The OSART missions are carried out by a team of experts from third party countries who, for two to three weeks, examine the safety organisation of the nuclear power plants in operation. The actual implementation of the recommendations and suggestions put forward by the team of experts is verified during a follow-up mission, 18 months after the visit by the experts.

The 23rd OSART mission performed in France took place from 14th November to 1st December 2011, at the Cattenom NPP. As with the previous missions, the concluding report will be published on the ASN website. The Fessenheim plant audit follow-up mission took place from 7th to 11th December, subsequent to the OSART mission in 2009.

For their part, the IRRS missions are devoted to analysing all safety aspects of the activities of a regulatory authority. ASN, which received an IRRS mission in 2006 and a follow-up mission in 2009, took part in several IRRS missions in 2011, in Romania, Korea, Germany (follow-up mission), Slovenia and Switzerland, where the ASN Director General, Jean-Christophe Niel, headed the team of experts.

The peer reviews were the key subject during discussions on changes to the international nuclear safety framework, in particular at the ministerial Conference of June 2011 (see point 2|2). Several countries considered that, because the IAEA safety standards are not binding, it was essential to make regular peer reviews mandatory, with widespread dissemination of their results. These points are currently being debated. It is worth noting that, through the provisions of the European directive on the safety of nuclear facilities, the EU member countries are already subject to periodic and mandatory peer reviews of their general safety arrangements.

ASN responds to other requests from the IAEA secretariat, for example to take part in regional radiation protection training and expert appraisal missions, primarily for French-speaking countries. In 2011, two ASN representatives thus gave radiation protection and radioactive source management



IRRS mission kick-off meeting, in Switzerland, from 20th November to 2nd December 2011

classes in Tunisia, and an ASN inspector went to Mauritania to analyse and advise this country's regulatory authority on implementing a process for licensing an accelerator used for radiotherapy.

The International Relations Department and the divisions in Lyon, Paris, Strasbourg and Dijon welcomed trainees from Vietnam, Romania and Morocco for courses lasting from one to four weeks and presented ASN, its experience and its inspection practices in the field of nuclear safety and radiation protection. One Lebanese trainee who was interested in the management and quality systems, also took a two-week course at ASN's Management and Expertise Office (MEA).

– Harmonisation of communication tools

ASN remains heavily involved in the work being done on the INES (International Nuclear Event Scale) in particular that initiated following the Fukushima Daiichi accident. It became clear on the occasion of this accident that the understanding of this tool was as yet incomplete and progress on this point is stipulated in the plan of action adopted in September 2011 (see point 2|2). The user's guide for the 2008 version of the INES scale has been applied in France since 2010 and the French version was published in 2011.

ASN is in favour of eventually incorporating patient radiation protection into the INES scale, taking account of the particularities related to rating these events, and the corresponding communication. The ASN/SFRO scale, produced in collaboration with SFRO (see chapter 4) received a favourable assessment by the working group on the classification of events involving patients, created at France's request. This working group comprises the IAEA Member States more particularly aware of the stakes involved in radiation protection of patients: Belgium, Brazil, Finland, France, Germany, Hungary, Japan, Spain, Ukraine and United States. In 2011, the group's work mainly involved drafting a proposal to take account of defence in depth when rating radiation protection events concerning patients.

2|3 OECD's Nuclear Energy Agency (NEA)

The NEA, created in 1958, now counts 30 member countries from Europe, North America and the Asia-Pacific region. Its main objective is to promote cooperation for the development of nuclear power as an energy source that is reliable and acceptable from the environmental and economic points of view.

Within NEA, ASN takes part in the work of the Committee on Nuclear Regulatory Activities (CNRA), the Committee on Radiation Protection and Public Health (CRPPH), the Radioactive Waste Management Committee (RWMC), the Nuclear Law Committee (NLC) and in other working groups of the Committee on the Safety of Nuclear Installations (CSNI).

Following the Fukushima Daiichi accident, the NEA set up a cross-disciplinary working group to identify subjects which could be dealt with by the various NEA committees and working groups. During the course of 2011, this working group met on two occasions and its work enabled initial experience feedback from this accident to be shared, with identification of the measures that could be implemented by the NEA committees and working groups in the short and medium term.

Committee on Radiation Protection and Public Health (CRPPH)

From 17th to 19th May, ASN took part in the 69th meeting of the NEA's CRPPH. This committee, which consists of high-level radiation protection experts, is recognised worldwide and works in close cooperation with the other international organisations active in the field of radiation protection (ICRP, IAEA, European Commission, World Health Organisation, UNSCEAR). The meeting's agenda included the Fukushima Daiichi accident and its impact on the activities of the various working groups within this Committee. The meeting also decided to set up a new expert group tasked with monitoring radiation protection aspects and coordinating steps within the CRPPH with respect to Fukushima (EGRPF, Expert Group on the Radiological Aspects of the Fukushima Accident). ASN also seconded one of its specialists in post-accident situation management to the CRPPH (EGRPF), on a part-time basis, so that the NEA was able to gain a clearer understanding of this topic.

Committee on Nuclear Regulatory Activities (CNRA)

This committee met in Paris on two occasions and enabled the first steps to be taken to integrate the experience feedback from the Fukushima Daiichi accident.

The CNRA meeting on 6th and 7th June was followed on 8th June by the "Fukushima Accident: Insight and Approaches" forum organised by the NEA. This forum brought together the regulatory authorities from the members countries of the G8 and the OECD, along with associate countries such as Brazil, India, Romania, South Africa and Ukraine. The participants in this forum defined priorities and recommendations in terms of know-how, experience-sharing, and the approaches and initial steps taken by the regulatory authorities in the wake of the Fukushima Daiichi accident. The conclusions of this conference were incorporated into the preparatory documents for the IAEA ministerial conference of 20th-24th

2|4 *Multinational Design Evaluation Program* (MDEP)

The NEA also handles the MDEP secretariat. The MDEP is an international cooperative initiative to develop innovative approaches to pooling of the resources and know-how of the regulatory bodies, which have responsibility for regulatory assessment of new reactors.

The MDEP, which is built around safety, is a multinational cooperative forum working within the framework of power reactor safety cases and aimed at ensuring the harmonisation and implementation of safety standards. An ASN agent is seconded to the NEA and is responsible for part of the MDEP's secretarial duties.

The MDEP organisation

The MDEP Policy Group and Steering Technical Committee are responsible for implementing the MDEP. The work of the MDEP is performed by the Design Specific Working Groups for nuclear reactors and the Issue Specific Working Groups.

Two Working Groups have been set up. One, of which Canada, China, Finland, France, United Kingdom and United States are members, is devoted to work on the EPR. The other group, of which China, United Kingdom and the United States are members, is working on the AP1000.

Also within the framework of the MDEP, three working groups were set up, focusing on harmonisation of multinational inspection of nuclear component manufacturers (Vendor Inspection Cooperation Working Group - VICWG), on standards and codes for pressure vessel components (Codes and Standards Working Group - CSWG), and on design standards for digital I&C (Digital Instrumentation and Control Working Group - DICWG).

MDEP activities

On the basis of the work started in 2010 to prepare for expansion of the MDEP to take in other reactor designs and other countries, a new mandate covering the activities of the programme was signed in early 2011.

The MDEP Policy Group, comprising leaders of nuclear regulators from the ten participating countries and chaired by the ASN Chair, met in June 2011. This meeting validated the working programmes of the various working groups and examined the membership process for India, which formally submitted its application to become a member of the MDEP.

The MDEP's 2010 activity report was published in June 2011, providing information about the MDEP to stakeholders, i.e. the regulatory authorities not participating in the MDEP, the nuclear sector industry and the general public.

Several joint inspections were performed in 2011, based on the work of the VICWG. "Common Positions" on various subjects were also published on the MDEP website (see chapter 12, point 2|4). Interaction with the nuclear industry was also reinforced, through the organisation of specific meetings with the designers and the CORDEL group of the World Nuclear Association (WNA).

In order to establish long-term dialogue with these stakeholders, a second MDEP conference on new reactor design was held on 15th and 16th September 2011, in Paris. This conference was an opportunity to review the four years of MDEP activity, in particular in the field of harmonisation, which is still very much a long-term goal. The MDEP will need to carry out more detailed analysis of the work done and the future prospects. The various participants also felt that they had a joint responsibility to define and implement appropriate safety measures in the wake of the Fukushima Daiichi accident.

2|5 The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR)

The United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR) was created in 1955. It examines all scientific data on radiation sources and the risks this radiation represents for the environment and for health. This activity is supervised by the annual meeting of the national representations of the Member States, comprising high-level experts, to which Mr Bourgignon, an ASN Commissioner, is invited. The reports published by this scientific body, which constitute the international reference, cover subjects such as the hereditary effects of ionising radiation and the consequences of the Chernobyl accident. An ad hoc expert group was set up to assess the health and environmental impact of the Fukushima accident. This group should present its preliminary conclusions in March 2012 and the final report in 2013, on the occasion of the General Assembly of the United Nations.

2|6 The International Nuclear Regulators' Association (INRA)

The International Nuclear Regulators' Association (INRA), which comprises the heads of nuclear regulatory bodies from Canada, France, Germany, Japan, South Korea, Spain, Sweden the United Kingdom and the United States, met in May 2011, and as a side-event at the Vienna General Conference in September 2011, with Ann-Louise Eksborg, Head of Sweden's nuclear safety regulator, in the chair.

Unsurprisingly, the members of INRA gave thought to how to react in the wake of the Fukushima Daiichi accident. Following the second meeting, the Chair of INRA sent a letter to Y. Amano, Director General of the IAEA, in which she offered her support for the IAEA plan of action, and in particular the steps aimed at promoting the performance of stress tests in all nuclear countries worldwide, and the reinforcement of the peer review systems (IRRS and OSART).

During the Vienna meeting, the extremely fruitful discussions ASN had hoped for, took place with representatives of the World Association of Nuclear Operators (WANO) on how the licensees intended to learn the lessons of Fukushima Daiichi. At the initiative of the ASN Chairman, a review was also initiated into the possible expansion of INRA to include new members.

In 2012, the INRA will be chaired by the Canadian nuclear regulator.

2|7 The Association of Nuclear Regulators of Countries Operating French Designed Nuclear Power Plants (FRAREG)

The FRAREG (FRAmatome REGulators) association was created in May 2000 at the inaugural meeting held in Cape Town at the invitation of the South African nuclear regulator. It comprises the nuclear regulators of Belgium, France, the People's Republic of China, South Africa and South Korea.

Its mandate is to facilitate transfer of operating experience gained from regulation of the reactors designed and/or built by the same supplier and to enable nuclear regulators to compare the methods they use to manage generic problems and evaluate the level of safety of the Framatome type reactors they regulate.

The Association's latest meeting was held in South Africa in 2010. Owing to the workload the nuclear regulators had to

bear following the Fukushima Daiichi accident, the meeting scheduled for France in 2011 should take place, still in France, but in 2012.

2|8 The European ALARA Network and the European Radiation Protection Authorities Network

ASN took part in the two six-monthly meetings of the European ALARA Network (EAN) management group, on 24th May and 24th November, in the ASN premises. These meetings are an opportunity for the various member countries to present topical subjects related to the ALARA approach. This year, at the May meeting, the discussions concerned the steps taken at a national level following the Fukushima Daiichi accident.

On 23rd May, ASN hosted the annual meeting of the European Radiation Protection Authorities Network (ERPAN), a sub-network of EAN. This meeting enables each regulatory body to present topical subjects related to radiation protection in the industrial and medical sectors. On this occasion, ASN presented the involvement of medical physicists in the medical imaging units in France.

3 BILATERAL RELATIONS

ASN works with many countries within the framework of bilateral agreements signed at different levels:
– governmental agreements (Belgium, Germany, Luxembourg, Switzerland);
– administrative arrangements between ASN and its counterparts (about twenty).

The bilateral relations developed between ASN and its counterparts proved to be extremely useful in maintaining an exchange of information during the Japanese emergency.

As early as the very first days of the accident in Japan, ASN took part in daily audio-conferences with several foreign regulators (United States, Canada, United Kingdom). These telephone conferences enabled the regulators to inform each other of the changing situation in Fukushima and of the recommendations issued by each country to its nationals present in Japan.

Thought is currently being given to how these exchanges could lead to greater cooperation between the regulatory authorities concerning experience feedback from the accident in Japan.

3|1 Staff exchanges between ASN and its foreign counterparts

Better understanding of how foreign nuclear safety and radiation protection regulators actually work is a means of learning pertinent lessons for the working of ASN itself and enhancing staff training. One way to achieve this goal is to develop the staff exchange system.

The nuclear safety and radiation protection regulators with whom staff exchanges have been arranged to date are those of Belgium, China, Finland, Germany, Hungary, Ireland, Japan, Spain, Switzerland, the United Kingdom and the United States.

Provision is made for several types of exchange: very short term actions (one to two days). These are a means of offering our counterparts cross-inspections and joint nuclear and radiological emergency exercises. In 2011, more than thirty joint inspections in the field of nuclear safety and radiation protection were organised. ASN inspectors participated in NPP inspections in Belgium, China, Finland, Germany, Switzerland, United Kingdom, etc. and inspectors from abroad (Belgium, China, Germany, Japan, Luxembourg, Spain, Switzerland and the United States) participated in inspections in French plants. A cross-inspection was also held with the British safety regulator at the Sellafield fuel reprocessing plant. Some of these joint inspections also related to radiation protection in the medical and industrial sectors in Belgium, France, Germany, Ireland, Spain and Switzerland.

Some of these inspections were linked to the European stress tests initiated following the Fukushima Daiichi accident (see chapter 4):
– short-term assignments (2 weeks to 6 months) aimed at studying a specific technical topic;
– exchanges giving an overview of all of a counterpart's activities;
– long-term exchanges (about one to three years) in order to become fully familiar with the ways in which foreign nuclear safety and radiation protection regulators work, to gain in-depth knowledge. Whenever possible, this type of exchange should be reciprocal.

Under the terms of an assistance contract, a staff member from the nuclear pressure equipment department is seconded to the British regulatory authority (Office for Nuclear Regulation - ONR) to work on the generic assessment of the new-design EPR and AP1000 reactors. Since early 2011, a French inspector from the nuclear power plant department has been seconded to the ONR, where he is in charge of monitoring the construction of the new reactors.

In exchange for the secondment to the Spanish Consejo de Seguridad Nuclear (CSN) of an engineer from the Research Facilities and Waste Department, for a three-year period starting on 1st February 2009, a CSN engineer was seconded to the Nuclear Power Plant Department until the beginning of 2012.

Since April 2009, a member of the nuclear pressure equipment department (DEP) has joined the American regulator, the US NRC (United States Nuclear Regulatory Commission) for a period of three years. Since the beginning of his secondment, this agent has worked in several departments of the commission, in particular dealing with queries concerning new reactors and extended reactor life. In October 2011, an agent from the US NRC joined the ASN international relations department for a period of one year. His duties include organising and implementing the peer review of the European stress tests initiated following the Fukushima Daiichi accident.

Staff exchanges are also organised with international organisations. For instance, a member of ASN has been working at IAEA since autumn 2010, in the team tasked with organising Integrated Regulatory Review Service (IRRS) assignments. Another ASN engineer, now recruited by IAEA, is also working at the Agency on safety standards, providing the scientific secretariat for the CSS (Commission on Safety Standards, see point 2|2). Finally, and as previously mentioned, ASN is making an ASN agent available to the NEA to help with correct implementation of the MDEP.

These exchanges will continue to enrich practices at ASN, which will thus be able to make use of the proven methods and good practices observed and which are employed by its counterparts. Furthermore, the experience acquired over nearly ten years now, indicates that inspector exchange programmes are an important factor in stimulating bilateral relations between nuclear safety and radiation protection regulators.

It is also worth underlining the appointment of representatives of foreign safety regulatory bodies to the Advisory Committees of experts. ASN employs this practice enabling experts from other countries to not only take part in the Advisory Committees but also, on occasion, to act as Chair or Deputy Chair. The participation of experts from European countries in the advisory committees devoted to the complementary safety assessments also confirms ASN's openness to the expertise and critical eye of foreign experts.

3|2 Bilateral cooperation between ASN and its foreign counterparts

Bilateral relations between ASN and its foreign counterparts are built around an approach that integrates nuclear safety and radiation protection for each of the countries with which ASN maintains priority relations. The following can be offered as examples.

Germany

The thirty-seventh Franco-German Commission on nuclear installation safety questions (Deutsch-Französische Kommission für Fragen der Sicherheit kerntechnischer Einrichtungen - DFK) met on 10th and 11th May in Marseille. This annual meeting enabled the two delegations to present topical matters related to nuclear safety and radiation protection in the two countries, as well as the annual reviews concerning the safety of the Fessenheim and Cattenom NPPs in France and Neckarwestheim and Philippsburg in Germany. The meeting



Visit to the Jules Horowitz (Cadarache) reactor construction site by the members of the Franco-German Commission on 10th March 2011

was also an opportunity to review the consequences of the Fukushima Daiichi accident in both countries.

The representatives of the four working groups set up by the DFK also presented the results of their annual work and their respective mandates were extended for the next year.

On the occasion of their meeting, the two delegations visited the ITER and Jules Horowitz reactor construction sites.

Luxembourg and the German states of Saarland and Rhine-Palatinate also appointed a joint expert to take part in the French complementary safety assessments (primarily for the Cattenom and Fessenheim NPPs). No reciprocal arrangement with these States was possible, because they do not operate any nuclear reactors.

Belgium

Relations with the Belgian Federal Nuclear Regulatory Agency (AFCN) and its technical support subsidiary BEL V cover all of ASN's areas of competence: safety, waste management, transport and radiation protection.

As in previous years, numerous cross-inspections are being organised with ASN's Belgian counterparts on NPPs or in the small-scale nuclear field. The management committee comprising ASN, AFCN and BEL V met on 26th and 27th January 2011 in Brussels. In addition to this meeting, the French delegation was able to visit the radio-therapy unit in the Saint-Luc university hospital of Brussels.

China

The high-level meetings organised for the ASN Chairman's trip to China in 2010 led to the definition of an action plan comprising a schedule of discussion meetings between the two divisions responsible for construction of the EPR reactors, on the one hand ASN's Caen division, and on the other the Guangdong division of China's National nuclear security administration (NNSA) - Guangdong regional office (GRO).

From 7th to 10th November 2011, a delegation of three GRO inspectors, including the deputy director, visited France. The first day was devoted to discussions concerning the respective approaches for implementation of the stress tests on

the French and Chinese NPPs, during a meeting with the ASN's Director of NPP safety. Over the following three days, the delegation visited Caen for two days of meetings with the ASN division and visited the EPR construction site at Flamanville. Inspection practices and the state of advancement of the construction of the French reactor and the two Chinese EPRs at Taishan were the main subject of the discussions between the French and Chinese inspectors.

For many years now, ASN's Lyon division has also enjoyed relations with the NNSA's Guangdong division. Three inspectors from this division went to China in November 2011. With their Chinese counterparts, they discussed the initial lessons learned from the nuclear accident of Fukushima Daiichi, in particular with regard to the nuclear power plant at Daya Bay - Lingao.

In 2011, two delegations from the Chinese ministry of water resources expressed a desire to meet ASN to discuss the impact of siting NPPs next to a river. The first delegation followedup the meeting organised at ASN with a visit to the Saint-Laurent-des-Eaux NPP, a meeting with this plant's local information committee and discussions with representatives of the various stakeholders in the Val de Loire river basin.

Finally, in November 2011, ASN received a delegation from the Chinese ministry for the environment, which was interested in radiological situation management procedures and the steps taken to regulate radioactive sources in France.

South Korea

Against a backdrop of changes to the nuclear safety regulatory system in South Korea and the creation of a nuclear safety regulator independent of all ministries, ASN welcomed a Korean delegation for whom the purpose of the visit was to study and compare the status, duties and responsibilities of several European safety regulators, including that of France. This meeting was an opportunity for ASN to present the TSN Act and promote its provisions.

In 2011, two other South Korean delegations were welcomed at ASN. One, from the city of Busan, was interested in radioactive waste management. It visited the Aube low and intermediate level, short-lived waste repository and met a few representatives from the local information committee. The other comprised experts from the KINS, the technical support organization for the South Korean regulatory authority. They went to Dijon for discussions with the nuclear pressure equipment department concerning inspections carried out with the help of third-party organisations.

Spain

Because of the considerable workload on both parties, the ASN-Consejo de Seguridad Nuclear (CSN) management committee meeting scheduled for 2011 was postponed. However, a meeting was held in Spain between the ASN and CSN departments in charge of communication and information, in September 2011 (see chapter 6).

The United States

The joint desire of ASN and the American regulator, the US NRC (US Nuclear Regulatory Commission), to maintain close relations was once again evident in 2011 through the many actions covering all types of cooperation.

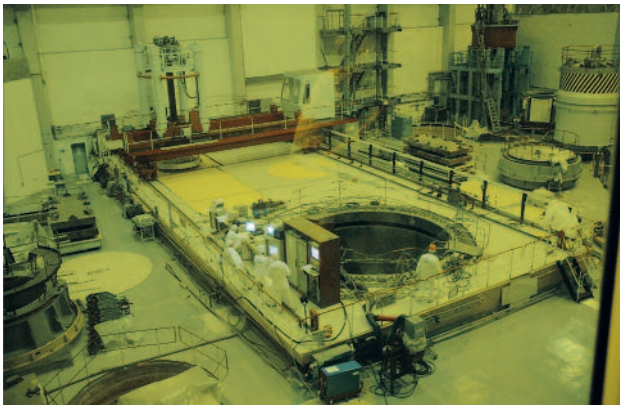
In addition, the invitations received by the ASN chairman to present the work of the MDEP and by the Director General to present experience feedback from regulation of the French NPP fleet, at the Regulatory Information Conference (RIC) in March 2011, are clear evidence of the high regard in which ASN is held by its American counterpart.

In August 2011, two ASN agents took a source security training course organised by the US NRC, following which they took part as observers in an inspection carried out by this Authority on this topic in a university hospital in Washington.

Finally, the Chairmen of the two Authorities met on several occasions. Meetings were also organised between French and American commissioners. These meetings were an opportunity to discuss the steps taken in the two countries following the Fukushima Daiichi accident (stress tests, analysis of accident management experience feedback).

The Russian Federation

As part of the reinforced cooperation between ASN and the Russian nuclear safety regulator Rostechnadzor (RTN), the Directors in charge of NPP regulation, waste, research and fuel cycle facilities and international relations, went to Moscow on



Visit to the Novovoronej-4 reactor, shut down for maintenance. This is a first-generation 440 MWe VVER reactor, which was commissioned in 1972



Visit to the Novovoronej-5 reactor hall – a second-generation VVER of 1000 MWe, commissioned in 1980

30th August 2011 for discussions with their RTN counterparts. This meeting covered three topics: the continued operation of power reactors, the fuel cycle and cooperation in the field of assistance with safety for countries adopting nuclear energy for the first time.

The ASN Chairman, a commissioner and the director general also went to Russia from 3rd to 7th October 2011, to meet their counterparts and visit three nuclear sites. The ASN delegation thus visited the NPP at Novovoronej (three VVER reactors in operation and a further two under construction), the Sia Radon centre in Serguiev Possad (waste management) and the Electrostal nuclear fuel fabrication plant.

During their plenary meeting on 7th October, the Chairmen of the two safety regulators, Messrs. Kutin and Lacoste, expressed their desire to continue and indeed build further on this cooperation. The following measures were decided on:
– performance of cross-inspections on safety and radiation protection;
– joint participation in national emergency exercises;
– creation of a working group to analyse incidents;
– cross-inspections of a fuel fabrication plant;
– exchanges of information about the stress tests initiated in each country;
– discussions on fast neutron reactor safety;
– considerations concerning severe accident emergency management, nationally and internationally;
– cooperation with new nuclear countries.

Finland

There has been longstanding cooperation between ASN and its Finnish counterpart STUK, especially in the area of management of waste and of spent fuel. But cooperation has been significantly enhanced in recent years owing to the construction of an EPR type reactor at the Finnish site of Olkiluoto.

Under the terms of the special arrangement between ASN and STUK covering exchanges of information on the construction of new reactors, a meeting was organised in May 2011 between the ASN and STUK teams responsible respectively for the Flamanville 3 and Olkiluoto 3 projects. Based on technical discussions and visits to the construction sites, the meetings helped to reinforce interaction between the two projects, in addition to the work carried out within the MDEP multilateral framework (see chapter 12).

India

Under the terms of an agreement between the Indian Atomic Energy Regulatory Board (AERB) and ASN, which was renewed in December 2010, the Chairmen of the two regulatory authorities met on 9th June 2011 in the ASN head offices. They discussed areas for cooperation to be developed further between their organisations, in the fields of nuclear safety and radiation protection. These areas include nuclear safety, in particular for the EPR, source security, preparedness for emergency situations and radiation protection in small-scale nuclear facilities. An ASN mission to India is scheduled for 2012 and will enable these subjects to be dealt with in greater detail.

More specifically with regard to the EPR, and at the request of the Indian Government, ASN on 2nd March 2011 welcomed the High Level Technical Committee tasked by Prime Minister Singh with conducting a study into the safety of the EPR.

Ireland

On 31st August, the annual meeting between the Radiological Protection Institute of Ireland (RPII) and ASN was held in the ASN premises. This meeting was an opportunity to review cooperation between the RPII and ASN as well as the measures to be taken in the wake of the Fukushima Daiichi accident, and to discuss the running of the stress tests in France. On 3rd May 2011, the ASN's director for ionising radiation and health participated, as a permanent member, in one of RPII's advisory committees.

Norway

A delegation from the Norwegian Radiation Protection Authority (NRPA) visited France from 19th to 21st September. This trip involved a visit to the La Hague plant (20th September) and a meeting with ASN (21st September in Paris). Following this visit, a cooperation agreement was signed by the ASN Chairman, Mr Lacoste, and Mr Harbitz, Director General of the Norwegian authority, on 8th December in Berne, on the occasion of the HERCA meeting (see point 2 | 1 | 7).

Italy

In 2010, ASN concentrated on bilateral relations with various Italian institutions involved in launching the country's nuclear power generating programme. The result of the referendum, held in June 2011, put an end to this programme. There would seem to be no question of the creation of the Italian nuclear safety agency being compromised by the abrogation of the texts specified in the referendum, but neither are there any signs of progress. Its designated Chairman, U. Veronesi, recently announced his resignation. For all these reasons, ASN relations with the Italian authorities in charge of nuclear safety and radiation protection remained limited in 2011.

Japan

In the weeks and months following the Fukushima Daiichi accident, nearly 20 Japanese delegations were received, at their request, by ASN. These delegations mainly comprised representatives from the Japanese safety regulator (NISA), the energy and natural resources agency (ANRE), Government representatives, members of parliament and local officials. Of particular note was the 14th June visit by Mr. Hosono, adviser to the Prime Minister at the time of the meeting and now Minister for the environment and for management of the consequences of the Fukushima Daiichi accident.

The subjects most frequently discussed at these meetings were directly linked to topical matters:
– the independence of the ASN, its roles, its responsibilities (TSN Act) within the context of the reorganisation of nuclear safety regulation and monitoring in Japan;
– the complementary safety assessment and stress test approaches adopted in France and Europe;

– worker radiation protection;
– management of post-accident situations (mainly at the initiative of ASN).

In addition to the general conference, a bilateral meeting was organised between the ASN Chairman and the new Director General of the NISA (Mr Fukano) appointed in the weeks following the Fukushima Daiichi accident.

As part of the regular exchanges with NISA and the technical support organisation (JNES), three inspectors from the ASN Lyon division went to Japan from 5th to 10th March 2011. They discussed inspection practices with their Japanese counterparts, in particular concerning the Ohi nuclear power plant and the Monju reactor.

The ASN Lyon division also welcomed a delegation of NISA and JNES members in September 2011. The topics covered concerned the nuclear accident at Fukushima Daiichi and the regulation and monitoring of fuel cycle facilities.

In addition to these bilateral meetings, there were also numerous contacts between the French and Japanese safety authorities within international bodies such as the IAEA, OECD/NEA and multilateral associations such as INRA (International Nuclear Regulators Association).

ASN Commissioner Philippe Jamet was thus a member of the IAEA mission which went to Japan in April 2011 (see point 2|2). The ASN Deputy Director General, Jean-Luc Lachaume, took part in an NEA conference on Fukushima on 16th and 17th October, specifically concerning the decontamination of polluted soils and the rehabilitation of the affected areas. This conference was an opportunity for ASN to present the results of 5 years of work looking into the issue of post-accident management (CODIRPA programme). Jean-Luc Lachaume also took part in a conference on stress tests, on 16th and 17th November, in Tokyo.

It should also be noted that for the purposes of monitoring the Fukushima Daiichi accident, and for a period of several weeks, ASN, together with other French players, held a daily and then weekly telephone conference with the nuclear department at the French Embassy in Tokyo. These telephone conferences began very soon after the accident occurred and proved to be extremely valuable in understanding and monitoring how the situation was developing in Japan.

Luxembourg

The tenth meeting of the Franco-Luxembourg Joint Commission on Nuclear Safety was held on 15th September 2011, in Paris. This meeting was mainly devoted to the steps taken in both countries during the Fukushima emergency (information of the public, information between the Authorities of the two countries). The involvement of Luxembourg experts in the complementary safety assessments (CSA) conducted in France (see box) was also reviewed. ASN also presented a report on monitoring of the EDF plant at Cattenom, located less than 40 kilometres from the border with Luxembourg.

Czech Republic

On the fringes of the WENRA meeting in Berlin, the ASN Chairman and his Czech counterpart, Mrs Drábová, signed an agreement on 15th November 2011 updating and expanding a prior version signed in 1994. This agreement concerns the exchange of technical information and cooperation between ASN and the SÚJB, the Czech safety regulator, in the fields of nuclear safety and radiation protection. The renewal of this agreement is clear evidence of the desire of the two regulatory bodies to continue their cooperation in the coming years.

Hungary

ASN's participation in the conference held to mark the twentieth anniversary of the Hungarian safety regulator was an opportunity to restate the desire of the two authorities to continue their cooperation. ASN also had an opportunity for discussions with its Hungarian counterpart in mid-November, when traces of iodine 131 were detected in several European countries. As soon as it was certain, the Hungarian safety regulator informed ASN that this iodine probably originated in a radioisotopes production centre in Budapest.

The United Kingdom

ASN and the British Office for Nuclear Regulation (ONR) have cooperated for many years and the arrangement has been enhanced and improved over time.

In 2011, the status of the ONR changed and it became an agency independent of the Health and Safety Executive (HSE) of which it had been a department. This change in status offers it greater independence in the management of its resources and enabled it to acquire new competence in terms of the safety of radioactive material transport (previously the competence of the Department for transport (DfT)).

During the past year, cooperation between ASN and the ONR focused mainly on activities related to the evaluation of new reactors. Furthermore, the assistance contract agreed between ASN and ONR in 2009, making provision for the secondment of an agent from the nuclear pressure equipment department, was extended by a further year (see point 3|1).

The annual meeting of the heads of the two bodies was initially scheduled for June 2011 but had to be postponed owing to the extremely high workload as a result of the Fukushima Daiichi accident. A new meeting is scheduled for 2012. The ASN-IRSN/ONR Franco-British Steering Committee met in February 2011 in the United Kingdom. ASN Commissioner Philippe Jamet, went to the United Kingdom from 23rd to 25th November, in order to visit the Heysham NPP and the Sellafield site (Cumbria).

Switzerland

The 22nd annual conference of the Franco-Swiss Commission (CFS) on Nuclear Safety and Radiation Protection took place on 13th September 2011, in Zurich. The meeting discussed exchanges of information on the safety of nuclear installations and radiation protection in the two countries, coordination of emergency protection measures and radioactive waste management. ASN and the federal inspectorate for nuclear safety (IFSN) discussed monitoring measures taken in the two countries after the Fukushima Daiichi accident and the results of the studies into the risk of leukaemia in children living near BNIs (see chapter 1).

Ukraine

An ASN Commissioner went to Ukraine on 21st April, to attend the technical meeting of the international conference entitled: "Chernobyl, 25 years on: safety for the future". This conference was organised from 20th to 22nd April by the Ukrainian ministry in charge of emergency situations. The subjects covered included the problems observed in the exclusion zone 30 km around the plant, in particular the slow decontamination of the soil and radioactive waste management.

ASN continued to provide Ukraine with assistance, especially through the nuclear safety cooperation instrument (see point 2|1|8), which involved the ASN Communication and Public Information Department. This cooperation is designed to help the Ukrainian safety regulator consolidate its public information policy (see chapter 6).

3|3 ASN bilateral assistance

ASN pays very close attention to nuclear installation projects in the "new nuclear countries", where the implementation of a safety plan requires a minimum lead time of fifteen years before a nuclear power reactor can come into operation under satisfactory conditions. Such countries need to develop and put in place a legislative framework and an independent and competent safety authority with adequate financial and human resources to be able to fulfil its mission, as well as building safety capacity and developing a culture of safety and of monitoring.

The many expressions of interest in nuclear power from various third party countries, which have been very frequent in recent years, fell off significantly this year, owing to the Fukushima Daiichi accident. Some countries however confirmed their interest and ASN carried out discussions with several of them.

The United Arab Emirates

ASN maintains regular relations with the safety regulator of the Emirates, the FANR, on various subjects. In 2011, the FANR expressed an interest in ASN's experience of monitoring of a reactor construction site and in the logistical organisation adopted by the French regulator (organisation and surface area of premises, layout of the emergency centre, "fire" safety, archive management, etc.). A formal cooperation agreement between the two regulatory bodies could also be prepared and signed in 2012.

Jordan

In 2011, ASN provided the Jordanian regulator (JNRC) with assistance in drafting regulations for radiation protection and the transport of radioactive materials. The Jordanian minister for energy, Khaled Touqan, was also received by two ASN commissioners, who took the opportunity to stress the importance, for any country making the transition to nuclear energy, of setting a competent safety regulator that is given the means necessary to perform its duties.

Poland

With a view to setting up a nuclear power generating programme in Poland by the 2022 time-frame, the Polish safety regulator, the PAA, is developing its expertise in the safety regulation and monitoring of power reactors. ASN thus presented the organisation of its regulatory activities and its inspector training procedures at a seminar held in Warsaw in March 2011, aimed at the Polish institutions concerned.

In September 2011, in Warsaw, the ASN Chairman also met the new Chairman of the PAA, Mr Włodarski, who had been appointed in January 2011. This meeting was an opportunity to identify future areas for cooperation and to finalise the draft agreement between the two bodies. It should shortly be ready for signature.

Vietnam

Cooperation with Vietnam in 2011 simply consisted of the secondment of a trainee from VARANS, the Vietnamese safety regulatory, through the IAEA's assistance programmes.

The four countries mentioned above are those that are at the most advanced stages from amongst those wishing to start a nuclear power programme and that have no previous experience of nuclear power plants. They do not, however, account for all of ASN's cooperation with "new entrant" countries.

Overall, ASN responded to about thirty requests in 2011 from countries indicating an interest in nuclear energy for the first time. In addition to its bilateral contacts, ASN is also involved in providing assistance to these countries via the Nuclear Safety Cooperation Instrument.

The Authority also participates in the Regulatory Cooperation Forum (RCF), a forum for discussions between safety authorities under the aegis of the IAEA, intended to facilitate the sharing of experience by regulators. ASN took part in two plenary sessions, in June and September 2011.

4 INTERNATIONAL AGREEMENTS

In the aftermath of the Chernobyl accident (26 April 1986), the international community negotiated a number of conventions designed to prevent accidents linked to the use of nuclear power and mitigate their consequences should they occur. These conventions are based on the principle of a voluntary commitment on the part of the States, who retain sole responsibility for the installations placed under their jurisdiction.

Two conventions deal with the prevention of nuclear accidents (Convention on Nuclear Safety and Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management), while two others deal with management of their consequences (Convention on early notification of a nuclear accident and Convention on assistance in the case of a nuclear accident or radiological emergency). France is a contracting party to these four conventions. IAEA (see point 2|2) is the depositary of these conventions and provides the relevant secretarial services.

4|1 The Convention on Nuclear Safety (CNS)

The CNS concerns civil nuclear power generating reactors. It was adopted in June 1994 and France signed it in September 1994 with ratification in September 1995. The convention came into force on 24 October 1996. As at 31 December 2011, it had been ratified by 74 States.

In ratifying it, the contracting parties agree to submit a report describing how they meet the obligations of the convention and apply its fundamental principles, as laid out in the IAEA safety fundamentals standard (SF-1), along with the good safety practices in their respective countries. The reports from the contracting parties are examined during a review meeting at which each party may ask questions of the others.

The four contracting party review meetings were held in April 1999, April 2002, April 2005 and April 2008.

The fifth meeting was held from 4th to 14th April 2011 at the IAEA. The 72 contracting parties were split into six groups, which discussed the reports presented by the countries in the group. An ASN commissioner chaired the debates of group 4.

The French report was presented by the ASN Director General, in the presence of the ASN Commission. Its review highlights France's good practices, such as implementation of an effective and transparent programme of information of the public and international harmonisation of safety requirements, to which France makes an active contribution in order to promote safety principles.

Various areas for improvements were also proposed to France, including the need to reduce performance deviations in nuclear safety, radiation protection and environmental protection between the various NPPs in operation. This effort should especially focus on plants where the results are less satisfactory, with particular attention paid to the involvement of the plant's management and to a high level of operating and equipment maintenance quality.

The French and English versions of the French report are available on the ASN website, in the "International" section.

This fifth meeting was held just a few weeks after the nuclear accident at the Fukushima Daiichi power plant. The conclusions of this review meeting (downloadable from *www-ns.iaea.org/downloads/ni/safety_convention/cns-summaryreport0411.pdf*) focused on the following points:
– drafting of a text expressing the position and engagement of the contracting parties, with regard to the steps to be taken following the Fukushima Daiichi accident;
– the organisation of an extraordinary review meeting, from 27th to 31st August 2012, on the measures actually taken by the contracting parties at that date.

The organising meeting for this extraordinary meeting was held on 20th September. The decision was taken to change the usual structure of the national reports, arranging them according to six predetermined technical topics (external events, design, on-site severe accident management, international organisations, preparedness and response to emergency situations and off-site post-accident situations, and international cooperation. 13th May 2012 was chosen as the date for submission of the English versions of these reports to IAEA.



Presentation of the French report to the Convention on Nuclear Safety on 6th April 2011 at the IAEA in Vienna (Austria)

4|2 The Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management

The "Joint Convention" as it is often called, is the counterpart of the CNS for management of the spent fuel and radioactive waste produced by civil nuclear activities. France signed it on 29th September 1997 and it entered into force on 18th June 2001.

There were 63 contracting parties to the Joint Convention as of 31st December 2011.

The Joint Convention's fourth review meeting will be held at IAEA from 14th to 23rd May 2012. In order to prepare for this meeting, France sent IAEA its national report on 14th October 2011.

This report, the drafting of which was coordinated by ASN, is the result of cooperation between the General Directorate for Energy and Climate (DGEC), the Nuclear Safety and Radiation Protection Mission (MSNR), the French National Agency for Radioactive Waste Management (ANDRA), the Institute for Radiation Protection and Nuclear Safety (IRSN), CEA, AREVA, Électricité de France (EDF) and ASN.

It presents the implementation of the obligations of the Joint Convention by all the players in France and details the latest developments and prospects in the field covered by this Convention, especially changes to European and French regulations and to radioactive materials and waste management policies. The report also specifies the steps taken by France to take account of experience feedback from the Fukushima Daiichi accident.

4|3 The Convention on Early Notification of a Nuclear Accident

The Convention on Early Notification of a Nuclear Accident came into force on 27th October 1986, six months after the Chernobyl accident. It had 112 contracting parties as at 19th September 2011.

The contracting parties agree to inform the international community as rapidly as possible of any accident leading to uncontrolled release into the environment of radioactive material likely to affect a neighbouring State. To this end, a system of communication between States is coordinated by IAEA and exercises are held periodically among the contracting parties. ASN is the competent national authority for France. It is worth noting that, as soon as the accident at Fukushima Daiichi occurred, Japan – a contracting party to this Convention – adhered to its provisions and informed the international community of the ongoing events.

4|4 The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency

The Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency came into force on 26th February 1987. As at 23rd September 2011, there were 107 contracting parties.

Its purpose is to facilitate cooperation between countries if one of them were to be affected by an accident with radiological consequences. This Convention has already been used on several occasions for accidents due to abandoned radioactive sources. France's specialised services have already treated irradiated victims. This was once again the case in 2010, with treatment being given to a patient from Latin America. ASN is the competent national authority for France.

In the case of the Fukushima Daiichi accident, it should be noted that the Japanese authorities did not feel that it was necessary to call on this provisions of this Convention.

Revision of these four international Conventions

The revision of the four international Conventions related to nuclear safety was a subject debated at all the international meetings subsequent to the Fukushima Daiichi accident (G8, G20, OECD/NEA, IAEA, etc.). Some highlighted inadequacies in the Convention on nuclear safety with regard to transparency or the independence of the safety regulators. Others observed that, despite the critical situation in which it found itself and the opportunity to obtain support from the international community, Japan worryingly never officially activated the "assistance" Convention. These considerations will no doubt continue to be discussed in 2012.

4|5 The other conventions linked to nuclear safety and radiation protection

Other international conventions, the scope of which does not fall within the remit of ASN, may be linked to nuclear safety.

Of particular relevance is the Convention on the Physical Protection of Nuclear Material, the purpose of which is to reinforce protection against malicious acts and against misappropriation of nuclear materials. The Convention came into force on 8 February 1987. It had 145 contracting parties in 2011.

Additional information on these conventions may be obtained from the IAEA's website: *www-ns.iaea.org/conventions/*

5 INTERNATIONAL CONFERENCES

In 2010, ASN played an important role on the international stage, taking part in the major conferences and workshops within its fields of competence. The following table gives the main events at which ASN was a participant.

Table 2: events in which ASN took part in 2011

Date	Place and organiser	Subject
20-22 January	Barcelona (EU)	ORAMED 2011
26 February - 4 March	Phoenix (WM Symposia)	Waste Management Conference 2011 (WM 2011)
8-11 March	Washington (NRC)	23rd Regulatory Information Conference (RIC 2011)
21-25 March	Lisbon (DOE/NNSA)	European Regional Workshop on the Megaports Initiative
20-22 April	Kiev (Ministry of emergency situations)	Chernobyl 25 years on: Safety for the future
3 May	Nice (SFEN)	International congress on advances in nuclear power plants (ICAPP 2011)
8-12 May	Paris (ISRS)	10th International symposium of the International Stereotactic Radiosurgery Society – Brain and body radiosurgery (ISRS 2011)
16-18 May	Opatija (CSNM)	7th International Congress of the Croatian Society of Nuclear Medicine
16-20 May	Vienna (IAEA)	Workshop on Regulatory Approaches and Strategies for Licensing the first NPP in Newcomer Countries
8 June	Paris (NEA)	Forum on the Fukushima accident: Insights and approaches
20-24 June	Vienna (IAEA)	IAEA ministerial conference on nuclear safety
28-29 June	Brussels (EU)	European Conference on nuclear safety
17-21 July	Baltimore (ASME)	American Society of Mechanical Engineers - Pressure Vessels and Piping Conference (ASME 2011)
14-16 September	Biarritz (SIRLaF)	10th International Symposium of Fundamental and Applied Radiobiology (CIRFA)
25-29 September	Reims (ASME)	14th International conference on Environmental Remediation and radioactive waste management (ICEM 2011)
16-17 October	Fukushima (NEA)	International Conference on Decontamination – Toward the Recovery of the Environment
17-21 October	Vienna (IAEA)	International Conference on the Safe and secure transport of radioactive material: the next fifty years of transport. Creating a safe, secure and sustainable framework
26-28 October	Washington (IAEA)	Workshop on the lessons learned from IRRS missions
6-11 November	New Delhi (HBNI)	International Conference on Structural Mechanics in Reactor Technology (SMiRT 21)
8-11 November	Vienna (IAEA)	International Conference on Clinical PET and Molecular Nuclear Medicine - Trends in Clinical PET and Radiopharmaceutical Development
14-18 November	Rabat (IAEA)	International Conference on Research Reactors: Safe Management and Effective Utilization

In 2011, ASN also organised or hosted international meetings and conferences in its premises. The list is given below.

Table 3: international meetings and conferences organised or hosted in its premises by ASN in 2011

Date	Place and organiser	Subject
2-4 March	Paris (IAEA)	6th Competent Authorities Meeting (IAEA CM - NCACG)
5-6 May	Paris (ASN)	2nd international seminar on post nuclear accident management: advances by CODIRPA
23 May	Paris (EU)	European Radiation Protection Authorities Network (ERPAN) meeting
14-18 November	Paris (IAEA)	Regional workshop on Evaluation of the Effectiveness of the Regulatory Bodies as part of the preparation for receiving an Integrated Regulatory Review Service mission
24 November	Paris (EU)	Meeting of the European ALARA network (EAN)

6 OUTLOOK

2012 will be marked by a number of major milestones, most of which are related to following up the steps taken in the wake of the Fukushima Daiichi accident.

In Europe, the national reports of the NPP stress tests will be peer reviewed from January to April 2012. The continuation of this exercise and the subsequent summaries by ENSREG and then the European Commission will be important moments. ASN is heavily involved in these exercises and will continue to devote efforts to ensuring that Europe remains a driving force behind improvements to nuclear safety around the world.

As for the possible changes to the European nuclear safety framework, which will be officially submitted by the Commission to the European Council in June 2012, ASN – in accordance with the provisions of the law – has initiated an analysis with the Government's competent departments of the first potential areas revealed by the Commission in its communication of 23rd November 2011, in order to ensure appropriate preparation of the deadline of next Spring.

At an international level, the schedule is also a busy one. In addition to the Joint Convention review meeting of May 2012 – which was of course scheduled independently of the events at Fukushima Daiichi – an extraordinary review meeting of the contracting Parties to the Convention on nuclear safety will be held in August 2012, to discuss the steps they have taken in the wake of the Fukushima Daiichi accident. ASN will be coordinating the drafting of the French report.

ASN also noted that there has been an extremely positive shift in the position adopted by the World Association of Nuclear Operators (WANO). ASN will be monitoring the changes to the initiatives launched by WANO and designed to reinforce international monitoring of operating safety.

ASN is convinced that wide-ranging changes are needed to the international safety framework and will also be attentive to the implementation of the action plan adopted by the IAEA Board of Governors in September 2011.

In addition to dealing with these exceptional activities related to the events at Fukushima Daiichi, ASN will in 2012 also be carrying out its usual international business, focusing on improvements to nuclear safety and radiation protection around the world. This aim will be pursued by maintaining strong and permanent ASN involvement in European and international bodies. Many cases need to be dealt with, ranging from negotiations around the new European "basic standards" directive, to the Commission's work on IAEA safety standards.

In line with its highly proactive policy of international cooperation, ASN will be looking to engage in all of these subjects.

REGIONAL OVERVIEW OF NUCLEAR SAFETY AND RADIATION PROTECTION

1 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE AQUITAINE, POITOU-CHARENTES AND MIDI-PYRÉNÉES REGIONS REGULATED BY THE **BORDEAUX** DIVISION 209

2 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE BASSE AND HAUTE NORMANDIE REGIONS REGULATED BY THE **CAEN** DIVISION 211

3 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE PICARDIE AND CHAMPAGNE-ARDENNE REGIONS REGULATED BY THE **CHÂLONS-EN-CHAMPAGNE** DIVISION 217

4 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE BOURGOGNE AND FRANCHE-COMTÉ REGIONS REGULATED BY THE **DIJON** DIVISION 221

5 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE NORD-PAS-DE-CALAIS REGION REGULATED BY THE **LILLE** DIVISION 223

6 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE RHÔNE-ALPES AND AUVERGNE REGIONS REGULATED BY THE **LYON** DIVISION 227

7 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE PROVENCE-ALPES-CÔTE-D'AZUR, LANGUEDOC-ROUSSILLON AND CORSE REGIONS REGULATED BY THE **MARSEILLE** DIVISION 233

8 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE PAYS DE LOIRE AND BRETAGNE REGIONS REGULATED BY THE **NANTES** DIVISION 239

9 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE CENTRE, LIMOUSIN AND ILE-DE-FRANCE REGIONS REGULATED BY THE **ORLÉANS** DIVISION 243

10 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE ILE-DE-FRANCE REGION AND OVERSEAS FRANCE *DÉPARTEMENTS* AND TERRITORIAL COMMUNITIES REGULATED BY THE **PARIS** DIVISION 247

11 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE ALSACE AND LORRAINE REGIONS REGULATED BY THE **STRASBOURG** DIVISION 249

CHAPTER 8

ASN has 11 regional divisions through which it carries out its regulatory responsibilities nationwide and in the Overseas France and Territorial Communities.

The activities of the ASN regional divisions are carried out under the authority of the regional ASN representatives (see chapter 2 - point 2|3|2.

The ASN divisions carry out direct inspections on the basic nuclear installations (BNIs), on radioactive material transport and on small-scale nuclear activities and investigate most of the licensing applications submitted to ASN by the nuclear activity licensees within their regions. The divisions check application of the regulations relative to nuclear safety and radiation protection, labour inspection, pressure equipment, installations classified on environmental protection grounds (ICPEs) and liquid and gaseous effluent discharges, in these installations.

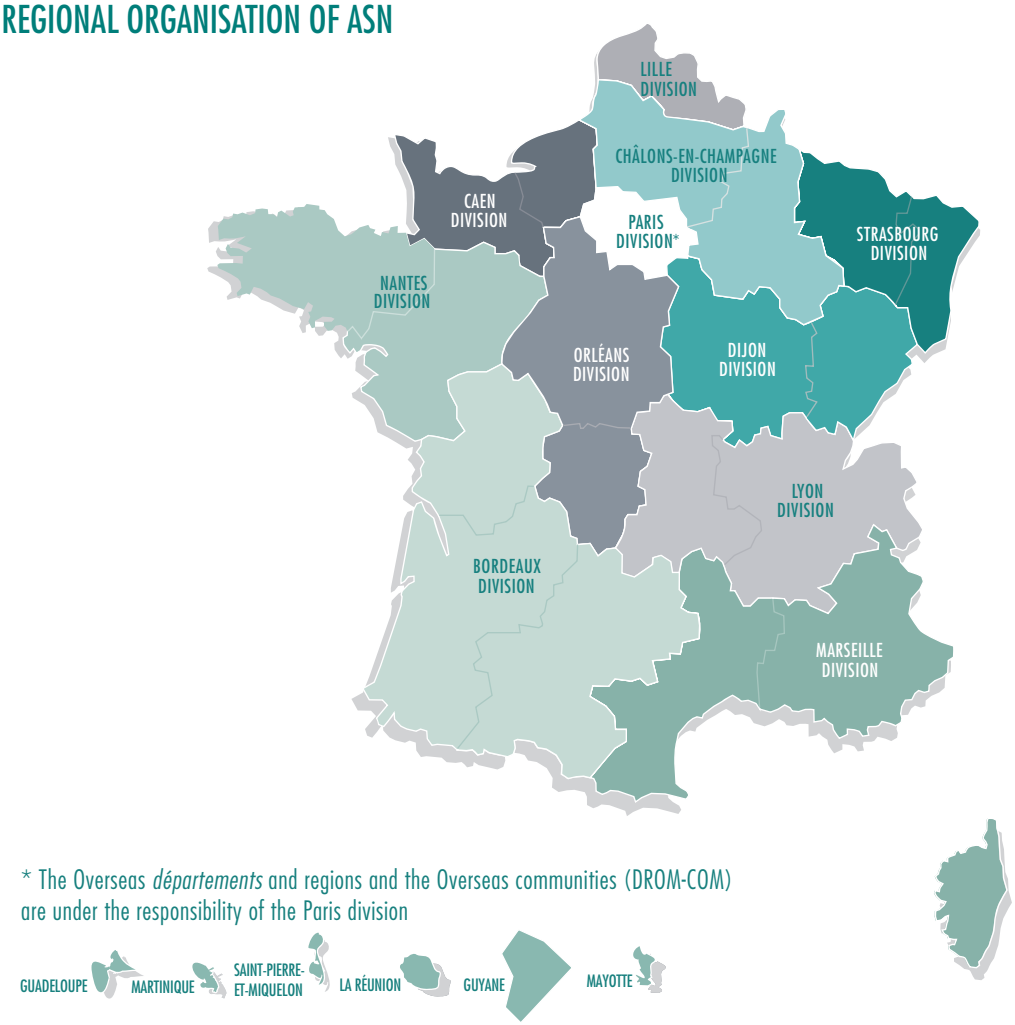
In radiological emergency situations, the divisions assist the *Préfet*[1] of the *département*, who is responsible for protection of the population, and check the measures taken on the site by the licensee to make the installation safe. To ensure preparedness for these situations, they take part in preparing the emergency plans drafted by the *Préfets* and in periodic exercises.

The ASN divisions contribute to the public information duty. They for example take part in the meetings of the local information committees (CLIs) of the BNIs, and maintain regular relations with the local media, elected officials, associations, licensees and local administrations.

The purpose of this chapter is, in addition to ASN's overall assessment of nuclear safety and radiation protection for each major activity and main licensee, to present an assessment of the situation observed locally by the ASN divisions.

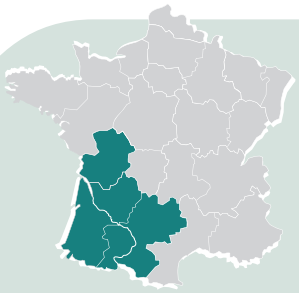
Each section addresses the nuclear safety and radiation protection aspects of the nuclear facilities on the sites in a particular region. It also provides insight into the local issues and identifies certain local initiatives that are particularly representative of ASN's regional action, particularly in terms of communication and cross-border relations.

THE REGIONAL ORGANISATION OF ASN



1. In a *département*, representative of the State appointed by the President

BORDEAUX



1 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE AQUITAINE, POITOU-CHARENTES AND MIDI-PYRÉNÉES REGIONS REGULATED BY THE **BORDEAUX** DIVISION

The Bordeaux division is responsible for regulating nuclear safety and radiation protection in the 17 *départements* of the Aquitaine, Poitou-Charentes and Midi-Pyrénées regions.
As at 31 December 2011, the workforce of the ASN Bordeaux division stood at 22 officers: 1 regional head, 2 deputies, 15 inspectors and 4 administrative officers, under the authority of an ASN regional representative.

The activities and installations to regulate in Aquitaine, Poitou-Charentes and Midi-Pyrénées comprise:
– the Le Blayais NPP (4 reactors of 900 MWe);
– the Civaux NPP (2 reactors of 1,450 MWe);
– the Golfech NPP (2 reactors of 1,300 MWe);
– 22 external radiotherapy departments;
– 8 brachytherapy departments;
– 24 nuclear medicine departments;
– 150 departments carrying out interventional radiology procedures;
– 150 tomography devices;
– about 6,900 medical and dental radiodiagnostic devices;
– about 1,500 veterinary radiodiagnostic devices;
— 32 industrial radiology companies;
– 600 industrial and research equipment items.

In 2011, ASN carried out 51 nuclear safety inspections, including 9 post-Fukushima inspections, and 26 labour inspections in the Le Blayais, Civaux and Golfech NPPs, 6 radioactive material transport inspections and 125 small-scale nuclear facility inspections in the Aquitaine, Poitou-Charentes and Midi-Pyrénées regions.

Eight significant events rated as level 1 on the INES scale were notified by the nuclear installation licensees of these regions in 2011. In small-scale nuclear activities, ASN was notified of two significant events rated level 2 and twenty-six significant events rated level 1 on the ASN-SFRO scale, and one significant event rated level 1 on the INES scale.

In the exercise of its regulation duties, ASN's Bordeaux division sent three violation reports to the public prosecutor's department.

1 Assessment by domain

1.1 Assessment of BNI nuclear safety

Blayais NPP

ASN considers that nuclear safety and radiation protection performance of the Blayais site on the whole matches ASN's general assessment of EDF, and that the radiation protection performance stands out positively. ASN considers that the site has shown rigour in this area, particularly in the management of controlled areas and dosimetry.

ASN considers that the site must be more rigorous in the preparation, performance and inspection of operating and maintenance activities. Consequently, application of the reliability enhancement practices must be improved.

Lastly, despite improved control of discharges, the site must be more rigorous in the tracking and maintenance of the equipment that contributes to environmental protection and monitoring, in order to guarantee compliance with the regulatory requirements.

Civaux NPP

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Civaux site on the whole match ASN's general assessment of EDF performance.

With regard to nuclear safety, ASN notes that certain improvements are required in the preparation and reliability of interventions on the site. It also observes recurrent conformity deviations on earthquake-qualified equipment.

In other respects, ASN notes that the collective dosimetry remains low despite the numerous work activities that went on during the 10-year inspection. It nevertheless wishes to see improvements in the conditions of implementation of the EVEREST initiative (entry into controlled areas wearing standard working overalls).

Lastly, ASN considers that the site must remain vigilant in the management of its discharges during low water periods.

Golfech NPP

ASN considers that nuclear safety and radiation protection performance of the Golfech site on the whole matches ASN's general assessment of EDF, and that the environmental protection and radiation protection performance stands out positively with respect to ASN's general assessment of EDF.

ASN considers that the site must be more rigorous in the preparation, performance and second-level inspection of plant operations and in the monitoring of maintenance activities performed by outside contractors. Furthermore, ASN thinks that the seismic risk should be given greater consideration and that emergency situation management must be improved.

ASN notes that the site continues the good radiation protection performance it has displayed for several years now, and ensures satisfactory contamination control in the controlled areas.

1|2 Assessment of radiation protection in the medical field

The inspection of the radiotherapy departments in 2011 revealed progress - to varying degrees - in application of the ASN decision relating to the quality and safety of radiotherapy treatments. While some centres have devoted considerable energy to this, others have fallen well behind in application of the decision. ASN will continue its inspections in this area.

ASN also endeavoured to check that the medical radiation physics teams were adequate, particularly with regard to the complexity of the devices used in each of the centres.

ASN's Bordeaux division moreover received a larger number of significant event notifications in radiotherapy, which reflects the undertaking of an experience feedback initiative to be continued in 2012.

This drive to improve treatment safety is to be reinforced in 2012, particularly with regard to the analysis of a priori risks and deepening the analysis of adverse events.

ASN continued its inspections in the field of interventional radiology and the use of X-rays in the operating theatre. Numerous shortcomings in worker and patient radiation protection were observed in the course of the 29 inspections carried out in operating theatres, including the failure of health professionals to wear dosimeters, the lack of enhanced medical surveillance of doctors, and deficiencies in the optimising of the equipment delivering the ionising radiation.

Owing to the lack of medical radiology technologists in the operating theatres, shortcomings in medical staff training in patient radiation protection, and deficiencies in quality checks of the equipment used, ASN considers that the doses received by patients are not sufficiently optimised.

The inspections conducted by ASN moreover reveal that measures must be taken to minimise the doses received by workers.

1|3 Assessment of radiation protection in the industrial and research sectors

ASN continues regular inspections of activities that have potentially high consequences from the radiation protection aspect, such as industrial radiology. During the twelve inspections carried out in 2011, ASN observed progress in the in-house radiation protection checks and precise defining of radiation protection zoning. It nevertheless considers that the ordering customers of the gamma radiography companies are insufficiently involved in radiation protection. More specifically, they make excessive use of on-site gamma radiography services instead of having the examinations performed in protected bunkers. Furthermore, they rarely draw up prevention plans and the zoning plans are poorly formalised.

Over the last two years, ASN's Bordeaux division has inspected each gamma radiography agency of South-West France at least once in an on-site situation. Moreover, on 16 June 2011 it invited the main industrial radiology enterprises to a day of information and discussion on application of the regulations.

ASN has noted that a number of universities in South-West France have established a procedure for regularising and disposing of the legacy radioactive sources held in their laboratories.



ASN inspection industrial radiography (gamma radiography) – October 2011

To do this they have created an organisational structure to track the activities that use radioactive sources and have decided on investments to bring the structures into compliance and ensure the disposal of sources. These efforts are to be continued in 2012.

ASN deems that any university that has not yet started these regularisation procedures must now make it a priority.

1|4 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

ASN carried out six inspections concerning the transport of radioactive material in 2011. It considers that the findings for the inspected organisations are generally satisfactory. Progress has been observed since 2006 among the local shippers of radiopharmaceutical products in particular.

This being said, the pre-departure verifications of the packages must be further improved, making them more systematic and rigorous.

Furthermore, the involvement of the transport safety advisors must result in greater presence and verifications on the ground so that their annual reports contain more precise and relevant recommendations that will improve worker radiation protection.

2 Additional information

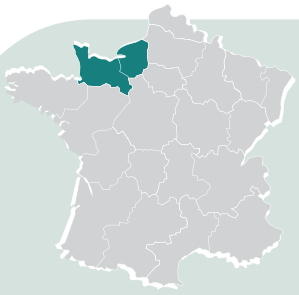
2|1 Public information actions in 2011

ASN supported the work of three local information committees (CLIs) in south-west France by attending all their annual general meetings and several technical committee meetings.

The CLIs sent observers who were able to attend several inspections, including the targeted post-Fukushima inspections conducted in each NPP in the region.

ASN held a press conference in Bordeaux on 24 May and in Toulouse on 26 May 2011.

asn CAEN



2 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE BASSE- AND HAUTE-NORMANDIE REGIONS REGULATED BY THE **CAEN** DIVISION

The Caen division regulates nuclear safety and radiation protection in the five *départements* of the Basse- and Haute-Normandie regions. The Caen division also covers the Monts d'Arrée site (Brennilis NPP currently undergoing decommissioning) in the Bretagne region.
As at 31 December 2011 the workforce of the Caen division stood at twenty-six officers: one regional head, three deputies, eighteen inspectors and four administrative officers, under the authority of an ASN regional representative.

The activities and facilities to regulate in Normandy and Brittany comprise:
– the EDF NPPs at Flamanville (2 reactors of 1,300 MWe), Paluel (4 reactors of 1,300 MWe) and Penly (2 reactors of 1,300 MWe);
– the construction site for the future EPR Flamanville 3 reactor;
– the AREVA NC spent nuclear fuel reprocessing plant at La Hague;
– the ANDRA Manche repository
– GANIL national large heavy ion accelerator (Caen)
– the Brennilis NPP (Finistère *département*) undergoing decommissioning;
– 8 radiotherapy centres (21 machines);
– 3 brachytherapy departments;
– 11 nuclear medicine units;
– 62 users of scanners;
– 35 interventional radiology departments;
– 750 medical radiodiagnostic devices;
– 1,400 dental radiodiagnostic devices;
– 18 industrial radiography companies;
– 250 industrial and research devices (including a cyclotron for the production of radionuclides);
– 6 head offices and 19 agencies of organisations approved for radiation protection checks.

In 2011, ASN carried out 150 inspections of nuclear facilities in Normandy and Brittany, including 19 inspections based on the initial experience feedback from the Fukushima accident:
– 60 inspections on fuel cycle and research facilities, and facilities undergoing decommissioning, including the AREVA NC site at La Hague;
– 60 inspections in the EDF's Flamanville, Paluel and Penly nuclear power plants;
– 25 inspections on the construction site for the future EPR Flamanville 3 reactor.

69 inspections were also carried out in 2011 in small-scale nuclear activities in Normandy, and 10 inspections in radioactive material transportation.

In addition, 91 days of labour inspection were carried out on the NPPs and the Flamanville 3 site. Sixteen events rated level 1 on the INES scale were notified by nuclear installation licensees of the Normandie and Bretagne regions in 2011. One event rated level 2 and seven events rated level 1 on the ASN-SFRO scale were declared by the heads of radiotherapy departments in the Normandie region. The inspections conducted in 2011 by ASN's Caen division led to the submission of five violation reports to the competent public prosecutors.

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

AREVA NC plant at La Hague

ASN considers that the situation of the AREVA NC plants in La Hague is satisfactory with regard to personnel exposure and discharges into the environment. The year 2011 was nevertheless marked by the unavailability of an evaporative capacity[1] that obliged changing the industrial operations schedule. ASN considers that AREVA NC must ensure that such technical difficulties are better anticipated in order to limit the delays in the recovery of certain wastes, and to repair the faulty equipment within acceptable times.

The industrial organisation of the AREVA La Hague site underwent major changes in 2011, which that consisted essentially in grouping the operating teams in charge of the in-service plant production and maintenance on "industrial platforms". While this general reorganisation went well on the whole, the project to outsource operational control of the energy production facilities failed. Insourcing of the safety engineers was also carried out and led to a relatively high rate of renewal of this engineering branch. ASN maintains vigilance to ensure that such reorganisation projects help maintain or improve interfaces, particularly between the operating control of the units and their maintenance.

ASN considers that AREVA must continue its efforts to improve the baseline safety standards of its plants by defining the elements important for the safety of its facilities, in compliance with the order of 10 August 1984[2]. Insofar as specific safety studies were demanded for the site as part of the Fukushima accident experience feedback, several other studies fell behind schedule during 2011. ASN is nevertheless ensuring that the studies necessary for the safety review of the

1. Evaporative capacity: equipment item using a heat source that separates the most radioactive substances in a liquid solution; the ultimate aim of the equipment is to direct the most radioactive substances towards waste packages and limit the other effluents to be treated or discharged.
2. Order of 10 August 1984 relative to the quality of design, construction and operation of BNIs.

UP3-A plant, which is currently in progress, are provided within the deadlines.

ASN observes that significant event notifications were satisfactory in 2011; the number is down in the safety sector, particularly for inspections and periodic tests, and stable in the environmental sector.

With regard to legacy waste recovery operations, ASN carried out a review inspection that revealed the good overall organisation of the management of the projects, most of which are in the study phase. In spite of the definite progress observed in the project studies, ASN notes that the tangible results of legacy waste recovery for 2011 remain very limited, given that the vitrification of UMo fission products has not started and the chemical treatment of the reconditioned drums in building 119 was virtually zero in 2011. ASN considers that the licensees must consider these legacy waste recovery projects - some of which have significant implications for safety - as priorities, and that they must comply with the schedules they have undertaken to follow or that ASN has prescribed.

Flamanville NPP

The Flamanville site in 2011 remains involved in a programme to improve the site's safety performance. ASN considers that in this area the site has attained a stable situation, and its performance now matches ASN's assessment of EDF's performance as a whole. The weaknesses of the site, which ASN has clearly identified, result from organisational problems, maintenance shortcomings, and inadequacies in the safety culture.

The investments in the facilities, made notably in the context of a specific action plan implemented since mid-2010, have considerably improved their condition. ASN also notes positively that efforts are being made to catch up on the substantial maintenance backlog.

ASN has observed a lack of responsiveness and foresightedness in several technical files during outages simply to refuel the reactors.

Paluel NPP

For the Paluel NPP, the year 2011 was a marked by significant events that reveal a decline in the rigour of operating and maintenance operations. These events also indicate weaknesses in activity monitoring and the safety culture of the personnel, and inadequate preparation for work interventions, particularly during the transient phases of shutdown and restarting.

The site has however progressed in occupational radiation protection. Emergency situation management is satisfactory, as was shown by the national emergency exercise held on 29 September 2011.

ASN considers that the site has improved the management of its non-radioactive waste discharges into the environment, despite the persistence of non-radioactive gaseous discharges from certain cooling units.

Penly NPP

The inspection conducted on the Penly NPP in 2011 revealed no particular difficulties and the site stands out positively with respect to ASN's general assessment of EDF. More particularly, ASN noted the progress the site has made in pressure equipment tracking and monitoring.

Reactor 1 was shut down in the last quarter of the year to undergo its second 10-year inspection, during which many maintenance operations performed, including full requalification of the main primary system, the reactor building containment tightness test, and partial overhaul of the rotating drum screens filtering the cooling sea water.

Construction of the EPR Flamanville 3 reactor

After delivering the creation authorisation decree (DAC) and the building permit, the construction work on the Flamanville 3 reactor began in September 2007. The first concrete for the nuclear island buildings was poured in December 2007. Since then the civil engineering works have continued. The installation of the first components (tanks, pipes, cables and electrical cabinets, etc.) began in 2010 and continued during 2011.

ASN conducted twenty-five inspections on the Flamanville 3 construction site in 2011. The inspections focused chiefly on the civil engineering of the buildings and structures, the mechanical and electrical assemblies of the systems and components, worker occupational exposure, environmental protection, the impact of the construction activities on reactors 1 and 2, and the monitoring of outside contractors. ASN also carried out inspections concerning the transfer of the facilities to the future licensee.

During the inspections on the construction site in 2011, ASN was particularly attentive to checking that the efforts devoted to worker safety culture training and awareness were adequate, and that this safety culture is lastingly maintained. On the whole, ASN considers that the organisational setup implemented by EDF is satisfactory in the areas inspected.

With regard to the civil engineering, ASN noted an overall improvement in the quality of the work, but it also noted technical difficulties with certain complex activities that required the implementation of specific plans of action at its request. ASN makes sure that these actions are monitored over time in order to guarantee satisfactory construction quality of the Flamanville 3 reactor. ASN also ensures that the workmanship standards in the activities that have become much more intense since early 2010, such as mechanical and electrical assembly operations, are maintained over time. Given the reactor commissioning times announced by EDF, ASN also ensures that appropriate equipment protection is maintained.

ASN considers that the environmental protection performance on the Flamanville 3 construction site is satisfactory on the whole. ASN considers that despite improvements in worker occupational exposure on the Flamanville 3 construction site, further improvements can be made. EDF must remain vigilant with regard to radiographic inspection procedures and ensure that they are strictly applied by the contractors working on the site. Lastly, concerning the preparation of the future licensee for entry into service, ASN considers that the main tasks are under way and that the organisation is gradually taking shape.

ASN fulfils the labour inspection duties on the Flamanville 3 construction site. During the first half of 2011, the construction



Overall view of the Flamanville EPR construction site – September 2011

site was marked by occupational accidents on 24 January and 11 June respectively, resulting in the death of two workers, and by the death of an employee in a road accident on 24 June when driving home from work. The ASN labour inspectorate submitted its conclusions on the accidents of 24 January and 11 June to the judicial and administrative authorities. For the accident of 24 June, it communicated the relevant information to the competent common law labour inspectorate. Further to these events and in response to the demand from ASN, EDF initiated measures to improve safety on the construction site. These measures will be monitored and checked by the ASN labour inspectorate in 2012.

ASN also investigated the conditions of notification of occupational accidents on the Flamanville 3 construction site and the administrative conditions of employment of the employees from the European Union working on the site. This work is carried out in close cooperation with the other State services.

ANDRA's Manche repository

During 2011 ANDRA continued its modification work on the cover by reducing the gradient of the embankments in the north section applying a comparable methodology to that used in the east section in 2010. ASN considers that this work increases the stability of the embankments and is part of a more general process to ensure the long-term integrity of the repository cover. ANDRA has also carried out work to optimise the management of the effluents collected in the buried gravitational separation system. Lastly, ANDRA has produced the updates of the Centre's operating and monitoring rules and its on-site emergency plan (PUI), in accordance with the conclusions of the safety review finalised at the end of 2009.

GANIL (national large heavy ion accelerator)

GANIL started construction work on the SPIRAL 2 facility, for which examination of the creation authorisation application could not proceed as initially planned. ASN opted to proceed only with the examination of phase 1 of SPIRAL 2, because GANIL had failed to provide certain safety studies for phase 2 within the initially specified times. ASN asked GANIL to file a new application for phase 2 of SPIRAL 2.

ASN has remained particularly attentive to compliance with the general operating rules following a number of events in 2011, but has also noted the continuing improvements in monitoring of the issues relating to safety and radiation protection.

The Brennilis NPP undergoing decommissioning

A decree of 27 July 2011 authorised EDF to resume the decommissioning work. This decree is a partial decommissioning authorisation, as the public inquiry commission had

recommended, with the aim of completing the inventory of the initial radiological and chemical status of the site, completing the effluent treatment station decommissioning operations, cleaning out and filling in the effluent discharge channel leading to the river Ellez, cleaning out the diffuse pollution areas, and lastly, starting decommissioning of the heat exchangers following their radiological characterisation.

Furthermore, on 1 September 2011, ASN adopted two decisions relative to water intake conditions and the conditions and limits of effluent discharges from the Brennilis NPP corresponding to the activities authorised by the partial decommissioning decree.

At the end of 2011, EDF lodged a file for the complete decommissioning of the facility as required by the decree of 27 July 2011.

1|2 Assessment of radiation protection in the medical field

In 2011, ASN inspected those radiotherapy departments in Normandy that were not inspected in 2010, along with the departments suffering a shortage of medical physicists. These inspections revealed continuing progress in the rigour, organisation and traceability of interventions and the progressive implementation of management systems to ensure the quality and safety of treatments. Nevertheless, in spite of the increased personnel numbers in some radiotherapy centres, several of the centres in Normandy lack personnel, and more particularly in the medical radiation physics sector. These difficulties are often an obstacle to progress.

The Caen division intensified its checks in the interventional radiology sector and the use of X-rays in operating theatres. This field entails risks for both patients and workers, risks that have to be well controlled. The inspections carried out revealed many areas for improvement, including with regard to the training and qualification of the staff using the equipment, equipment quality controls, the quality of staff individual protective equipment, medical monitoring of non-salaried workers, and optimisation of practices in this sector.

In 2011, ASN inspected one third of the nuclear medicine departments in Normandy. The inspections revealed a relatively satisfactory situation, although a few areas for improvement remain in the coordination of the prevention measures for outside contractors and taking account of radiation exposure of workers' extremities (hands).

1|3 Assessment of radiation protection in the industrial and research sectors

Regulation of industrial radiology remains a high priority for ASN, which implemented an increased level of unannounced night-time inspections in 2011, notably with an inspection campaign in Haute-Normandie conducted jointly with the DIRECCTE (Regional directorate for enterprises, competition, consumption, work and employment) and the CARSAT (Retirement and occupational health insurance fund) of Normandy. These inspections have brought to light a widely contrasting picture of the way different companies handle the risk of worker exposure to ionising radiation: work conditions are improving on the whole, but some companies are not making progress. At the same time, the ASN, together with the DIRECCTE of Haute-Normandie and the CARSAT of Normandy is continuing to disseminate and promote good practices in this field, by urging the ordering customers and the radiology contractors to adhere to a regional charter drawn up in December 2007 at the instigation of ASN and the labour inspectorate. About forty companies have signed up to date.

1|4 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

The ten inspections conducted by ASN in the area of radioactive materials transport in 2011 hinged around different priority topics, in both the basic nuclear installations and small-scale nuclear activities.

ASN considers that the organisational measures in the BNIs in Normandy are satisfactory, with a good degree of involvement of the transport safety advisors. The inspections conducted in 2011 did nevertheless disclose deviations on which ASN must provide information. In small-scale nuclear activities, ASN considers that the situation can be improved, even if the deviations detected during the inspections do not call into question the safety of the transport operations. The deviations concerned



ASN inspection of a convoy of radioactive waste in Valognes – November 2011

more particularly the radiation protection of the carrier, the radiological inspections and quality assurance.

ASN also monitored the transportation from France to Germany of containers of vitrified radioactive waste originating from the reprocessing of German spent fuel on the AREVA NC site in La Hague. ASN performed two inspections to check that the dose rate around the convoy did not exceed the regulatory limits.

2 Additional information

2|1 International action by the Caen division

Given that EPR reactors are being built at Olkiluoto in Finland and Flamanville in France, the ASN Caen division is participating in the close cooperation between ASN and the Finnish nuclear regulator.

Thus in 2011, three inspectors from the Finnish nuclear regulator took part in a cross-inspection of the Flamanville 3 construction site and a day of technical discussions.

The Caen division was also able, in the context of the bilateral relations with the Chinese nuclear regulator (NNSA), to discuss the regulation practises of the two authorities, each of which is responsible for overseeing nuclear facilities under construction.

In addition to this, technical discussions were held, allowing the sharing of experience feedback specific to the EPR reactor construction sites in France and China.

An inspector from the Caen division took part in a cross-inspection with the UK's Office for Nuclear Regulation (ONR) on the Sizewall B nuclear power plant in England.

A cross-inspection was also held with the ONR on the Sellafield nuclear fuel reprocessing site. This inspection provided the opportunity for technical discussions on subjects that also concern the La Hague site: facilities in operation, legacy waste recovery, the decommissioning of old plants.

2|2 Public information actions in 2011

The Caen division held three press conferences on the nuclear safety and radiation protection situation in 2011, in Caen, Rouen and Rennes (the last was held jointly with the Nantes division).

ASN took part in various meetings of the CLI of Normandy and Brittany. During these meetings, ASN presented its assessment of the situation of the nuclear facilities concerned, and the control of the activities around the basic nuclear installations. ASN also presented the procedure for the complementary safety assessments required by the ASN as part of the initial experience feedback from the Fukushima accident.



Visit of the Flamanville EPR construction site with the Chinese nuclear regulator – November 2011



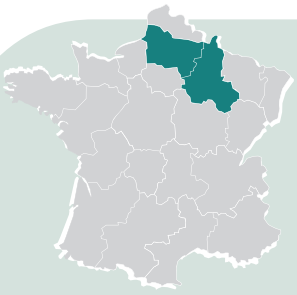
OPECST visit to the La Hague site – May 2011

ASN's Caen division invited the CLIs to attend the ASN inspections on several occasions. The inspections carried out in the EDF facilities, and the two inspections out six for which AREVA accepted the presence of the CLIs, in the framework of the initial experience feedback from the Fukushima accident, gave the CLI observers a precise picture of the ASN's duties.

2|3 Prospects for 2012

ASN's Caen division will carry out inspections to specifically verify that the corrective actions following the inspections of 2011 in the light of the initial feedback from the Fukushima accident and drawn from the complementary safety assessments, have been properly engaged. The ASN inspectors will also inspect the Brennilis NPP, currently being decommissioned, in the light of the Fukushima accident.

CHÂLONS-EN-CHAMPAGNE



3 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE PICARDIE AND CHAMPAGNE-ARDENNE REGIONS REGULATED BY THE CHÂLONS-EN-CHAMPAGNE DIVISION

The Châlons-en-Champagne division is responsible for regulating nuclear safety and radiation protection in the seven *départements* of the Champagne-Ardenne and Picardie regions.
As at 31 December 2011 the workforce of the Châlons-en-Champagne division stands at twelve officers: one regional head, two deputies to the regional head, seven inspectors and two administrative officers, under the authority of an ASN regional representative.

The activities and facilities to regulate in Champagne-Ardenne and Picardie comprise:
- the Chooz A NPP (currently being decommissioned);
- the Chooz B NPP (two 1,450 MWe reactors);
- the Nogent-sur-Seine NPP (two 1,300 MWe reactors);
- the low and intermediate level short-lived radioactive waste repository located at Soulaines-Dhuys in the Aube *département;*
- ANDRA's underground research laboratory in Bure, in preparation for the creation of a geological repository for high-and medium-level long-lived radioactive waste;
- about 80 licensed medical institutions, including 12 radiotherapy departments, 3 brachytherapy departments, 13 nuclear medicine departments and some fifty scanners;
- about 400 licensed industrial activities, with more than one-third of the licenses being for possession of devices to detect lead in paint;
- about ten research laboratories, mainly situated in the universities of Champagne-Ardenne and Picardie.

In 2011, ASN carried out 46 inspections of nuclear facilities (EDF power plants, radioactive waste disposal facility), of which six were targeted "post-Fukushima" inspections. 60 inspections were also carried out in small-scale nuclear activities and 3 inspections in radioactive material transportation.

ASN conducted 7 labour inspections in the nuclear power plants.

Five significant events rated level 1 on the INES scale were notified by nuclear installation licensees in 2011. In the small-scale nuclear facilities, 4 significant events of level 1 on the ASN-SFRO scale and 1 significant event of level 1 on the INES scale were notified to ASN.

In the framework of its regulation duties, ASN submitted two violation reports to the public prosecutor's department.

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

Nogent-sur-Seine NPP

ASN considers that the results for the Nogent-sur-Seine site are globally satisfactory in the areas of radiation protection and conventional pressure equipment.

ASN observes a slight reduction in safety performance, with progress to be made in operating rigour. Three events rated level 1 on the INES scale were effectively notified during reactor shutdowns in 2011. The equipment padlocking errors resulting partly from the excessive work load during shutdown periods remain a subject of concern for ASN. The site must moreover ensure better dissemination of experience feedback within the operating teams. ASN also notes a deterioration in the quality of the operations performed on the nuclear pressure equipment compared with the previous years.

ASN moreover considers that monitoring of outside contractors can be improved, from the aspects of process control, transposing national requirements into the site organisation memos, and ensuring the presence of EDF personnel on the ground.

Lastly, ASN considers that the NPP's environmental efforts are not yet conclusive. ASN observes in particular that the management of certain liquid effluent retentions areas is still not up to standard.

Chooz NPP

ASN considers that in 2011 the Chooz NPP maintained satisfactory standards in radiation protection, especially during the



ASN inspection on the theme of the environment at the Nogent-sur-Seine NPP – December 2011

reactor 1 maintenance outage, and in the operation of pressure equipment.

With regard to safety, ASN considers that the operator must remain vigilant in the application of the facility operating instructions; several failures to comply with the operating technical specifications were observed, essentially during the reactor 1 maintenance outage.

This being said, ASN considers that the licensee has made progress in the control of the maintenance activities, and these efforts must be continued. The majority of the deviations from the operating technical specifications originate in work carried out in 2010 or earlier. Improvements must also be made in work site ergonomics (lighting, work stations).

With regard to the environment, ASN has observed inadequacies in the operation and maintenance of the monochloramine treatment facilities for the cooling effluents. It has, on the other hand, noted the good quality of the work of the environmental monitoring laboratory, even though the environmental monitoring systems are still often unavailable. ASN has also noted the significant reduction in leaks of coolant compared with previous years; the licensee must not slacken its vigilance in this respect, particularly with regard to intervention times.

Lastly, ASN considers that significant and appreciable progress was made in the control of containment, radiation protection and safety in the dismantling activities on the Chooz A decommissioning site in 2011. The licensee responded positively and energetically to the deviations observed in late 2010 and early 2011.

The waste repository at Soulaines-Dhuys and the Bure laboratory

Operation of the low-and intermediate-level, short-lived, waste repository at Soulaines-Dhuys, and the work done by ANDRA in the Bure underground laboratory continued in 2011 with a good level of quality that is comparable with the performance of previous years.

1|2 Assessment of radiation protection in the medical field

External beam radiotherapy

Considering the conclusions of the inspections of all the twelve centres carried out in 2010, only four centres with structural difficulties (personnel shortage) and/or organisational difficulties (delay in applying quality assurance to the patient management process) were inspected in 2011. These inspections revealed positive developments in both personnel numbers and quality management system deployment. In 2012 it is planned to inspect the eight centres that were not inspected in 2011.

Interventional radiology

Continuing the measures undertaken since 2009, eleven inspections were carried out in 2011, mainly in operating theatres. As in the previous years, highly contrasting situations were observed, but on the whole they call for strong measures in terms of radiation protection of the workers and the patients. More specifically, progress is required in personnel training and inspection of the medical equipment. Considering this context, the level of inspections applied in 2011 will be maintained in 2012, that is to say about ten inspections.

Nuclear medicine

Six of the thirteen centres were inspected in 2011, thereby ensuring that all the centres have been inspected at least once since 2009. These inspections show that radiation protection is duly taken into account. Improvements are nevertheless expected in the management of contaminated effluent and the optimising of worker occupational exposure. These conclusions were presented to all the centres at a seminar attended by some fifty participants, held in Reims on 4 November 2011. The participants greatly appreciated the seminar, and would like to see it become a periodic event.

Computed tomography (CT)

For inspections were carried out in 2011, stepping up the examination of the patient radiation protection measures taken by the centres. The reason for this is that CT examinations represent a significant source of exposure to ionising radiation in the French population. It has been found that patient radiation protection is a genuine concern in the centres, taken into account in the choice of new equipment and resulting in mean exposure levels for the most common examinations that are lower than the reference levels indicated in the regulations. Progress can nevertheless still be made by optimising certain protocols. Increased involvement of medical physicists could contribute to progress in this respect.

1|3 Assessment of radiation protection in the industrial sector

Industrial radiography

Given the potential implications in terms of radiation protection, ASN performed a large number of inspections on work sites using gamma radiography. The areas for progress in this domain include personnel training, work site preparation, development of the safety culture and preparation for incident situations.

Lead detectors

ASN conducted a sampling inspection campaign of holders of detectors of lead in paint. These inspections confirmed the numerous deviations from the regulations observed in a similar campaign carried out in 2010: regulatory verifications not carried out, expired authorisations, transfer of devices to unauthorised users, etc. This activity sector will be subject to further inspections in 2012.

Along with decentralized Government services and ANDRA, ASN contributed to the study of the treatment of legacy radioactive pollution resulting from the operation of the former ORFLAM-PLAST plant in Pargny-sur-Saulx (*département* 51). The first clean-out operations that began in 2010 were continued in 2011 and should normally be completed in 2012.

1|4 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

ASN carried out three inspections in 2011, involving two carriers and one shipper of radiopharmaceuticals. These inspections reveal that the regulations governing the transport of radioactive substances are generally well respected. Certain operations nevertheless need to be better documented.

2 Additional information

2|1 International action by the Châlons-en-Champagne division

The Châlons-en-Champagne division continued to maintain regular relations with AFCN, the Belgian nuclear regulator. The cross-inspections continued in small-scale nuclear activities and in the field of nuclear safety. Belgian and French inspectors took part in the inspections conducted on the Chooz and Tihange sites in the light of the experience feedback from the Fukushima accident. The Châlons division took part in the meetings of the Franco-Belgian management committee and the work of the Franco-Belgian "safety" working group, as well as the meetings held by the EDF and Electrabel - the licensees of the Chooz and Tihange sites respectively - to present the complementary safety inspections to the AFCN and ASN. It also took part in the Franco-Luxembourg committee meeting.

Lastly, it helped host several foreign delegations that came to visit the Bure Laboratory and the Soulaines-Dhuys repository, and accompanied a delegation from the Bure CLIS that visited the waste disposal research facilities of Mont Terri in Switzerland.

2|2 The other notable findings in the Champagne-Ardenne and Picardie regions

In the context of major risk prevention, the ASN division participated – in collaboration with the Ministry of Defence – in the emergency exercise organised on the Saint-Dizier airbase.

2|3 Public information actions in 2011

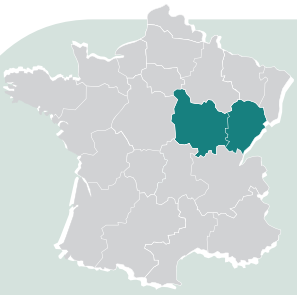
The Châlons-en-Champagne division held two press conferences on the status of nuclear safety and radiation protection in spring 2011, one in Châlons-en-Champagne, the other in Amiens.

ASN took part in various meetings of the Chooz, Nogent-sur-Seine and Soulaines CLIs. At these meetings it presented ASN's assessment of the safety of the nuclear facilities concerned, the work of the CODIRPA on the management of post-accident phases, the known information relative to the accident at the Fukushima NPP in Japan, and the process of the complementary safety assessments (CSA) implemented by the licensee EDF on the Chooz and Nogent-sur-Seine sites, and the results of the inspections carried out on the themes adopted for the CSAs. The Châlons-en-Champagne division also attended annual general meetings, meetings of the board of governors and meetings of the commissions of the Bure CLIS, contributing in particular to the informing of the local populations.



Day of information and discussions with the nuclear medicine professionals of the Champagne-Ardenne and Picardie regions on 4 November 2011

DIJON



4 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE BOURGOGNE AND FRANCHE-COMTÉ REGIONS REGULATED BY THE **DIJON** DIVISION

The Dijon division of ASN monitors nuclear safety and radiation protection in the eight *départements* of the Bourgogne and Franche-Comté regions.
As at 31 December 2011 the workforce of the Dijon division stood at 6 officers: 1 regional head, 4 inspectors and 1 administrative officer, under the authority of an ASN regional representative.

The activities and installations to regulate in Bourgogne and Franche-Comté comprise:
– 8 external radiotherapy departments (19 accelerators, 1 contact radiotherapy device);
– 3 brachytherapy departments;
– 14 nuclear medicine departments;
– 42 surgical units using interventional radiology;
– 41 diagnostic tomography devices;
– about 700 medical radiodiagnostic devices;
– about 1,100 dental radiodiagnostic devices;
– 310 industrial and research facilities.

ASN carried out 63 inspections in 2011, of which 6 addressed radioactive material transport and 57 were in small-scale nuclear facilities.

No radiation protection incidents affecting patients rated above level 0 on the ASN-SFRO scale were notified to the Dijon division in 2011.

In the framework of its regulation duties, the Dijon division sent one violation report to the public prosecutor's department.

1 Assessment by domain

1|1 Assessment of radiation protection in the medical field

External radiotherapy

In 2011, ASN inspected four of the eight external radiotherapy centres of Bourgogne and Franche-Comté. It also conducted four technical visits for the commissioning of accelerators (replacement of two machines and installation of new accelerators in Auxerre and Nevers). All the centres thus have a machine that complies with the criteria required by the INCa.

The shortage of human resources in medical radiation physics evidenced in the previous years is becoming less marked. The situation nevertheless remains delicate due to the numerous job opportunities available to medical physicists.

The implementation of a quality assurance system pursuant to the ASN decision of 1 July 2008 is under way. Although many centres have not complied with the implementation deadlines, this initiative, which enables the centres to formalise their practices and analyse the risks, should be concluded in 2012, with the aim of improving the safety of treatments.

The centres have set up an organisation to ensure the in-house and external quality checks required by the decision of AFSSAPS, the French Health Product Safety Agency. This being said, the organisation is not always formalised in writing, and the in-house checks are not carried out in full. Progress remains to be made in this area.

ASN observes a clear improvement in the health professionals' awareness of the need to detect, analyse and notify events liable to affect the health of patients or workers. Seven of the eight external radiotherapy centres have notified ASN of events since 2008.

Interventional radiology

In 2011, the number of surgical platforms fell sharply in the Bourgogne and Franche-Comté regions (closure of operating theatres in small hospital centres and sharing of means in private clinics).

In 2011, ASN carried out twelve inspections of centres that use image intensifiers in the operating theatre. The situation remains contrasted from one centre to another: there are great disparities in the performance of the devices used, in the performance of the quality checks of these devices as required by the AFSSAPS, and in the setting up of controlled areas ("zoning") within the operating theatres.

The involvement of doctors in radiation protection in the operating theatre remains low, and far below that of the rest of the personnel, particularly in the case of operations carried out by private practitioners.

The inspections carried out over the last three years in interventional radiology show an improvement in the dosimetric monitoring of the workers. Likewise, ASN observes a slight improvement in the integration of radiation protection in the operating theatres. Greater involvement of medical physics in this sector of activity would ultimately help to achieve a more tangible reduction in doses delivered to patients.

Nuclear medicine

Over the last three years ASN has observed a notable improvement in the formalising of risk assessments and zoning in nuclear medicine. It is moreover increasingly frequent to have a medical physicist analyse the activity levels of radiopharmaceuticals administered in the context of the diagnostic reference levels (DRL), thereby helping achieve an appreciable reduction in the activities administered to patients.

The quality inspections, however, are not always conducted exhaustively, and the work station analyses are rarely complete.

Computed tomography (CT)

The inspection of medical imaging services equipped with a CT scanner was stepped up in 2011. Particular attention was paid to patient radiation protection. Eleven services were thus inspected in the Bourgogne and Franche-Comté regions.

ASN observes that techniques for reducing or optimising doses delivered to patients are widely applied through the adaptation of examination protocols and when choosing new equipment.

Nevertheless, although compliance with the principle of optimisation that controls the individually delivered doses is generally observed, the justification for the CT examination is not always provided.

Furthermore, ASN notes that certain examinations that could be performed using a magnetic resonance imaging (MRI) scanner instead of the CT scanner, are not performed because there are not enough MRI scanners available.

1|2 Assessment in the industrial sector

The inspections of the industrial radiology activity conducted by the Dijon division of ASN in 2011 provide contrasting results.

The radiation doses likely to be received by the personnel during radiological inspections are almost always estimated on a predictive basis. Radiation measuring equipment is worn equally well on the outdoor job sites as during inspections performed in dedicated enclosures.

On the other hand, improvements can be made in the marking out of operation areas, of areas prohibited to the public, and in the control of access to these areas, particularly on the outdoor job sites. The job site preparatory work must therefore be improved in order to remedy this situation.

The use of X-ray generators instead of the traditional high-activity sources seen in the previous years is becoming more widespread, particularly for the inspection of pipes.

1|3 Assessment of the transport of radioactive substances

ASN notes an improvement in the conditions of transport of radiopharmaceuticals and increased rigour in the management of the statutory documentation and the verification of the safety equipment. Securing of the loads has been substantially improved.

The same goes for the holders of radioactive sources who transport their equipment themselves. However, the documentation relative to the transport operations is not always referenced in the company quality manuals.

2 Additional information

2|1 The other notable findings in the Bourgogne and Franche-Comté regions

The former uranium mining sites

After inspecting virtually all the mining sites of Saône-et-Loire in 2009, ASN participated in 2011 in an unannounced inspection of the residue disposal site in Gueugnon, alongside the DREAL (Regional Directorate for the Environment, Planning and Housing) of Bourgogne.

As regards the Gueugnon site, the clean-out operations were carried out in 2009 and 2010. A final radiological inspection of these zones revealed that a small number of them required further clean-out. This clean-out was performed by AREVA in 2011. The population and local associations were informed regularly of the progress of the works and involved in the surveillance actions. Thus, a meeting of the local information and surveillance committee (CLIS) was held on 20 September 2011 to present a full review of the work and the radiometric measurements taken.

Furthermore, on 8 November 2011 the administrative tribunal of Dijon cancelled the complementary prefectural order of 29 June 2009 that had been taken to allow the material excavated during the clean-out work to be stocked on the site. In 2012, a new complementary order will be taken to integrate the modification of the classified installations nomenclature that took place in January 2011.

With regard to the Issy-l'Évêque site, investigations must be carried out in early 2012 to better characterise this disposal site. The works undertaken were presented to the elected officials and local associations on 30 September 2011, at a meeting of the CLIS created for this purpose.

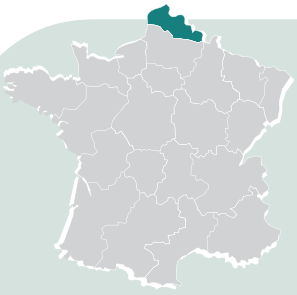
2|2 International action by the Dijon division

The Dijon division took on a Moroccan trainee for two weeks, at the request of the IAEA. He took part in the preparation and performance of several inspections in the industrial and medical sectors. Besides this, discussions were held with all the division's personnel on the authorisation delivery practices and the inspections carried out in this context.

2|3 Public information actions in 2011

At the end of May 2011 the Dijon division held a press conference on the status of nuclear safety and radiation protection in the Bourgogne and Franche-Comté regions.

asn LILLE



5 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE NORD-PAS-DE-CALAIS REGION REGULATED BY THE **LILLE** DIVISION

The Lille division is responsible for regulating nuclear safety and radiation protection in the 2 *départements* of the Nord Pas-de-Calais region.
As at 31 December 2011 the workforce of the Lille division stood at 16 officers: 1 regional head, 2 deputies, 5 nuclear safety inspectors and 6 radiation protection inspectors as well as 2 administrative officers, under the authority of an ASN regional representative.

The activities and installations to be regulated by the Lille division include:
– the EDF Gravelines NPP (6 reactors of 900 MWe);
– the SOMANU (nuclear maintenance company - AREVA) site in Maubeuge (Nord *département*);

Installations and activities using ionising radiation in the medical, industrial and research sectors:
– 12 external radiotherapy departments;
– 2 brachytherapy departments;
– 15 nuclear medicine departments;
– 85 tomography devices;
– about 3,000 medical and dental radiodiagnostic devices;
– about 1,500 industrial devices;
– 30 research laboratories.

EASN carried out 128 inspections in 2011: 31 inspections in the Gravelines NPP (including 3 post-Fukushima inspections) and 2 inspections of SOMANU, the nuclear maintenance company in Maubeuge. 90 inspections were also carried out in small-scale nuclear activities, in the medical, industrial and research sectors, and 5 inspections in the area of radioactive material transport.

Three labour inspections were carried out in the Gravelines NPP.

Number of events in 2011:
– The Gravelines NPP notified 10 significant safety events rated level 1 on the INES scale;
– The radiotherapy centres notified 5 events rated level 1 or less on the ASN-SFRO scale.

The division drew up three violation reports and one formal notice to comply further to its inspections of the facilities.

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

Gravelines NPP

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Gravelines site on the whole match its general assessment of EDF performance.

ASN nevertheless considers that the site must demonstrate greater rigour, firstly in the detection and analysis of significant events in terms of safety, and secondly in the maintenance and operation of the reactors. ASN has more particularly asked the licensee to rapidly remedy the conformity deviations of certain equipment items involved in reactor cooling, which could be affected in the event of an earthquake.

In 2011, EDF began the third 10-year inspection programme for the Gravelines site. ASN has examined the results of the reactor 1 inspections. These inspections evidenced a crack in a bottom-mounted instrumentation penetration of the reactor, the first finding of such a fault in the French nuclear fleet.

ASN notes the positive development in the way EDF takes industrial risks into account in the site environment. These efforts must continue.

2011 was also a year marked by a fatal occupational accident that occurred while working at height.

The Société de Maintenance Nucléaire *(nuclear maintenance company) in Maubeuge*

ASN considers that operation of its installations is satisfactory. As part of its periodic safety review, SOMANU has committed itself to a large-scale rework of its documentary baseline. The identified areas for improvement concern the tightening of the links between the operating documentation and the standard of practices, particularly in the areas of inspections and periodic tests, management of waste from reprocessing foreign nuclear materials and its return to the country of origin, and on the response times to ASN demands. Lastly, ASN has noted an increase in the number of significant events in the areas of safety, the environment and the transport of radioactive substances.

1|2 Assessment of radiation protection in the medical field

Radiotherapy

In 2011, ASN observes the continuation of real improvement in rigour, organisation and traceability in the radiotherapy departments. The implementation of a quality assurance system within the establishments is continuing in a satisfactory manner.

In 2011, ASN's inspections focused primarily on the radiotherapy centres with structural problems (shortages of personnel and more specifically physicists) and/or organisational problems (delays in applying quality assurance to the patient care process). The overall situation regarding numbers of physicists improved during the year, even if two centres still have difficulties



ASN commissioning inspection of a radiotherapy installation in the Dentellières clinic in Valenciennes – October 2011

in this respect. Over the last few years, the region has widely benefited from the arrival of medical physicists qualified in Belgium. The number of medical physicists in the region's centres is nevertheless below the national average. Regarding the application of quality assurance to the patient care process, the progress observed with respect to the applicable regulatory provisions is satisfactory. Encouraging progress is being made in the area of treatment safety and reliability.

The areas for improvement concern the finalising of the radiotherapy process risk studies, more particularly with the identification of the main failure scenarios and the implementation of the "Defence in Depth" concept. Likewise, the individual responsibilities of each person involved in the care of the patient must be more clearly defined. As far as document management is concerned, the use of specific computerized tools has enabled the fluidity and reliability of the applicable documentation to be greatly improved. Lastly, all the centres have implemented procedures for recording and analysing adverse events since 2008, but notifications of significant radiation protection events lost momentum in the course of the year.

Nuclear medicine

ASN continued its inspections in the nuclear medicine sector. These inspections have revealed that these structures are still proceeding too slowly in their implementation of radiation protection measures. ASN also confirms that certain departments fail to plan ahead for authorisation renewal applications, or creation authorisation applications when new departments are set up.

Computed tomography (CT)

ASN conducted six inspections in computed tomography facilities. The rules relative to the occupational radiation protection are known and on the whole applied satisfactorily. Nevertheless, improvements can still be made, notably by giving the persons competent in radiation protection sufficient time to fulfil their duties, by formalising to a greater extent the radiation protection technical checks and outside contractor personnel interventions, and by making doctors on temporary contracts apply the radiation protection rules.

With regard to patient radiation protection, it is not yet common practice to have the practitioner formally approve the radiological procedure; improvements are still required in terms of optimisation of doses delivered to patients. The machine quality checks are carried out in the majority of cases, but their exhaustiveness and organisation can still be improved.

Interventional radiology

ASN has intensified its inspections in interventional radiology, and in operating theatres in particular. Margins for improvement have been identified, particularly with regard to the wearing of dosimeters and personal protective equipment by medical staff, their training in radiation protection and the optimisation of doses delivered to patients.

1|3 Assessment of radiation protection in the industrial and research sectors

Industrial radiology

Thirty companies practise industrial radiography in the region. The inspections carried out in 2011 showed continuing but slow improvement in the organisation of radiation protection in the companies, and worker monitoring is still satisfactory. Unannounced inspections continued to be performed: there are still shortcomings in the application of the radiation protection rules, particularly as regards the delineation, signalling and monitoring of the work area.

Veterinary clinics: targeted inspections campaign

As in 2010, ASN renewed its random inspections of the thirty-two veterinary clinics in the Nord Pas-de-Calais region in June 2011. This revealed, as in 2010, inadequate application of radiation protection measures by the profession and provided the opportunity to underline the main regulatory provisions applicable.

Research

Thirty research laboratories in the region use ionising radiation. The division's inspection measures have led to improvement initiatives, notably in the management of ionising radiation sources and radioactive waste. The division considers that these laboratories are moving in the right direction with regard to radiation protection.

1|4 Assessment of radioactive material transport

In 2011, ASN continued its regulation activities in the radioactive materials transport sector. These inspections did not reveal any major deviations from the regulations.

2 Additional information

2|1 Emergency situation management

The exercise of 18 January 2011 in the Gravelines NPP provided the opportunity to test a real evacuation of the local population and extensive public communication measures, particularly via Radio France. The exercise led to the evacuation of about 1300 people, essentially school pupils, in coaches chartered by the public authorities. The results of the exercise reveal areas for improvement in the behaviour of the population, the means of evacuation and public information, in the alert systems and the nuclear site personnel management in an accident situation.

2|2 International action by the Lille division

In 2011, the division continued its international exchanges, including with the Belgian and British nuclear safety authorities, with a view to mutual sharing of experience in the field of nuclear safety and radiation protection. These exchanges involve joint inspections in nuclear installations and in the industrial and medical environment. The Lille division participated in meetings with the Belgian nuclear safety authority to discuss the complementary safety assessments of the Tihange (Belgium), Gravelines and Chooz NPPs.

Lastly, the division took part in the training of African radiation protection inspectors organised by the International Atomic Energy Agency (IAEA) in Tunis.

2|3 Other significant events in Nord-Pas-de-Calais

Assessment of waste management by the division

At the request of ASN, the Robin des Bois Association carried out a survey of the radioactive ash and phosphogypsum spoil heaps in 2009. On the basis of this survey, ASN has continued its efforts, jointly with the DREAL (Regional directorate of the environment, planning and housing), to implement radiological monitoring of the sites.

ASN, in partnership with the DIRECCTE (Regional directorate for enterprises, competition, consumption, work and employment), has instituted a charter of good practices in industrial radiography. This charter, the objective of which is to optimise the use of ionising radiation in this activity sector, has been signed by 18 gamma radiography companies as well as ordering customers in the region. A monitoring committee has been set up. Exchange and work protocols between the division and DIRECCTE on the one hand, and the ARS (Regional Health Agency) on the other, set the framework of joint actions to improve integration of radiation protection measures in the industrial, research and medical sectors.

The nuclear licensees published their annual report as required by Article 21 of the TSN Act.

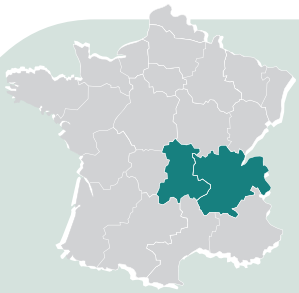
ASN has kept the local information committees (CLI) of the Gravelines NPP and SOMANU in Maubeuge regularly informed about the files in progress in the two nuclear facilities. More specifically, the Gravelines CLI has been involved in the



ASN inspection in reactor 1 building of the Gravelines NPP – January 2012

division's inspections on account of the complementary safety assessments. The CLI has also been regularly informed about the performance of the third 10-year inspection of the Gravelines NPP reactor 1. Lastly, it was involved in the national emergency exercise of 18 January 2011.

In 2011 ASN held two press conferences on the status of nuclear safety and radiation protection, one in Lille, the other in Dunkerque.



6 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE RHONE-ALPES AND AUVERGNE REGIONS REGULATED BY THE **LYON** DIVISION

The Lyon division regulates nuclear safety and radiation protection in the 12 *départements* of the Rhône-Alpes and Auvergne regions.
As at 31 December 2011, the workforce of the Lyon division stood at 37 officers: 1 regional head, 1 delegate regional head, 3 deputies, 16 nuclear safety inspectors, nine radiation protection inspectors and 7 administrative officers, under the authority of a regional representative.

The activities and installations to regulate in the Rhône-Alpes and Auvergne regions comprise:
- the NPPs at Bugey (4 reactors of 900 MWe), Saint-Alban (2 reactors of 1,300 MWe), Cruas-Meysse (4 reactors of 900 MWe) and Tricastin (4 reactors of 900 MWe) operated by EDF;
- the AREVA FBFC nuclear fuel fabrication plants in Romans-sur-Isère;
- the nuclear fuel cycle plants operated by AREVA and situated on the Tricastin industrial platform;
- the high flux reactor in the Laue-Langevin Institute in Grenoble;
- reactor 1 undergoing decommissioning at the Bugey NPP operated by EDF;
- the activated waste packaging and storage facility (ICEDA), under construction on the Bugey nuclear site operated by EDF;
- the SUPERPHÉNIX reactor undergoing decommissioning at Creys-Malville, and its auxiliary installations;
- the IONISOS irradiation facility in Dagneux;
- the nuclear fuel fabrication plant and pelletising unit in Veurey-Voroize operated by AREVA SICN, undergoing decommissioning;
- the reactors and plants of the CEA (French Alternative Energies and Atomic Energy Commission) in Grenoble, undergoing decommissioning;
- the CERN international research centre located on Swiss-French border;
- the small-scale nuclear activities, comprising about 4,500 dentists, 500 radiologists, 500 veterinary surgeons, 100 scanners, 22 radiotherapy departments (6 of which also conduct brachytherapy), 22 nuclear medicine departments, 20 gamma radiography devices, 190 X-ray generators, 30 unsealed source users, 200 lead detector users and 20 gammadensimeter users.

ASN conducted 335 inspections in Rhône-Alpes and Auvergne in 2011. Of these inspections, 91 were carried out in the four nuclear power plants, and 12 of these were targeted post-Fukushima inspections. 136 inspections were carried out in small-scale nuclear activities, 99 inspections were carried out in the other nuclear facilities overseen by the division, and 16 of these were targeted inspections in the light of the Fukushima accident, while 9 inspections concerned radioactive material transport.

In addition, ASN conducted 36.5 days of labour inspection on the four nuclear power plants and the Creys-Malville site.

During 2011, 331 significant events were notified by the BNI licensees of the Rhône-Alpes region. Twenty-nine of these events were rated level 1 on the INES scale. On February 16, 2011, an incident affecting the emergency diesel generators of the Tricastin NPP was rated level 2 on the INES scale by ASN.

In the small-scale nuclear activities sector in the Rhône-Alpes and Auvergne regions, of the 55 significant events notified to ASN, 21 in the medical field were rated level 1 on the ASN-SFRO scale, while 2 events related to industrial activities were rated level 1 on the INES scale.

In the area of BNIs, ASN issued two formal notices to comply concerning the Superphénix facility and reactor 1 of the Bugey NPP. It also drew up one violation report further to the detection of weakly radioactive rubble from reactor 1 of the Bugey NPP.

In the area of small-scale nuclear activities, ASN drew up two formal notices to comply and one violation report.

1 Assessment by domain

1.1 Assessment of BNI nuclear safety

• *Nuclear power plants*

Bugey NPP

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Bugey site on the whole match its general assessment of EDF performance.

With regard to nuclear safety, ASN notes that the quality of operation of the Bugey site showed signs of weakness in 2011, as it did in 2010. ASN considers more specifically that substantial improvements must be made with respect to padlocking, the configuring of systems and compliance with the operating technical specifications.

In 2011 the site had to cope with major reactor shutdowns, including the third 10-year inspections of reactors 4 and 5, which lasted five and six months respectively. Restarting of reactor 5 was disturbed by several operating incidents linked to system configuration deviations, delaying the return of the reactor to commercial operation by one month.

With regard to radiation protection, ASN notes a slight improvement in site worker dosimetry.

With regard to protection of the environment, ASN considers that the site must improve its waste management.

More generally, ASN expects the Bugey site to make considerable progress in its operating rigour in 2012, after two years marked by major works programmes.

Bugey NPP reactor 1 undergoing decommissioning

At the end of 2010, ASN authorised starting of the first phase of decommissioning, outside the reactor vessel. On the whole, ASN considers that these operations have been conducted under satisfactory conditions of safety.

Nonetheless, following the dumping of weakly radioactive rubble in a quarry on 9 August 2011, and the reactive inspection it conducted further to this, ASN issued formal notice to EDF to update the waste analysis of the Bugey NPP reactor 1.

The activated waste packaging and interim storage installation (ICEDA) at Bugey

The ICEDA was licensed by the decree of 23 April 2010. ASN conducted two inspections of the construction work in 2011 to check the construction quality of the buildings that will house the packaging process.

ASN considers that EDF shows rigour in its management of the construction site, from both the documentary organisation and the contingency management aspects.

Saint-Alban NPP

As in 2009 and 2010, ASN considers that the overall performance of the Saint-Alban site falls short of its general assessment of EDF performance.

In 2011, ASN observed that important requirements issued by EDF's national body are not correctly applied on the site, and the lateness accrued in this area over the last three years not being remedied. ASN also considers that the independent safety organisation is insufficiently deployed and that the site's major decision-making bodies do not give adequate consideration to its analyses and recommendations.



Post-Fukushima inspection by ASN in the Cruas NPP – October 2011

With regard to the monitoring of pressure equipment, the *Préfet* of the Isère *département* decided, after consulting ASN, not to renew the approval of the site's inspection service in 2011.

With regard to radiation protection, ASN considers that the site's performance is in line with its general assessment of EDF performance. Although control of access to limited stay areas and prohibited areas is satisfactory, the control of contamination on the work sites during reactor shutdowns must be improved.

With regard to environmental protection, ASN considers that the site's performance falls short of its general assessment of EDF performance, and notably lacks rigour in the operation of installations classified on environmental protection grounds.

More generally, ASN considers that the Saint-Alban site must rapidly take determined, concrete measures on a scale commensurate with the types of problems it has observed.

Cruas-Meysse NPP

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Cruas-Meysse site on the whole match ASN's general assessment of EDF performance.

With regard to nuclear safety, the site must continue its efforts to increase rigour in operational control, notably by increased application of practices to enhance reliability during interventions.

In terms of radiation protection, the site again displays contrasting results in 2011: the results for gamma radiography inspections are satisfactory, but control of access to limited-stay radiological areas must be tightened. ASN considers moreover that the radiological cleanliness of the site must be substantially improved.

With regard to protection of the environment, in 2011 ASN again found deficiencies in the way in which the environmental implications of new facilities are taken into account.

ASN noted a marked deterioration in work safety conditions in 2011, and expects to see concrete measures in this area in 2012.

Lastly, given the way the personnel training plans have fallen behind schedule, ASN considers that the Cruas-Meysse site must improve its skills management. The monitoring of outside contractors working on the site must also be significantly increased.

Tricastin NPP

Regarding nuclear safety, ASN considers that the site's performance stands out positively with respect to its assessment of EDF as a whole.

ASN observes more specifically that the site duly managed a particularly intense level of activities in 2011. The site must however reinforce the application of requirements on the ground and not give priority to the management of short-term contingencies at the expense of important medium-term measures. The site must also ensure that the independent safety organisation is correctly manned.



ASN post-Fukushima targeted "flood" inspection in the Cruas NPP – October 2011

With regard to radiation protection, ASN considers that the conditions of radiological cleanliness must be improved, particularly during reactor shutdowns.

The environmental performance of the Tricastin NPP can be improved. Greater attention must be paid to this subject and efforts must be made to ensure compliance with the regulations and the quality of the files submitted to ASN.

Lastly, ASN observes that working safety conditions improved on the Tricastin site in 2011, but still remain very tenuous.

- *Nuclear research facilities or facilities undergoing decommissioning, nuclear plants and units*

The AREVA FBFC nuclear fuel fabrication plants in Romans-sur-Isère (Drôme département*)*

ASN considers that the safety performance of AREVA FBFC must be improved. The industrial equipment renewal programme of the nuclear fuel fabrication unit is nearing completion. This site is nevertheless late in implementing its commitments with respect to ASN, particularly those concerning the updating of the baseline safety standards and the renovation of the laboratory and reprocessing unit. Some shortcomings were nevertheless detected in the site's management of inspections and periodic tests. Lastly, ASN notes that the cleaning and upgrading works on the effluent drainage systems were completed in 2011.

High flux reactor in the Laue-Langevin Institute (ILL) in Grenoble (Isère département*)*

ASN considers that the safety of the ILL is satisfactorily ensured. Nevertheless, the operator must progress with the formalising of the quality assurance requirements as provided for by the order of 10 August 1984 on the quality of design, construction and operation of the basic nuclear installations.

In 2011 the ILL devoted great efforts to the complementary safety assessments demanded by ASN further to the Fukushima nuclear accident. Lastly, the ILL has successfully taken over the management of environmental monitoring, formerly ensured by the CEA (Alternative Energies and Atomic Energy Commission).

SUPERPHÉNIX reactor at Creys-Malville (Isère département*)*

ASN considers that the safety of SUPERPHÉNIX reactor is satisfactorily ensured. However, in 2011 the site was issued formal notice to comply with the regulations relative to pressure equipment, some equipment inspections having been postponed beyond the regulatory deadlines. The industrial operation of the sodium treatment facility and the on-site storage of the concrete blocks produced by this process continued under satisfactory conditions of safety (about 7,000 blocks produced). The Off-Site Emergency Plan (PPI) was revised to take into account shutdown of the reactor and the sodium treatment facility. Removal of the large primary components (pumps, intermediate heat exchangers) continued. These components were treated, cut up then disposed of as nuclear waste.

IONISOS irradiator in Dagneux (Ain département*)*

ASN considers that the safety of the IONISOS irradiator is satisfactorily ensured. ASN also reiterated the obligation to set up a CLI for this installation.

The AREVA SICN nuclear fuel fabrication plant in Veurey-Voroize (Isère département*)*

The decommissioning work in the former AREVA SICN plant is completed. However, ASN's inspections in 2011 found shortcomings in the post-operational clean-out of certain galleries and the treatment of certain underground pipes. ASN considers that these shortcomings reveal inadequate monitoring of the work sites. Consequently, the regulatory delicensing of this nuclear facility is dependent on carrying out further work in these areas.

CEA centre reactors and plants in Grenoble (Isère département*)*

ASN considers that CEA Grenoble is a rigorous licensee but must nevertheless remain vigilant in the control of installation safety and security, as it makes extensive use of subcontractors.

Decommissioning of the CEA's nuclear installations in Grenoble continued in 2011. The delicensing procedure for the MÉLUSINE reactor is about to be concluded. The SILOE clean-out operations are nearing completion, but they have revealed that the reactor basemat also needs to be cleaned out. Lastly, as a precautionary measure, the effluent and waste treatment station (STED) decommissioning operations have had to be suspended since October 2011 further to the discovery of grenades buried on the work sites. The bomb disposal squad was called in to dispose of these grenades.

- *Nuclear fuel reprocessing plants situated on the Tricastin industrial platform (Drôme* département*, Vaucluse)*

AREVA NC - W and TU5 plants in Pierrelatte (Drôme département*)*

ASN considers that the safety performance of AREVA NC must be improved. In 2011, AREVA NC had difficulties in controlling the quantity of hydrogen present in the process of the W plant.

ASN also considers that modernisation work is necessary in the W plant's hydrofluoric acid storage area (tanks and structures). The licensee has undertaken to carry out this work by the end of 2014. Lastly, on 5 October 2011, AREVA NC notified ASN of a significant event concerning an accrued dose higher than 1mSv on two monitoring dosimeters placed on the site perimeter fencing. In the light of this event, ASN considers that AREVA NC must make substantial efforts regarding its communication of information to ASN.

COMURHEX fluoridation plant for converting uranium into hexafluoride - Pierrelatte (Drôme département*)*

ASN has observed that COMURHEX implemented several action plans to improve operating rigour and pollution prevention in 2011. The site's transparency with regard to deviations and events has progressed. Nevertheless, ASN considers that the site's safety results are still insufficient. Several events result from incomplete preparation of the work interventions on the facilities. Lastly, construction of the COMURHEX 2 plant continued in 2011.

EURODIF - European gaseous diffusion enrichment plant in Pierrelatte (Drôme département*)*

The level of safety of the EURODIF facilities is considered relatively satisfactory. Nevertheless, the ASN inspectors observed a failure of the reinforced protection systems for the containers containing liquid uranium hexafluoride in the cooling phase. This event was rated level 1 on the INES scale. In 2011, EURODIF reduced the plant operating conditions, thereby reducing the quantities of hexafluorine present in the enrichment facilities. The plant will be gradually shut down in 2012, after ASN has delivered the successive authorisations.

SET GEORGES BESSE II - Uranium enrichment plant in Pierrelatte (Drôme département*)*

The GEORGES BESSE II gas centrifuge uranium enrichment plant entered service in 2011. ASN had imposed three holding points in the various opening phases. The satisfactory conclusions of the safety tests before proceeding to the next phase led ASN to progressively lift these holding points. Lastly, the construction of the North part of the plant is continuing.

SOCATRI - Company operating a clean-up and recovery installation - Bollène plant (Vaucluse département*)*

ASN considers that the level of safety of the SOCATRI facilities is relatively satisfactory. Nevertheless, ASN observes that a large number of deviations and significant events originate from shortcomings in work preparation (incomplete or even non-existent operating procedures). The periodic safety review of the facilities began in 2011. ASN's analysis of the conclusions of this review will be a prerequisite for the implementation of the facility development projects planned by SOCATRI.

CERN – Accelerator and research centre (Geneva)

Further to the signing of an international agreement between France, Switzerland and the CERN, measures to clarify the safety and radiation protection requirements applicable at the CERN have been undertaken between ASN, the OFSP (the Swiss radiation protection inspection agency) and the CERN. They concern transport, waste and radiation protection. ASN and the OFSP jointly conducted two inspections of the CERN facilities in 2011.

1|2 Assessment of radiation protection in the medical field

On the whole, ASN considers that radiation protection in the medical field in the Rhône-Alpes and Auvergne regions is relatively satisfactory.

Radiotherapy

In 2011, ASN inspected half of the radiotherapy centres in the Rhône-Alpes and Auvergne regions. This campaign has enabled the inspections concerning the implementation of the quality assurance system, which is mandatory since 2011, to continue. This system addresses aspects such as the worker responsibility, management of resources, delivery of treatments and the management of adverse situations and malfunctions. Particular attention has also been focused on the centres that put in place innovative treatment technologies.

The results of these inspections show that the large majority of the centres have taken organisational steps since 2009 to implement a quality assurance approach to improve the delivery of treatments to patients. Nevertheless, the quality assurance systems deployed must now be used systematically and be subject to continuous improvement.

With regard to the medical physicist workforce, ASN found no critical situations in 2011. The summer vacation period did not lead to interruptions in the activity of radiotherapy departments due to personnel shortages. This being said, medical physicist numbers remain limited in certain centres and tenuous situations can arise in the event of personnel changes or departures.

Interventional radiology

ASN considers that patient radiation protection practices can be optimised in interventional radiology. Although the medical teams are generally trained, large disparities between the centres have been observed. The good practices are on the whole known and applied, but the doses delivered are only occasionally optimised. Medical physicists are still too rarely assigned to this activity. In 2011, ASN conducted a survey of 266 centres that could use interventional radiology procedures in the Rhône-Alpes and Auvergne regions. Out of the 120 centres that indicated that they had practised interventional radiology procedures, 86 perform them in the operating theatre. In 2012, the Lyon division will present the conclusions of its survey to the professionals concerned in order to improve the protection of workers against occupational exposure.

Dental surgeries

En 2011, ASN conducted a targeted inspection campaign in the dental surgeries of the Rhône-Alpes and Auvergne regions. ASN considers that even if the radiation protection implications are limited for this type of facility, the radiation protection of patients and workers can be significantly improved.



View of the Saint-Priest site in 2011

1|3 Assessment of radiation protection in the industrial radiology sector

ASN considers that radiation protection of workers is taken into account relatively satisfactorily in the industrial radiology sector. The inspections carried out in 2011 brought to light no significant regulatory non-conformities, even if there is still room for improvement in worker radiation protection.

Furthermore, following the signing of a charter of good practices in industrial radiology in 2010, ASN is continuing its awareness-raising work to improve occupational radiation protection in the gamma radiography sector by coordinating a network of professionals in the Rhône-Alpes and Auvergne regions, within which the good practices are disseminated.

1|4 Assessment of the transport of radioactive substances

In 2011, ASN conducted nine inspections concerning the transport of radioactive substances in the Rhône-Alpes and Auvergne regions. These inspections concerned the transport operations carried out by nuclear installation licensees, nuclear medicine departments and technical inspection companies (gamma radiography, gamma densitometry). They did not reveal any worrying situations.

Progress can nevertheless still be made in the transport of the packages "not subject to approval" used to transport the least hazardous radioactive substances and which represent the majority of radioactive substance transport operations in France.

2 Additional information

2|1 International action by the Lyon division

In 2011, the Lyon division continued the bilateral exchanges of views with the Swiss nuclear safety authority (ENSI) concerning the inspection practices applied for NPPs and industrial radiology.

Inspectors from the Lyon division also took part in discussions with the Japanese and Chinese nuclear safety authorities concerning the inspection practices and measures implemented further to the Fukushima accident.

The Lyon division has established contacts with the American nuclear regulator on the monitoring and regulation of the safety of sources.

As a general rule, these exchanges have allowed the sharing of good practices in the methods of monitoring and regulating nuclear facilities.

2|2 The other notable findings in the Rhône-Alpes and Auvergne regions

Monitoring of the former uranium mines

ASN considers that the work carried out by AREVA on the sites of Saint-Pierre-du-Cantal (Cantal *département*) and Saint-Priest-la-Prugne (Loire *département*) limits the risk of the neighbouring populations being exposed to ionising radiation.

The implementing of institutional controls at Saint-Pierre-du-Cantal will enable the future use of the site to be controlled and the industrial history of the land to be archived.

This being said, ASN observes that the redevelopment work undertaken by AREVA on the Saint-Priest-la-Prugne site and the identification of the mining waste rock have fallen behind schedule. ASN expects significant improvements in this respect on the part of AREVA in 2012.

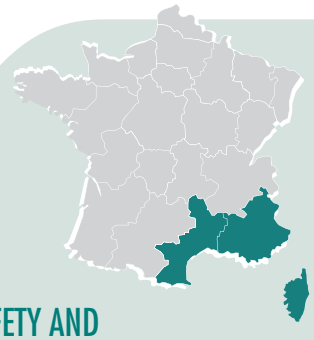
2|3 Public information actions in 2011

All the nuclear facilities in the Rhône-Alpes region, apart from the Ionisos irradiator in Dagneux (Ain *département*), have a local information committee (CLI). All these CLIs, whose activity has developed considerably since 2009, held meetings in 2011.

ASN organised two information seminars, held on 5 October and 6 December 2011 and addressing professional audiences on the subjects of approved organisations and nuclear medicine respectively.

Lastly, on 10 May 2011, ASN held a press conference on the state of nuclear safety and radiation protection, and on the first follow-ups in France from the Fukushima nuclear accident.

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7 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE PROVENCE-ALPES-CÔTE-D'AZUR, LANGUEDOC-ROUSSILLON AND CORSE REGIONS REGULATED BY THE **MARSEILLE** DIVISION

The Marseille division regulates nuclear safety and radiation protection in the 13 *départements* of the Provence-Alpes-Côte-d'Azur, Languedoc-Roussillon and Corse regions. It exercises this activity in the BNIs, in small-scale nuclear activities and in the transport of radioactive materials.
As at 31 December 2011, the workforce of the Marseille division stood at 22 officers: 1 regional head, 2 unit heads, 15 inspectors and 4 administrative officers, under the authority of an ASN regional representative.

The range of activities regulated covers 27 basic nuclear installations (BNI) that are in the project , construction, operation or decommissioning phase, and 2 installations under creation.

Cadarache site (Bouches du Rhône *départements*):
– the CEA Cadarache research centre which counts 20 BNI's, including the Jules Horowitz reactor currently under construction;
– the international ITER project that is under construction, adjacent to the CEA Cadarache centre.
Marcoule platform (Gard *départements*):
– the MÉLOX "MOX" nuclear fuel production facility;
– the CEA Marcoule research centre, which includes the ATALANTE and PHENIX BNIs, and the project for the creation of DIADEM, a waste storage facility;
– the CENTRACO facility for processing low-activity waste;
– the GAMMATEC industrial ioniser, currently under construction.
Narbonne (Aude *départements*):
– certain storage areas of the COMURHEX Malvési uranium ore conversion facility (AREVA group), that will constitute the ECRIN facility.
Marseille (Bouche-du-Rhône *départements*)
– the GAMMASTER industrial ioniser.

In addition to this pool of BNIs, there are many small-scale nuclear activities scattered around the region.

Medical field:
– 5 blood product ionisers
– 8 brachytherapy departments;
– 21 external radiotherapy departments;
– 27 nuclear medicine departments;
– 113 computed tomography departments;
– 140 departments practising interventional radiology;
– about 2,500 medical radiodiagnostic devices;
– about 4,500 dental radiodiagnostic devices.

Industrial and research sector:
– 11 head offices of industrial radiography companies;
– 350 establishments holding sealed and/or unsealed sources;
– 500 users of lead detectors.

Organisations approved by ASN for the performance of radiation protection checks:
– 21 approved organisation locations, including 11 head offices.

ASN conducted 208 inspections in the three regions of PACA, Languedoc-Roussillon and Corsica in 2011: 97 inspections in the BNIs and 111 inspections in small-scale nuclear activities. 9 of these inspections examined the transport of radioactive substances. Five BNI's underwent post-Fukushima inspections: MELOX, PHENIX, RJH, ATPu and MASURCA.

Five significant events rated level 1 on the INES scale (including the CENTRACO industrial accident of 12 September) were notified by BNI licensees, and fifteen significant events rated level 1 on the ASN-SFRO scale (concerning patients) were notified by the radiotherapy centres of the PACA, Languedoc-Roussillon and Corsica regions in 2011.

Seven violation reports were drawn up in 2011.

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

• *Cadarache site*

CEA's centre in Cadarache

ASN considers that the safety of the centre improved in 2011. It finds a good level of management involvement, but considers that the CEA's monitoring of outside contractors varies greatly from one BNI to another.

ASN conducted a tightened inspection of criticality from 11 to 13 July 2011, with about ten inspections on the different BNIs in the centre. It did not identify any major shortcomings in the CEA's management of this risk, but it found disparities between the BNIs and remains attentive that the licensee does not minimise the importance of this risk.

The CEA must demonstrate greater forward planning and rigour in the management of radioactive waste and liquid effluents. ASN also observed that the commissioning of the new liquid effluent treatment station at the Cadarache centre has again fallen behind schedule and is now planned for the second half of 2012.





ASN inspection on the STER construction site – January 2012

ASN considers that the licensee must remain very attentive to the progress of decommissioning and post-operational clean-out work on its oldest installations. ASN notes that the CEA is persistently behind schedule with its commitments.

In 2011, ASN continued its "civil engineering" inspections on the construction sites. ASN's assessment in this area is globally positive.

A nuclear emergency exercise integrating a seismic dimension, simultaneously affecting various installations in the centre as well as neighbouring communities, was held at Cadarache on 17 January 2012. It was actively prepared for in 2011.

ASN delivered partial authorisations allowing decommissioning of the ATPu facility to continue. At the end of 2011, 170 of the ATPu equipment items had been decommissioned and 155 remained to be decommissioned.

ITER

The public enquiry relative to the creation authorisation application was held from 15 June 2011 to 4 August 2011, and resulted in the enquiry commission issuing a favourable opinion accompanied by recommendations. Other consulted administrative services and the ITER CLI gave their opinion on the file. ASN will continue its examination in 2012 on the basis of these opinions, the technical opinion of the IRSN and that of the advisory committees of experts to whom the ASN submitted the file at the end of 2011.

ASN performed its first inspection of ITER on 20 July 2011. The inspection showed that the licensee had a robust organisation that could ensure rigorous management of the civil engineering operations inherent to the construction of the nuclear facility.

• *Marcoule platform*

At the request of the French civil and defence nuclear safety authorities (ASN and ASND respectively), an overall radiological impact study of the Marcoule platform was carried out by the licensees in September 2010. This study was revised and resubmitted by the licensees to the two safety authorities in January 2012 further to their requests for complementary information. This initiative was engaged at the same time as the platform licensees asked to modify their environmental effluent discharge limits for the ATALANTE, CENTRACO, and MELOX facilities, and for the secret BNI in the CEA centre of Marcoules, whose application has been submitted to the ASND. In relation with the Gard-Marcoule CLI, a public information initiative was held from 5 November to 5 December 2011; several public information meetings were organised allowing summaries of the abovementioned modifications to be presented in layman's terms. ASN will adopt a position with respect to the licensees' demands in 2012, and will be induced to issue new requirements.

MELOX plant

Progress has been made in criticality risk management in the MELOX plant, notably through better integration of the social, organisational and human factors, but in-house skills in this area must be further improved. The licensee implements an action plan that notably provides for an increase in safety engineer numbers. ASN will be attentive to ensure that this is a lasting initiative, and remains vigilant regarding the role of the facility's instrumentation and control - which the licensee is currently modifying - in preventing the criticality risk.

2011 was marked by an incident that occurred on 28 June 2011 and was rated level 1 on the INES scale. During a fuel rod

assembly operation, five rods hit a mechanical element and were damaged.

The premises in which assembly was taking place were contaminated, and major decontamination work was carried out until November. ASN asked the licensee to draw all the relevant lessons from this event, particularly as regards the ergonomics of the assembly operation and the associated procedures.

CEA's centre in Marcoule

ASN's assessment of the CEA Marcoule centre's safety and radiation protection management is positive on the whole, and partly matches that of the CEA Cadarache centre. ASN nevertheless remains vigilant regarding the monitoring of outside contractors and meeting commitments within deadlines.

In 2011, ASN was obliged to initiate nationwide action further to malfunctions in the CEA Marcoule centre concerning masks for protecting the respiratory system. As the defect in question, found on a limited series of masks, could be of a generic nature, ASN asked all the nuclear licensees to verify their masks and make the necessary replacements.

ASN considers that the licensee must step up its efforts to integrate the social, organisational and human factors on the ATALANTE facility, and expects to see progress in the quality of the safety files submitted to ASN.

ASN will pay particular attention to the decommissioning strategy for the PHENIX reactor, for which the authorisation application file was communicated to ASN in late 2011. The ongoing decommissioning preparation operations involve many outside contractors and ASN remains vigilant about how the CEA monitors them. ASN considers that operating deviations and significant event notifications must be managed with greater rigour.

CENTRACO facility

Since 2009 ASN has applied tightened monitoring to the CENTRACO facility in order to verify the effectiveness of its action plan to develop the safety culture at all levels of the organisation and to reinforce on-the-ground supervision measures. Although improvements have been observed, tightened monitoring by ASN was continued in 2011 to verify the robustness and durability of the measures implemented. Eight inspections were thus carried out in 2011, including one unannounced night-time inspection on 31 May and 1 June to test the licensee's night-shift organisation.

The year 2011 was marked by an occupational accident on 12 September 2011 that caused the death of one employee and injured four others, one very seriously. This accident, although serious in its human consequences, was rated level 1 on the INES scale due to the limited implications from the purely radiological standpoint. This accident and ASN's intervention are described in chapter 16 of this report.

GAMMATEC ioniser

Isotron France started the construction of the new GAMMATEC ionisation facility in 2011.



ASN inspection on the GAMMATEC installation at Marcoule – February 2012

• *Other installations*

ECRIN installation (COMURHEX Malvési)

In 2009 ASN had considered that some of the storage areas of the COMURHEX Malvési facility constituted a BNI pursuant to the regulations in effect, and came under ASN control. A creation authorisation application file had therefore been requested, and is currently being examined by ASN. The licensee is planning major development work to limit the environmental impact of the site as a whole.

GAMMAMASTER ioniser

The GAMMAMASTER industrial ionisation installation is intended for the gamma radiation treatment (with cobalt 60 sources) of medical equipment in particular (sterilisation). The safety issues chiefly concern access management, and ASN is vigilant about this.

1|2 Assessment of nuclear safety in the transport of radioactive materials

In 2011, ASN continued its inspections of small transport companies working in the medical nuclear field (transportation of radiopharmaceuticals, etc.), which vary greatly in their application of the regulatory provisions.

ASN conducted an awareness-raising operation with the maritime transport players in the Port of Marseille.

ASN inspected several air transport companies based at Marignane airport, and pointed out the large disparities in personnel training and the radiation protection measures applied.

1|3 Assessment of radiation protection in small-scale nuclear activities

• *Medical applications*

Medical imaging

ASN continues its vigilance with regard to the increase in average doses delivered in medical imaging.

The inspections carried out in interventional radiology in 2011 generally reveal a low level of application of the optimisation principle in the radiological procedures, due in particular to the lack of medical physicists in this field. ASN also points out the shortcomings in the setting up of a dosimetry system adapted to the workers, particularly for the extremities (hands, etc.). The ASN's findings are particularly marked with regard to applications in the operating theatre, where the awareness of health professionals to the radiological risks is considered insufficient.

In 2011, ASN supplemented its inspection process with an awareness-raising initiative. In June it organised a first inter-regional meeting of health professionals in Marseille, attended by some one hundred participants.

Radiotherapy

In 2011 ASN noted that the radiotherapy centres of the PACA, Languedoc-Roussillon and Corsica regions had at least two medical physicists and did not detect any significant non-conformity with respect to the regulatory criteria for the presence of medical physicists.

On the whole, ASN observes a positive development in quality management, but remains attentive to the long-term mobilisation of the players. ASN maintains its vigilance over those establishments it considers insufficiently mobilised with respect to the new regulatory requirements, such as the Pays d'Aix radiotherapy centre, the Clémentville clinic (part of the Greater Montpellier oncology GCS (cooperative health grouping), and to a lesser extent the Oncodoc establishment in Bézier and the Carémeau CHU (university hospital centre) in Nîmes.

ASN notes that all the radiotherapy centres have an internal system for notifying incidents but considers that progress nevertheless remains to be made in the effective notification of events to ASN, and in the quality of the analyses conducted for experience feedback purposes.

Following on from initiatives of these last few years, in 2011 ASN continued to encourage discussions and experience sharing between the region's centres, by organising the first inter-regional forum on safety in radiotherapy, which was held on 13 December 2011 in Marseille and attended by about one hundred health professionals from the three regions of South-East France.

Nuclear medicine

ASN considers that the radiation protection of patients in nuclear medicine is duly taken into account. As for the radiation protection of health professionals, this remains an important issue in nuclear medicine and ASN maintains its vigilance over application of the labour code requirements.

• *Universities and research laboratories*

Over the last few years, ASN has observed appreciable progress in the management of radioactive sources in the Universities of Montpellier, Perpignan, Marseille and Nice. ASN does however note that the University of Aix-Marseille has still not applied the requested measures regarding the holding of radionuclides used in the past. ASN continued its monitoring of the University of Toulon, where radioactive sources had been discovered by the faculty personnel. Likewise, Montpellier University remains subject to monitoring, as it still has waste and sources requiring disposal.

• *Industrial applications*

Industrial radiography

Industrial radiology remains a high priority for ASN, with unannounced night-time inspections on the work sites being continued in 2011. ASN moreover continued its prevention actions in a context complementary to that of the inspections, by organising a meeting day with the professionals in Martigues in November 2011, in relation with the labour inspectorate in particular.

Lead detectors

A campaign of unannounced inspections of twenty-six property surveyor firms using devices to detect lead in paint (devices containing a radioactive source) was conducted from 1 to 15 April 2011. Criminal proceedings were instituted against users who did not have a valid authorisation.

• *Polluted sites, former uranium mines and enhanced natural radioactivity*

ASN is continuing to ensure that sites polluted by radioactive materials, such as Bandol (Var *département*) or Ganagobie (Alpes-de-Haute-Provence *département*), have been identified and are secure. A solid waste sorting operation was carried out on the Ganagobie site in November. The sampled products were analysed and drums were shipped to a waste treatment facility. The Bandol site is subject to regular monitoring and discussions with the Bandol town council with regard to its future.

ASN continued its collaboration with the ministry in charge of the environment on the "post-uranium mines" measures. In relation with the Languedoc-Roussillon DREAL (Regional directorate for the environment, planning and housing), ASN conducted a joint inspection of the Lozère sites and participated in their CLIS.

2 Additional information

2|1 International action by the Marseille division

In 2011, the Marseille division participated in two IAEA advisory missions in Mauritania concerning the setting up of a nuclear safety authority. It also took part in an NEA working group on the safety of experimental reactors. Two of the division's inspectors took part in an international seminar organised by the IAEA on this same subject, in Rabat (Morocco), while another inspector contributed to a post-earthquake assignment in Spain. Lastly, in 2011 the division met a delegation from the American NRC (Nuclear Regulatory Commission) that had travelled to South-East France, a Euratom delegation conducting an environmental verification on the Cadarache site, and a delegation from the European Parliament visiting the ITER construction site.



ASN inspection on the Jules Horowitz reactor construction site – December 2011

2|2 Public information actions in 2011

• *The general public and the CLIs*

In 2011, ASN held three press conferences in Marseille, Montpellier and Nice on the state of nuclear safety and radiation protection, which raised subsequent intense media interest.

2011 was marked by particular attention from the media and local associations further to ASN's inspections. A very substantial increase in external information or document communication requests was noted (including prior to the Fukushima accident). ASN ensures that the nuclear licensees meet their obligations in terms of transparency in this respect, notably by promoting application of article 19 of the TSN Act.

In 2011 ASN continued to support the CLIs by actively participating in the majority of the meetings and annual general meetings of the Cadarache, ITER and Gard-Marcoule CLIs, and by making contributions at public meetings organised by the CLIs.

Following on from the public information days on the consideration of the seismic risk in the nuclear installations in the south of France, held on 4 February 2010 in Marseille and 7 December 2010 in Avignon, a specific meeting was organised on the subject of natural external hazards with the Gard-Marcoule CLI (proceedings available at *www.journeeseisme-asnmarseille.org*).

With regard to the targeted post-Fukushima inspections conducted in 2011, ASN deeply regrets the refusal of the CEA and AREVA to allow external observers - particularly the CLIs - to attend these inspections, as it was favourable to their presence.

Lastly, ASN considers that the CLIs of GAMMASTER in Marseille and COMURHEX Malvési in Narbonne must now be set up as quickly as possible.

• *The professional public*

With regard to informing and raising awareness in the professional public, 2011 was marked by the organisation of three days of meetings and discussions in the sectors of interventional radiology (June), industrial radiography (November) and radiotherapy (December). ASN remains attached to this approach, which promotes the sharing of experience between professionals with a view to making radiation protection progress in the small-scale nuclear activities.

3 Outlook

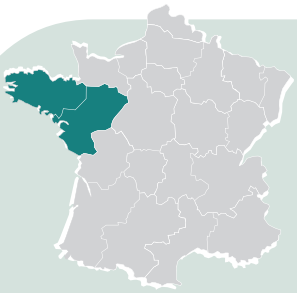
In 2012, ASN will carry out post-Fukushima inspections on 10 BNIs classified as "priority 2", and will reinforce its oversight of outside contractor monitoring. ASN will continue examining and monitoring the construction sites of the new BNIs, especially JHR and ITER. It will extend its technical enquiry into the CENTRACO accident in liaison with the judicial authority, and oversee restarting of the facility. ASN will issue new

requirements governing the discharge of effluents from the Marcoule platform BNIs.

The optimisation of doses delivered to patients in medical imaging, quality management in radiotherapy and the protection of industrial radiography workers against occupational exposure will remain high priorities for ASN in the PACA, Languedoc-Roussillon and Corsica regions.

ASN will continue its initiative to inform the general public and raise the awareness of the professionals on the issues of safety and radiation protection.

asn NANTES



8 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE PAYS DE LOIRE AND BRETAGNE REGIONS REGULATED BY THE **NANTES** DIVISION

The Nantes division is responsible for regulating nuclear safety and radiation protection in the 9 *départements* of the Pays de Loire and Bretagne regions.
As at 31 December 2011 the workforce of the Nantes division stood at 11 officers: 1 regional head, 8 inspectors and 2 administrative officers, under the authority of an ASN regional representative.

The activities and facilities to regulate in the Pays de la Loire and Bretagne regions comprise:

– three basic nuclear installations (BNIs): the NPP of the Monts d'Arrée site*, the IONISOS irradiator in Sablé-sur-Sarthe and the IONISOS irradiator in Pouzauges;

* The Monts d'Arrée site (Brennilis plant currently being decommissioned) is regulated by the ASN Caen division.

– the medical services: 16 radiotherapy centres (17 locations), 9 brachytherapy departments, 18 nuclear medicine departments, 97 establishments practising interventional radiography, 89 computed tomography scanners, and approximately 5,000 medical and dental radiology machines;
– industrial and research uses: 43 industrial radiology companies, including 10 gamma radiography contractors, about 750 licences for industrial and research equipment, including more than 300 users of devices to detect lead in paint, devices containing a radioactive source;
– 9 agencies and one head office of organisations approved for radiation protection technical checks, 7 establishments for radon checks and three head offices of laboratories approved for taking environmental radioactivity measurements.

In 2011, ASN carried out 132 inspections, including 3 inspections in BNIs and 5 in the transport sector.

At the end of 2011, a significant event was notified on the Sablé-sur-Sarthe site by the company IONISOS. This event, rated level 1 on the INES scale at the beginning of 2012, concerns a radioactive source identification error when preparing the shipment of old radioactive sources to Canada.

Three violation reports were drawn up for small-scale nuclear activities: the first two in industrial radiography came with a suspension of activity and formal notice to put the situation into order, while the third concerned the holder of a device for detecting lead in paint.

Thirteen significant events rated level 1 on the ASN-SFRO scale were notified by the radiotherapy departments of the Bretagne and Pays de la Loire regions. An overexposure incident affecting an interventional radiology patient in the Angers CHU (university hospital centre) resulted in an information note being published on the ASN web site. Two events rated level 1 on the INES scale were also notified, one in nuclear medicine, the other in the industrial sector.

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

The IONISOS nuclear facilities in Sablé-sur-Sarthe and Pouzauges

The company IONISOS operates two industrial irradiation facilities used chiefly for two applications: product sterilisation (essentially medical equipment, and to a lesser extent foodstuffs) and the treatment of plastic materials to improve their mechanical characteristics.

Following the significant incident of June 2009 relative to the untimely opening of the irradiation cell access door on the Pouzauge site, the licensee implemented the transient technical measures demanded by ASN to reinforce security of access to this cell. IONISOS moreover submitted a safety assessment of the overall management of cell access for the Pouzauges installation in February 2011 and for the Sablé-sur-Sarthe installation in May 2011. Further to the first opinion of the IRSN given in November 2011 for the Pouzauges installation, and after receiving the second opinion concerning the Sablé-sur-Sarthe installation, expected in February 2012, ASN will adopt a position in early 2012 on the measures to apply to enhance the irradiation cell access management.

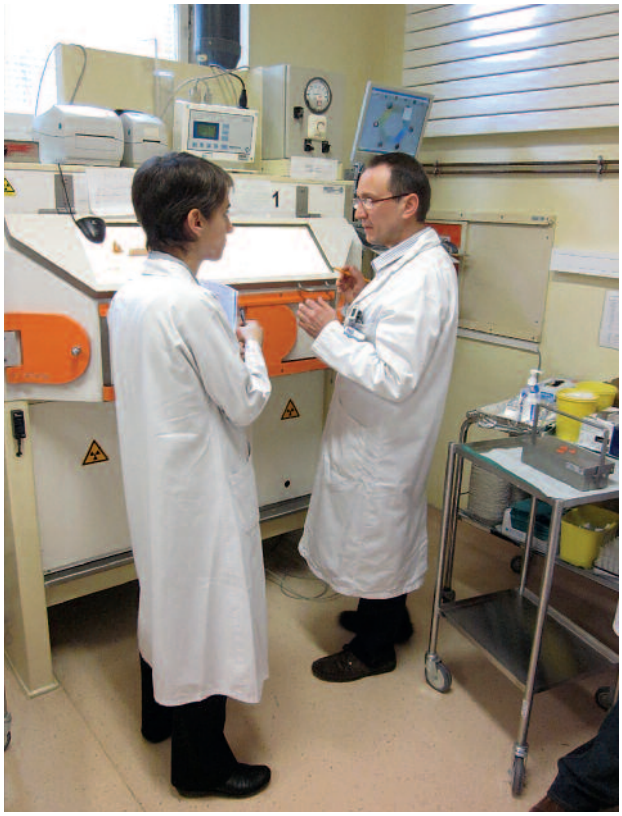
During ASN's inspection of the removal of numerous radioactive sources having reached their service life limit, a storage area was found outside the irradiation cell, and a situation regularisation request was issued for it. This case, and the transport operations associated with the removal of the radioactive sources will be subject to specific inspections in 2012.

1|2 Assessment of radiation protection in the medical field

Sixty-five inspections were carried out in the medical field, twenty of which were part of the inspection campaigns targeting dentists and radiologists. These inspection campaigns revealed continuous progress in training in patient radiation protection and the provision of personal protective equipment. Furthermore, all the radiologists inspected are engaged in the diagnostic reference levels (DRL) initiative to optimise doses delivered to patients. This being said, progress is still required in the training of workers and the performance of in-house radiation protection checks. In dental radiology, shortcomings were again found in the administrative registrations and in the implementation of periodic external radiation protection inspections and quality inspections. There are still numerous regulatory deviations due to the failure to use persons competent in radiation protection (PCR).

Radiotherapy

Ten external radiotherapy centres out of the sixteen in the Bretagne and Pays de la Loire regions were inspected in 2011. ASN observed continuing progress in rendering treatments safer. The increase in numbers of medical physicists observed in the last few years means that virtually all the centres can now meet the regulatory requirements regarding the presence of medical physicists during the treatments. Implementation of the quality assurance system is also progressing: in the inspected centres, the various steps in the treatment process are correctly formalised in writing, but several centres still have document management shortcomings. All the centres have set up a system for managing and analysing adverse events that could occur during the radiotherapy treatment process, but do not adequately integrate the new criteria for notifying ASN of significant events. Furthermore, about a third of the inspected centres must still carry out or complete the analysis of the risks run by the patients, as required by ASN decision 2008-DC-103.



ASN inspection in the nuclear medicine department of the Morvan CHU in Brest on 1st March 2012

The equipment quality checks provided for in the regulations are, on the whole, correctly performed. Nevertheless, the organisational setup for ensuring these inspections and maintenance of the medical devices must be more clearly defined.

In 2011, the Nantes division also gave ASN a report drawn up in partnership with the regional health professionals concerning the assessment of risks in brachytherapy. This guide is subject to an ultimate validation step with the learned societies concerned.

Interventional radiology

Ten establishments were inspected in 2011. The inspections chiefly concerned coronarography, angiography/angioplasty and cardiology. ASN observes that continuing progress is required in the quantification of doses received by the health professionals at the extremities (hands/eyes). With regard to patient radiation protection, the Nantes division placed the emphasis on the efforts required to optimise the intervention protocols and to record information relative to the doses delivered in the medical procedure reports. This is because, on the basis of the incident that occurred in Pays de Loire in 2011, ASN has identified three chief factors behind patient overexposure: inadequate knowledge of the equipment operating mode, the lack of additional X-ray filtration devices, and the lack of intervention protocols.

Computed tomography (CT)

Six centres were inspected in 2011. Emphasis was placed more particularly on patient radiation protection. The regulations applicable in this area were found to be well implemented on the whole in the inspected centres. All the inspected centres have adopted the diagnostic reference levels approach and protocols have been developed to optimise the doses delivered to patients. Efforts must however still be made in radiation protection training, in the performance of in-house radiation protection and quality checks, and in the implementation of active dosimetry during interventional procedures.

1|3 Assessment of radiation protection in the industrial and research sectors

Fifty-four inspections were carried out in industrial and research facilities, and eleven of these were part of the inspection campaign targeting holders of devices for detecting lead in paint. This inspection campaign revealed highly contrasting situations: three companies implement the main provisions applicable in radiation protection in a highly satisfactory manner. The other companies, however, still display poor knowledge of radioactive source management rules, failure to replace the radioactive sources according to the technical characteristics of the devices, and lastly, insufficient protection against fire and theft.

Industrial radiology

Sixteen inspections were carried out in 2011, which meant that all the gamma radiography professionals had been covered over a three-year period. ASN notes the satisfactory design of the fixed radiography installations, the improved organisational measures (procedures), and the periodic performance of external technical radiation protection checks. Progress nevertheless remains to be made in the in-house technical radiation protection checks, and the setting up of an operation zone on construction sites.

In 2011, ASN was induced to suspend the operations of an industrial radiography contractor established in Loire-Atlantique owing to serious and repeated violations of the regulations intended to protect workers against ionising radiation. This company is currently under compulsory liquidation.

The Nantes division has also set up, on an experimental basis, a system for remotely declaring construction site schedules for industrial radiography contractors. The nationwide extension of this tool will be examined in 2012.

Lastly, in collaboration with the DIRECCTE (Regional directorate of enterprises, competition, consumption, labour and employment) of the Pays de la Loire and Bretagne regions, and the professionals of the sector, a regional charter for optimising industrial radiography practices has been drawn up and was presented to the industrial radiography professionals at a seminar held on 17 November 2011. Twelve companies have already signed this charter.

Research

Three inspections were carried out in this area in 2011, meaning that 75% of the public research sector has been covered in six years. ASN observes the continuing reduction in the number of irregular administrative situations, and strong involvement of the persons competent in radiation protection, enabling practices to be turned towards techniques that reduce personnel exposure, and even techniques that avoid using radioactive sources. Progress is still expected with regard to the updating of the zoning and the waste and effluent management plans, and formalising and updating the periodic in-house and external radiation protection checking programmes.

2 Additional information

2|1 International action by the Nantes division

On the international front, the Nantes division participated in an IRRS mission in Slovenia in October 2011, and the training of some fifteen African decision-makers on the regulation of ionising radiation sources organised by the IAEA in Tunisia in October 2011. The Nantes division also hosted an Israeli representative from the Soreq nuclear research centre in June 2011, for a nuclear medicine inspection.

2|2 The other significant events in Pays de Loire and Bretagne regions

The former uranium mines

ASN conducted two inspections on the former mining sites in the Pays de la Loire region. ASN also took an active part in the information and discussion meetings organised by the offices of the *Préfets* of the Loire-Atlantique and Vendée *départements* on the subject of the former uranium mines. It also participated in a meeting organised by the offices of the *Préfet* of Morbihan with the view of creating an information committee for the former Breton mining sites of the Morbihan and Finistère *départements*. The first meeting of this committee is planned for the first quarter of 2012.

On 11 July 2011 ASN received AREVA's environmental assessments for the former mining sites of the Morbihan and Finistère *départements* in application of the prefectural orders of July 2010. These studies provide a precise situation assessment of all the former mining sites in Brittany. At the beginning of January 2012, after analysing these studies jointly with the Brittany DREAL, ASN sent the *Préfets* concerned the additional information to be requested from AREVA for a small number of sites presenting radiological characteristics that could give rise to remediation measures.

2|3 Public information actions in 2011

In 2011, ASN held two press conferences in Nantes and Rennes on the state of nuclear safety and radiation protection.

It also contributed to patient radiation protection training courses dispensed to medical radiation technologists and dentists.

In 2011, ASN participated in the meetings of the local information committees (CLIs) for the IONISOS nuclear installations on 6 July in Sablé-sur-Sarthe, and 28 June and 25 October in Pouzauges.

ASN also organised three regional seminars on:
– occupational radiation protection for some twenty external PCRs working in the companies of the Pays de la Loire and Bretagne regions;
– nuclear medicine, that was attended by more than seventy professionals (doctors, medical physicists, technologists) from the two regions;
– industrial radiography, on the occasion of the signing of the charter on industrial radiography in the Pays de la Loire and Bretagne regions. This seminar was attended by more than eighty professionals (ordering customers, outside contractors, etc.).

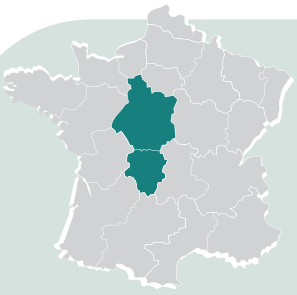


"La robe et le nuage" (The dress and the cloud" exhibition in Nantes – October 2011

Lastly, ASN participated in the organising and financing of two exhibitions on nuclear topics:

– *"la robe et le nuage"* (the dress and the cloud) in Nantes (more than 13,500 visitors). As part of this operation, in late September it took part in a conference on radiation protection: *"Citoyen, sommes-nous protégés ?"* (Citizen, are we protected?);
– *"sur les traces des Becquerel"* (tracking the Becquerels) in Pornichet (nearly 3,500 visitors).

ORLÉANS



9 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE CENTRE, LIMOUSIN AND ILE-DE-FRANCE REGIONS REGULATED BY THE **ORLÉANS** DIVISION

The Orléans division is responsible for regulating nuclear safety and radiation protection in the 9 *départements* of the Centre and Limousin regions. The Orléans division is also at the disposal of the ASN Paris regional representative, under whose authority it regulates the safety of the BNIs of the Ile-de-France region[1].
As at 31 December 2011 the workforce of the ASN Orléans division stood at 27 officers: 1 regional head, 3 deputies, 18 inspectors and 5 administrative officers, under the authority of an ASN regional representative.

The activities and installations to be regulated in the Centre, Ile-de-France and Limousin regions comprise:
– the Belleville-sur-Loire NPP (2 reactors of 1,300 MWe);
– the Dampierre-en-Burly NPP (4 reactors of 900 MWe);
– the Saint-Laurent-des-Eaux site: the NPP (2 reactors of 900 MWe) in operation, as well as the 2 French gas-cooled reactors (GCR) undergoing decommissioning and the irradiated graphite sleeve storage silos;
– the Chinon site: the NPP (4 reactors of 900 MWe) in operation, the 3 French gas-cooled reactors undergoing decommissioning, the irradiated material facility (AMI) and the inter-regional fuel warehouse (MIR);
– the 8 BNIs in the CEA Saclay centre, including the OSIRIS, ISIS and ORPHÉE experimental reactors;
– the CIS bio international plant in Saclay;
– the 2 BNIs undergoing decommissioning in CEA's Fontenay-aux-Roses centre;
– the electromagnetic radiation laboratory in Orsay, undergoing decommissioning (LURE);
– the medical services of the Centre and Limousin regions that use ionising radiation: 12 radiotherapy centres, 5 brachytherapy departments, 12 nuclear medicine departments, 33 interventional radiology departments, 60 computed tomography scanners, 1,600 medical radiology machines and 2,100 dental radiodiagnostic devices;
– the industrial and research utilisations of ionising radiation in the Centre and Limousin regions: 20 industrial radiology companies, including 6 gamma radiography contractors, some 400 industrial, veterinary and research devices subject to the licensing system, and some 100 industrial, veterinary and research devices subject to the notification system.

In 2011, ASN carried out 239 nuclear safety and radiation protection inspections: 124 inspections of the nuclear installations on EDF's Belleville-sur-Loire, Chinon, Dampierre-en-Burly and St-Laurent NPPs, including 39 labour inspections; 43 inspections on the nuclear sites in the Ile-de-France region (CEA Saclay and Fontenay-aux-Roses centres, CIS bio at the Saclay centre, CNRS - the French National Centre for Scientific Research - at Orsay), 72 inspections on small-scale nuclear facilities in the Centre and Limousin regions. ASN conducted 14 post-Fukushima inspections in 2011 (Chinon, Belleville-sur-Loire, Dampierre-en-Burly, Saint-Laurent-des-Eaux and OSIRIS at Saclay), two of which were attended by members of the local information committee.

It also carried out 7 inspections in the radioactive material transport sector.

In 2011, 5 significant events of level 1 on the INES scale were declared by the licensees of EDF nuclear installations in the Centre region, and 4 significant events of level 1 were notified by the licensees of the Ile-de-France nuclear sites. In the small-scale nuclear activities, five events of level 1 on the ASN/SFRO scale were notified in the Centre and Limousin regions. The inspections conducted by the Orleans division led to the issuing of four formal notices and two violation reports, which were submitted to the competent public prosecutors.

CIS bio notified ASN of the exceeding of one of its annual gaseous discharge limit values. This event, rated 1 on the INES scale, led ASN to give CIS bio formal notice in April to comply with the discharge provisions for the facility.

In June 2011, ASN deployed ten inspectors for two weeks to conduct an in-depth inspection of occupational radiation protection in the four nuclear power plants of the Centre region.

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

Belleville-sur-Loire NPP

ASN considers that the improvements in safety of installations registered by the Belleville-sur-Loire site in 2010, continued in 2011. Its performance on the whole matches the ASN's general assessment of EDF. The efforts must be maintained with regard to the operation of the facilities and the rigour of work interventions, for which there are still some deviations. ASN considers the implementation of a more operational programme for integrating EDF's national prescriptive documents is a positive measure. Better managerial tracking of the deadlines for remedying the identified deviations is also apparent.

Some radiation protection deviations still persist on the maintenance work sites. The licensee, however, is pursuing several

1. Radiation protection in Ile-de-France is ensured by the Paris division.

ambitious improvement measures that seem to bring better control in this area.

Lastly, with regard to the environment, ASN considers that the fundamental measures started in 2010 must be maintained in order to continue improving the NPP's performance in this domain.

Chinon site

ASN considers that the nuclear safety and radiation protection performance of the reactors in operation at the Chinon NPP is still below the average assessment level for EDF.

The site's safety results remain marred by numerous deviations linked to inadequate preparation of the interventions or laxity in the application of the operating procedures. Nevertheless, site management is implementing a determined plan of action to improve operating rigour. ASN, which is monitoring the effectiveness of this plan, noted some positive developments at the end of 2011, even if there is still considerable room for progress.

Alongside this, the Chinon site's performance in radiation protection is still not up to standard. During its inspections, ASN has more particularly observed a serious lack of a radiation protection culture and a lack of personnel on the ground responsible for checking radiation protection. ASN observes that shutdown durations are still poorly controlled and lead to work overloads and a lack of vigilance on the part of the workers.

In the changing context of the AMI (irradiated materials) facility, with the preparation for the transfer of the expert appraisal activities to a new facility in 2012 and organisational changes appropriate for the future use of the facility, ASN considers that the licensee must in particular reinforce compliance with the requirements of the safety baseline standard, its operating rigour, its control over outside contractors and its radiation protection management.

ASN considers that on the whole the level of safety of the nuclear facilities of the former Chinon NPP is satisfactory. The main issue in the monitoring of these facilities lies in the future decommissioning of the Chinon A3 heat exchangers. This is because the future effluent emissions must remain in conformity with the discharge limitation values, which are currently being modified.

Dampierre-en-Burly NPP

ASN considers that the Dampierre-en-Burly NPP's performance is on the whole in line with ASN's average assessment level for EDF. The safety results for 2011 are in line with those of 2010 and the efforts to improve operating rigour must be continued. Further to the deficiencies in maintenance contractor monitoring observed in 2010, the site has implemented a plan of action that should reverse the trend.

Deviations from the regulations in the areas of safety and radiation protection are still observed during work site inspections. Nonetheless, the good results in collective dosimetry and the reduction in the number of significant events relating to radiation protection are to be noted.

With regard to the impact of the facilities on the environment, the Orleans division considers that the site is still positively positioned. The continuous improvement in chemical and radioactive discharges was maintained in parallel with the implementation of new discharge and intake permits.

Saint-Laurent-des-Eaux site

ASN considers that the Saint-Laurent-des-Eaux site's performance is on the whole in line with ASN's general assessment of EDF. With regard to safety, ASN considers the monitoring and performance of the corrective actions to be satisfactory. Progress has also been made in certain domains, particularly with respect to component padlocking and the integration of experience feedback. Nonetheless, a deterioration in several weak points already identified in 2010 has been observed. Numerous technical inspection deficiencies have been identified, notably involving the operating supervisors, and especially during peak activity periods. In addition, coordination deficiencies have arisen between certain services, such as for the management of the periodic tests. The appropriateness of the corrective actions initiated recently by the site therefore remains to be evaluated as from 2012.

The site's radiation protection organisation is satisfactory on the whole. In certain areas, the site demonstrates a spirit of initiative by setting requirements that are more stringent than those of the EDF in-house safety baseline standard. Nevertheless, the site must remain attentive to the way the workers take into account the question of radiation protection.

On the environmental front, the optimising of radioactive discharges remains one of the site's positive points. This being said, further to the lack of foresightedness on the impact of the new discharge decisions, the site must ensure that its action plan is properly implemented.

ASN considers that on the whole the level of safety of the nuclear installations of the former Saint-Laurent-des-Eaux NPP (BNIs 46 and 74) is satisfactory. The main issue in the monitoring of these installations lies in the removal of certain contaminated liquid effluents. The installation of the geotechnical containment around the irradiated graphite sleeve storage silos in 2010 has reinforced the protection of this facility against the risk of flooding by the River Loire.

• *Nuclear research facilities or facilities undergoing decommissioning, nuclear plants and units*

CEA's Saclay centre

ASN considers that the safety of the BNIs in the CEA centre in Saclay is properly controlled, in particular for the experimental reactors and the irradiated fuels and materials appraisal laboratory.

The ASN review conducted in 2011 confirmed the good emergency organisation of the centre and its ability to engage the operational resources necessary to respond to an emergency situation. ASN nevertheless considers that improvements must be with regard to the training requirements of the players involved in the emergency, the conditions of integrating experience feedback from the exercises, and emergency management coordination between the BNIs and the centre. The complementary inspection of the OSIRIS reactor conducted by ASN as part of

the campaign of targeted inspections on the first experience feedback from the Fukushima accident concluded that the safety baseline standard in effect was correctly applied.

Overall monitoring of the centre's radioactive gaseous discharges appeared rigorous. Likewise, the requirements of ASN decision No. 2010-DC-0178 of 16 March 2010 on the conditions of implementation of the in-house authorisations systems were found to be well respected.

ASN also verified application of the European regulations relative to the recording, assessment, authorisation and utilisation of chemical substances: a few deviations were noted here and there.

ASN also underlined the quality of the conditions of restarting of the concreting unit of BNI 72 and of entry into service of the STELLA unit of BNI 35.

Nevertheless, the inspections revealed a lack of rigour in several periodic inspections and tests, and maintenance operations. Consequently, ASN considers that the efforts undertaken in the last few years in this respect must be continued.

The CIS bio international plant in Saclay

The renovation work currently being finalised should help improve the safety of the plant. However, the operating weaknesses observed, combined with the late submittals and shortcomings of the safety files, particularly the periodic safety review file, gave ASN a sustained workload in 2011. Furthermore, this situation prevents the safety review from being concluded before 2012. This being said, the plant's radioactive iodine inventory has already been decreased in order to reduce the potential consequences of a severe accident.

One event of noncompliance with the gaseous discharge limits led ASN to issue formal notice to CIS bio to comply with the plant's discharge provisions. This deviation and the identified operating weaknesses, particular with regard to compliance with the safety baseline standard and operating rigour, highlight the need for the licensee to continue reinforcing its safety management. Although organisational changes and improvements in the operating processes have been initiated, clearly tangible progress is required.

The CEA's centre in Fontenay-aux-Roses

ASN considers on the whole that the level of safety of the centre's facilities is satisfactory. The system of in-house authorisations is well mastered by the licensee. At present the discharge limits and monitoring conditions for the BNIs in the centre are regulated by ministerial orders dating from 1988. In the near future, ASN will take a decision to ask the licensee to lodge an updated discharge authorisation application file.

There has been an appreciable increase in the number of significant events notified to ASN compared with 2010, including two events rated level 1 on the INES scale. They reveal technical failures of equipment and deficiencies in work preparation and personnel training.

Lastly, control of the dynamic containment in the facilities of BNI 165 can be further improved, given that there are still deviations from the negative pressure ranges set in the baseline standard. New operating criteria must therefore be defined.

1|2 Assessment of radiation protection in the medical field

To guarantee the safety of treatments by external beam radiotherapy, ASN checks that a quality improvement approach for all the patient treatment stages is implemented in the medical centres in the Centre and Limousin regions.

In 2011, ASN observed that the management of each centre inspected had defined a "quality" policy and was now ensuring it had the human resources to implement that policy. These centres have also set up an effective organisational structure to detect and analyse the adverse events noted during the treatments, and to take measures to reduce their number and their consequences.

In this context of tangible improvement, ASN notes that only the "quality" referencing of a few common practices can be further improved, and some sites still seem to lack robustness in the application of the "quality" approach when there is a shortage of human resources.

ASN notes the improvement in practices in nuclear medicine, particularly through the progressive decrease in radiological exposure of the personnel. Nevertheless, in ASN' opinion, insufficient consideration is given to occupational radiation protection issues. ASN also considers that the management of contaminated effluents and waste can be improved. The interest in positron emission tomography (PET), which opens new perspectives in the diagnosis of cancers, has raised new radiation protection issues for four centres licensed by ASN in the Centre and Limousin regions in 2011.

ASN considers that radiation protection measures are not sufficiently implemented in the operating theatres. The eight inspections in interventional radiology carried out by the division revealed that the organisation of in-house and external quality checks of the radiology devices is progressively materialising, as are the training of personnel in the use of the devices and raising worker awareness of the risks involved. More generally, ASN considers that the centres using this technique should conduct a deeper reflection on the subject. This reflection should lead to the optimisation of practices and of the use of radiology devices in operating theatres.

1|3 Assessment of radiation protection in the industrial and research sectors

For the companies established in the Centre and Limousin regions, ASN notes that radiation protection measures are satisfactorily implemented in the industrial radiology activities.

More particularly, non-destructive testing contractors using gamma radiography devices are showing ever-greater control of their on-site working conditions: the virtually systematic use of equipment (collimators, collective protective equipment, etc.) to limit the exposure of the workers and the public must be underlined.

ASN has however noticed that the time between ordering and conducting an inspection is often very short. Thus, the preliminary phase of radiological optimisation (predicted dose assessments, defining of the operation zone), in the same way as the

overall prevention of other risks, may be incomplete, or even inexistent. ASN will continue to be very attentive to this point in its inspections in 2012.

The year 2011 was marked by tighter ASN monitoring of the organisations responsible for the external radiation protection checks. These ASN-approved organisations are subject to checks on the ground, branch office visits and head office audits when they make their approval renewal application, which was the case for three of them in 2011, coinciding with significant changes in the regulatory baseline that same year. ASN considers that the organisational structures within the organisations audited in 2011 must be consolidated.

ASN conducted a veterinary inspection campaign that targeted 17 practices, mainly in the equine sector. This allowed the regularisation of administrative situations relating to the use of X-ray generators, while at the same time checking the conditions of diagnostic X-ray imaging on the animal owners' premises (wearing of protective equipment, active dosimetry monitoring, etc.).

1|4 Assessment of radioactive material transport

In 2011, ASN performed nine inspections of consignors – with highly diverse quantities, materials and types of packages shipped – and road transport carriers. The checks, which focused primarily on the operational measures applied, the organisational structures in place, the conformity of the packages, and which were supplemented by the examination of the security advisors' reports, show that on the whole the regulatory requirements are satisfied, but some improvements are expected in terms of organisation and quality assurance.

The significant events, essentially caused by human or organisational factors, had no notable impacts. They are limited in number, except for the incidents in airport zones, where handling conditions must be improved.

2 Additional information

2|1 International action by the Orleans division

The Orleans division hosted a Chinese delegation from the Ministry of Water in 2011, to discuss the issues associated with the installation of a nuclear power plant beside a river, and a Croatian delegation to discuss occupational radiation protection.

2|2 The other significant events in the Centre, Limousin and Ile-de-France regions

Monitoring of former uranium mines in the Limousin region

ASN considers that the actions undertaken to further knowledge of the impact of the former mining sites in the Limousin region on the environment and health must be continued. As part of the inventorying of waste rock from mines required by the circular of 22 July 2009, AREVA conducted helicopter overflights of the identified areas of interest. This was supplemented by a ground investigation phase. The aim of this procedure is to verify the compatibility of the use of mining waste rock with the areas concerned by its reuse. ASN will examine this inventory, which must be finalised in 2011 for the Limousin region.



Searching for radioactive mining waste rock in a tile factory in the Limousin region – May 2011

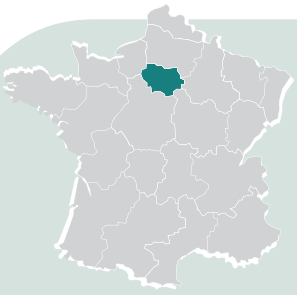
2|3 Public information actions in 2011

Pursuant to the new regulatory provisions, the Chinon and Dampierre CLIs were consulted on ASN's draft decisions defining the requirements applicable to the NPP's water take-offs and discharges.

In 2011, ASN held two press conferences in Orléans and Nanterre on the state of nuclear safety and radiation protection.

ASN, in partnership with the Centre region DIRECCTE (Regional directorate of enterprises, competition, consumption, labour and employment), organised an inter-regional day on industrial radiology (gamma radiography and X-ray radiography), held on 7 April 2011 in Orléans. This event, intended for "ordering customers" and NDT services contractors, was attended by more than fifty people.

asn PARIS



10 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE ILE-DE-FRANCE REGION AND OVERSEAS FRANCE *DÉPARTEMENTS* AND TERRITORIAL COMMUNITIES REGULATED BY THE **PARIS** DIVISION

The Paris division regulates the small-scale nuclear activities in the eight *départements* of the Ile-de-France region and the 5 overseas (Outre-Mer) *départements* (Guadeloupe, Martinique, Guyane, La Réunion, Mayotte). It also fulfils duties as expert to the competent authorities of French Polynesia and Nouvelle-Calédonie. As at 31 December 2011 the workforce of the Paris division stood at 22 officers: 1 regional head, 2 deputies, 17 radiation protection inspectors and 2 administrative officers, under the authority of an ASN regional representative.

The small-scale nuclear facilities to be regulated in the Ile-de-France region and in the *départements* of Overseas France represent 22% of the French total. The two particularities are the diversity and the number of facilities to be regulated. It effectively comprises:
– 33 external radiotherapy departments (nearly 90 accelerators);
– 18 brachytherapy departments;
– 65 nuclear medicine departments;
– more than 250 tomography devices;
– about 4,000 medical radiodiagnostic devices;
– about 8,000 dental radiodiagnostic devices;
– 15 industrial radiology companies;
– more than 500 industrial research devices or sources.

The BNIs of Ile-de-France are regulated by the ASN Orléans division.

The Paris division carried out 216 inspections in small-scale nuclear activities in 2011. These inspections covered a variety of areas: radiotherapy, nuclear medicine, interventional radiology, computed tomography, industrial radiology, radioactive material transport, monitoring of organisations approved by ASN, etc.

116 events were notified to the Paris division in 2011. 2 concerned the transport of radioactive materials and 114 concerned radiation protection of workers, patients, the public or the environment in small-scale nuclear activities.

1 Assessment by domain

1|1 Assessment of radiation protection in the medical field

External radiotherapy

ASN carried out 42 inspections of radiotherapy departments in the Île-de-France region and the overseas *départements* in 2011.

The 33 radiotherapy departments were all inspected for the fifth year in succession.

Nine entry-into-service inspections of new machines were also carried out.

Significant progress was observed in the actions contributing to treatment safety (analysis of deviations, in vivo dosimetry, etc.). The contrasting situation is still observed in the development of the quality assurance procedures and compliance with the regulatory requirements demanded by ASN in this area.

Interventional radiology

ASN carried out 21 inspections in 2011. These inspections confirmed the strong radiation protection implications for patients and workers during interventions carried out using ionising radiation. ASN noted that the way the radiation protection requirements have been integrated in this sector varied greatly according to the departments and specialities. Progress must be made in the harmonisation of professional practices to optimise the doses delivered to patients.

Nuclear medicine

ASN carried out 19 inspections in 2011. Three events relating to leaks of radioactive effluents were notified to ASN. These three events had no consequences on either worker radiation protection, the public or the environment.

Computed tomography (CT)

ASN carried out 64 inspections in 2011, 48 of them during a specific inspection campaign devoted to examining the patient radiation protection organisation implemented in the departments. This allowed the organisation of patient radiation protection in the computed tomography centres in the Ile-de-France region to be fully appraised. It reveals that, although the majority of the centres inspected know the regulations in force and have initiated measures to satisfy them, the organisation of patient radiation protection must be improved so that the optimisation principle can be even better applied. Potential avenues for improvement include adaptation of the protocols to the patient's morphology and periodically optimising the doses delivered to the patients.

Lastly, ASN drew up one violation report against a centre that had failed to register and ask for authorisations for its radiology devices.

1|2 Assessment of radiation protection in the industrial and research sectors

ASN continues its regulation and monitoring actions further to the incidents that occurred in 2010, particularly the tritium contamination incident at Saint-Maur-des-Fossés, where the CEA (alternative energies and atomic energy commission) is conducting clean-out operations.

ASN has moreover drawn up a violation report and issued formal notice to a property surveyor who had declared a non-existent place for the storage of its devices for detecting lead in paint.

1|3 Assessment of radiation protection of the public and the environment: management of waste contaminated by radionuclides and management of polluted sites and soils

In the framework of its duties to inform the public and monitor radiation protection with regard to the management of polluted sites and land, ASN oversaw and inspected the clean-out worksites of the Charvet site on Ile-Saint-Denis (*département* 93), the Curie Institute site in Arcueil (*département* 94) and the former Marie Curie school site in Nogent-sur-Marne (*département* 94).

The Radium Diagnostic operation has been launched in Ile-de-France since 21 September 2010. The government decided to perform the diagnostics free of charge in order to detect, and where applicable treat, any legacy radium pollution. This operation, which is placed under the responsibility of the *Préfet* of the Ile-de-France region, the *Préfet* of Paris, and is coordinated by ASN, concerns 84 sites in Ile-de-France.

By the end of 2011, 146 diagnostics had been carried out on twelve sites. They found 130 premises free of pollution and detected traces of radium on fifteen premises.

For the occupants and owners of the polluted premises, personalised assistance is being provided to apply the necessary precautionary measures and start the rehabilitation works - paid for by the State. The rehabilitation work is in the final phase on two of the premises, about to be started on five, and in the preparation phase on the remaining eight premises.

The measured levels of activity are low and the exposure does not present a health risk for the occupants.

2 Additional information

2|1 ASN's action in the overseas *départements* and territories

ASN carried out two inspection campaigns representing 26 inspections in the overseas *départements*, as it does each year. ASN considers that assimilation of the radiation protection requirements overseas is on average the same as in the metropolitan facilities.



Seminar on "radiotherapy in Ile-de-France and the Overseas *départements*" – 17 May 2011

ASN continued its cooperative work with French Polynesia during 2011. Two inspectors thus carried out a two-week assignment in French Polynesia, where they visited eleven facilities and gave training courses. ASN also continued giving its support to the Polynesian authorities in order to develop the regulatory framework governing nuclear activities in Polynesia.

2|2 International action by the Paris division

ASN took on a trainee from the Romanian nuclear safety authority for four days in 2011. The trainee participated in division's activities, which including three inspections in radiotherapy, interventional radiology and computed tomography. These inspections provide an opportunity to discuss the inspection and regulation practices of the two authorities.

2|3 Public information actions in 2011

ASN held a press conference in the Hauts-de-Seine *département* to give a run-down of its regional activity.

2|4 Monitoring of organisations approved for radiation protection technical checks

In 2011, ASN renewed the approvals of six organisations approved for conducting radiation protection technical checks. The audits carried out for this purpose confirmed the conformity of these organisations with the provisions of decision no.2010-DC-0191 of 22 July 2010 setting the conditions and modes of approval of the organisations mentioned in Article R. 1333-95 of the public health code.

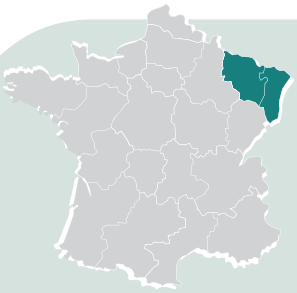
ASN also carried out seven unannounced supervisory checks during the interventions of these organisations, which on the whole were found to be satisfactory.

2|5 Outlook

ASN will continue its regulation and monitoring actions in 2012, particularly in radiotherapy, nuclear medicine and medical imaging departments, along with its public information initiatives. One event on the agenda is a seminar on dose optimisation intended for interventional radiology professionals.

Lastly, ASN will continue its action in the management of sites and land polluted by radioactive substances.

STRASBOURG



11 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE ALSACE AND LORRAINE REGIONS REGULATED BY THE **STRASBOURG** DIVISION

The Strasbourg division regulates nuclear safety and radiation protection in the 6 *départements* of the Alsace and Lorraine regions.
As at 31 December 2011 the workforce of the Strasbourg division stood at 16 officers: 1 regional head, 2 deputies, 10 inspectors and 3 administrative officers, under the authority of an ASN regional representative.

The installations to regulate in the Alsace and Lorraine regions comprise:
– the NPPs at Fessenheim (2 reactors of 900 MWe) and Cattenom (4 reactors of 1,300 MWe);
– 9 external radiotherapy departments;
– 3 brachytherapy departments;
– 14 nuclear medicine departments;
– about 50 interventional radiology departments;
– about 76 CT scanners;
– 4,000 medical and dental radiodiagnostic devices;
– 200 industrial research establishments;
– 2 cyclotrons producing fluorine 18.

ASN carried out 152 inspections in 2011: 44 inspections on the nuclear sites of Fessenheim and Cattenom (with post-Fukushima inspections on both these sites); 4 inspections in the transport of radioactive substances; 102 inspections in small-scale nuclear activities.

ASN also conducted 7 labour inspections in the nuclear power plants.

In 2011, 5 significant events of level 1 on the INES scale were declared by the licensees of EDF nuclear installations in the Centre region, and 4 significant events of level 1 were notified by the licensees of the Ile-de-France nuclear sites.

In the small-scale nuclear activities in these regions, 6 significant events of level 1 on the ASN-SFRO scale were notified by radiotherapy departments, and 2 events rated level 1 and 2 respectively on the INES scale were notified for industrial activities.

In the framework of its regulation duties, ASN submitted two violation reports to the public prosecutor's department and issued formal notice to comply to two establishments.

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

Fessenheim NPP

ASN considers that the Fessenheim plant's performance in nuclear safety, environmental protection and radiation protection is satisfactory.

ASN notes progress in the maintenance of the facilities and the monitoring of outside contractors in 2011, which was a particularly busy year, with the third 10-year inspection of reactor 2 and a concomitant shutdown of reactor 1, among other things. The licensee took into account experience feedback from the previous shutdowns.

ASN notes that many items of equipment have been replaced to improve the condition of the facilities. Compliance with the technical requirements issued by ASN further to the third 10-year inspection of reactor 1 will help raise the level of safety so that continuation of operation of this reactor for another 10 years can be envisaged.

On the other hand, ASN considers that worker radiation protection is not improving, despite a proposed plan of action further to its findings of 2010. The licensee has not sufficiently learnt the lessons from the previous years.

Cattenom NPP

ASN considers on the whole that Cattenom NPP's performance in nuclear safety, environmental protection and radiation protection is satisfactory. More particularly, ASN considers that worker radiation protection is improving thanks to the measures taken by the site, and notably due to strong involvement of the risk prevention department.

ASN considers that the site is well prepared for emergency situations. The on-site inspection conducted by ASN from 2 to 5 August 2011 in the context of Fukushima experience feedback found management of the mobile emergency equipment to be satisfactory, and the concrete situation simulations showed good forward planning on the part of those involved.

In November 2011, the International Atomic Energy Agency (IAEA) conducted an assessment of safety in operation (Operational Safety Review Team - OSART - mission) at the Cattenom NPP, the second on the site following that of 1994, and confirmed ASN's judgement of it.

1|2 Assessment of radiation protection in the medical field

Computed tomography (CT)

EIn 2011, ASN began stepping up the inspections of medical imaging departments possessing a CT scanner. The reason behind this is that CT examinations represent a significant source of exposure to ionising radiation in the French population. Faced with this fact, and without calling into question the irrefutable medical benefits of this activity, the Strasbourg



ASN inspection at the Fessenheim NPP – September 2011

division - through its contacts with the medical institutions - has undertaken actions aiming to acquire better insight into the conditions of use of CT scanners and identify ways of reducing the doses delivered during the examinations. Three departments were thus inspected in Alsace-Lorraine in 2011, and twenty authorisations were delivered.

ASN notes that patient radiation protection is a growing concern in medical imaging departments. It reveals that, although the majority of the centres inspected know the regulations in force and have initiated measures to satisfy them, only half of the centres have set up a process of optimisation and periodic monitoring of the doses received by patients and involving a medical physicist.

ASN has also noted with satisfaction that patient and worker radiation protection is a criterion taken into account by the imaging departments when choosing new equipment. Furthermore, ASN notes that certain examinations that could be performed using a magnetic resonance imaging (MRI) scanner instead of the CT scanner, are not, because too few MRI scanners are available.

Interventional radiology

The inspections conducted in the medical departments carrying out interventional radiology procedures have confirmed the progressive implementation of in-house and external quality checks. They have also confirmed the improvement in personnel training. ASN nevertheless considers that there is still progress to be made in the optimisation of radiation protection, particularly in the operating theatre: this can be achieved by having better knowledge of the devices, more detailed tracking of dosimetric information, and frequent involvement of medical physicists.

In Octobre 2011, ASN conducted an inspection in four departments of the Strasbourg CHU (university hospital centre) to verify that the action plan decided further to the event notified by the interventional neuroradiology department in March 2009, had been implemented in all the departments. This inspection confirmed that this action plan is indeed implemented and positions the CHU among the most advanced French medical centres in terms of patient radiation protection.

Radiotherapy

In 2011, ASN inspected all of the nine radiotherapy departments in Alsace and Lorraine.

These inspections confirmed that the departments have continued implementing a quality assurance and risk management system, in accordance with the new regulatory requirements defined by the ASN. Nevertheless, the implementation deadlines set by the ASN decision are not always met and the risk analyses and formalising of practices are not all of the same standard.

1|3 Assessment of radiation protection in the industrial and research sectors

Industrial radiography

On account of the high risks it represents, industrial radiology is a high priority for ASN. In order to verify that work is performed under satisfactory conditions of safety, ASN performs numerous unannounced inspections, particularly at night, on the work sites involving outside NDT contractors. In 2011, the thirteen inspections conducted in this respect confirmed that the companies generally comply with the radiation protection regulations, particularly the dosimetric monitoring of the personnel. ASN moreover notes progress in the implementation of safety zoning and in work site preparation. Vigilance must nevertheless be maintained with this type of high risk activity.

Level 2 gamma radiography incident at Rambervillers

On 22 September 2011, ASN was alerted of an incident that occurred in Rambervillers (*département* 88), involving a radiographic inspection device used for inspecting welds on a pipe. A metal part fell onto the flexible hose of the gamma radiography device, preventing the radioactive source from retracting to its safety position inside the device. ASN immediately sent two inspectors to the site, who checked that the safety perimeter was properly monitored and ensured that the neighbouring population had been duly informed. The incident analysis revealed that the operator attempted to free the source manually under conditions that did not comply with radiation protection rules. Even though the dose received by the operator was within the regulatory limits, this analysis led ASN to rate this event at level 2 on the INES scale.

An intervention carried out on 24 November 2011 by the device manufacturer using a specifically developed tool enabled the source to be put back inside the device in its safety position. The long time lapse before this intervention shows the need to put in place the material and organisational means for managing malfunctions of such devices.

1|4 Other actions of the Strasbourg division in small-scale nuclear activities

Large-scale inspection operation in the Vosges département

ASN carried out a large-scale radiation protection inspection campaign in the Vosges from 6 to 8 June 2011. A team of 5 inspectors performed a total of 47 inspections, mostly unannounced. These inspections reveal that while the industrial sector complies with the regulations virtually in full, action is required in the other sectors, especially dental surgeries and, to a lesser extent, veterinary practices, to restore regulatory compliance.

Management of polluted sites and land

In 2011, ASN continued its monitoring of polluted sites and land, including an unannounced inspection during the clean-out work in a laboratory of Strasbourg University contaminated due to the storage of a collection of samples of radioactive uraniferous ores.

Monitoring of approved organisations

The year 2011 was marked by intensive monitoring of the organisations responsible for the external radiation protection checks. These organisations, approved by ASN, are subject to unannounced inspections when performing their services, audits of their head office organisation, and examination of their procedures as part of the approval application.

In 2011, the ASN Strasbourg division conducted eight inspections on approved organisations.

1|5 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

In 2011, ASN carried out four inspections concerning the transport of radioactive materials and monitored the safety of transport from France to Germany of containers of vitrified radioactive waste originating from the reprocessing of spent German fuel on the La Hague site. ASN verified that the packages were duly approved and that the dose rate around the convoy did not exceed regulatory limits. The Strasbourg division of ASN assisted the defence zone *Préfet* in the zone command post.

2 Additional information

2|1 International action by the Strasbourg division

In the framework of the bilateral exchanges with its German, Luxembourgois and Swiss counterparts, the Strasbourg division of ASN took part in more than 10 cross-inspections in nuclear power plants and medical or industrial establishments, either as a guest in foreign countries, or as host to foreign counterparts.

A Franco-German working group compared the significant events notification criteria between France and Germany. The comparison showed that the notification criteria are specific to each country, even if the INES severity scale is the same.

A similar study was initiated in 2011 between France and Switzerland.

In the framework of the targeted post-Fukushima inspections, the Strasbourg division inspectors were accompanied at Cattenom by observers from Luxembourg and Germany, and at Fessenheim by Swiss observers. In return the Swiss safety authority invited ASN to participate in post-Fukushima inspections in the Swiss NPPs. Without waiting for the peer reviews of the 1st half of 2012, the Swiss authority involved the Strasbourg division in the monitoring of the stress tests engaged by the European Commission as of November 2011.

In 2011 the Strasbourg division met the German locally elected officials to present the opinion of ASN on the continuation of operation of the Fessenheim NPP reactor 1.

Lastly, the Strasbourg division hosted a trainee from the Romanian safety authority in charge of radiation protection for one week, and two Israeli observers during inspections in the medical field.

2|2 Public information actions in 2011

In 2011, ASN held two press conferences in Strasbourg and Metz on the state of nuclear safety and radiation protection.

ASN took part in various meetings of the CLIs of Fessenheim and Cattenom. During these meetings, ASN presented its assessment of the situation of the nuclear facilities concerned, and the control of the activities around the basic nuclear installations. It also presented the procedure for the complementary safety assessments it had required as part of the initial experience feedback from the Fukushima accident.

ASN also invited the CLIs on several occasions to come and observe the inspections performed in the EDF facilities as part of the initial experience feedback from the Fukushima accident. The numerous observers from the CLIs were thus able to get a clearer picture of the ASN's activities and the relations between the licensee and the ASN during the on-the-ground inspections. They were subsequently able to share their impressions at the plenary meetings of the CLIs.



Press conference of the ASN Strasbourg division on 9 June 2011

MEDICAL USES OF IONISING RADIATION

1 **MEDICAL AND DENTAL RADIODIAGNOSIS INSTALLATIONS** 253

1|1 **Presentation of the equipment inventory**
1|1|1 Medical radiodiagnosis
1|1|2 Interventional radiology
1|1|3 Dental radiodiagnosis

1|2 **Technical rules for radiology and tomography installations**

2 **NUCLEAR MEDICINE** 258

2|1 **Presentation of nuclear medicine activities**
2|1|1 *In vivo* diagnosis
2|1|2 *In vitro* diagnosis
2|1|3 Targeted internal radiotherapy
2|1|4 The new nuclear medicine tracers

2|2 **Nuclear medicine unit organisation and operating rules**

3 **EXTERNAL-BEAM RADIOTHERAPY AND BRACHYTHERAPY** 261

3|1 **Description of the techniques**
3|1|1 External-beam radiotherapy
3|1|2 Brachytherapy
3|1|3 The new radiotherapy techniques

3|2 **Technical rules applicable to installations**
3|2|1 Technical rules applicable to external-beam radiotherapy installations
3|2|2 Technical rules applicable to brachytherapy installations

4 **BLOOD PRODUCT IRRADIATORS** 265

4|1 **Description**

4|2 **Blood product irradiator statistics**

4|3 **Technical rules applicable to installations**

5 **THE STATE OF RADIATION PROTECTION IN THE MEDICAL FIELD** 265

5|1 **Exposure situations in the medical field**
5|1|1 Exposure of health professionals
5|1|2 Exposure of patients
5|1|3 Exposure of the general public and environmental impact

5|2 **Some general indicators**
5|2|1 Authorisations and declarations
5|2|2 Dosimetry of medical staff
5|2|3 Report on significant radiation protection events

5|3 **The radiation protection situation in radiotherapy**
5|3|1 Radiation protection of radiotherapy staff
5|3|2 Radiation protection of radiotherapy patients
5|3|3 Summary

CHAPTER 9

5|4 The radiation protection situation in nuclear medicine
5|4|1 Radiation protection of nuclear medicine staff
5|4|2 Radiation protection of nuclear medicine patients
5|4|3 Protection of the general public and the environment
5|4|4 Summary
5|5 The radiation protection situation of patients in conventional radiology and computed tomography
5|6 The radiation protection situation in interventional radiology
5|6|1 Radiation protection of interventional radiology staff
5|6|2 Radiation protection of interventional radiology patients
5|6|3 Summary
6 OUTLOOK 275

For more than a century now, and for both diagnostic and therapeutic purposes, medicine has made use of a variety of sources of ionising radiation, produced either by electric generators, or by artificial radionuclides. Even if their benefits and usefulness have long been medically proven, these techniques do however make a significant contribution to exposing the general public to ionising radiation. Behind exposure to natural ionising radiation, they represent the second source of exposure for the general public and the leading source of artificial exposure (see chapter 1).

Protection of the staff working in installations using ionising radiation for medical purposes is regulated by the provisions of the Labour Code (see chapter 3). The installations themselves and their use are required to comply with specific technical and administrative rules, while the use of radioactive sources is subject to specific management rules contained in the Public Health Code (see chapter 3).

In recent years, the technical regulations have been considerably strengthened with the creation of a new set of regulations dedicated to patient radiation protection (see chapter 3). The principles of justification of procedures and optimisation of the doses delivered are the foundation of these new regulations. However, unlike the other applications of ionising radiation, the principle of dose limitation does not apply to patients, given the resulting health benefits for them and the fact that, to obtain an image of diagnostic quality or the desired therapeutic effect, the doses must reach a certain level.

1 MEDICAL AND DENTAL RADIODIAGNOSIS INSTALLATIONS

1|1 Presentation of the equipment inventory

Radiology is based on the principle of differential attenuation of X-rays by the organs and tissues of the human body. The information is gathered either on radiological film or more and more often on digital media allowing computer processing, transfer and archival storage of the images obtained.

Radiodiagnosis, which is the oldest of the medical applications of radiation, is a discipline containing all the techniques for morphological examination of the human body using X-rays produced by electric generators. It enjoys pride of place in the medical imaging field and comprises various specialities (conventional radiology, interventional radiology, computed tomography, angiography and mammography) and a wide variety of examinations (radiography of the thorax, the abdomen, and so on).

The request for a radiological examination by the physician must be part of a diagnostic strategy taking account of the relevance of the information sought, the expected benefit for the patient, the anticipated exposure level and the possibility of using other non-irradiating investigative techniques (see the French medical imaging good practices guide, chapter 3).

1|1|1 Medical radiodiagnosis

Conventional radiology

This uses the principle of conventional radiography and covers the vast majority of radiological examinations carried out.

The main subjects are the skeleton, thorax and abdomen. Conventional radiology can be split into two main families:

– radiodiagnosis performed in fixed installations specifically built for the purpose;
– radiodiagnosis carried out using mobile devices, especially by the patient's bedside. This practice is however restricted to those patients who cannot be transported.

Digital subtraction angiography

This technique, which is used to explore the blood vessels, is based on the digitisation of images before and after injecting a contrast medium. Computer processing removes the structures around the vessels by subtracting the pre-contrast images from the later ones.

Mammography

Given the composition of the mammary gland and the degree of detail sought for the diagnosis, high definition and perfect contrast are required for the radiological examination. This can only be achieved by special devices working with low voltage. These generators are also used for breast cancer screening campaigns.

Computed tomography

Using a closely collimated X-ray beam emitted by an X-ray tube rotating around the patient and a computer-controlled image acquisition system, computed tomography scanners give a three-dimensional picture of the organs with image quality



Mammography examination

higher than that of conventional equipment, thus providing a more detailed picture of the organ structure.

For some investigations, this technique is today facing a strong challenge from magnetic resonance imaging (MRI). However, the new generation of devices (multi-slice CT scanners) enables the scope of investigation of computed tomography to be expanded, with easier and faster investigation, which can however mean that more images are taken, which runs contrary to the optimisation principle, thus leading to a significant rise in the doses of radiation delivered to the patients.

Teleradiology

Teleradiology makes it possible to guide the performance of radiological examinations carried out in another location and to interpret the results, also from a distance. Data transmissions must be carried out in strict application of the regulations (relating to radiation protection and image production quality in particular) and professional ethics.

Essentially two practices are concerned:
– telediagnosis, which enables the doctor on the scene (e.g. an emergency doctor), who is not a radiologist, to send images to a radiologist for interpretation for diagnostic or therapeutic purposes. If necessary, the radiologist can guide the radiological technician during the examination and imaging process;
– tele-expertise, whereby radiologists can exchange opinions by asking a remote expert radiologist ("teleradiologist") to refine and/or confirm a diagnosis and determine a therapeutic orientation or guide a remote examination.

The data transmissions are protected bidirectionally to preserve medical secrecy and image quality.

Teleradiology involves many responsibilities which must be specified in the agreement binding the practitioner performing the procedure (radiologist or not), to the teleradiologist.

1|1|2 Interventional radiology

Interventional radiology concerns "all invasive diagnostic and/or therapeutic medical procedures, as well as surgical procedures using ionising radiation for per-procedural guidance, including monitoring[1]".

This involves techniques that use fluoroscopy with an image intensifier or flat panel detector and require special equipment, for example in surgical contexts or when using cardiovascular probes. These techniques are used during diagnostic interventions (examination of coronary arteries, etc.) or for therapeutic purposes (dilation of coronary arteries, etc.) as well as during surgical procedures using ionising radiation to guide or monitor the surgeon's actions. They might require long-term exposure of the patients, who then receive high doses which can sometimes lead to radiation-related deterministic effects (cutaneous lesions, etc.). The staff are usually working in the immediate vicinity of the patient and are also exposed to higher dose levels than during other radiological practices. In these conditions, given the risk of external exposure for the operator and the patient, interventional radiology must be justified by a clearly determined medical need and its practice must be optimised in order to improve the radiation protection of both operators and patients.

Fixed interventional radiology installations are used in interventional neuro-radiology, interventional cardiology and, more generally, in vascular radiology. Mobile devices comprising a radioscopy mode are used in the operating theatre for a number of medical specialities, in particular digestive surgery, orthopaedic surgery and urology.

ASN does not know the exact number of installations in which interventional practices are performed. The ASN



ASN "interventional radiology" inspection at the Villefranche-de-Rouergue university hospital – December 2010

1. Definition from the Advisory Committee for medical exposure (reporting to ASN)

divisions initiated actions to compare the information held by the health insurance offices and the Regional Health Agencies (ARS) in order to obtain a more accurate picture of the health-care activities concerned.

1|1|3 Dental radiodiagnosis

Intra-oral radiography

Intra-oral type radiography generators are mounted on an articulated arm, to provide localised images of the teeth. They operate with relatively low voltage and current and a very short exposure time, of about a few hundredths of a second. This technique is increasingly frequently combined with a system for digital processing of the radiographic image which is displayed on a monitor.

Panoramic dental radiography

Primarily used by dental specialists (orthodontists, stomatologists) and radiologists, panoramic radiography gives a single picture showing both jaws, by rotating the radiation generating tube around the patient's head for about ten seconds.

Cone-beam computed tomography

In the dental radiology field, the development of devices using a cone-beam computed tomography mode (3D) is continuing and the irradiation fields of view proposed by these devices are increasingly wide. ASN has defined the practical aspects of ensuring operator protection.

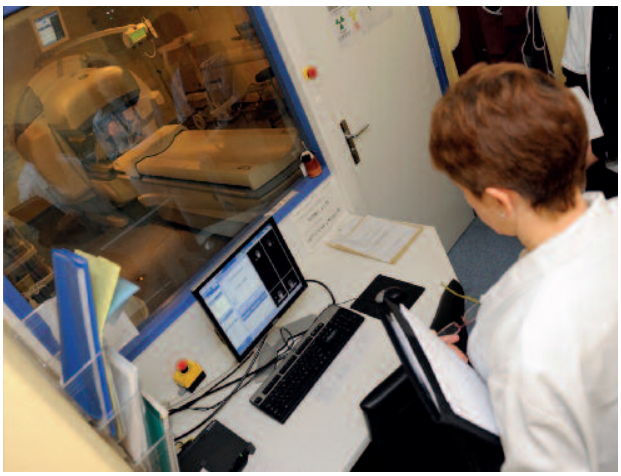
1|2 Technical rules for radiology and computed tomography installations

Radiology installations

A conventional radiological installation comprises a generator (high-voltage unit, X-ray tube and control unit), associated with a support for moving the tube and an examination table or chair. The general standard NFC 15-160, published by the Union technique de l'électricité (UTE), defines the conditions in which the installations must be fitted out to ensure human safety against the risks resulting from the action of ionising radiation and electrical current. It is supplemented by specific rules applicable to medical radiodiagnosis procedures (NFC 15-161).

These standards stipulate that the walls of radiology rooms must be sufficiently opaque to radiation and may require the installation of reinforced lead protection. In the light of the changes to the radiation protection regulations, which have resulted in a reduction in the exposure limits for both the public and workers, these standards were revised at the end of 2010 (see box).

In addition to complying with the above-mentioned standards, the devices must bear the CE marking, which has been mandatory since June 1998. This certifies that the device is in conformity with the essential requirements of health and safety mentioned in articles R. 5211-21 to 24 of the Public Health Code. It should be noted that the 25-year limit on the lifetime of the generators was abrogated by the order of 1st December 2011, amending the order of 14 May 2004 concerning the general licensing and registration regime defined in chapter V-I "ionising radiation" of the Public Health Code. This duration had been set before the periodic quality controls on medical devices stipulated by a decision of the Director General of the AFSSAPS became mandatory. These ensure that the long-term performance of the medical devices



ASN inspection on the CT installation in the nuclear medicine unit of the Oscar Lambret centre in Lille – November 2011

UNDERSTAND

Revision of standards NFC15-160, NFC15-161, NFC15-162 and NFC15-163

The standards in the NFC15-160 series relative to installations for the production and utilisation of X-rays have been revised. These standards included general rules (NFC15-160) and specific rules for medical and veterinary radiodiagnosis installations (NFC15-161), for roentgen therapy[2] installations (NFC15-162) and for dental radiodiagnosis installations (NFC15-163). The new standard introduces a method of calculation for determining the thickness of the radiation shielding in all the medical installations in which X-ray generating devices and particle accelerators are used.

2. The roentgen therapy installations mentioned in this standard are radiotherapy installations.

is maintained. The regulations concerning medical devices also enable bans to be issued, as applicable, for any equipment that proves to be obsolescent.

Computed tomography installations

Computed tomography installations must be fitted out in accordance with the requirements of special standard NFC 15-161, which sets rules primarily for the dimensions of the examination room and for the radiological safety measures to be taken. A computed tomography device can therefore only be installed in a room with a surface area of at least 20m² and in which no linear dimension is smaller than 4 metres. The opacity of the walls (including floor and ceiling) of the room must correspond to an equivalent thickness of 0.2 to 1.5mm of lead, depending on the purposes for which the adjoining rooms are used. The French radiological equipment pool comprised 905 computed tomography installations in 2009 (figure provided by France's Court of Audit). This figure would rise to about 1,150 if the devices used for radiotherapy simulation were included. The 25-year limit on the lifetime of the generators was abrogated by the above-mentioned order of 1 December 2011, amending the order of 14 May 2004.

2 NUCLEAR MEDICINE

2|1 Presentation of nuclear medicine activities

Nuclear medicine includes all uses of unsealed radioactive sources for diagnostic or therapeutic purposes. Diagnostic uses can be divided into in vivo techniques, based on administration of radionuclides to a patient, and exclusively *in vitro* applications.

This sector comprises a total of 236 operational nuclear medicine units, containing both *in vivo* and *in vitro* installations.

On the whole, the number of nuclear medicine units practicing in vivo diagnosis and therapy has been stable over the last three years. Sixty percent of them are located in public or comparable structures and 40% are in private structures. There are about 90 positron emission tomographs (PET) in service at the end of 2011. Forty nuclear medicine units are equipped with targeted internal radiotherapy rooms.

Nuclear medicine comprises about 500 specialist practitioners, to whom should be added 1,000 physicians working jointly with the nuclear medicine units (internists, cardiologists, endocrinologists, etc.).

2|1|1 *In vivo* diagnosis

This technique consists in examining the metabolism of an organ with a specific radioactive material – called a radiopharmaceutical – administered to a patient. The nature of the radiopharmaceutical, which has medication status, depends on the organ or function studied. The radionuclide can be used directly or fixed to a carrier (molecule, hormone, antibody, etc.). For example, table 1 presents some of the main radionuclides used in the various investigations.

Table 1: some of the main radionuclides used in the various nuclear medicine examinations

Type of examination	Radionuclides used
Thyroid metabolism	Iodine-123, technetium-99m
Myocardial perfusion	Thallium-201, technetium-99m
Pulmonary perfusion	Technetium-99m
Pulmonary ventilation	Krypton-81m, technetium-99m
Osteo-articular process	Technetium-99m
Oncology – search for metastasis	Fluorine-18



Handling of radioactive products during the inspection of the nuclear medicine unit of the Oscar Lambret centre in Lille – November 2011

The radioactive material administered, usually technetium-99m, is located in the organism by a specific detector – called a scintillation camera or gamma-camera - which consists of a sodium iodide scintillation crystal (in most cameras) coupled with a computer-controlled image acquisition and analysis system. This equipment is used to obtain images of how the investigated organs are functioning (scintigraphy). As these are digitised images, the physiological processes can be quantified, along with a three-dimensional reconstruction of the organs (single-photon emission computed tomography or SPECT), using the same principle as for the X-ray scanner.

Fluorine-18, a radionuclide that emits positrons, is today commonly used in the form of a sugar, fluorodeoxyglucose (FDG), for examinations in cancerology. It requires the use of a scintillation camera that can detect positron emitters (PET).

Nuclear medicine allows the production of functional images and therefore complements the purely morphological pictures obtained with the other imaging techniques: conventional radiology, X-ray scanner, echography or magnetic resonance imaging. In order to make it easier to merge functional and morphological images, hybrid cameras have been developed: positron emission tomographs (PET) are now systematically coupled with a CT scanner (PET-CT) and more and more nuclear medicine units are acquiring gamma-cameras coupled with a CT scanner (SPECT-CT).

2|1|2 *In vitro* diagnosis

This is a medical biology analysis technique – without administration of radionuclides to the patients – for assaying certain compounds contained in biological fluid samples taken from the patient: hormones, drugs, tumour markers, etc. This technique uses assay methods based on immunological reactions (antibody - antigen reactions labelled with iodine-125), hence the name RIA (*radioimmunology assay*). The activity levels present in the analysis kits designed for a series of assays do not exceed a few kBq. Radioimmunology is currently being strongly challenged by techniques which make no use of radioactivity, such as immuno-enzymology.

2|1|3 Targeted internal radiotherapy

Internal radiotherapy aims to administer a radiopharmaceutical emitting ionising radiation, which will deliver a high dose to a target organ for curative or remedial purposes.

Certain therapies require hospitalisation of the patients for several days in specially fitted out rooms in the nuclear medicine unit, until most of the radionuclide administered has been eliminated through the urinary tract. The radiological protection of these rooms must be appropriate for the type of radiation emitted by the radionuclides. This is in particular the case with treatment of certain thyroid cancers after surgery, involving the administration of about 4,000 MBq of iodine-131.

Other treatments can be on an out-patient basis. Examples include administering iodine-131 to treat hyperthyroidism, strontium-89 or samarium-153 for painful bone metastases, and phosphorus-32 for polyglobulia. Joints can also be treated using colloids labelled with yttrium-90 or rhenium-186. Finally, radioimmunotherapy can be used to treat certain lymphomas using yttrium-90 labelled antibodies. The treatment of hepatocellular carcinomas by spheres labelled with yttrium-90 is also currently being developed.

2|1|4 The new nuclear medicine tracers

In recent years, research has been underway in France and around the world to develop new radioactive tracers. This primarily concerns positron emission tomography and targeted internal radiotherapy.

In 2009, clinical tests continued into the use of various fluorine-18 tracers in PET and antibodies labelled with yttrium-90 in targeted internal radiotherapy. New tracers are available for research purposes, using alpha emitters in particular.

The use of new radiopharmaceuticals means that the radiation protection requirements associated with their use must be taken into account as early as possible in the process. Given the activity levels involved, the characteristics of the radionuclides and the known preparation and administration protocols, exposure of the operators, particularly their hands, could reach or even exceed the dose limits set by the regulations. ASN has reminded operators of the regulatory requirements and undertaken awareness-raising actions, notably by encouraging the development of automated preparation and/or injection systems for these radionuclides.

2|2 Nuclear medicine unit design and operating rules

Given the radiation protection constraints involved in the use of unsealed radioactive sources, nuclear medicine units are designed and laid out so that they can receive, store, prepare and then administer unsealed radioactive sources to patients or handle them in laboratories (radioimmunology for instance). Provision is also made for the collection, storage and disposal of radioactive wastes and effluents produced in the installation, particularly the radionuclides contained in patients' urine.

From the radiological viewpoint, the workers are subjected to a risk of external exposure, in particular on the fingers, due to the handling of sometimes highly active solutions (as is the case with fluorine-18, iodine-131 or yttrium-90), and a risk of internal exposure through accidental intake of radioactive materials. In these conditions, the nuclear medicine units have to comply with specific layout rules, the main provisions of which are described below.

Location and layout of premises

The premises of a nuclear medicine unit must be located away from the general circulation areas, clearly separated from premises intended for ordinary use, grouped so that they form a single unit allowing easy marking out of controlled areas, categorised in descending order of radioactive activity levels.

They comprise at least:
– an entry and changing area for the staff, separating normal clothing from work clothing;



ASN inspection on the outfitting work in the nuclear medicine unit's premises in the Oscar Lambret centre in Lille – November 2011

– examination and measurement rooms and waiting rooms for injected patients prior to examination;
– areas for storage and preparation of unsealed sources (radiopharmacy);
– an injection room adjoining the radiopharmacy;
– installations for reception of the radionuclides delivered and storage of radioactive waste and effluents.

Layout of premises

The walls are sized to ensure protection of the workers and the public in their vicinity. The floors, walls and worktop surfaces must be made of smooth, impermeable, seamless and easily decontaminable materials. The washbasin taps must not be hand-operated. The changing entry area must be equipped with washbasins and a shower. The sanitary facilities for the patients who have received an injection must be connected to a septic tank, itself directly connected to the establishment's main sewer. The radiopharmacy must be fitted with one or more shielded cells for storing and handling radioactive sources, offering protection against the risks of external exposure and the dispersal of radioactive materials.

Ventilation of the controlled area

The ventilation system must keep the premises at negative pressure, with air renewed at least five times per hour. It must be independent of the building's general ventilation system and foul air must be extracted with no possibility of recycling. The shielded cells for storage and handling of radioactive materials in the radiopharmacy must be connected to independent extraction ducts fitted with filters.

In 2010, ASN began working on updating the design rules for nuclear medicine units (see box).

Collection and storage of radioactive solid waste and liquid effluents

The order of 28 July 2008 approving ASN decision 2008-DC-0095 of 29 January 2008 lays down the technical rules to be followed for the disposal of waste and effluents contaminated by radionuclides.

Generally speaking, nuclear medicine units have a room for interim storage of waste contaminated by radionuclides until disposal. Contaminated liquid effluents are channelled to a system of storage tanks to allow radioactive decay prior to discharge into the sewerage network.

TO BE NOTED

In 2010, ASN began work on updating the design rules for the premises in which nuclear medicine is carried out. A report defining the orientations and requirements was drawn up jointly with representatives of the profession. It will be presented to the Advisory Committee for medical exposure (GPMED) in early 2012 and an ASN technical decision will then be published.

3 EXTERNAL-BEAM RADIOTHERAPY AND BRACHYTHERAPY

3|1 Description of the techniques

Alongside surgery and chemotherapy, radiotherapy is one of the key techniques employed to treat cancerous tumours. Some 200,000 patients are treated each year. Radiotherapy uses ionising radiation to destroy malignant cells. The ionising radiation necessary for treatment is either produced by an electric generator, or emitted by radionuclides in the form of a sealed source. A distinction must be made between external beam radiotherapy, in which the radiation source is placed outside the patient and brachytherapy, in which the source is positioned in direct contact with the patient, either in or close to the area to be treated.

At the end of 2010, the external beam radiotherapy installations comprised 439 treatment devices, including 419 isocentric linear accelerators (see points 3|1|1 and 3|1|3). These facilities are installed in 176 radiotherapy centres, half with public status and half with private status.

544 radiation oncologists were identified, including 44% private practitioners and 56% salaried staff. 70 brachytherapy units are linked to these installations (Radiotherapy Observatory, September 2010, INCa).

3|1|1 External-beam radiotherapy

Before the irradiation sessions take place, a treatment plan is always drawn up. For each patient, and in addition to the dose to be delivered, this plan defines the target volume to be treated, the irradiation beam setting and the dose distribution, as well as the duration of each treatment session. Preparation of this plan, which aims to set conditions for achieving a high dose in the target volume while protecting healthy tissues, requires close cooperation between the radiation oncologist and the medical physicist, but also the dosimetrists.

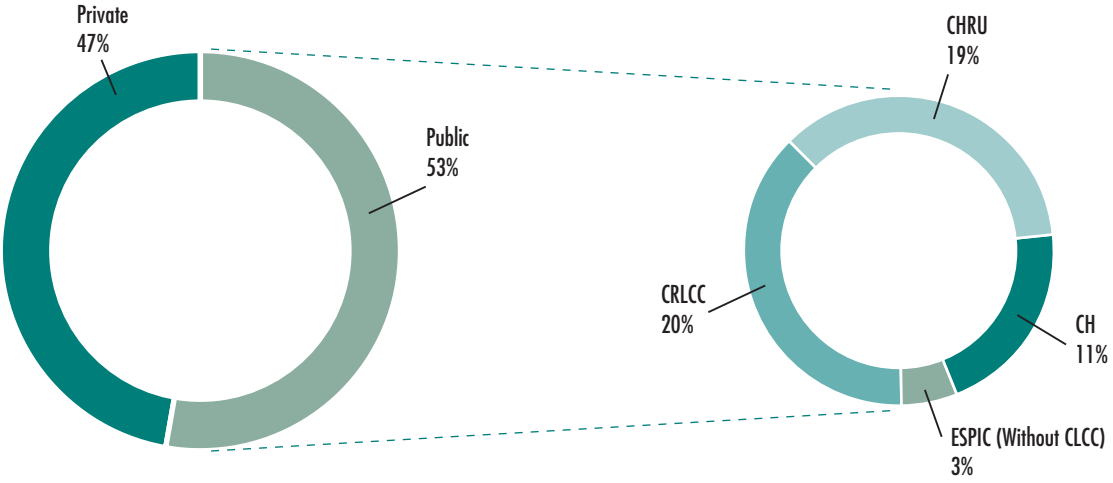


ASN inspection of the Dentellières clinic in Valenciennes on the subject of commissioning a radiotherapy installation – October 2011

For the vast majority of treatments, irradiation uses linear particle accelerators with an isocentric arm, producing beams of photons or electrons with an energy ranging between 6 and 25 MeV and delivering dose rates of between 2 and 6 Gy/min.

For certain specific therapeutic indications (see point 3|1|3), a number of centres propose treatments that are made possible through the use of:
– a specific linear particle accelerator;
– a gammatherapy device equipped with more than 200 sources of cobalt 60 focused on a single point;
– a cyclotron producing proton beams.

Diagram 1: breakdown of the number of linear accelerators in France according to the status of the establishments



CRLCC : Regional anti-cancer centre
CHRU : Regional university hospital centre
CH : Hospital centre
ESPIC : Private health establishment in the public interest

It must be remembered that in France, telegammatherapy devices are no longer used for patient treatment.

Stereotactic radiotherapy

Stereotactic radiotherapy is a treatment method which aims to offer millimetre-precise, high-dose irradiation, using small beams converging in the centre of the target, for intra-cranial pathology that is surgically inaccessible. Radio-surgery treatment is defined as being a single session of stereotactic radiotherapy. In stereotactic radiotherapy treatments, the total dose is delivered either in a single session or in a hypofractionated manner, depending on the type of pathology being treated. This technique requires considerable precision when defining the irradiation target volume and the treatment has to be as conformational as possible.

It was originally developed to treat non-cancerous pathologies in neurosurgery (artery or vein malformations, benign tumours) and uses specific techniques to ensure precise localisation of the lesion. It is also more and more frequently used to treat cerebral metastases, but also for extracranial tumours.

This therapeutic technique uses three types of equipment:
– dedicated systems such as Gamma Knife® which directs the emissions from more than 200 cobalt-60 sources towards a single focal spot (four units are currently in service in three facilities), and CyberKnife® which consists of a miniaturised linear accelerator mounted on a robotic arm (see detail in point 3.1.3);
– dedicated linear accelerators offering dynamic irradiation mode (Novalis®, five units currently in service);
– "conventional" linear accelerators, providing dynamic irradiation mode and equipped with additional collimating systems (mini-collimators, localisers) to generate small beams.

In May 2010, 28 centres had equipment enabling them to perform stereotactic radiotherapy treatments.

3|1|2 Brachytherapy

Brachytherapy allows specific or complementary treatment of cancerous tumours, specifically in the H&N field, as well as of the skin, the breast or the genitals.

This technique consists in implanting radionuclides, exclusively in the form of sealed sources (iridium-192 wires, considered to be unsealed sources, are a special case), either in contact with or inside the solid tumours to be treated.

The main radionuclides employed in brachytherapy are caesium-137 (^{137}Cs, half-life 30 years), iridium-192 (^{192}Ir, half-life-74 days) and iodine-125 (^{125}I, half-life 60 days).

Brachytherapy techniques involve three types of applications:

• Low Dose-Rate (LDR) brachytherapy:
– delivers dose rates between 0.4 and 2 Gy/h;
– using ^{192}Ir sources in the form of divisible wires, ^{137}Cs sources implemented using a specific source applicator. These sources are put into place for a limited duration;
– using ^{125}I sources, in the form of seeds, installed permanently.

The iridium-192 sources, positioned inside tissues, take the form of wires 0.3 or 0.5 mm in diameter, with a maximum length of 14 cm at delivery and with an activity per unit length ranging from 30 MBq/cm and 370 MBq/cm.

The caesium-137 sources take the form of sealed sources 3 mm in diameter and 2 to 8 cm long. The brachytherapy ward must have a "library" of the various sources, corresponding to the types of applications the user wishes to employ. The sources are placed in a storage unit and transferred to the applicator system at the time of treatment.

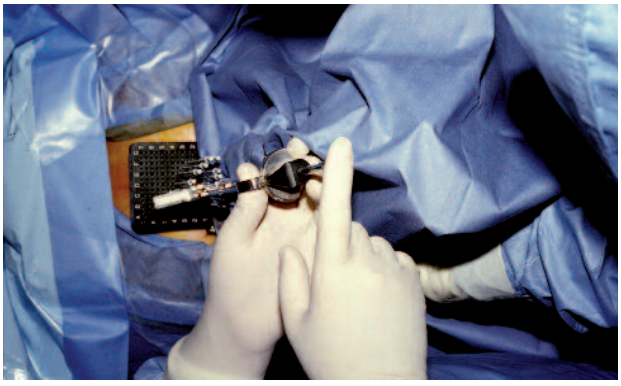
Low dose rate brachytherapy requires patient hospitalisation for several days in a room with radiological protection appropriate to the maximum activity of the radioactive sources emplaced (rooms with radiological protection) where the patient stays for the duration of his or her treatment (except for brachytherapy of the prostate with seeds of iodine-125 and ophthalmic brachytherapy).

Endocavity techniques (inside natural cavities) use either iridium-192 wires or caesium-137 sources. In both cases, the sources remain in place in the patient for the duration of hospitalisation.

For the treatment of prostate cancers, iodine-125 sources are used. These sources, 4.5 mm long and 0.8 mm in diameter, are positioned permanently inside the patient's prostate gland. Their unit activity is between 10 and 30 MBq and treatment requires about a hundred seeds representing a total activity of 1 to 2 GBq.



Treatment of a brain tumour by multi-beam stereotactic radiotherapy



Brachytherapy of the prostate

Low dose rate brachytherapy requires that the following premises be available:
– an application room, usually an operating theatre where the source carrier tubes (non-radioactive) are installed in the patient and their correct positioning is checked by X-rays or tomography imaging;
– an area for radioactive source storage and preparation.

Low dose rate brachytherapy using sources of ^{192}Ir and sources of ^{137}Cs is in the process of being phased out. The technique using sources of ^{125}I (prostate and ophthalmic brachytherapy) is rapidly growing.

• Pulsed Dose-Rate (PDR) brachytherapy:
– delivers dose rates of between 2 and 12 Gy/h;
– using ^{192}Ir sources in the form of a source 3.5 mm long, 1 mm in diameter and maximum activity of 18.5 GBq, implemented with a specific remote-controlled afterloader.

This technique requires patient hospitalisation for several days in a room with radiological protection appropriate to the maximum activity of the radioactive source used.

This technique is based on the use of a single radioactive source, which delivers several pulses: the source moves stepwise along each application vector and stops in predetermined positions for predetermined times (the various parameters being set during planning of the treatment).

The doses delivered are identical to those of low dose rate brachytherapy, but are delivered in sequences of 5 to 20 minutes, or sometimes even 50 minutes, every hour for the duration of the planned treatment, hence the name pulsed dose-rate brachytherapy.

Pulsed dose-rate brachytherapy offers a number of radiation protection advantages:
– no handling of sources;
– no continuous irradiation, thus enabling the patient to receive medical care without irradiating the staff or having to interrupt the treatment.

However, it is necessary to make provision for accident situations related to the operation of the afterloader and to the high dose rate delivered by the sources used.

• High Dose-Rate (HDR) brachytherapy:
– delivers dose rates in excess of 12 Gy/h;
– uses ^{192}Ir sources in the form of a source 3.5 mm long, 1 mm in diameter and maximum activity of 370 GBq, implemented with a specific remote-controlled afterloader.

This technique requires no patient hospitalisation in a room with radiological protection and is performed on an outpatient basis, in a room with a configuration comparable to that of an external beam radiotherapy room. The treatment is performed with an afterloader containing a ^{192}Ir source and involves one or more sessions of a few minutes, spread over a period of several weeks.

High dose rate brachytherapy is used mainly for gynaecological cancers but also for the oesophagus and bronchial passages. This technique is being developed for treatment of prostate cancers, usually in association with an external beam radiotherapy treatment.

3|1|3 The new radiotherapy techniques

New techniques, called tomotherapy and "robotic" radiotherapy are now supplementing conventional tumour irradiation methods and have been in use in France since the beginning of 2007.

Tomotherapy performs irradiation by combining the continuous rotation of an electron accelerator with the longitudinal displacement of the patient during irradiation. The technique employed is similar to the principle of helical image acquisitions obtained with computed tomography. A photon beam of 6 MV at 8 Gy/min formed by a multi-leaf collimator enabling the intensity of the radiation to be modulated will allow irradiation of large volumes of complex shape as well as extremely localised lesion which may be in anatomically independent regions. It is also possible to acquire images in treatment conditions and compare them with reference computed tomography images, in order to improve the quality of patient positioning. Eleven devices of this type have been installed in France since the end of 2006, and have been used to treat patients since the first quarter of 2007.

Stereotactic radiotherapy with a robotic arm consists in using a small particle accelerator producing 6 MV photons, placed on an industrial type robotic arm with 6 degrees of freedom, marketed under the name CyberKnife®. By combining the robot's ability to move around the treatment table and the degrees of freedom of its arm, it is thus possible to use multiple, non-coplanar beams to irradiate small tumours that are difficult to access using conventional surgery and radiotherapy. This allows irradiation in stereotactic conditions that can also be synchronised with the patient's breathing.

Given the movement capabilities of the robot and its arm, the radiation protection of the treatment room does not



Linear accelerator for IMRT and specialised treatments

correspond to the usual standards and will therefore require a specific study. Six installations of this type are in service in France in 2011, in Nancy, Nice, Lille, Lyon, Tours and Caen.

Following on from intensity modulated radiation therapy[3] (IMRT), a new radiotherapy technique was recently developed and is being gradually introduced into France: volumetric modulated arc therapy. This technique, referred to differently (VMAT, RapidArc) depending on the manufacturer concerned, consists in irradiating a target volume by continuous irradiation rotating around the patient. Several parameters can vary during the irradiation: the shape of the multi-leaf collimator aperture, the dose rate, and the rotation speed of the arm.

This type of treatment is performed using conventional isocentric linear accelerators that feature this technological option.

3|2 Technical rules applicable to installations

The rules for radioactive source management in radiotherapy are comparable to those defined for all sealed sources, regardless of their use.

3|2|1 Technical rules applicable to external-beam radiotherapy installations

The devices must be installed in rooms specially designed to guarantee radiation protection of the staff, turning them into veritable bunkers (wall thickness can vary from 1 m to 2.5 m of ordinary concrete). A radiotherapy installation comprises a treatment room including a technical area containing the treatment device, a control station outside the room and, for some accelerators, auxiliary technical premises.

The protection of the premises, in particular the treatment room, must be determined in order to respect the annual exposure limits for the workers and/or the public around the premises. A specific study must be carried out for each installation by the machine supplier, together with the medical physicist and the person competent in radiation protection (PCR).

This study defines the thicknesses and nature of the various protections required, which are determined according to the conditions of use of the device, the characteristics of the radiation beam and the use of the adjacent rooms, including those vertically above and below. This study should be included in the file presented to support the application for a licence to use a radiotherapy installation, examined by ASN.

In addition, safety systems must indicate the machine status (operating or not) or must switch off the beam in an emergency or if the door to the irradiation room is opened.

3|2|2 Technical rules applicable to low dose rate brachytherapy installations

Low dose rate brachytherapy

This technique requires the following premises:
– an application room, usually an operating theatre where the source carrier tubes (non-radioactive) are installed in the patient and their correct positioning is checked by X-rays or tomography imaging;
– hospitalisation rooms specially reinforced for radiation protection reasons, in which the radioactive sources are positioned and where the patient stays for the duration of the treatment;
– an area for radioactive source storage and preparation.

For certain applications (use of caesium-137 in gynaecology), a source applicator can be used to optimise staff protection.

Pulsed dose rate brachytherapy

This technique uses source applicators (generally 18.5 GBq of iridium-192). The treatment takes place in hospitalisation rooms with radiological protection appropriate to the maximum activity of the radioactive source used.

High dose rate brachytherapy

The maximum activity used is 370 GBq of iridium-192, so irradiation may only take place in a room with a configuration comparable to that of an external beam radiotherapy room.

3. For the duration of the session, the collimator leafs move while the beam is being emitted, thus modulating it in a complex manner.

4 BLOOD PRODUCT IRRADIATORS

4|1 Description

Blood products are irradiated in order to eliminate certain cells that could lead to a fatal illness in patients requiring a blood transfusion. The blood bag is irradiated with an average dose of about 20 to 25 grays. This irradiation uses a device with built-in lead radiological shielding, so that it can be installed in a room which does not require additional radiation protection. Depending on the version, irradiators are equipped either with radioactive sources (1, 2 or 3 sources of caesium-137 with a unit activity of about 60 TBq) or with electrical X-ray generators.

4|2 Blood product irradiator statistics

In 2011, the French installations of this type totalled 31 irradiators in operation in blood transfusion centres, 9 with radioactive sources and 22 with electrical generators and X-ray tubes.

The policy to replace source irradiators with X-ray irradiators, implemented in 2009, was slowed down by the lack of reliability of the X-ray generators, in particular with regard to electrical instability and problems with X-ray tube cooling. From now on, the companies installing these irradiators are proposing appropriate systems for avoiding recurring failures and guaranteeing the continuity of service to the patients.

4|3 Technical rules applicable to installations

A blood product irradiator containing radioactive sources must be installed in a special room designed to provide physical protection (fire, flooding, break-in, etc.). Access to the device, which must have a lockable control console, must be limited to authorised persons only.

5 THE STATE OF RADIATION PROTECTION IN THE MEDICAL FIELD

Radiation protection in the medical field concerns the patients receiving treatment or undergoing diagnostic examination, the health professionals (physicians, medical physicists, technologists, nurses, etc.) using or participating in the use of ionising radiation, and also the population, such as members of the public moving around a health facility, or population groups that could be exposed to waste or effluents from nuclear medicine units.

As of 2008, ASN began to prepare regional reports based on the main lessons learned from its inspections. These summaries, which will be periodically updated, are now collated nationally and placed on-line on the ASN website. The following were published:
– the ASN reports of the radiation protection situation in the nuclear medicine units (published in 2009 for the 2008 inspections) and in interventional radiology (published in 2011 for the 2009 and 2010 inspections);
– the ASN reports of the safety of radiotherapy care (published in 2009 and 2011 for the 2008, 2009 and 2010 inspections).

As in 2009, ASN and the AFSSAPS jointly prepared a report of the radiation protection events notified by the radiotherapy centres. This report, concerning the years 2008-2009, was published in 2011.

Over the last few years, alongside its inspection tasks, and associating where necessary the Advisory Committee for medical exposure (GPMED) or the IRSN, ASN has taken initiatives to request specific expert investigations or organise national or international events in what it considers to be priority domains given the stakes in terms of radiation protection.

These actions as a whole enabled ASN to draft a report of the state of radiation protection in the medical field (*Contrôle* magazine no. 192) which was presented to the press in July 2011.

5|1 Exposure situations in the medical field

5|1|1 Exposure of health professionals

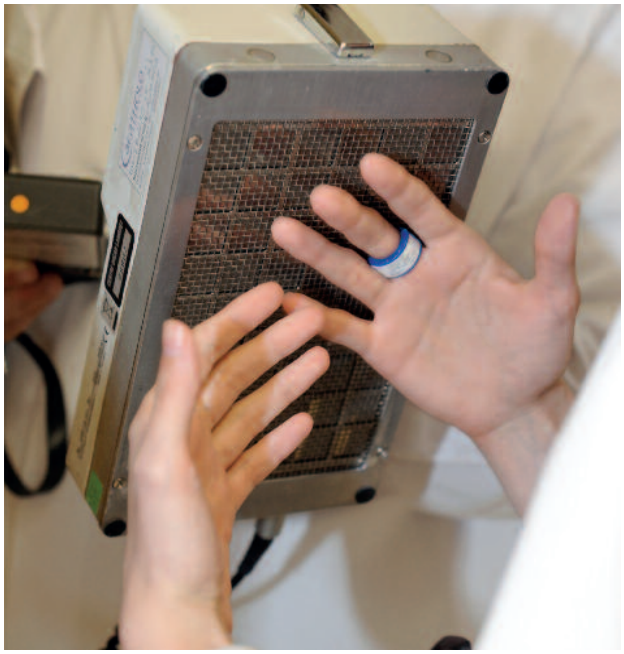
The risks associated with medical applications using ionising radiation for medical staff are either external exposure risks, generated by the medical equipment (devices containing radioactive sources, or X-ray generators or particle accelerators), or internal contamination risks resulting from the use of non-sealed sources (radiopharmaceuticals in particular). The risks of health professionals being exposed to ionising radiation come under the provisions of the Labour Code relative to the radiation protection of workers.

5|1|2 Exposure of patients

Exposure of patients to ionising radiation differs from the exposure of other people (workers, general public) because it is not subject to any limitations, with only the justification and optimisation principles being applicable. This is in fact

Table 2: different exposure levels from medical examinations using ionising radiation

	Type of examination	Adult exposure value (effective dose in mSv)
Conventional radiology		
	Thorax (front)	0.02
	Pelvis (front)	0.7
	Mammography	0.6
Computed tomography		
	Head	1.3
	Thorax	9
	Abdomen – Pelvis	10
	Heart (CT angiography)	8 to 30
Scintigraphy (diagnostic nuclear medicine)		
	Skeleton	4
	Thyroid (99mTc)	0.5
	Lungs (ventilation and perfusion)	0.6 +1.1 or 1.7
	Cerebral (HMPAO)	3.6
	Myocardium with molecules marked with 99mTc	8
	Myocardium with 201Tl	23
	PET-Scan	10 to 20
Source IRSN, SFR, SFMN		



Check on medical staff dosimetry in the Oscar Lambret centre in Lille

the only situation in which ionising radiation is intentionally delivered to individuals, in this case, patients. The situation differs depending on whether the patient is being exposed for diagnostic reasons (radiology or diagnostic nuclear medicine) or is receiving external or internal radiotherapy treatment. In the first case, optimisation must be achieved by delivering the minimum dose required to obtain relevant diagnostic data, while in the second, the dose needed to destroy the tumour must be delivered, while maximising preservation of the surrounding healthy tissue.

Optimisation of the dose delivered to the patient depends on the quality of the equipment used along the entire preparation and treatment chain, from acquisition of the diagnostic image (X-ray generator, gamma-camera, image acquisition and processing system, etc.) to the actual treatment itself (linear accelerators, treatment planning systems, etc.). Periodic quality controls must be performed on all of these systems. The examination and treatment procedures and the equipment settings also play an important role in implementing the optimisation principle.

Finally, the gradual implementation of patient radiation protection training for the health professionals, which has



Radiotherapy session at the Pitié Salpêtrière Hospital in Paris – May 2011

been mandatory since 2004, is a key factor in progressing towards improving the radiation protection of patients in all fields.

5|1|3 Exposure of the general public and environmental impact

With the exception of incident situations, the potential impact of medical applications of ionising radiation potentially concerns:
– the professional categories liable to be exposed to effluents or waste produced by nuclear medicine units;
– members of the public, if the premises containing installations emitting ionising radiation are not fitted with the required protection;
– persons close to patients having received a treatment or a nuclear medicine examination that uses radionuclides such as iodine-131.

The available information concerning radiological monitoring of the environment carried out by IRSN, in particular measurement of ambient gamma radiation, on the whole reveals no significant exposure level above the variations in the background radiation. However, radioactivity measurements in major rivers or wastewater treatment plants in the larger towns occasionally reveal the presence above the measurement thresholds of artificial radionuclides used in nuclear medicine (iodine-131, technetium-99m). The available data on the impact of these discharges indicate doses of a few microsieverts per year for the most exposed individuals, in particular the workers employed in the sewerage networks (source: IRSN study, 2005). However, no trace of these radionuclides has ever been measured in water intended for human consumption.

The recommendations made by the physician after using radionuclides in nuclear medicine were the subject of the specific work by the French High Public Health Council, particularly with respect to examinations and treatment using iodine-131. The aim was to harmonise the advice on lifestyle already dispensed by each physician. The recommendations, which were published by ASN in 2007, concern the residual activity after hospitalisation (in the case of therapy using high activity levels) or the activity level administered if the patient receives iodine-131 without hospitalisation (exploration or treatment of hyperthyroidism).

5|2 Some general indicators

5|2|1 Authorisations and declarations

In 2011, ASN issued:
– 5,977 acknowledgements of receipt of declarations of medical and dental radiodiagnostic devices, of which nearly 70% concerned dental radiology devices;
– 661 authorisations (for entry into service, renewal or cancellation), of which 352 were in computed tomography, 155 in nuclear medicine, 125 in external-beam radiotherapy, 25 in brachytherapy and 4 for blood product irradiators.

5|2|2 Dosimetry of medical staff

According to the data collected by IRSN in 2010, 188,073 people working in sectors using ionising radiation for medical purposes, that is to say more than 57% of all exposed workers monitored, all activity sectors included, were subject to dosimetric surveillance. Medical radiology alone accounts for nearly 59% of the medical staff exposed.

In all, more than 98% of the health staff monitored in 2010 received an annual effective dose of less than 1 mSv, while 4 cases exceeding the annual effective dose limit of 20 mSv, and 4 exceeding the annual dose limit at the extremities (500 mSv) were recorded (in the interventional radiology field).

5|2|3 Report on significant radiation protection events

ASN was notified of 470 significant radiation protection events in the medical field in 2011, compared with 419 in 2010. On the whole, there is a significant rise in notifications in the nuclear medicine and computed tomography sector and a stable number of notifications in radiotherapy.

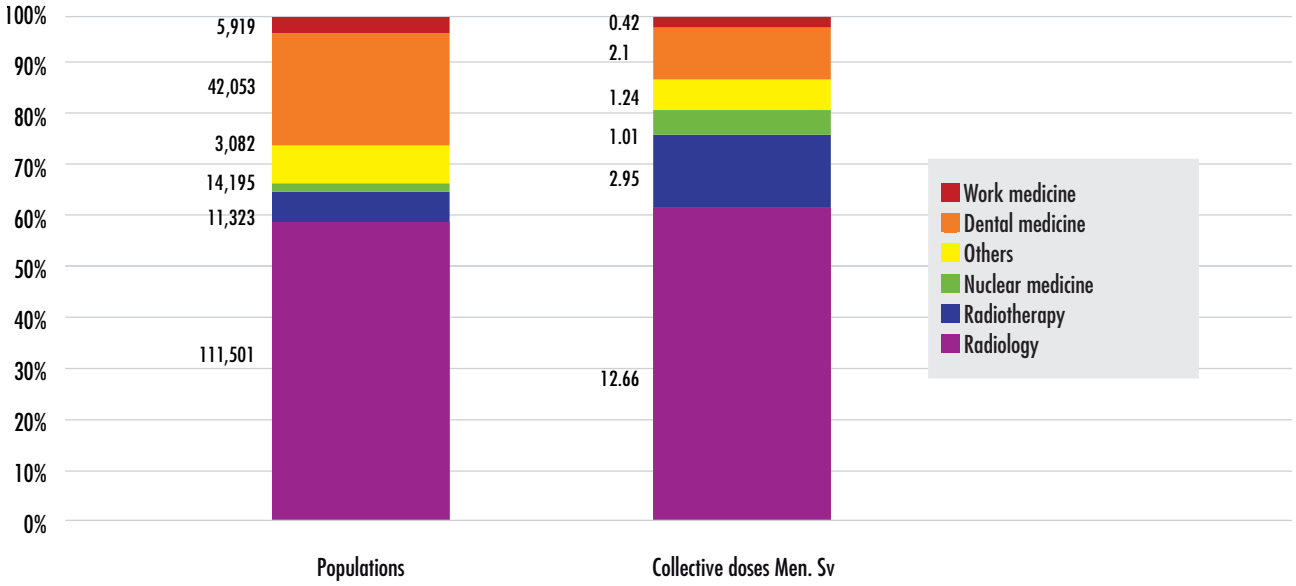
It is thus found that, depending on the domain of activity:
– 55% of significant events were notified in radiotherapy, of which 2% were in brachytherapy;
– 22% in nuclear medicine;
– 20% in diagnostic and dental radiology;
– 2% in interventional radiology;
– 1% in fields involving a mixed activity (radiotherapy and radiology or radiology and nuclear medicine).

According to the signification radiation protection event notification criteria defined by ASN (see ASN Guides 11 and 16):
– 53% of events concerned exposure of a radiotherapy patient;
– 16% concerned exposure of a radiodiagnosis patient (wrong patient, error in the administration of a radiopharmaceutical, appearance of a radio-induced effect);
– 16% concerned exposure of the foetus in women unaware of their pregnancy



ASN-AFSSAPS report

Diagram 2: breakdown of population monitored and collective doses in the medical field in 2010 (source IRSN 2011)



at the time of a radiodiagnostic examination;
– 7% concerned staff exposure primarily in nuclear medicine and computed tomography;
– 4% concerned an event relating to the management of radioactive sources or waste and effluents (leak or overflow of radioactive effluent retention tanks, uncontrolled discharges, loss of sources);
– 4% concerned any other event liable to have radiation protection consequences (operating anomaly, worker exposure below regulation limits, packaging fault, procedural error, etc.).

Events concerning staff (criterion no. 1 of ASN notification guide no. 11): 27 events recorded in 2011 as opposed to 31 in 2010.

During 2011, ASN received 27 notifications of significant radiation protection events concerning persons working in medical facilities. They primarily concern nuclear medicine and medical imaging and, to a lesser extent, radiotherapy and interventional radiology.
– nuclear medicine: staff exposure or contamination when handling or preparing radiopharmaceuticals, contamination by splashing when using injection equipment;
– radiology including computed tomography: staff exposure in the room during the examination, or dosimetry result showing significant exposure but without exceeding the regulation dose limits;
– external beam radiotherapy and brachytherapy: worker locked in during operation of the accelerator, exposure from unconfined sealed sources;
– interventional radiology: significant exposure of the extremities of the operator – surgeon or radiologist in interventional CT.

Events concerning patients (criteria no. 2.1 and 2.2 of ASN guide no. 11): 314 events notified in 2011 as opposed to 302 in 2010.

In 2011, 314 significant events concerning patients exposed for diagnostic or therapeutic purposes were notified to ASN.

They can be broken down as follows:
– 78% in radiotherapy (external beam radiotherapy, brachytherapy and targeted internal radiotherapy);
– 16% in nuclear medicine;
– 4% in computed tomography;
– 2% in radiology (including interventional radiology).

Events concerning patients in radiotherapy (criteria no. 2.1 of ASN guide no. 11): 243 events notified in 2011.

Most of the events were due to a patient positioning anomaly or an error in patient identification, with no consequences for the health of the patient. They are rated level 0 or 1 on the ASN-SFRO scale. 139 ESR, notified in 2011, were rated level 1 on the ASN-SFRO scale. Quarterly reports of these level 1 ESR are produced and published on the ASN website.

Three external beam radiotherapy events, notified in 2011, were rated level 2 on the ASN-SFRO scale (7 in 2010). The incident notifications are published on the ASN website.

The radiotherapy event notification approach is the most significant and accounts for about 77% of the patient event notifications. The proportion of radiotherapy units which have declared at least one event to ASN since the notification system was set up in 2007, is significant (86%). Over the past three years, about half of the units have declared at least one event per year.

Since July 2011, a web address has given access to a site to help with drafting a radiation protection significant event notification *(www.vigie-radiotherapie.fr)*. This site, designed in partnership with the AFSSAPS, with and for the radiotherapy professionals, helps them meet their notification obligations with regard to radiation protection and medical device surveillance. Since the site opened, most event notifications have been drafted with the help of this notification portal.

It has been possible to build on experience feedback owing to the rising number of notifications collected (more than 1,000 since 2007) and the analyses carried out by the centres.

The second ASN/AFSSAPS report, published in 2011, presents a summary of the 519 significant radiation protection events in external beam radiotherapy notified to ASN, and the 161 incidents or serious incident risks reported concerning radiotherapy devices declared to the AFSSAPS for 2008 and 2009 on account of medical device surveillance.

A radiotherapy patient safety bulletin was designed by the radiotherapy professionals and ASN. Two issues appeared in 2011, one on patient identification and the other on the first treatment session for a radiotherapy.

Events concerning nuclear medicine and radiology patients (criterion 2.2 of ASN guide no. 11): 71 events recorded in 2011 as opposed to 33 in 2010.

ASN observes a gradual rise in the number of events notified by the nuclear medicine units, indicating that the notification culture is being assimilated.

These events are mainly linked to an error in administration of the radiopharmaceutical (syringe labelling error, wrong flask collected), or a patient identification error (similar name, lack of vigilance in patient identification).

Two interventional radiology events were notified, one following observation of temporary alopecia and the other because of the appearance of deterministic effects in a patient who underwent two particularly lengthy and delicate interventional radiology procedures. The procedure took place on a device unable to offer optimised protocol conditions and not comprising any dose indication device.

Events concerning pregnant women (criterion no. 3 of ASN guide no. 11): 74 events notified in 2011 as opposed to 39 in 2010.

ASN was notified of 74 significant events concerning the public during 2011. This only concerns notification of exposure of the fetus in women who were unaware that they were pregnant at the time of the examination (13% in nuclear medicine and 87% in radiology). The doses received as a result of these diagnostic procedures have no consequences for the fetus or the child once it is born[4].

Events concerning sources (criteria no. 4.0, 4.1, 4.6 of ASN guide no. 11): 9 events notified in 2011 as opposed to 7 in 2010.

In 2011, ASN was notified of 9 significant events involving losses of radioactive sources used in the medical field. This concerns the loss of calibration or localisation sources used in nuclear medicine. Two notifications concerned a source leak in its container and the loss of a mobile X-ray generator, respectively.

One of the events concerning a source loss was rated level 1 on the INES scale and was the subject of an incident notification.

Events linked to the dispersion of radionuclides (criteria no. 4.3, 4.4 and 4.5 of ASN guide no. 11): 8 events were notified to ASN in 2011, as opposed to 16 in 2010.

These chiefly concerned leaks of radioactive effluents after the rupture or obstruction of pipes in the system carrying the radioactive effluents to the retention tanks, or the discharging of waste to an inappropriate treatment process.

One event was rated level 0 on the INES scale and was the subject of an incident notification owing to discharge of effluents into the sewerage network.

Events considered to be significant by ASN or the notifying party (criteria 6.1 and 6.2 of ASN guide no. 11): 38 notifications in 2011 (27 in 2010).

38 notifications refer to events considered to be significant by the notifying party or ASN. These events do not meet the definition of notification criteria no.1 to 5 in ASN guide no. 11, but are notified owing to their interest in terms of experience feedback, either at the initiative of the notifying party, or at the request of ASN. However, most of them are notified as a result of insufficient knowledge of the notification criteria, in particular for those events involving radiotherapy patients.

These extremely diverse events can concern equipment anomalies (injection equipment, faulty medical device, etc.), installation malfunctions (flooding, effluent retention tanks filling anomaly, etc.), minor exposure or contamination of the staff. These notifications are interesting, because they constitute early-warning signs of an event liable to have greater consequences.

It should be noted that some of the events notified are covered by several notification criteria: this concerns patient exposure associated with a loss of traceability of the treatment source, or exposure or contamination of a worker associated with the dispersion of radionuclides.

An event relative to the loss of traceability of a source and exposure of the patient was the subject of an incident notification rated level 1 on the INES scale and provisionally level 2 on the ASN-SFRO scale (see box).

4. ICRP 103

To summarise:

Since 2008, the reporting of significant radiation protection events in the medical field has risen, reaching 470 annual notifications at the end of 2011 (i.e. an average of 39 declarations per month).

The event notification approach in radiotherapy is the most significant and accounts for more than half of all notifications. The number of centres which have never issued a notification is down and the number of notifications has been stationary since 2010.

Event notifications are clearly up in the field of nuclear medicine and those concerning identity surveillance have doubled in two years.

The number of fetus exposure notifications is rising and has doubled in the field of CT radiology.

There are very few significant radiation protection events concerning interventional radiology, despite these procedures involving particularly high doses for the patient and the operator.

5|3 The radiation protection situation in radiotherapy

Radiotherapy

The safety of radiotherapy treatments has been a priority domain for ASN control since 2007, and each year all the radiotherapy centres are inspected. Furthermore, ASN actively participates in the work of the national committee for radiotherapy monitoring coordinated by INCa. In this context, the complementary actions to be incorporated into the radiotherapy roadmap, resulting from the conclusions of the international conference on the radiation protection of patients organised by ASN in Versailles in December 2009, were presented in 2011. ASN in particular hopes that research will lead to the definition of a patient radiosensitivity test (see chapter 1) – this request was also brought before the European Commission – and that a risk/benefit assessment of new radiotherapy practices will be carried out, with the participation of the users.

Stereotactic radiotherapy

After the radiotherapy accident that occurred in the Rangueil hospital centre (Toulouse) between April 2006 and April 2007, and in addition to the opinion issued in 2009 on the measurement of the absorbed dose in the very small photon beams used in stereotactic radiotherapy (see ASN decision 2009-DL-0009), GPMED issued an opinion in June 2010 on the conditions for practising stereotactic radiotherapy and the associated medical physics.

On the basis of this opinion, and following the deliberations of the Commission (see ASN decision no. 2011 DL-0025 concerning the improvement of radiation protection during stereotactic radiotherapy procedures), ASN informed the units and agencies linked to the Ministry for health, and the professionals, of the actions it considered to be necessary in order to improve the radiation protection of patients during stereotactic radiotherapy procedures.

TO BE NOTED IN 2011

Event notified by the Claudius Regaud Institute (Toulouse, September 2011)

In September 2011, ASN was informed of the discovery of a fragment of iridium 192 wire in medical waste, after a detection portal was triggered at the entrance to a waste treatment centre.

Analysis of the event revealed that organisational and human factors led to the loss of traceability of the fragment of an iridium wire, which had remained for several months in a patient, after removal of the wires used for interstitial brachytherapy treatment.

After a patient consultation in a clinic in the region, the fragment of wire was removed by a surgeon, unaware of the fact that it was radioactive. The waste was taken to an infectious risk medical waste disposal facility.

The patient received a significant dose in excess of that prescribed, leading to the event being provisionally rated 2 on the ASN-SFRO scale. The breakdown in source traceability also means that the event was rated level 1 on the INES scale.

ASN carried out an inspection following this event and asked the Claudius Regaud Institute to have all iridium wires removed in the presence of a radiation oncologist, to comply with procedures checking the number and length of the wires used during treatment and to use a measuring instrument to check that no radioactive sources remain in the patient, before he or she is released from the care unit.

ASN and the regional health agency are investigating the failure to transmit patient information to the surgeon carrying out the biopsy.

IRSN was asked to carry out an appraisal of the evaluation of the dose received by the patient and the expected consequences. The results will either confirm or entail changes to this rating criterion.

Generally speaking, ASN considers that the treatment of intra- or extracranial lesions by stereotactic ionising radiation, should be subject to the authorisation and quality assurance rules and approval criteria applicable to external beam radiotherapy. It however specifies that these rules and criteria should be adapted when this type of treatment is carried out with a single dose of ionising radiation, especially in neurosurgery.

Over and above the regulatory issues, ASN considers that among the steps to be taken to improve patient radiation protection, there is a particular need to extend the initial training of the professionals involved, with additional theory and practical training in stereotactic radiotherapy, to establish a guide of good practices, to develop quality assurance with the assistance of the medical physicist, and to define specific quality control procedures for equipment and devices, including the various associated imaging techniques, such as magnetic resonance imaging.



Quality control of a linear accelerator by a medical physicist at the Pitié Salpêtrière Hospital in Paris

5|3|1 Radiation protection of radiotherapy staff

The inspections carried out checked that the deviations from the provisions of the Labour Code observed in 2009, regarding prevention of the risk of irradiation after being accidentally locked in the treatment room, had been corrected.

5|3|2 Radiation protection of radiotherapy patients

Status of human resources in medical physics

The ASN inspections carried out in 2010 confirm the positive trend begun in 2008 and continued in 2009, with regard to the increased human resources deployed in the medical radiation physics field. The results of these inspections show that a significant number of medical physicists were hired, following the increase in the number of training places decided on in the national radiotherapy plan and, to a lesser extent, that radiation therapy technicians were assigned to dosimetrist positions.

The situation with regard to the organisation of medical physics, especially in terms of the number of centres with too few medical physicists (12 centres at the end of 2009), improved, although it is not yet fully satisfactory, because six of them had still to meet their additional staffing requirement as at the end of 2010. At the end of 2011, four centres still only had a single medical physicist. However, the permanent presence of a medical physicist for the duration of treatment is guaranteed.

Assessment of treatment safety

Even if ASN has also observed progress in the implementation and widespread adoption of safety and quality management with regard to the care given to the patients, it considers that the involvement of the senior staff of the establishments in overseeing this management of safety and quality of care is still insufficient. Some centres need to further reinforce their culture of safety and quality of care, in particular by formally drafting patient care practices and training the staff in risk analysis methods.

In general, the effort to draft formal practices and competences must be continued for many centres, with regard to the delegation[5] procedures within the teams and validation of the control images for patient repositioning during the course of treatment.

Although internal notification of malfunctions is now widely used, analysis of the causes and medium and long term monitoring of improvement measures still needs to be improved.

5|3|3 Summary

To conclude, ASN is on the whole satisfied with the progress made by the centres and feels that its observations at the end of 2010 are encouraging. There has been a very real rise in awareness and reactivity within the profession, with regard to radiation protection culture, formal drafting of practices and risk management with regard to external beam radiotherapy patient treatment. Moreover, the steps taken as part of the 2009-2013 cancer plan and the continuation in 2011 of the numerous measures initiated by the centres in 2010 to meet both the quality criteria set by INCa and ASN decision no. 2008-DC-0103 of 1st July 2008 should enable this situation to be improved still further.

5|4 The radiation protection situation in nuclear medicine

In 2010, ASN carried out 73 inspections in the field of nuclear medicine, or about 35% of the nuclear medicine units within ASN's geographical area of competence (metropolitan France and overseas France).

5. The transfer of medical procedures to other health professions is regulated by the steps taken pursuant to Act 2009-879 of 21st July 2009 on hospital reform, relating to patients, health and territories (HPST) in particular its article 51 requiring the establishment of protocols.

5|4|1 Radiation protection of nuclear medicine staff

The inspections carried out by ASN in 2010 show that there is still inadequate compliance in the nuclear medicine units with the regulatory requirements concerning worker radiation protection, which is a key issue for nuclear medicine: the workstation analyses and risk assessments are generally either not carried out or are incomplete; insufficient use is made of the worker dosimetry results, medical monitoring of "occasional" workers is rare, etc.

For example, 30% of the units inspected in 2010 use a "historical" zoning of the premises which is not based on any risk assessment, and 16% of the units which produced an assessment of their risks did not adopt any zoning for all the premises concerned.

The 2011 update of the INRS[6] radiation protection sheets for nuclear medicine, work that was carried out in collaboration with the professionals concerned, IRSN and ASN, should make it easier to implement the regulations concerning risk assessment, zoning and workstation evaluations.

These inadequacies must however be put into perspective in terms of the corresponding risk. The results of the dosimetric monitoring transmitted to IRSN in 2009 for this field showed no overdoses in relation to the regulatory annual limit.

The ASN inspections of nuclear medicine units will be continued in 2012. A report on radiation protection in nuclear medicine units, based on the inspections carried out in 2009, 2010 and 2011, will be published in 2012.



Discussions between the ASN inspectors and the staff of the nuclear medicine unit of the Oscar Lambret centre in Lille – November 2011

5|4|2 Radiation protection of nuclear medicine patients

Most of the regulatory requirements concerning radiation protection of patients are generally well-known and adhered to by the nuclear medicine units inspected in 2010 (e.g.: transmission of dosimetric readings for comparison with the diagnostic reference levels, inclusion of dosimetric data in the patient report, training of workers in radiation protection of patients, etc.).

Although the findings are on the whole satisfactory, the ASN inspections showed that certain points needed to be taken further or improved, such as drafting of the medical physics organisation plans[7] or quality controls on the nuclear medicine installations used for diagnostic purposes.

5|4|3 Protection of the general public and the environment

In 2009, about 80% of the licensees or heads of nuclear medicine units inspected had drawn up a contaminated waste and effluent management plan. The inspections carried out in 2010 showed that nearly all the units inspected (97%) today have a contaminated waste and effluent management plan.

However, it must be said that these documents do not always comply with the requirements of the order of 23rd July 2008[8]. Only half of the existing plans are in fact in conformity with the current regulations. The publication of the guide to disposal of effluents and waste contaminated by radionuclides, in order to clarify the procedures for implementation of the order, should make it easier to apply these regulations (publication in March 2012).

5|4|4 Summary

In addition to the inspections carried out in 2011 in the nuclear medicine units, ASN initiated or continued work to improve radiation protection in this field of activity. For example:

– the creation of a working group involving members of the profession (SFMN, AFTMN, AFPPE, SoFra[9], etc.) to define minimum design, operating and maintenance rules for nuclear medicine installations (in progress);
– the publication in early 2012 of the guide designed to help with application of ASN decision no. 2008-DC-0095 of 29 January 2008, approved by the order of 23 July 2008, concerning the disposal of effluents and waste contaminated by radionuclides produced in facilities licensed under the Public Health Code;
– drafting of the first report on significant radiation protection events notified to ASN in the field of nuclear medicine and

6. *http://en.inrs.fr/*
7. NB: the organisation of medical physics within a nuclear medicine unit, to be defined by the head of the establishment, must be described in a medical physics organisation plan in accordance with the order of 19th November 2004 concerning the training, duties and working conditions of the medical physicists.
8. Order of 23rd July 2008 approving ASN decision n°2008-DC-0095 of 29th January 2008, setting the technical rules applicable to the disposal of effluents and waste contaminated by radionuclides, or liable to be so contaminated owing to a nuclear activity, implementing the provisions of article R. 1333-12 of the Public Health Code.
9. SFMN (French Society of Nuclear Medicine), AFTMN (French association of nuclear medicine technicians), AFPPE (French association of radiographers), SoFra (French association of radiopharmacists).

consultation of representatives of the profession. This report was distributed on the occasion of the 31st study and training seminar organised by the French association of nuclear medicine technicians (AFTMN), in May 2011, in Toulouse.

5|5 The radiation protection situation in conventional radiology and computed tomography

In 2011, ASN continued the work started in 2010 on the question of the increased doses delivered to patients undergoing medical imaging (an average increase of nearly 50% since 2002), especially in computed tomography (CT). The deliberations of the ASN Commission on 14 June 2011 concerning the increase in the doses delivered to patients during CT and conventional radiology examinations, based on the conclusions of the seminar held by ASN on 16 September 2010 with all the professionals and organisations concerned, presented proposals to achieve satisfactory management of the doses delivered to the patients.

ASN thus considers that the rise in doses in imaging is of increasing concern and that urgent measures must be taken to control the doses delivered to the patients during medical imaging examinations, in particular CT examinations.

ASN considers that the principle of justification of radiological examinations needs to be more effectively applied, so that each examination performed is actually useful, and that the doses delivered during the examinations need to be optimised, through greater quality assurance at all stages. ASN draws the attention of the health authorities to the lack in France of MRI, a non-irradiating imaging technique, and the need to promote access to this system to avoid having to use CT examinations when they are not justified.

ASN also underlines the need to continue the medical physicist training and recruitment effort for at least five consecutive years, so that there are sufficient numbers of them to be able to staff the medical imaging field.



Commissioning inspection of a radiotherapy installation in the Dentellières clinic in Valenciennes – October 2011

The various stakeholders (health authorities, health professionals) were notified of the measures identified by ASN.

At the same time as the recommended measures for achieving better dose management, ASN in 2011 decided to devote a part of its inspection programme to the radiation protection of CT patients.

Finally, at the European level, ASN is taking part in the HERCA[10] initiative aimed at ensuring that CT manufacturers improve the optimisation tools on their medical devices.

5|6 The radiation protection situation in interventional radiology

Since 2009, the monitoring and regulation of radiation protection in interventional radiology has become a national priority for ASN. Tasked with investigating this question, the GPMED (Advisory Committee for medical exposure) has submitted its conclusions to ASN, based on the report of the ad hoc working party. This work, published in 2011, along with the report of the inspections carried out in 2009, led ASN to issue a position statement following its deliberations of 14 June 2011 concerning the improvements to radiation protection in interventional radiology.

5|6|1 Radiation protection of interventional radiology staff

The report on the inspections carried out in 2010 is based on the results of inspections of 260 units carrying out fluoroscopy-guided interventional procedures (168 fixed installations and 92 operating theatres). This 2010 report is characterised by a rise in the number of establishments inspected (+17%) by comparison with 2009.

The report on the inspections carried out in 2010 confirms the 2009 observations. It shows that the radiation protection of workers is better integrated in fixed radiology facilities than in operating theatres where mobile devices are used.

Overall, the inspections revealed inadequacies in the risk assessments, workstation studies and in identification and delimitation of regulated areas. Incomplete use of active dosimetry and a lack of appropriate dosimetric monitoring, in particular of the extremities in the case of certain fluoroscopy-guided procedures, as well as an absence of medical monitoring of the practitioners, are also significant shortcomings.

For the PCRs (person competent in radiation protection), there are still methodological and organisational difficulties and they do not always have the means or the powers enabling them to perform their duties in full.

5|6|2 Radiation protection of interventional radiology patients

As with the medical staff, the radiation protection of patients appears to be better in fixed facilities than in operating theatres, particular with regard to the adaptation of the radiological

10. *http://www.herca.org/*

equipment to the medical procedures performed. Overall, the inspections revealed incomplete application of the principle of dose optimisation, mainly owing to inadequate operator training, both in patient radiation protection and in the use of the radiology devices, as well as a shortage of medical physicists but also of appropriate equipment. The lack of radiological protocols for most of the procedures performed in the operating theatre and an imperfect understanding of the doses emitted during the procedures contributed to a failure to apply the optimisation principle, creating potential risk situations.

5|6|3 Summary

ASN considers that urgent steps must be taken to improve the radiation protection of patients and workers in interventional radiology, particularly for fluoroscopy-guided interventional procedures in operating theatres. Even if in certain aspects (medical physicist numbers, user training, quality assurance, audit of professional practices), the proposals are similar to those for medical imaging, measures specific to interventional practices are required.

The availability of PCRs and the means given to them must be increased, in order to make up for the inadequacies observed, in particular in terms of risk assessment, workstation analysis and wearing of individual protective equipment and dosimeters, especially for monitoring the dose at the extremities or the lens of the eye of the operator.

ASN also considers that an initiative must also be taken with regard to the managers of public and private health establishments, in particular the directors of CHU (university hospitals) and CHR (regional hospitals), underlining the specific risks of interventional procedures for both patients and professionals, and recalling their statutory obligations as employers. This initiative should be accompanied by recommendations for improved radiation protection in this field, in particular entailing strong incentives to equip existing facilities with devices able to estimate the radiation dose emitted during radiological procedures, if not already so equipped. Together with the departments concerned at the Ministry for Labour, Employment and Health, ASN thus sent out a letter to the regional health agency Director Generals in November 2011, describing the current radiation protection situation in the medical field. This letter highlights the necessary improvements concerning the radiation protection of patients and health staff, especially in terms of human resources.

ASN also asked the learned societies and professional organisations representing the radiologists and non-radiologist practitioners (interventional cardiologists, vascular surgeons, neurosurgeons, orthopaedists, etc.) who perform interventional radiology procedures, to step up their efforts with regard to training and the drafting of guides of good practice.

The measures identified by ASN were transmitted to the various stakeholders (health authorities, health professionals).

Owing to the inadequacies observed in radiation protection in the interventional radiology field, ASN is maintaining the national priority status it accords to the control of interventional radiology in its 2012 inspection programme.



Press conference on the occasion of publication of number 192 of *Contrôle* magazine devoted to medical imaging

6 OUTLOOK

The gradual improvement in the safety of radiotherapy procedures, year after year since 2007, observed by ASN through its inspections, must be continued in order to achieve complete control of procedures and thus guarantee the radiation protection of the patients. In this new quality management culture, ASN will remain particularly attentive in its inspections to the identification and internal analysis of deviations, which is the only way to ensure permanent improvement and progress. The centres which are still understaffed with medical physicists will continue to be the subject of particularly close attention.

In the medical imaging field, following the publication of two decisions in July 2011, jointly with the health administrations and the health professionals, ASN will be organising detailed monitoring of the steps taken to achieve true control of the doses delivered to the patients in conventional radiology and in computed tomography and to improve radiation protection in the field of interventional practices. ASN will in particular remain highly attentive to the question of human resources and the corresponding skills, on the one hand to ensure compliance with the provisions of the Labour Code in operating theatres where radiology equipment is used and, on the other, to enable medical physicists to intervene in all fields of medical imaging, computed tomography and interventional radiology.

In the field of medical physics, the efforts made since 2007 to boost the numbers of medical physicists, must be continued in order to meet the medical imaging needs. In 2012, ASN will prepare recommendations for the health authorities, so that the organisation and implementation of the regulations applicable to medical physicists are consolidated, with regard to the involvement of professionals, other than medical physicists, in the performance of medical physics tasks.

Finally, ASN will play an active part in the work overseen by the French national authority for health, concerning the assessment of clinical practices exposing individuals to ionising radiation for medical purposes. This work began in November 2011.

NON-MEDICAL USES OF IONISING RADIATION

1 **PRESENTATION OF NON-MEDICAL ACTIVITIES USING IONISING RADIATION** 283

1|1 **Sealed radioactive sources**
1|1|1 Industrial irradiation
1|1|2 Non-destructive testing
1|1|3 Verification of physical parameters
1|1|4 Neutron activation
1|1|5 Other common applications

1|2 **Unsealed radioactive sources**

1|3 **Electrical devices emitting ionising radiation**
1|3|1 Industrial applications
1|3|2 Veterinary radiodiagnostics

1|4 **Particle accelerators**

1|5 **Electrical devices emitting ionising radiation**

2 **REGULATING NON-MEDICAL ACTIVITIES** 290

2|1 **Integration of the fundamental principles of radiation protection in the regulation of non-medical activities**

2|2 **Authorities regulating the sources of ionising radiation**

2|3 **Licensing and notification of ionising radiation sources used for non-medical purposes**
2|3|1 Applicable licensing and notification legal systems
2|3|2 Statistics for 2011

2|4 **Revocation of unjustified or prohibited activities**
2|4|1 Application of the ban on the intentional addition of radionuclides in consumer goods and construction products
2|4|2 Application of the principle of justification for existing activities

2|5 **Reinforcement of the regulation of electrical devices generating ionising radiation**

2|6 **Detection of radioactivity in France**

2|7 **Implementation of monitoring of radioactive source protection against malicious acts**

3 **MONITORING NON-MEDICAL ACTIVITIES** 297

3|1 **Checks conducted by ASN**

3|2 **The main incidents in 2011**

4 **ASSESSMENT OF RADIATION PROTECTION IN THE NON-MEDICAL SECTOR AND OUTLOOK** 298

CHAPTER 10

Industry, research, and also a large number of other sectors have for a long time been using sources of ionising radiation for a wide variety of applications and in a large number of locations. The purpose of the radiation protection regulations currently in force is to check that the safety of workers, the public and the environment is ensured. This protection includes source management, monitoring of the conditions in which sources are held, used and disposed of, from fabrication through to end-of-life. It also involves increasing the monitoring of the main stakeholders, the source manufacturers and suppliers, and enhancing their accountability.

The regulatory framework governing nuclear activities in France has undergone major changes and been tightened over the last few years. It falls within the scope of the Labour Code and the Public Health Code, and orients the regulation activities for which ASN is responsible.

The radiation sources used are either radionuclides, primarily artificial, in sealed or unsealed sources, or electrical devices generating ionising radiation. The applications presented in this chapter concern non-medical activities (the medical activities are presented in chapter 9) and activities that do not fall under the framework of the basic nuclear installations (presented in chapters 12, 13 and 14). All other applications however, including those carried out within installations classified on environmental protection grounds (ICPEs), are concerned. The main activity sectors are presented below.

1 PRESENTATION OF NON-MEDICAL ACTIVITIES USING IONISING RADIATION

1|1 Sealed radioactive sources

The main uses of sealed radioactive sources (sources whose structure or packaging, in normal use, prevents any dispersal of radioactive materials into the environment) are described below.

1|1|1 Industrial irradiation

Industrial irradiation is used for sterilising medical equipment, pharmaceutical or cosmetic products and for the conservation of foodstuffs. It is also a means of voluntarily modifying the properties of materials, for example, to harden polymers.

These consumer product irradiation techniques can be authorised because, after being treated, these products display no residual artificial radioactivity (the products are sterilised by passing through radiation without themselves being "activated" by the treatment). Industrial irradiators often use cobalt 60 sources, whose total activity can be very high and exceed 250,000 terabecquerels (TBq). Some of these installations are classified as BNIs (see chapter 14).

1|1|2 Non-destructive testing

Gamma radiography is a non-destructive testing technique that uses radioactive sources to detect homogeneity defects in metals, and particularly in weld beads. This technique primarily uses



Gamma radiography device on work site

sources of iridium 192, cobalt 60 and, more recently, selenium 75, whose activity can reach about twenty terabecquerels at the most. Gamma radiography is usually performed using a mobile device which can be moved from one worksite to another and consists primarily of:
– a source applicator, used as a storage container when the source is not in use;
– a guide tube, end-piece and remote-control for moving the source between the applicator and the object to be inspected, while protecting the operator who can thus remain at a distance from the source;
– a radioactive source inserted into a source holder.

Gamma radiography devices mainly use high-activity sources that present substantial operator risks. As such, it is an activity with high radiation protection implications that figures among ASN's inspection priorities.

1|1|3 Verification of physical parameters

The operating principle of these physical parameter verification devices is the attenuation of the signal emitted: the difference between the emitted signal and the received signal can be used to assess the information looked for.

The radionuclides most frequently used are krypton 85, caesium 137, americium 241, cobalt 60 and prometheum 147. The source activity levels are between a few kilo becquerels (kBq) and a few giga becquerels (GBq).

These sources are used for the following purposes:
– atmospheric dust measurement; the air is permanently filtered through a tape running at a controlled speed, placed between source and detector. The intensity of radiation received by the detector depends on the amount of dust on the filter, which enables this amount to be determined. The most commonly used sources are carbon 14 (activity level: 3.5MBq) or prometheum 147 (activity level: 9MBq). These measurements are particularly used for air quality monitoring by verifying the dust content of discharges from plants;
– basis weight measurement: a beta radiation beam passes through the paper and is then received by a detector. The signal attenuation on this detector gives the paper density and thus the basis weight. The sources used are generally krypton 85, prometheum 147 and americium 241 with activity levels not exceeding 3GBq;
– liquid level measurement: a beam of gamma radiation passes through the container filled with a liquid. It is received by a detector positioned opposite. The signal attenuation on this detector indicates the level of filling of the container and automatically triggers certain operations (stop/continue filling, alarm, etc.). The radionuclides used depend on the characteristics of the container and the content. As applicable, americium 241 (activity level: 1.7GBq), caesium 137 - barium 137m (activity level: 37MBq) are generally used;
– density measurement and weighing: the principle is the same as for the above two measurements. The sources used are generally americium 241 (activity level: 2GBq), caesium 137 - barium 137m (activity level: 100 MBq) or cobalt 60 (30GBq);
– soil density and humidity measurement (gammadensimetry) in particular in agriculture and public works. These devices operate with a pair of americium-beryllium sources and a caesium 137 source;
– logging, which enables the geological properties of the sub-soil to be examined by inserting a measurement probe comprising a source of cobalt 60, caesium 137, americium 241 or californium 252.

1|1|4 Neutron activation

Neutron activation consists in irradiating a sample with a flux of neutrons to activate the atoms in the sample. The number and the energy of the gamma photons emitted by the sample in response to the neutrons received are analysed. The information collected enables the concentration of atoms in the analysed material to be determined.

Some cement works in France and abroad use neutron analysers for on-line analysis of the chemical characteristics of the cement constituent materials. There are some thirty cement works in France, and three of them use this technology. To use of this technology, which activates the analysed material, it is necessary to obtain a waiver as provided for by Article R.1333-4 of the public health code. ASN was referred to by the Government, firstly to examine a waiver application for the use of a neutron analysis device in a cement works (ASN opinion 2011-AV-0105 of 11/01/2011), and secondly to give an opinion on a draft order granting that waiver (ASN opinion 2011-AV0124 of 07/07/2011).

The waiver to the ban on adding radionuclides for the purpose of neutron analysis in the manufacture of cement was granted by an order of 18 November 2011 from the ministers in charge of health and construction (*Official Journal* of 3 December 2011).

Reminder: *Article R.1333-3 of the Public Health Code [prohibits]* ***the use of materials and waste originating from a nuclear activity for the manufacture of consumer goods and construction products,*** *if they are or could be contaminated by radionuclides, including by activation, as a result of this activity.*

Article R. 1333-4 of this same code provides that ***"waivers (to these prohibitions] can, if they are justified by the advantages they bring in relation to the health risks they can represent,*** *be granted by order of the minister in charge of health and, depending on the case, by the minister in charge of consumption or the minister in charge of construction, after consulting ASN and HCSP (French High Public Health Council)".*

1|1|5 Other common applications

Sealed sources can also be used for:
– eliminating static electricity;
– calibrating radioactivity measurement devices (radiation metrology);
– practical teaching work concerning radioactivity phenomena;
– electron capture detectors using sources of nickel 63 in gaseous phase chromatographs. This technique can be used to detect and dose various elements;
– ion mobility spectrometry used in devices that are often portable and used to detect explosives, drugs or toxic products;
– detection using X-ray fluorescence. This technique is particularly useful in detecting lead in paint. The portable devices used today contain sources of cadmium 109 (half-life 464 days)



Device for detecting lead in paint

or cobalt 57 (half-life of 270 days). The activity of these sources can range from 400 MBq to 1500 MBq. This technique, which uses a large number of radioactive sources in France (nearly 4,000 sources), results from a legislative measure to prevent lead poisoning in children, which obliges a verification of the lead concentration in the paintwork of any residential building built before 1st January 1949, if it is to be sold or to undergo works significantly affecting the surface coatings in the common parts of the building.

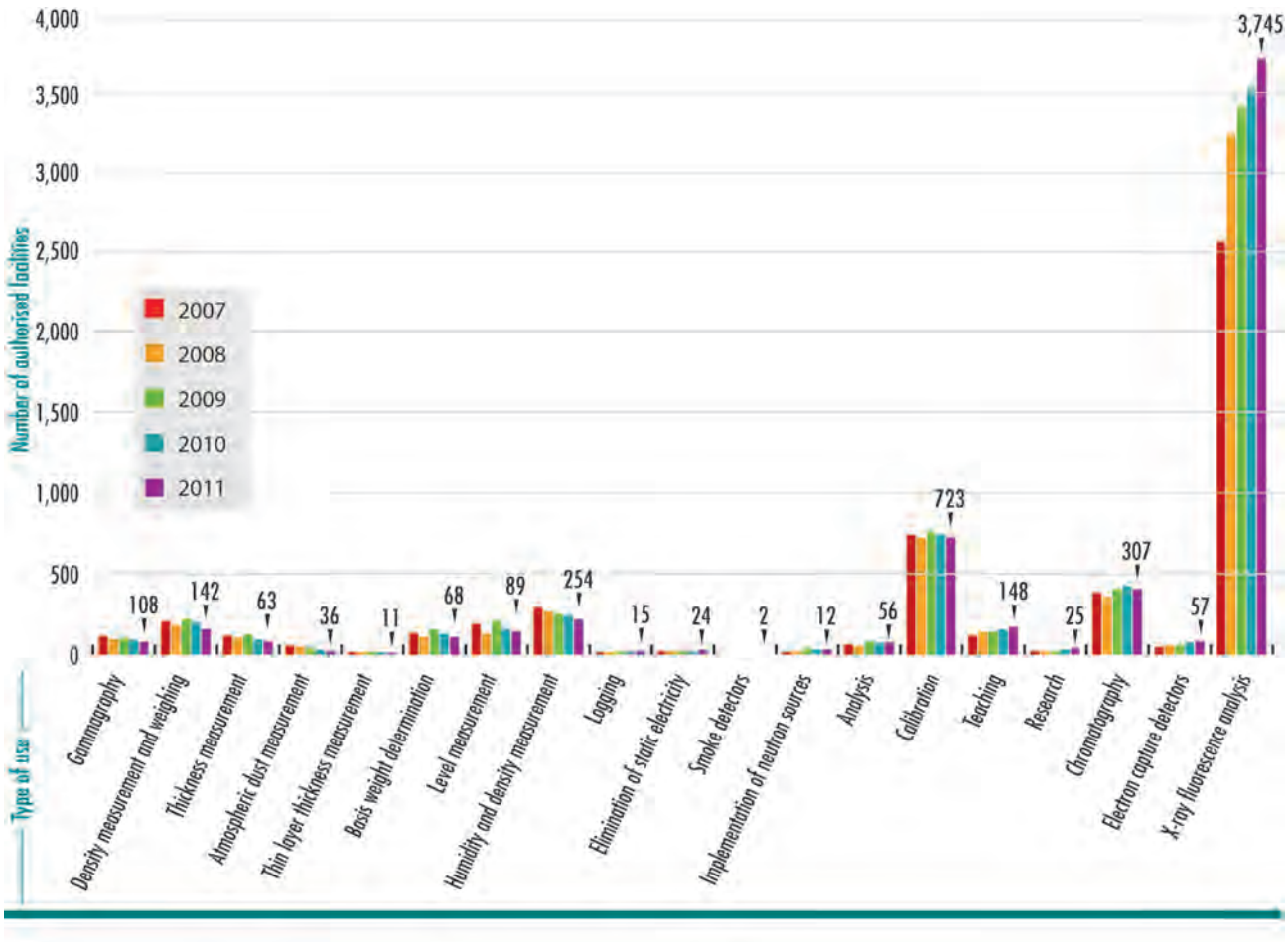
Graph 1 specifies the number of facilities authorised to use sealed radioactive sources for the applications identified. It illustrates the diversity of these applications and their development over the last five years (from 2007 to 2011).

It should be noted that a given facility may carry out several activities, and if it does, it appears in graph 1 and the following diagrams for each activity.

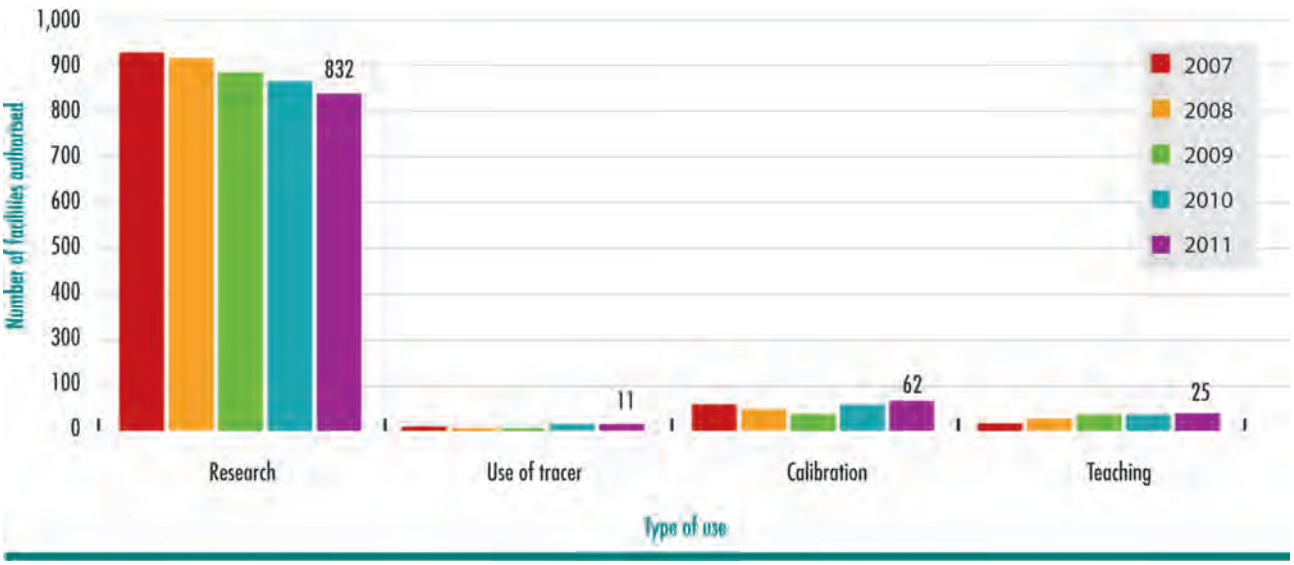
1|2 Unsealed radioactive sources

The main radionuclides used in the form of unsealed sources are phosphorus 32 or 33, carbon 14, sulphur 35, chromium 51, iodine 125 and tritium. They are used as tracers for calibration

Graph 1 : use of sealed radioactive sources



Graph 2: use of unsealed radioactive sources



and teaching. Using radioactive tracers incorporated into molecules is common practice in biological research. They are thus a powerful investigative tool in cellular and molecular biology. Unsealed sources are also used as tracers for measuring wear, searching for leaks or friction spots, for building hydrodynamic models and in hydrology.

The number of facilities authorised to use unsealed sources stands at 930.

Graph 2 specifies the number of facilities authorised to use unsealed radioactive sources in the applications identified in the last five years (from 2007 to 2011).

1|3 Electrical devices emitting ionising radiation

Graphs 3 and 4 specify the number of facilities authorised to use electrical devices generating ionising radiation in the listed applications. It illustrates the diversity of these applications and they have evolved over the last five years (from 2007 to 2011). This evolution is closely related to the regulatory changes introduced in 2002 and later in 2007, which created a new licensing or notification regime for use of these devices. At present, the situation of the professionals concerned is being brought into compliance in many activity sectors, but a large number of users have not yet taken any action.

1|3|1 Industrial applications

The electrical devices emitting ionising radiation are chiefly X-ray generators. Like the devices containing radioactive sources, they are used in industry, non-destructive structural analyses (analysis techniques such as tomography, diffractometry, also called X-ray crystallography, etc.), checking the quality of weld beads or inspecting materials for fatigue (in aeronautics in particular).

The applications of these devices, which work using the principle of X-ray attenuation, include use as industrial gauges (measurement of drum filling, thickness measurement, etc.), inspection of goods containers or luggage and also the detection of foreign bodies in foodstuffs.

The increasing number of types of device available on the market can be explained more particularly by the fact that when possible, they replace devices containing radioactive sources. The advantages of this technology are significant with regard to radiation protection, given the total absence of ionising radiation when the equipment is not in use. Their utilisation does nevertheless lead to worker exposure levels that are quite comparable with those resulting from the use of devices containing radioactive sources.

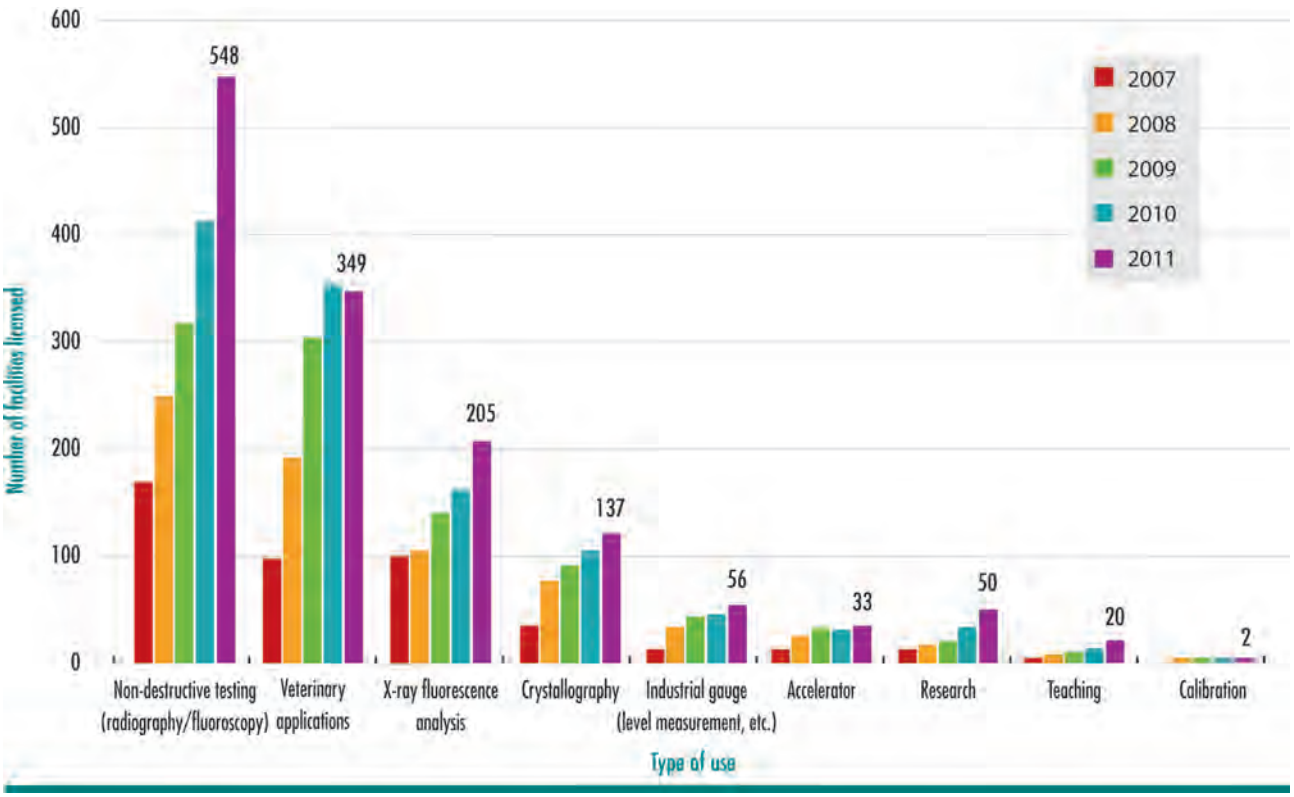
Radiography for checking the quality of weld beads or for the fatigue inspection of materials

These are fixed or worksite devices that use directional or panoramic beams. These devices can also be put to more specific

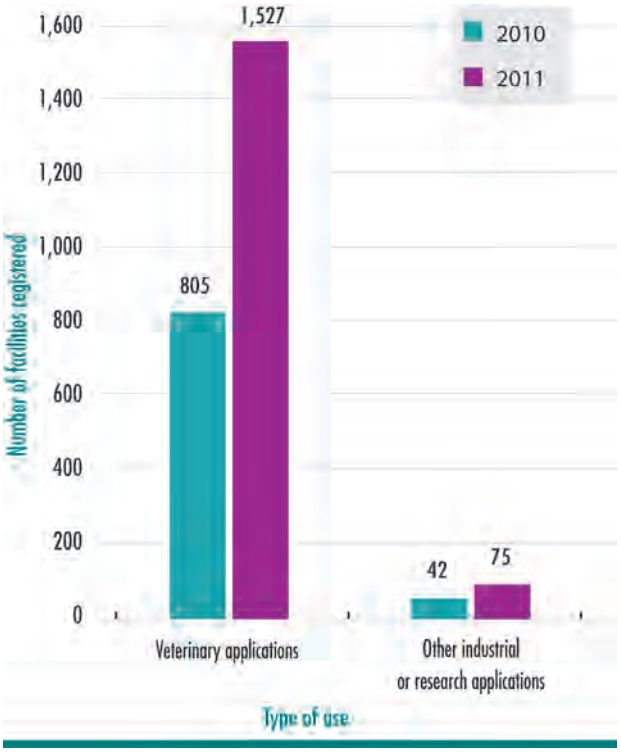


Baggage screening system from the Hi-Scan product range

Graph 3 : use of electrical devices generating ionising radiation (activities subject to licensing)



Graph 4 : use of electrical devices generating ionising radiation (activities subject to notification)



uses, such as radiography for restoration of musical instruments or paintings, archaeological study of mummies or analysis of fossils.

Baggage inspection

Ionising radiation is used constantly in security screening checks, whether for the systematic verification of baggage or to determine the content of suspect packages. The smallest and most widely used devices are installed at the screening checkpoints in airports, in museums, at the entrance to certain buildings, etc.

The devices with the largest inspection tunnel areas are used for screening large baggage items and hold baggage in airports, as well as for air freight inspections. This range of devices is supplemented by tomographs, which reconstruct the volume of an object from a series of cross-sectional image slices.

The irradiation zone inside these appliances is sometime delimited by doors, but most often by one or more lead curtains.

X-ray body scanners

After the failure of several attempted terrorist acts in recent months, X-ray body scanner technologies are the subject of growing interest, particularly in airports where there use is envisaged to reinforce security checks.

This particular use is given for information only, since pursuant to the Article L. 1333-11 of the Public Health Code, the use of X-ray scanners on people in security checks is prohibited in France.



X-ray device for screening foodstuffs

The experiments currently under way in France use image-generating technologies based on non-ionising millimetre waves.

Various technologies using X-rays have been developed and are already used in other countries:
– the backscatter X-ray body scanner produces a superficial image of the scanned person comparable to that obtained with a millimetre wave scanner. It does not detect materials inside the body. The screened person is exposed to about 0.1 microsievert (µSv) per scan). This technology is used in the United Kingdom and the USA, for example;
– the transmission X-ray body scanner gives an internal image of the screened person comparable to that obtained in medical examinations. This technique can detect materials hidden on and inside the body of a person. The screened person's exposure varies, according to the manufacturers' information, from 0.25 µSv/scan (whole body dose) to 6 µSv/scan (utilisation in the South African diamond mines).

The members of the association HERCA (Heads of European Radiological Protection Competent Authorities) have recognised the need to define a common European approach on the justification of the use of X-ray body scanners. They adopted a joint position on the subject on 1st December 2010. The declaration, which can be consulted on the HERCA web site *(www.herca.org)*, reaffirms the importance of applying the three principles of dose justification, optimisation and limitation in full, whatever the dose received by the persons concerned at each screening by an X-ray scanner.

Inspection of foodstuffs

In the last few years the use of appliances similar to baggage screening systems for detecting foreign bodies in food products has developed.

X-ray diffraction analysis

X-ray diffraction appliances, which are self-shielded, are being increasingly used by research laboratories. Experimental devices used for X-ray diffraction analysis can however be built by experimenters themselves with parts obtained from various suppliers (goniometer, sample holder, tube, detector, high-voltage generator, control console, etc.).

X-ray fluorescence analysis

These portable X-ray fluorescence devices are intended for the analysis of metals and alloys.

Measuring parameters

These appliances, which operate on the principle of X-ray attenuation, are used as industrial gauges for measuring fluid levels in cylinders or drums, for detecting leaks, for measuring thicknesses or density, etc.

Irradiation treatment

More generally used for performing irradiations, the self-protected appliances exist in several models that sometimes differ only in the size of the self-shielded chamber, while the characteristics of the X-ray generator remain the same.

1|3|2 Veterinary radiodiagnostics

The profession counts approximately 16,000 veterinary surgeons and 14,000 non-veterinary employees. Veterinary surgeons use radiodiagnostic devices in a similar context to that of the devices used in human medicine. Veterinary radiodiagnostic activities essentially concern pets.
– 90% of the 5,793 veterinary clinics have at least one radiodiagnostic device;
– ASN moreover notes an increase in the number of computed tomography scanners used in veterinary applications, with about fifteen in France at present;
– projects for implementing other practices drawnfrom the medical sector have materialised more recently. Three scintigraphy centres and one brachytherapy centre are identified on the national scale.

The treatment of horses requires powerful devices installed in specially equipped premises (radiography of the pelvis, for example) and portable X-ray generators, used either inside premises - dedicated or not - or outside in the open air. This activity, which has strong radiation protection implications for the veterinary surgeons, will be one of ASN's inspection priorities in 2012.



Veterinary equine X-ray examination



Relocatable linear accelerator used for inspecting loads



Mobile linear accelerator used for inspecting loads

The appliances used in the veterinary sector sometimes come from the medical sector, but the profession is increasingly using appliances developed specifically for its needs.

1|4 Particle accelerators

The Public Health Code defines an accelerator as a device or installation in which electrically charged particles undergo acceleration, emitting ionising radiation at an energy level in excess of 1 megaelectronvolt (MeV).

Use of this type of device is subject to the notification or licensing regime specified in Articles L.1333-4 and R.1333-17 of the Public Health Code. When they meet the characteristics specified in Article 3 of decree 2007-830 of 11 May 2007 concerning the list of BNIs, these facilities are listed as BNIs.

Certain applications require the use of particle accelerators which produce photon or electron beams, as applicable. The inventory of particle accelerators in France, whether linear (linacs) or circular (cyclotrons and synchrotrons), comprises about 50 identified installations (except for BNIs) which can be used in a wide variety of fields:
– research, which sometimes requires the coupling of several machines (accelerator, implanter, etc.);
– radiography (fixed or mobile accelerator);
– radioscopy of lorries and containers during customs checks (fixed-site or mobile accelerators);
– modification of material properties;
– sterilisation;
– conservation of foodstuffs;
– etc.

In the field of research, a number of synchrotron radiation production installations can be mentioned: the ESRF (European synchrotron radiation facility) in Grenoble, and the SOLEIL synchrotron at Gif-sur-Yvette.

1|5 Other electrical devices emitting ionising radiation

This category covers all the electrical devices emitting ionising radiation other than those mentioned above and not excluded by the license and notification exemption criteria set out in Article R. 1333-18 of the Public Health Code.

This category includes the other accelerators generating ionising radiation (not covered by the Public Health Code or the BNI regulations), ion implanters, electron-beam welding equipment, klystrons, certain lasers, certain electrical devices such as the high-voltage fuse tests.

More recently, particle accelerator imaging systems have been used in France to combat fraud and large-scale international trafficking. This technology, which is felt by the operators to be effective, must however be used under certain conditions in order to comply with the radiation protection rules applicable to workers and the public, in particular:



6 MeV Varian linear accelerator and its collimator

– a ban on activation of construction products, consumer goods and foodstuffs as specified by Article R.1333-4 of the Public Health Code, by ensuring that the maximum energy of the particles emitted by the accelerators used rules out any risk of activation of the materials being verified;
– a ban on the use of ionising radiation on the human body for purposes other than medical. Thus, the use of ionising technologies to seek out illegal immigrants in transport vehicles is prohibited in France;
– the setting up of procedures to check that the verifications conducted on the goods or transport vehicles do not lead to accidental exposure of workers or the public. During customs inspections of trucks using tomographic techniques, for example, the drivers must be kept away from the vehicle and other checks must be performed prior to irradiation to detect the presence of any illegal immigrants, in order to avoid unjustified exposure of persons during the inspection.

2 REGULATING NON-MEDICAL ACTIVITIES

The provisions of the Public Health Code relating specifically to the industrial and research applications provided for in the Public Health Code are specified in this section. The general rules are detailed in chapter 3 of this report.

2|1 Integration of the fundamental principles of radiation protection in the regulation of non-medical activities

ASN verifies application of the three major principles governing radiation protection and which are written in the Public Health Code (Article L. 1333-1), namely justification, optimisation of exposure and limiting of doses.

The Public Health Code (CSP) stipulates that "*a nuclear activity or intervention may only be undertaken or carried out if justified by the advantages it procures, particularly in health, social, economic or scientific terms, with respect to the risks inherent in the exposure to ionising radiation to which the individuals are likely to be subjected*". Assessment of the expected benefit of a nuclear activity and the corresponding health drawbacks may lead to prohibition of an activity for which the benefit does not seem to outweigh the risk. In this case, either prohibition is declared generically, or the license required on account of radiation protection is not extended. The uses of radium for which the detriment to health was considered too high were banned several decades ago in application of this principle. For existing activities, justification is reassessed when license renewal applications are made if current know-how and technology so warrants.

Optimisation is a notion that must be considered in the technical and economic context, and it requires a high level of involvement of the professionals. ASN considers in particular that the suppliers of non-medical devices must be at the core of the optimisation approach (see 2 | 3). They are responsible for putting the devices on the market and must therefore design them such that the exposure of the future users is minimised. ASN also checks application of the principle of optimisation when examining the license application files, when conducting its inspections, and when analysing the various significant events notified to it.

2|2 The Authorities regulating the sources of ionising radiation

In application of the Public Health Code, ASN is the authority that grants the licenses and receives the notifications, in accordance with the system applicable to the nuclear activity concerned.

The public health code does nevertheless provide for a series of waivers to alleviate the licensees' administrated constraints. The notification or licensing obligation does not apply to installations licensed under another system:

– for the radioactive sources held, manufactured and/or used in installations licensed under the mining system (Article 83 of the Mining Code) or in installations classified on environmental protection grounds (ICPE) which come under Articles L. 511-1 to L. 517-2 of the Environment Code, and have a licensing system, the *Préfet*[1] is the authority responsible for ensuring that these same licenses contain instructions relative to the radiation protection of the nuclear activities carried out on the site;
– for installations and activities relating to national defence, ASND (Defence Nuclear Safety Authority) is responsible for regulating radiation protection aspects;
– for the installations licensed under the BNI regime pursuant to Act 2006-686 of 13 June 2006 relative to transparency and security in the nuclear field (now codified in books I to V of the environmental code by Order 2012-6 of 5 January 2012), ASN regulates, under this regime, the sources necessary for the functioning of these same installations (radioactive sources and electrical devices emitting ionising radiation). Holding and using other sources within the bounds of the BNI remain subject to licensing pursuant to Article R.1333-17 of the Public Health Code.

In no way do these waivers exempt the beneficiary from the need to comply with the requirements of the Public Health Code, in particular those concerning the acquisition and transfer of sources.

The distribution, importing and exporting of radioactive sources, however, are not concerned by these waivers, and are subject to ASN authorisation.

Nuclear materials, for their part, are subject to specific regulations provided for in Article L. 1333-2 of the defence code. Application of these regulations is overseen by the Minister of Defence for nuclear materials intended for defence needs, and by the minister in charge of energy for nuclear materials intended for any other use.

2|3 Licensing and notification of ionising radiation sources used for non-medical purposes

2|3|1 Applicable licensing and notification legal system

Applications relating to the holding and use of ionising radiation sources are entirely reviewed by the regional divisions of ASN. The reviewing of supplier licenses is kept at national level.

The licensing regime

The initiative implemented by ASN to have a simplified and graduated approach according to the radiological risks and implications was continued in 2011 with the revising of the license application forms. Following on from the issue of the ASN decision specifying the content of the files to include with the license applications (decision 2010-DC-0192), new forms setting out the provisions of this decision were drawn up and issued in 2011:

– the application form for a license to hold / use devices containing radioactive sources for the purpose of detecting lead in paint (AUTO/IND/PLOMB);
– the application form for a license to exercise an activity in industrial radiography / fluoroscopy (AUTO/ IND/RADIO).

Other forms will be forthcoming, including :
– the application form for a license to hold, use or manufacture sealed radioactive sources (AUTO/IND/SS);
– the application form for a license to hold, use or manufacture non-sealed radioactive sources (AUTO/IND/SNS).

These forms list the documents that must be enclosed with the application. This list is established applying a graduated approach to the risks according to the envisaged nuclear activity.

All the documents listed in the appendix to ASN decision 2010-DC-0192 of 22 July 2010 must of course be held by the applicant and kept available for the inspectors in the event of verification. It is moreover possible that ASN will request further information during its examination of the license application.

To better integrate the true situation of responsibilities in the non-medical sectors, where the radioactive sources and devices are more often managed by an entity than by an individual, these new forms provide the possibility of making license applications as a representative of an artificial person, in application of Article R. 1333-24 of the public health code.

All the forms relative to non-medical small-scale nuclear activities will be reviewed, applying the formality and principles of the above-mentioned forms.

The notification system

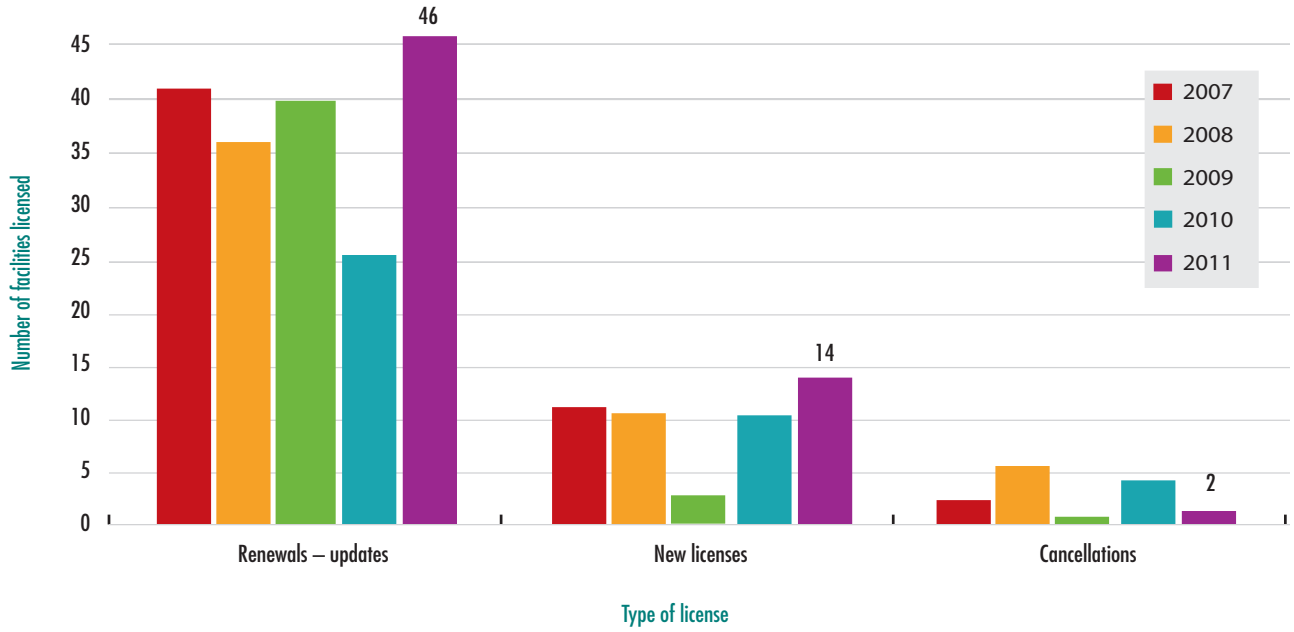
To achieve a balance in the sectors of activity subject to notification or licensing, and therefore better adapt the regulatory requirements to the radiation protection implications, ASN introduced a notification system in the non-medical sector in 2009. This led to the publication of several approved decisions (see chapter 3) defining on the one hand the scope of application of this new system and on the other, its implementation procedures.

The following are concerned:
– veterinary radiodiagnostic devices (fixed only) meeting one of the following conditions:
  • the emission beam is directional and vertical, except for all tomography devices;
  • the device is used for intra-oral radiography (ASN decision 2009-DC-0146 of 16 July 2009, amended by decision 2009-DC-0162 of 20 October 2009, *Official Journal* of 26 February 2010);
– electrical devices emitting ionising radiation, for which the equivalent dose rate at 10cm from all accessible surfaces in normal conditions of use and as a result of their design, is less than 10 µSv.h-1.

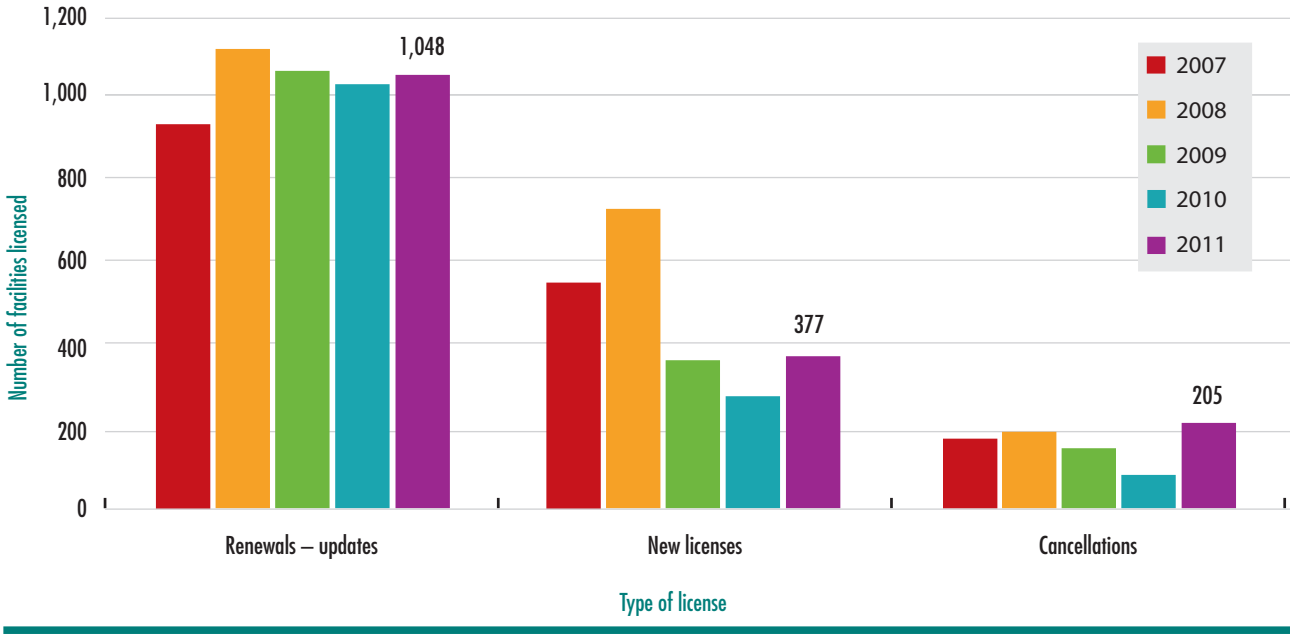
The notification form drawn up by ASN to facilitate application of decision 2009-DC-0148 defining the detailed content of the information to be appended to the notifications has been designed so as to simplify its utilisation and processing. No document has to be added to the notification form if the devices declared meet the requirements specified in ASN's decisions and are eligible for this system.

1. In a *département*, representative of the State appointed by the President. The Ministry of Defence substitutes for the *Préfet* for the ICPEs situated on military sites. In other respects, ASN exercises the functions of the *Préfet* for the ICPEs located within the bounds of a BNI.

Graph 5: radioactive source "supplier" licenses delivered



Graph 6: radioactive source "user" licenses delivered



2|3|2 Statistics for 2011

Suppliers

ASN monitoring of the suppliers of radionuclide sources or of devices containing such sources used for non-medical purposes is essential to ensure the security of source movements, their traceability and the recovery and disposal of used or end-of-life sources. Source suppliers must also play a teaching role with respect to users. It is important that their situation with regard to radiation protection rules be satisfactory and that their activities be duly covered by the license specified in Article R. 1333-17 of the Public Health Code.

In 2011, 60 licenses or license renewals were issued to suppliers.

Graph 5 shows the licenses delivered in 2011 and the trends for license deliveries over the last five years (from 2007 to 2011).

Users

Case of radioactive sources
In 2011, ASN reviewed and notified 377 new licenses, 1,048 license renewals or updates and 205 license cancellations. Graph 6 presents the licenses issued or cancelled in 2011 and trends in this area for the last five years.

Once the license is obtained, the licensee can procure sources. To do this, it collects supply request forms from the Institute of Radiation Protection and Nuclear Safety (IRSN), enabling the institute to verify - as part of its duty to keep the inventory of ionising radiation sources up to date - that the orders are in conformity with the licenses of both the user and the supplier. If the order is correct, the movement is then recorded by IRSN, which notifies the interested parties that delivery can take place. If any difficulty is encountered, IRSN informs ASN.

Electrical generators of ionising radiation
ASN has been responsible for regulating these devices since 2002, and is gradually building up its capacity in this area where numerous administrative situations need to be regularised. It granted 198 licenses and 126 license renewals for the use of electrical X-ray generators in 2011. Given the new regulatory provisions allowing the implementation of a notification system in place of the licensing system since 2010, ASN also delivered 755 notification receipts in 2011. A total of 1,314 licenses and 1,602 notification receipts have been delivered for electrical devices emitting ionising radiation since decree 2002-460 was issued.

2|4 Revocation of unjustified or prohibited activities

2|4|1 Application of the ban on the intentional addition of radionuclides in consumer goods and construction products

The public health code indicates "*that the intentional addition of radionuclides in consumer goods and construction products is prohibited*" (Articles R. 1333-2 and 3 of the public health code, see 2|1|3 of this chapter).

The trading of radioactive stones or decorative objects, accessories containing sources of tritium such as watches, key-rings, hunting equipment (sighting devices), navigation equipment (bearing compasses) or equipment for river fishing (strike detectors) is specifically prohibited.

Several findings of radioactive substances in consumer goods were reported to ASN in 2011. A number concerned the presence of small quantities of radionuclides of natural origin in technical ceramics imported from Asia and used in consumer goods (textiles and certain laundry balls, for example). ASN was thus induced in 2011 to remind companies importing components or products based on technical ceramics, particularly from Asia, that any use of radioactivity must be justified by the benefits it brings, and that any advertising relative to the use of radionuclides or products containing radionuclides is prohibited by the public health code. With regard to consumer goods, the intentional addition of radionuclides - including those of natural origin - for their radioactive properties, is strictly prohibited.

2|4|2 Application of the principle of justification for existing activities

In application of the principle described in point 2|1, the justification of existing activities must be re-assessed periodically in the light of current knowledge and the way techniques evolve. If the activities are no longer justified by the benefits they bring, or with respect to other non-ionising technologies that bring comparable benefits, they must be withdrawn from the market. A transient period for definitive withdrawal from the market may be necessary, depending on the technical and economic context, particularly when a technological substitution is necessary.

Smoke detectors containing radioactive sources

Devices containing radioactive sources have been used for several decades to detect smoke in buildings, as part of the fire-fighting policy. These devices comprise two ionisation chambers, of which only one allows the combustion gases to enter. By comparing the strength of the current crossing the two chambers, a change in the atmosphere can be detected when the smoke enters the unsealed chamber. This triggers the fire alarm. Several type of radioisotopes were initially used to ionise the content of the two chambers (americium 241, plutonium 238, nickel 63, krypton 85), but only americium is currently used in the smoke detectors available on the market. The activity of the most recent sources used does not exceed 37 kBq, and the structure of the detector, in normal use, prevents any propagation of radioactive substances into the environment.

New non-ionising technologies have gradually come to compete with these devices. Optical devices now provide comparable detection quality, and can therefore satisfy the regulatory and normative fire detection requirements. ASN therefore considers that smoke detection devices using radioactive sources are no longer justified and that the seven million ionic smoke detectors installed on 300,000 sites must be progressively replaced.

Regulatory changes were developed on the basis of the ASN proposal. They were submitted for consultation to various groups and entities representative of the stakeholders involved. They were also examined by the Advisory committee of experts in radiation protection (GPRAD), the HCSP (French High Public Health Council), the Simplification Commissioner, and the CCEN (Consultative Committee for the Evaluation of Standards). A presentation note was posted on the web site of the HCTISN (French High Committee for Transparency and Information on Nuclear Security).

The order introducing the waiver to Article R.1333-2 of the public health code for ionisation chamber smoke detectors was signed on 18 November 2011, further to ASN opinion 2011-AV-0134, and published in the *Official Journal* on 3 December 2011. The regulatory provision is supplemented by two ASN decisions:
1. Decision 2011-DC-0252 of 21 December 2011 subjecting certain nuclear activities to notification in application of 2° of Article R. 1333-19 of the public health code;
2. Decision 2011-DC-0253 of 21 December 2011 defining the particular conditions of use and the procedures for the registration, monitoring, recovery and disposal of ionisation chamber smoke detectors.



Reconditioning of smoke detectors

Surge suppressors

Surge suppressors (sometimes called lightning arresters) are small objects with a very low level of radioactivity used to protect telephone lines against voltage surges in the event of lightning strike. The use of surge suppressors has been gradually abandoned since the end of the 1970s, but the number remaining to be removed, collected and disposed of is still very high (approximately 1 million units). Once installed, these devices do not present an exposure risk for people, but there can be a risk of contamination if they are handled without taking precautions. These risks must be taken into account in the removal, storage and disposal operations in order to protect the public and the workers. ASN issued a reminder of this to France Télécom, which is currently drawing up a plan of action to organise the removal and disposal of surge suppressors in compliance with the regulations.

Lightning arresters

In 1914, Léo Szilard, a Hungarian scientist, developed the first lightning arrester with a radioactive head. In 1932 the French company Hélita put the first radioactive lightning arrester onto the market. Companies subsequently developed other products, including the brands Duval Messien, Franklin France and Indelec. Having radioactive sources on the head of the lightning arrester was supposed to increase the protection radius compared with a "conventional" lightning arrester, by rendering conductive the air around the sealed sources. The arresters were equipped, according to their type, with sealed sources of radium 226, and subsequently americium 241.

Radioactive lightning arresters were manufactured and installed in France between 1932 and 1986. The ban on the sale of radioactive lightning arresters was declared in 1987. This order did not make the removal of installed radioactive lightning arresters compulsory. Consequently, there is no obligation to remove the radioactive lightning arresters installed in France at present, apart from in certain ICPEs (order of 15 January 2008 setting the removal deadline at 1 January 2012) and certain installations under Ministry of Defence responsibility (order of 1 October 2007 setting the removal deadline at 1 January 2014).

ANDRA, the national agency for radioactive waste management, estimates that there are still 40,000 radioactive lightning arresters installed in France. ASN considers that these radioactive objects - even if they generally present no risk unless handled - contain sources with significant levels of activity and therefore present exposure risks for the people coming into contact with them, during their removal for example.

Furthermore, experience has shown that the containment of radioactive sources can deteriorate over time, thereby increasing the radiological risks when the lightning arrester is removed. The removal operations must therefore be carried out by specialist companies and be directed towards the disposal routes established by ANDRA.

ASN wants to see the progressive and organised recovery of these radioactive lightning arresters, and for several years now has been informing the professionals to ensure that their removal guarantees compliance with radiation protection requirements for the workers and the public. ASN has stepped up its action in this respect since 2009, by reminding the professionals of their obligations, particularly that of having an ASN license for the activity of removing and storing the lightning arresters pursuant to Articles L.1333-1, L.1333-4, and R.1333-17 of the public health code.

In parallel with this, ASN conducted on-ground verifications of the companies involved in the recovery of these objects in 2012. ASN's verifications in this area will be stepped up in 2012.

Additional information on radioactive lightning arresters is available on the following web sites:
– *www.paratonnerres-radioactifs.com/*
– *www.andra.fr/*

Light bulbs containing small quantities of radioactive substances

Certain light bulbs, chiefly very high intensity discharge lamps used in public places or professional environments, and in certain vehicles, contain small quantities of radioactive substances (krypton 85, thorium 232 or tritium). These substances serve to increase the light intensity or facility illumination of the lamps. Addition of these radioactive substances has been common practice for several decades.

On the basis of technical assessments demonstrating their very low impact in terms of radiation protection, several European countries have exempted these objects from the licensing or notification system provided for by the European regulations relative to radiation protection . Other countries, such as France, are currently assessing the technical reports available on this subject.

ASN has taken up this issue since 2009, reminding the manufacturers concerned by the production and distribution of light bulbs that the intentional introduction of radionuclides into



Cutting off the head of a lightning arrester

consumer goods is prohibited in France by the public health code. To put their situation in order, the manufacturers have lodged files with the DGPR (General Directorate for Risk Prevention), applying for a waiver to this prohibition. These files were transmitted to ASN on 19 October 2011 and are currently being examined.

ASN is also taking part in international think tanks in this area (see information note published in July 2011 further to the seventh meeting of HERCA: *www.asn.fr*).

2|5 Reinforcement of the regulation of electrical devices generating ionising radiation

ASN wishes to supplement the provisions introduced into the public health code in 2007, and thus complete the development of the regulatory framework allowing the distribution of electrical devices for generating ionising radiation to be subject to licensing in the same way as the suppliers of radioactive sources. Experience shows that in this respect, the joint technical examination of files by ASN and the device suppliers/manufacturers brings substantial gains in radiation protection optimisation (see point 2|1).

For electrical devices used for non-medical purposes, there is no equivalent of the medical CE marking confirming conformity with several European standards covering various fields, including radiation protection. Furthermore, experience feedback shows that a large number of devices do not have a certificate of conformity to the standards applicable in France. These standards have been obligatory for many years now, but some of their requirements have been partly obsolete or inapplicable due to the lack of recent revisions.

Back in 2006, ASN contacted the Ministry of Work, the LCIE (Central Laboratory of the Electrical Industries), the CEA and the IRSN, and urged the *Union Technique de l'Electricité* (UTE) to start updating these standards. The UTE led a revision process for the NF-C 15-160 standards, and the associated specific standards (installation standards), which led to the approval of a new standard in February 2011. ASN took part in this work and is preparing the regulatory modifications necessary for it to be taken into account.

With regard to the design of the devices, ASN is looking into the development of the applicable technical requirements to license the devices. After presenting the first orientations to the GPRAD in June 2010, ASN continued its work with the support of the IRSN and the assistance of other reference players such as the CEA and the LCIE, with a view to developing a baseline technical standard for this type of device. The results of the technical work were presented to the GPRAD in December 2011.

Similarly to the ASN decision 2008-DC-0109 relative to the distribution of radioactive sources, ASN is working on a draft decision to define the detailed content of the information that must be enclosed with the initial applications for a license to distribute X-ray generators. The lack of a relevant baseline technical standard at both national and international level, obliges the integration of technical design requirements into the envisaged licensing process, while ensuring their compatibility with the European regulations.

The results of the work entrusted by ASN to the IRSN, the Veritas Bureau, the LCIE and the CEA, should enable the required technical characteristics of X-ray generators with respect to the radiation protection requirements for the users and the public to be defined.

2|6 Detection of radioactivity in France

ASN considers that the increase in the number of cases of detection of radioactivity in metals and consumer goods across the world is worrying. Noteworthy recent findings include:
– an accident that occurred in April 2010 on a metal recycling site in India, and was rated level 4 on the INES international radiological events scale;
– the discovery in July 2010 in the port of Gênes Voltri in Italy, of a container displaying a dose rate on contact of 600mSv/h, originating from Saudi Arabia;
– several cases of triggering of radiation portal monitors in Belgian ports by containers being shipped to France, reported by the AFCN (Federal Agency for Nuclear Regulation), ASN's Belgian counterpart. Triggering was caused by contaminated consumer goods (bathroom tap kits contaminated with cobalt 60, laundry balls, etc.) or naturally radioactive substances coming from China (tourmaline powder containing natural radionuclides, intended for the impregnation of fabrics).



Utilisation of an X-ray generator on work site

At present, the French regulations concerning the movements of goods at the French borders do not provide for specific checks to search for radioactive materials. The detection of radioactivity at the borders allows the detection of the arrival on European territory of consumer goods contaminated by radioactive substances. It is also a means of combatting nuclear terrorism, insofar as it makes it more difficult to illegally introduce into France radioactive material that could subsequently be used for malicious purposes.

Furthermore, the post-Fukushima situation has demonstrated the value of radiation portal monitors for checking the radiological quality of trade flows following a nuclear accident.

In the light of this experience feedback, ASN has strengthened its contacts with the administrations concerned by this domain, and with its European counterparts, notably by participating in a European conference aiming at sharing good practices in radioactivity detection in strategic places (ports, airports, etc.). ASN effectively considers that France must rapidly adopt a national strategy for radioactivity detection on its territory, and make the corresponding investments in equipment and training.

2|7 Implementation of a system for monitoring radioactive source protection against malicious acts

Even if the safety and radiation protection measures brought by the regulations do guarantee a certain level of protection against the risk of malicious acts, they cannot be considered sufficient. Tightening the monitoring of protection against malicious acts (a notion often summarized in the word “security”, as opposed to “safety”, which designates all the technical and organisational measures aiming to reduce the probability of accidents and, if an incident were to occur, to mitigate its consequences) targeting hazardous sealed radioactive sources was thus strongly encouraged by IAEA, which published a Code of Conduct on the Safety and Security of Radioactive Sources (approved by the Board of Governors on 8 September 2003) along with guidance on the import and export of radioactive sources (published in 2005). The G8 supported this approach, including at the Evian summit (June 2003) and France sent IAEA confirmation that it was working on implementation of the guidance stipulated in the Code of Conduct (undertaken by the Governor for France on 7 January 2004). The general aim of the Code is to obtain a high level of safety and security for those radioactive sources which can constitute a significant risk for individuals, society and the environment.

Monitoring sources for radiation protection and safety purposes and monitoring them to combat malicious acts have many aspects in common and mutually consistent objectives. This is why ASN’s counterparts abroad are usually responsible for monitoring both domains. ASN has the necessary hands-on knowledge of the sources concerned - which are regularly inspected by its regional divisions - to accomplish both missions.

The Government has decided to entrust ASN with the role of regulating the security of radioactive sources, in other words to monitor the prevention of acts of terrorism concerning these sources.

The legislative process initiated by the Government in 2008 with the aid of ASN has not been concluded to date. It is necessary for France to adopt legislative provisions on the protection of sources against malicious acts in order to meet its international commitments.

3 MONITORING NON-MEDICAL ACTIVITIES

3|1 Checks conducted by ASN

The checks applied to radiation sources are adapted to the nature and use of the sources. They are presented in chapter 4.

3|2 The main incidents in 2011

A full run down of radiation protection events in the domain, excluding BNIs, is presented in chapter 4. The following two events gave rise to in-depth experience feedback in 2011.

Level 2 incident occurring while using a gamma ray projector on the premises of STIC, a company located in Rambervillers (Vosges département[2]*)*

The incident occurred on 22 September 2011 and involved a gamma ray projector (an industrial radiographic inspection device) used on the premises of STIC, a company situated in Rambervillers (Vosges *département* - 88), during a weld inspection performed by the LEM (Montereau Test Laboratory).

A metal part fell onto the guide tube, deforming it and preventing the radioactive source (iridium 192 of 500 GBq) from retracting to its safe shielded position inside the device. The operators established a safety perimeter to avoid any risk of exposure of the public.

The emergency services and two ASN inspectors went to the site to check that this safety perimeter had been properly set up and that the area was under due surveillance.

The installation of leaded blanket shielding around the source enabled the safety perimeter to be reduced to one portion of the building on Friday 23 September 2011. ASN asked LEM to ensure that the areas was kept under surveillance and to define, through consultation with specialised companies, the necessary measures to retrieve the source.

At the request of LEM, Cegelec - the company that supplies the gamma ray projectors of this type in France - performed a borescope inspection of the guide tube to identify the exact causes of the blockage and define an intervention protocol. The inspection results led Cegelec to design and develop a specific tool to straighten the guide tube and release the source. The intervention, which was subject to a prior technical examination and authorisation by ASN, was successfully carried out on site by the Cegelec technicians on 24 November 2011. The doses received by the operators during the intervention (0.007mSv maximum), were below the dosimetric predictions established beforehand (0.05mSv) and well below the annual regulatory limit set for workers (20mSv).

This event caused no radiation exposure for the public.

Analysis of the incident showed that an operator from LEM attempted to unjam the source by intervening manually on the damaged device on 22 September. The intervention consisted in manipulating the guide tube on either side of the assumed position of the source.

Owing to the very short duration of the operation, the operator exposure, estimated at 1.5 millisievert (mSv), is below the annual exposure limit set by the regulations (20mSv). An additional evaluation of exposure of the hands was carried out at the request of ASN by the IRSN, its technical support body. This evaluation did not reveal a risk of the operator suffering irreversible effects.

Even though the intervention lasted a very short time, this manual manipulation in the immediate proximity of a high-activity source is contrary to the rules of radiation protection. Consequently, ASN rated this event level 2 on the INES scale, which comprises 8 levels, from 0 to 7.

Follow-ups to the Feursmetal incident in Feurs (Loire département*)*

On 26 May 2010, six people from Feursmetal, Cegelec and the IRSN, and premises and items of tooling of the Feursmetal foundry were contaminated during an attempt to retrieve a high-activity (1.25 TBq) cobalt 60 radioactive source that was jammed in the guide tube of a gamma ray projector. The gamma ray projector and the jammed source had been jammed since 7 May in a bunker on the Feursmetal site where the projector was regularly used to inspect castings.

Although the human consequences turned out to be limited (dosimetric impact on the workers evaluated at between 0.2mSv and 0.6mSv, depending on the person), the material consequences were considerable, since significant contamination was measured in the bunker, the adjacent premises, and certain peripheral areas internal to the company, affecting the casting moulds necessary for the fabrication of parts.

The first decontamination phase targeting the moulds and the areas in the periphery of the bunker, which began in 2010, was continued in 2011 in compliance with the prefectural order of 22 June 2010 that provides the regulatory framework for this decontamination work.

Thus, all the moulds necessary for production were decontaminated. Besides this, ASN and the Rhône-Alpes region DREAL (Regional Directorate for the Environment, Planning and Housing) delicenced the section of the road within the company that had been affected by the contamination, in the light of the inspection reports drawn up further to the decontamination work. Lastly, studies have been started with a view to launching the works concerning the most seriously affected areas in 2012, namely the gamma radiography bunker and the adjacent premises.

ASN rated this event level 2 on the INES radiological events scale.

2. Administrative region headed by a *préfet*

4 ASSESSMENT OF RADIATION PROTECTION IN THE NON-MEDICAL SECTOR AND OUTLOOK

In the field of regulating applications of ionising radiation in the non-medical sector, ASN works to ensure that the operators take full account of the risks involved in the use of ionising radiation. This problem is accentuated by the diversity and the number of the parties involved.

Industrial radiography

The recent gamma radiography incidents that occurred in 2010 and 2011 in France (Feursmetal, Hachette & Driout, Rambervillers) brought home the importance of radiation protection in industrial radiography activities. Over and beyond the health risks for the operators, the economic consequences of accidents can be very considerable.

The work conditions on the site (poor accessibility, night work, etc.), equipment maintenance (projector, guide tubes, etc.) are major factors affecting personnel safety. The incidents often result from sources getting jammed outside the safe shielded position. ASN notes that the exposure rates and condition of the equipment are not unrelated to the probability of an incident. It moreover underlines that if any equipment operating anomalies are observed, such as abnormal source projection or retraction forces, operations should be immediately stopped and the equipment inspected. Furthermore, if a source gets jammed, no attempts should be made to release it, and the on-site emergency plans required by the regulations - though rarely drawn up - must be implemented.

Beyond the incidents noted, ASN considers from its inspections that the way risks are taken into account varies between companies. Although on the whole the regulations relating to worker training and the periodic external inspection of sources and devices are satisfied, further progress must be made in work preparation, particularly for on-site operations (predicted dose evaluations, marking out of zones, etc.) and in the coordination between the ordering companies and contractors to enhance work preparation and allow the application of effective preventive measures.



Static X-ray generator in a workshop

After considering the questions of justification and optimisation, the non-destructive testing professionals have drafted guides, including a guide for companies seeking an alternative to iridium 192 for the gamma radiography inspection of pipe fabrication welds (ALTER'X, coordinated by the French Welding Institute), and a guide coordinated by COFREND, promoting the use of alternative methods and including functional tools such as a flow chart for identifying the gamma radiography substitution conditions, and matrices describing the inspection and its objectives.

ASN considers that the involvement of the ordering customers is vital to make progress in radiation protection in industrial radiography.

The regulation and monitoring of industrial radiography is a priority for ASN, with 114 inspections carried out in 2011, some in collaboration with the labour inspectorate. This priority is maintained in 2012.

Enhancing the awareness of all the players is also a priority. Regional initiatives to establish charters of good practices in industrial radiography have been underway for several years at the instigation of ASN and the labour inspectorate, particularly in the Provence-Alpes-Côte d'Azur, Haute-Normandie, Rhône-Alpes, Nord - Pas-de-Calais and Bretagne/Pays de la Loire regions. These initiatives allow regular exchanges between the various stakeholders and are therefore going to be continued. The ASN divisions and other regional administrations concerned also organise regional awareness-raising and discussion symposia which are attracting growing interest from the stakeholders of this branch.

Research

ASN's monitoring of establishments and laboratories using radioactive sources for research purposes, which began in 2002, shows a distinct improvement in radiation protection in this sector. The actions taken over the last few years have produced appreciable results, particularly in the involvement of Persons Competent in Radiation protection (PCRs), the training of exposed workers and radiation protection technical inspections.

ASN notes a gain in overall awareness of the importance of radiation protection issues. This being said, the lack of involvement of certain stakeholders and the considerable legacy of installations to be brought into conformity with radiation protection requirements, combined with removal of very old and "forgotten" radioactive sources, can represent serious obstacles.

In 2011, ASN established contacts with the nine health and safety at work inspectors of the Ministry of Research in order to discuss inspection practices and look into reciprocal methods of exchanging information to improve the effectiveness and complementarity of the inspections. An agreement should be drawn up in 2012 between ASN and the general inspectorate of the Ministry responsible for research and higher education.

Veterinar

The administrative situation of the veterinary structures is improving (1,527 structures notified and 349 licensed at the end of 2011), but is not yet satisfactory. The inspections carried out in 2011 showed that the work of the national professional institutions in the field of radiation protection, leading to the drafting of guides and good practices sheets, is not uniformly applied in the field. The radiation protection technical inspections, the workstation studies and risk analyses must be improved. In the last few years ASN has nevertheless seen progress in the employment of persons competent in radiation protection, in dosimetric monitoring and in the wearing of personal protective equipment.

ASN will continue its inspection actions in 2012, with a view to putting the administrative situation of all the players in order and improving their radiation protection practices, particularly in the equine sector. These inspections will enable the effectiveness of the recommendations and good practices issued by the national professional institutions to be judged on the ground.

Removal of lightning arresters

The removal of old lightning arresters containing radioactive sources is an activity requiring strict radiation protection measures (see point 2|2|2). ASN has planned to reinforce the inspections in this area in 2012 to ensure that the professionals exercise their activities in compliance with radiation protection regulations and good practices.

Suppliers of ionising radiation sources

As stated in point 2|3, ASN considers that the regulatory oversight of suppliers of electrical ionising radiation generators is still insufficient, given that the technical characteristics of the devices put on the market are of prime importance for the optimisation of the exposure protection of their users. The work conducted by ASN in this area should enable a decision setting the technical requirements for the devices distributed in France to be established in 2012.



ASN inspection of a gamma radiography work site at Roissy airport – February 2012

ASN is also stepping up its inspections in radiopharmaceutical research and production using cyclotrons. The 27 cyclotrons existing in France, which are subject to licensing by ASN, have strong radiation protection implications and display high technical complexity. Eleven inspections are planned in this area in 2012.

TRANSPORT OF RADIOACTIVE MATERIALS

1 **MOVEMENTS AND RISKS IN THE TRANSPORT SECTOR** 299

1|1 The diversity of radioactive material transport movements

1|2 Risks associated with the transport of radioactive materials

2 **REGULATION DUTIES AND RESPONSIBILITIES IN THE TRANSPORT OF RADIOACTIVE MATERIALS** 301

2|1 Regulation of nuclear safety and radiation protection

2|2 Protection against malicious acts

2|3 Regulation of the other classes of dangerous goods

3 **DEVELOPMENT OF THE INTERNATIONAL AND EUROPEAN REGULATIONS RELATIVE TO THE TRANSPORT OF RADIOACTIVE MATERIALS** 302

3|1 The different types of package

3|1|1 Excepted packages

3|1|2 Non-fissile industrial or type A packages

3|1|3 Fissile and type B packages

3|1|4 Type C packages

3|2 Requirements applicable to each type of package

3|3 Defining responsibilities in the transport of radioactive materials

3|4 Monitoring of radiation protection relative to the transport of radioactive materials

3|5 Regulation of the safety of transport operations within the bounds of nuclear facilities

3|6 Public information in the transport sector

4 **ASN ACTION IN THE TRANSPORT OF RADIOACTIVE MATERIALS** 305

4|1 Delivery of approval certificates and shipment approvals

4|2 Monitoring all the stages in the life of a package and its shipment conditions

4|2|1 Package manufacturing inspections

4|2|2 Maintenance inspections of type B packages

4|2|3 Inspections of packages not requiring approval

4|2|4 Inspections of the shipment of packages of radioactive materials

4|2|5 Analysis of incidents

4|3 Participation in international relations in the transport sector

4|3|1 Participation in the work of the IAEA

4|3|2 Participation in the work of the European Association of Competent Authorities on transport

4|3|3 Bilateral relations with ASN's foreign counterparts

5 **ASN'S OPINION ON THE SAFETY OF TRANSPORT OF RADIOACTIVE MATERIALS, AND PROSPECTS** 312

CHAPTER 11

The transport of radioactive materials is a specific sector of dangerous goods transport. It involves transporting materials with specific hazardous properties due to their radioactivity, and whose safety must be ensured.

The scope of regulation of the safety of radioactive material transport covers many sectors: Industrial medical and research sector. It is based on stringent and restrictive international regulations.

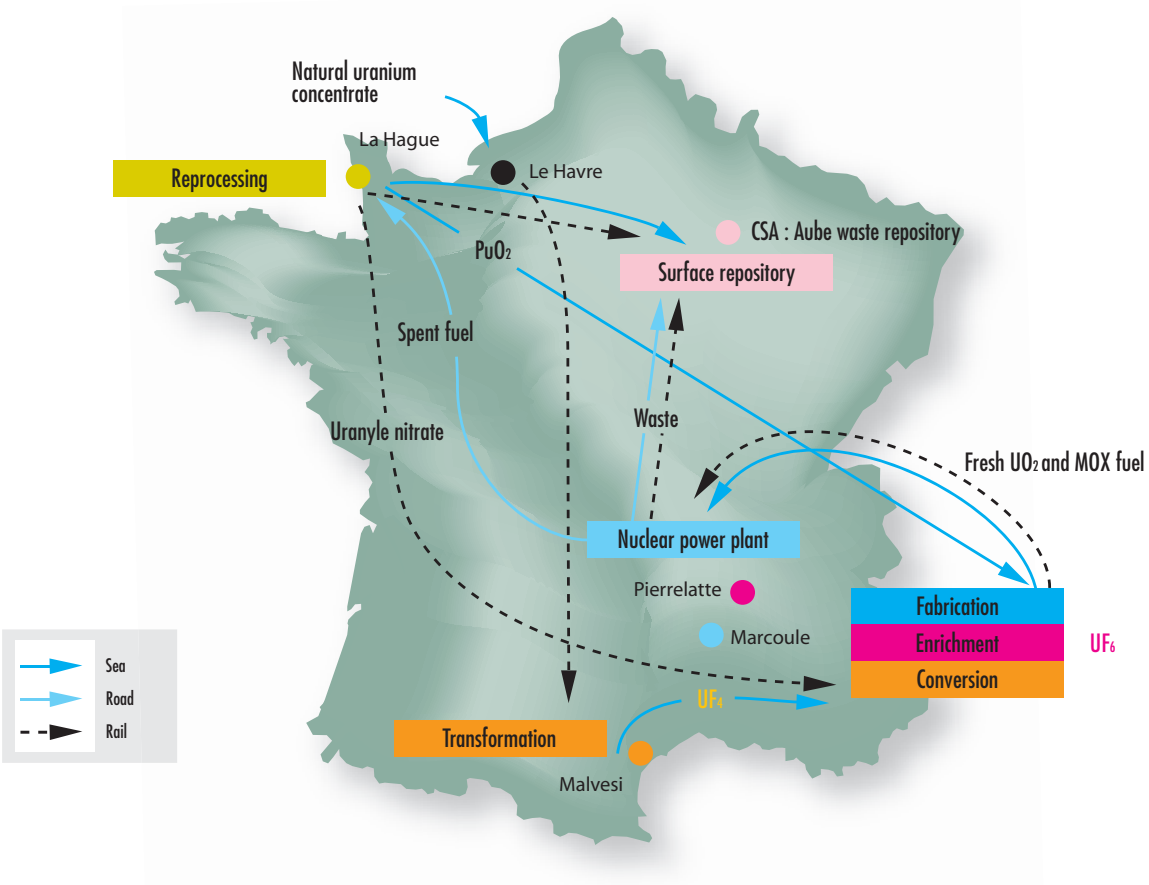
1 MOVEMENTS AND RISKS IN THE TRANSPORT SECTOR

1|1 The diversity of radioactive material[1] transport movements

Fifteen million dangerous goods packages are transported each year in France. The regulations place these packages in different risk classes. Class 1, for example, corresponds to explosive materials and objects, class 3 to flammable liquids, and class 6 to toxic and infectious materials. Class 7 corresponds to hazardous radioactive material. About 900,000 packages of radioactive materials are transported each year, which represents just a small percentage of the total number of dangerous goods packages transported each year in France.

The nuclear industry only represents about 15% of the annual transport movements of radioactive materials: 85% of the transported packages are intended for the medical, non-nuclear industries or research sectors, referred to as small-scale nuclear activities, of which about 30% is accounted for by the medical sector alone.

Transport operations relating to the fuel cycle in France



1. The statistical data provided in this chapter are taken from data collected in 2002. A new study is scheduled for 2012 to update these data.

Table 1 : breakdown of shipments by mode of transport

Approximate number of packages and shipments		Rail	Sea	Sea and rail	Road	Road and air	Road and rail	Road and sea	Total (approx.)
Packages approved by ASN	Number of packages	20		50	90,000	150	130	1,000	90,000
	Number of shipments	20		415	58,000	70	110	20	60,000
Packages not requiring approval by ASN	Number of packages	3,900	20	21,300	760,000	45,000	1,400	14,200	850,000
	Number of shipments	30	20	100	542,000	14,000	460	280	560,000
Approximate number of packages		3,920	20	21,350	850,000	45,150	1,530	15,200	900,000
Approximate number of shipments		50	20	515	600,000	14,070	570	300	600,000

The fuel cycle necessitates an estimated annual total of 11,000 shipments involving 141,000 packages. These include approximately:
– 1,000 shipments from or to foreign countries or transiting via France, representing about 50,000 packages;
– 300 shipments of new uranium-based fuel and some 30 shipments of new uranium and plutonium-based "MOX" fuel;
– 200 shipments transporting spent fuel from the nuclear power plants operated by EDF to the La Hague reprocessing plant operated by AREVA;
– about 60 shipments of plutonium in oxide form transported from the La Hague reprocessing plant to the MELOX fuel production plant in the Gard *département*[2];
– 250 shipments of uranium hexafluoride necessary for the fuel manufacturing cycle.

The field of nuclear industry research, which essentially concerns the CEA, accounts for a little less than 3,000 shipments per year transporting about 8,000 packages.

1|2 Risks associated with the transport of radioactive materials

The content of the packages varies greatly: their radioactivity varies over more than twelve orders of size, that is to say from a few thousand becquerels for low-activity pharmaceutical packages, to trillions of becquerels for irradiated fuel. Their weight also varies from a few kilogrammes to about a hundred tonnes.

The major risks involved in the transport of radioactive materials are:
– the risk of external irradiation of persons in the event of damage to the "biological protection" of the packages, a technical material that reduces the radiation received through contact with the package;
– the risk of inhalation or ingestion of radioactive particles in the event of release of radioactive materials;
– contamination of the environment in the event of release of radioactive materials;
– the starting of an uncontrolled nuclear chain reaction ("criticality safety" risk) that can cause serious irradiation of persons if water is present and the safety of fissile radioactive materials is not controlled.

Moreover, the radioactive materials can also be toxic and corrosive. This, for example, is the case with shipments of natural uranium with low radioactivity, for which the major risk for man is the chemical risk if it is ingested. Similary, uranium hexafluoride (UF_6), used in the manufacture of fuels for nuclear power plants can, in the case of release and contact with water, form hydrofluoric acid, a powerful corrosive and decalcifying agent.

Catering for these risks implies having full control over the behaviour of the packages to avoid any release of material and deterioration in the package protection in the event of:
– fire;
– physical impact further to a transport accident;
– ingress of water into the packaging, as water facilitates chain nuclear reactions in the presence of fissile materials;
– chemical interaction between the various constituents of the package;
– substantial release of heat from the transported materials, to avoid possible heat damage to the package constituent materials.

This approach means that safety principles must be defined for the transport of radioactive materials:
– safety is based first and foremost on the package: regulatory tests and safety demonstrations are required by the regulations to prove that the packages can withstand reference accidents;
– the required level, particularly with regard to the reference accidents that the package must withstand, depends on the level of risk presented by the package.

2. Administrative region headed by a *préfet*.

2 REGULATION DUTIES AND RESPONSIBILITIES IN THE TRANSPORT OF RADIOACTIVE MATERIALS

2|1 Regulation of nuclear safety and radiation protection

The objective of ensuring the safety of shipments of radioactive materials is to prevent nuclear accidents and their radiological consequences for people, by implementing organisational and technical measures.

In France, ASN has been responsible since 1997 for regulating the safety of transport of shipments for civil uses, while ASND (the defence nuclear safety authority) fulfils this role for the shipments relating to national defence. ASN's action in the field of transport comprises:
– hecking, from the safety aspect, all the stages in the life of a package, from design and manufacture through to maintenance;
– checking compliance with the safety regulations during the shipment and transportation of the packages.

Section 4 of this chapter gives more details on these inspections.

2|2 Protection against malicious acts

The prevention of malicious acts consists in preventing sabotage, losses, disappearances, theft and misappropriation of nuclear materials that could be used to manufacture weapons. In the regulatory framework, the defence and security high officials (HFDS), under the ministers responsible for energy and defence, are the Authority responsible for preventing malicious acts targeting nuclear materials. In practice, it is the HFDS of the ministry in charge of ecology who is delegated this role by the two abovementioned HFDS's.

2|3 Regulation of the other classes of dangerous goods

Regulation of the transport of dangerous goods is monitored by the MTMD (hazardous materials transport mission) of the ministry in charge of ecology and transport. This entity is tasked with ensuring the measures relative to the security of transport of dangerous goods other than class 7 (radioactive) by road, rail and inland waterways. It has a consultative body (CITMD – Interministerial hazardous materials transport committee) that is consulted for its opinion on any draft regulations relative to the transport of dangerous goods by rail, road or inland waterway.

Inspections on the ground are ensured by land transport inspectors attached to the DREALs (Regional directorates for the environment, planning and housing).

For the regulation action to be as consistent as possible, ASN collaborates regularly with the administrations responsible for applying the regulations in their particular sector of activity. The breakdown of ASN's various missions is summarized in the table below.

Table 2: administrations responsible for regulating the mode of transport and the package

Mode of transport	Regulation of mode of transport	Package regulation
Sea	General Directorate for Infrastructure, Transport and the Sea (DGITM) of the Ministry of Ecology, Sustainable Development, Transport and Housing (MEDDTL). ASN assists it with monitoring compliance with the requirements of the international code for the safe carriage transport of irradiated nuclear fuels, plutonium and high level radioactive waste on-board ships (INF code).	The DGITM is competent to regulate packages of dangerous goods in general, and in close coordination with ASN for packages of radioactive materials.
Road, rail, inland waterways	The design rules are defined by the road and traffic safety delegation of the Ministry of Ecology, Sustainable Development, Transport and Housing (MEDDTL).	The General Directorate for Risk Prevention (DGPR) is responsible for regulating packages of dangerous goods in general and in close coordination with ASN for radioactive materials.
Air	The General Directorate for Civil Aviation (DGAC) of the Ministry of Ecology, Sustainable Development, Transport and Housing (MEDDTL).	The DGAC is competent to regulate packages of dangerous goods in general and in close coordination with ASN for packages of radioactive materials.

3 DEVELOPMENT OF THE INTERNATIONAL AND EUROPEAN REGULATIONS RELATIVE TO THE TRANSPORT OF RADIOACTIVE MATERIALS

The international nature of radioactive material transport has given rise to regulations, drafted under the supervision of IAEA (International Atomic Energy Agency), that ensure a high level of safety.

3|1 The different types of package

The degree of safety of the packages of radioactive materials is adapted to the potential danger of the material transported. There are five broad types of packages: excepted packages, industrial packages, type A packages, type B packages and type C packages. These package types are determined according to the characteristics of the transported material, such as the total radiological activity, the specific activity - which corresponds to the level of concentration of the material, its physical-chemical form or the possible presence of fissile radioactive materials that could cause a nuclear chain reaction.

3|1|1 Excepted packages

Excepted packages are used to transport very small quantities of radioactive materials, such as very low activity radiopharmaceuticals. These packages are not subject to any qualification tests. They must nevertheless comply with a number of general specifications, notably with regard to radiation protection, to guarantee that the radiation around the excepted packages remains very low.

3|1|2 Non-fissile industrial or type A packages

Industrial packages are used to transport material with low radioactivity per unit mass. Uranium-containing materials extracted from foreign uranium mines are, for example, transported in France in industrial drums with a capacity of 200 litres loaded into 20-foot containers or conventional rail wagons.

Type A packages are used to transport radioactive materials with low total activity. Type A packages can, for example, be used to transport radioisotopes for medical purposes commonly used in nuclear medicine departments, such as technetium generators.

3|1|3 Fissile and type B packages

Type B packages allow the transport of large quantities of some of the most radioactive materials such as spent fuels, vitrified high-activity long-lived nuclear waste and fresh fuels. Given the level of risk associated with these packages, they are subject to an approval delivered by ASN based on the examination of a safety file. Approximately 60,000 type B packages are transported each year in France, essentially for the nuclear industry and for industrial technical controls, including industrial radiology.

Type A packages and industrial packages containing fissile radioactive materials are also subject to ASN approval.

3|1|4 Type C packages

Type C packages are designed for transporting highly radioactive materials by air. In France there is no approval for type C packages for civil uses.

3|2 Requirements applicable to each type of package

The regulations define safety requirements for each type of package, including tests to assess their robustness.

The regulations thus require that type A packages that contain no fissile materials (such as enriched uranium), be designed to withstand incidents that can occur during handling or storage operations. They must therefore be subjected to the following tests:
– exposure to a severe storm (rainfall reaching 5 cm/hour for at least 1 hour);
– drop test onto an unyielding surface from a height varying according to the mass of the package (maximum 1.20 m);
– compression equivalent to 5 times the weight of the package;
– penetration by dropping a standard bar onto the package from a height of 1 m.

Additional tests are required if the content of the package is in liquid or gaseous form.

Type A packages are not subject to ASN approval: the package design and performance of the tests are the responsibility of the manufacturer. These packages and their safety demonstration files are inspected by the ASN inspectors.

Type B packages, which are used to transport the most dangerous materials, must be designed such that safety is guaranteed, including in the event of transport accident. These accidents are represented by the following tests:
– three consecutive tests:
• a 9 m drop test onto an unyielding surface,
• a 1 m drop onto a spike,
• encircling fire of at least 800 °C for 30 minutes;
– immersion in 15 m deep water for 8 h (200 m water depth for spent fuel).

These tests, which are comparable with automotive industry “crash tests”, have been recommended by the International Atomic Energy Agency (IAEA). They have been designed, firstly to cover 95% of the most severe accidents, and secondly with the aim of being readily reproducible from one country to another. These tests are thus recognized and applied very widely by the IAEA member countries. Their performance is obligatory within the European Union.



Drop test of a packaging intended for the transport of spent fuel



Packaging mock-up undergoing a fire test

3|3 Defining responsibilities in the transport of radioactive materials

The main participants in transport arrangements are the consignor and the carrier.

The consignor is responsible for package safety and accepts its responsibility by way of the dispatch note accompanying the package remitted to the carrier. The carrier is responsible for carriage of the shipment to its destination. Other participants are also involved: the package designer, manufacturer and owner and the carriage commission agent (authorised by the consignor to organise the transport operation).

For a radioactive material shipment to be carried out in satisfactory conditions of safety, a stringent chain of responsibility has to be set up. So, for major transport operations:

– the corresponding packaging must be designed and sized in accordance with conditions of use and the current regulations. The designer must have lodged an ASN-approval application and obtained it;
– the manufacturer must produce packaging in accordance with the description given in the approval;
– the consigner must check that the material is authorised for transport and only use approved, correctly maintained packagings that are suitable for the goods in question, and comply with requirements concerning the mode of transport and the shipment restrictions. The consignor must more particularly carry out the inspections of leak-tightness, dose rate, temperature, contamination, and mark and label the packages. It must also provide the carrier with all the required documents and information;
– the actual transport is organised by the carriage commission agent. The carriage commission agent is responsible for obtaining all the necessary authorisations on behalf of the consignor, and for sending the various notices. He also selects the means of transport, the carrier and the itinerary, in compliance with the regulatory requirements;
– the carrier, usually a specialised company with the necessary authorisations, appropriate vehicles and duly trained drivers, must verify the completeness and availability of the information provided by the consigner, and the good overall condition and correct labelling of the vehicles and packages. It must also verify that the materials to be transported are authorised for transport;
– the consignee, for its part, is under the obligation not to postpone, without vital reason, acceptance of the goods and to verify, after unloading, that the requirements of the corresponding ADR have been satisfied;
– finally, the container owner must set up a maintenance system in conformity with that described in the safety documents and the authorisation certificate.

The transport of some radioactive materials (including packages containing fissile material) is subject to prior notification to ASN and the Ministry of the Interior by the consignor. The notification indicates the materials transported, the packages used, the transport conditions and the contact details of the persons involved. 1,426 notifications were sent to ASN in 2011.

3|4 Monitoring radiation protection around shipments of radioactive materials

The radiation protection of workers and the public around shipments of radioactive materials must be a constant concern.

The general regulations relative to radiation protection provided for by the public health code and by the labour code also apply to the transport of radioactive materials as a nuclear activity in its own right: the public and non-specialised workers must not be exposed to a dose exceeding 1 millisievert (mSv) per year. However, this limit is not intended to be an authorisation to expose the public to up to 1 millisievert (mSv): the regulations provide that any exposure, even low, must be both justified and optimised. These principles, applicable to any nuclear activity, apply particularly to the transport of radioactive materials.

Radiation protection forms the subject of specific requirements in the regulations applicable to the transport of radioactive materials. Thus, for transport by road, the regulations[3] stipulate that the radiation at the surface of the package must not exceed 2 mSv/h (this limit can be increased to 10 mSv/h in the case of exclusive use, where actions near the package are limited). The radiation at the surface of the vehicle must not exceed 2 mSv/h, and must be less than 0.1 mSv/h at a distance of 2 metres from the vehicle. In the case of exclusive use, these limits can be increased to 10 mSv/h on contact with the vehicles, on condition that the vehicle is equipped with an enclosure preventing the access of unauthorised persons, and that operations near the package are restricted (loading and unloading operations between the start and end of shipment are prohibited).

Assuming that a transport vehicle reaches the limit of 0.1 mSv/h at 2 metres, a person would have to spend 10 hours without interruption at a distance of 2 metres from the vehicle for the radiation dose received to reach the annual public exposure limit.

These limits are supplemented by requirements relative to the organisation of radiation protection within companies. The transport stakeholders must establish a radiological protection programme that integrates the measures taken to optimise human exposure. Training is a key factor in the radiological protection programmes.

This training is also required by the regulations. All the stakeholders in the transport chain must thus be trained and made aware of the nature of the risks associated with radiation so that they can protect themselves and others against them.

3|5 Regulation of the safety of transport operations within the bounds of nuclear facilities

Dangerous goods transport operations can take place on the private roads of nuclear sites, in what are referred to as "on-site transport operations". Such operations are not subject to the regulations governing the transport of dangerous goods, which only apply on public highways.

On-site radioactive material transport operations are currently governed on nuclear sites by "internal transport rules" specific to each site.

ASN thus plans reinforcing, in the framework of the "BNI" order published on 7 February 2012 (see chapter 3), the legal basis of these rule by demanding their integration in the baseline safety standard of the basic nuclear installations. The on-site transport of dangerous goods presents the same risks and inconveniences as the transport of dangerous goods on the public highway. The safety of transport must be overseen with the same rigour as for any other risk or inconvenience present within the bounds of the BNI.

3|6 Public information in the field of transport

Order no.2012-6 of 5 January 2012 which codifies Act no.2006-686 of 13 June 2006 relative to the security and transparency in the nuclear field, extends the public information obligations to those in charge of nuclear activities. It is Article L. 125-10 that sets the threshold beyond which the person responsible for transport must communicate the information requested by a citizen, by reclassification of the provisions of decree 2011-1844 of 9 December 2011.

The thresholds are defined as being those *"above which, in application of the international conventions and regulations governing the transport of dangerous goods, of the code of transport and of the texts taken for their application, the transport of radioactive materials is subject to the delivery – by ASN or by a foreign Authority competent in the field of radioactive material transport – of an approval of the transport package design or a shipment approval, including under special arrangement"*. Any citizen can therefore now ask the persons in charge of transport for information on the risks presented by the transport operations referred to in the decree.

A person to whom a nuclear licensee or transport supervisor has refused to communicate information, can refer the matter to the CADA (Committee of access to administrative documents), instituted by Article 20 of the Act of 1978, for its opinion. The matter must be referred to the CADA prior to any legal action. Disputes relative to communication refusals can then be brought before the administrative jurisdictions, even if they are between two private individuals.

2. ADR: European Agreement concerning the International Carriage of Dangerous Goods by Road, concluded in Geneva on 30 September 1957, including the amendments in force on 1 January 2011.

4 ASN ACTION IN THE TRANSPORT OF RADIOACTIVE MATERIALS

4|1 Delivery of approval certificates and shipment approvals

To verify that type B packages and packages containing fissile materials satisfy all the regulatory requirements, ASN calls upon the IRSN (Institute of Radiation Protection and Nuclear Safety) to appraise the file demonstrating the safety of the package provided by the manufacturer. ASN takes the decision to deliver an approval certificate on the basis of this technical examination, possibly combined with requests for further information to be brought to the safety file before the next approval renewal deadline.

In some cases the IRSN appraisal is supplemented by a meeting of the Advisory committee of experts in the transport of radioactive materials (GPT). The opinions of the Advisory committees are always published on the ASN website. The GPT, for example, met twice in 2011 to examine new package concepts (TN833 and TN843 designed by the company TN International).

These approval certificates are usually issued for a period of a few years. At present, about a hundred approval applications per year are lodged with ASN by the manufacturers. The approval certificate specifies the package manufacturing, operating and maintenance conditions.

The approval certificate is often issued for a package design independently of the transport operation, strictly speaking, for which no prior notification of ASN is generally required, but which may involve security checks (physical protection of materials under the control of the Defence and Security Executive Officer at the Ministry for Ecology, Sustainable Development, Transport and Housing).

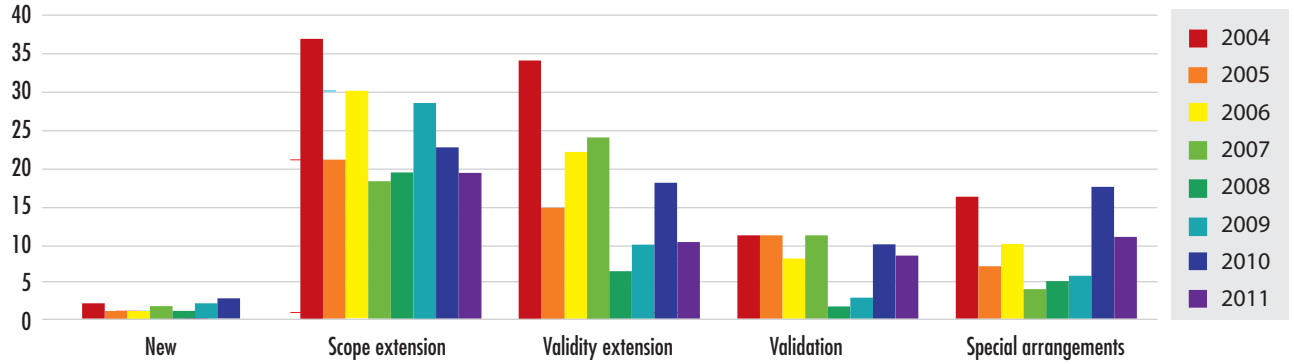
When the conditions required by the regulations for the consignment of radioactive materials with regard to the content, the package design or its shipment are not satisfied in full, the shipment can exceptionally be approved under special arrangement. The application must demonstrate at least equivalent conditions of safety in transport to compensate for the noncompliance with certain "standard" requirements.

In the case of certificates issued abroad, the international regulations provide for their recognition (validation). Validation can be indicated by endorsement on the original certificate or by the delivery of a separate approval by the competent Authority of the country in which shipment takes place.

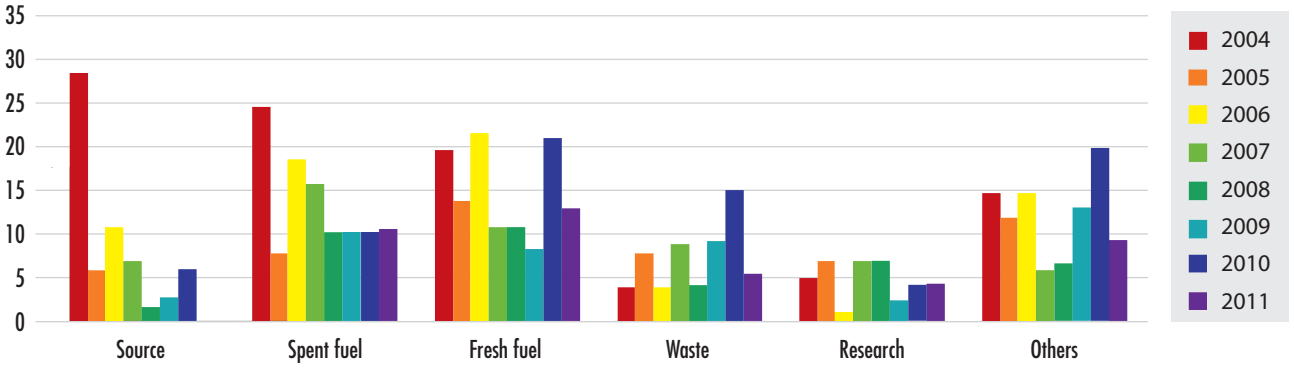
ASN delivered 50 approval certificates in 2011, for which the breakdown by type is shown in graph 1.

The breakdown and nature of the transport operations concerned by these certificates in 2011 are shown in graph 2.

Graph 1: breakdown of the number of approvals according to type



Graph 2: breakdown of the number of approvals according to their content



Finally, in May 2009, ASN published an applicant's guide for approval of shipments and package designs or radioactive materials for civil purposes transported on the public highway. The guide presents ASN's recommendations to the applicants, to facilitate reviewing of the package approval applications and of the shipment approvals for the transport of radioactive materials. It also specifies how the safety cases are to be transmitted to ASN and to IRSN, their structure, the contents of the draft approval certificate, the minimum processing times, the operating experience feedback from previous reviews and the requirements to be met if a package design or material is modified. This guide was translated into English in 2010, for distribution to some of the European Union competent authorities for transport issues. An update of this guide is planned for the beginning of 2012.



4|2 Monitoring all the stages in the life of a package and its shipment conditions

4|2|1 Packaging manufacturing inspections

The manufacture of transport packaging is subject to the regulations for the transport of radioactive materials. In accordance with the regulatory requirements, each manufacturer of an approved package design must be able to provide ASN with all the elements for ensuring the conformity of packaging manufacture with the package design specifications approved by ASN. These specifications are defined in the safety file specific to each packaging, which represents the demonstration of safety for the package design. The safety file sets the objectives in terms of packaging design. It contains all the elements relative firstly to the requirements concerning the packaging and its content, and secondly to the tests that can be required to demonstrate the safety of the package design.

The role of ASN is to check that the manufacturing specifications and the inspection procedures match up to the design requirements defined in the safety file.

The quality assurance system is applied and conformity with the safety file specifications is ensured in all the operations from procurement through to final inspection.

ASN inspected the manufacture of three package designs in 2011:

– CTB: used for the transport of sources,
– TN 112 : used for the transport of spent fuel,
– 30B cylinders: used with an overpack for the transport of uranium hexafluoride.

The follow-up letters to these inspections are available on the ASN web site.

During these inspections, ASN checks the quality assurance system implemented for the production of a package from the design data, and for tracing in-process inspections and any deviations.

It also visits the manufacturing shops to check the package component storage conditions and the conformity of the various manufacturing operations (welding, assembly, etc.).



ASN inspects the in-process inspection of a 30B cylinder on 28 July 2011 (Socorom site in Romania)



Thermal test on a transport packaging

When subcontractors are used, ASN checks the monitoring of manufacturing by the manufacturer in charge and intervenes directly on the manufacturing sites, which are sometimes located in foreign countries. Thus, for the inspection of the manufacture of the 30B cylinders, ASN inspected a production factory in Romania.

In parallel with these package manufacturing inspections, ASN inspects the manufacture of the specimens used for the regulatory drop tests and fire tests. The objectives are the same as for the series production model, because the specimens must be representative and comply with the minimum requirements indicated in the mock-up manufacturing file, which will determine the minimum characteristics of the actual packaging to be manufactured.

ASN thus inspected the manufacture of two specimens in 2011:
– Marianne: used for the transport of irradiated targets,
– DN30: overpack for the transport of 30B cylinders filled with uranium hexafluoride.

4|2|2 Type B package maintenance inspections

The consigner or user of a package filled with radioactive material must be ready to prove to ASN that this package is periodically inspected and, if necessary, repaired and maintained in good condition such that it continues to satisfy all the relevant requirements and specifications of its safety file and approval certificate, even after repeated use. For type B packages, the ASN inspections concern the following maintenance activities, for example:
– the periodic inspections of the components of the containment envelope (screws, bolts, welds, seals, etc.) ;
– the periodic inspections of the securing and handling components;
– the frequency of replacement of the package components which must take account of any reduction in performance due to wear, corrosion, aging, etc.

In 2011, ASN carried out three targeted inspections on the maintenance of gamma ray projectors, the maintenance of packages intended for the transport of fuel and waste from research activities, and the maintenance of the cylinders intended for the transport of uranium hexafluoride. This latter inspection was carried out further to three events concerning the package closing system.

4|2|3 Oversight of packages not requiring approval

For the packages that do not require ASN approval (see chapter 3), the consigner must be able, at the request of ASN, to provide the documents proving that the package design complies with the applicable requirements. A certificate attesting full compliance with the design specifications for each package must be held at the disposal of ASN.

The various inspections performed reveal that these elements are often unavailable or incomplete on the sites of the entities concerned (designer, manufacturer, distributor, owner, consigner, companies performing the regulatory drop tests, package maintenance, etc.). The areas for improvement concern the following points in particular:
– the description of the authorised contents per type of package;
– demonstration that there has been no loss or dispersion of the radioactive content under normal transport conditions;

UNDERSTAND

Feedback from reactive inspection of the UX-30 packaging on 20 April 2011

The UX-30 overpack is an American designed packaging for the transport of uranium hexafluoride contained in a 30B cylinder.

It is made up of two half-shells joined together by a ball-lock closing system.

Further to the notification of three events involving disengagement of the ball-locks, ASN conducted a UX-30 shell maintenance inspection. It visited a packaging maintenance workshop belonging to the AREVA group to verify the conditions of performance of the maintenance operations and the conformity of the shop procedures with the maintenance manual provided in the safety file of the UX-30 overpack. ASN also visited two consignors to check how the periodicity of maintenance is managed.



These inspections and the three incidents revealed deficiencies in AREVA's organisation with regard to:
– *the tracking of changes in the requirements of the UX-30 safety file;*
– *management of event notifications between the different entities of the group;*
– *management of maintenance dates of packagings currently in carriage;*
– *taking incidents into account in the maintenance operations.*

Further to these findings, ASN asked the AREVA group to implement a plan of action. ASN is currently assessing the results on site.



ASN inspection prior to maritime shipment of empty packagings for the transport of radioactive waste – Port of Cherbourg 2011

– compliance with the regulatory radiation protection requirements;
– the representativeness of the tests performed.

ASN's website (*www.asn.fr*) thus provides a guide to the structure and minimum content of the safety files to demonstrate that packages not subject to approval do comply with all applicable requirements, and indicating the minimum content of a certificate attesting conformity of package design with the regulations.

4|2|4 Oversight of the shipment of packages of radioactive materials

ASN devotes more than half of its transport inspections to the checking of shipments and carriers, at both regional and national level.

During these inspections, the checks concern all the regulatory requirements incumbent upon each stakeholder in the transport process, grouped around two topics: the organisation of the company and the procedures or measures implemented to verify conformity of the transport process with the regulations.

In 2011, ASN carried out 100 inspections in radioactive material transport (all sectors considered).

Among the observations or findings formulated further to the inspections, the most frequent are about quality assurance, documentation, or compliance with procedures and established practices as indicated in the approval certificates, safety files or, more generally, regulatory texts.

ASN's inspections reveal deficiencies in the knowledge of the regulations and responsibilities on the part of the transport stakeholders in small-scale nuclear activities. To remedy this shortcoming, ASN organised information seminars in 2010 and 2011. Control of subcontracting is a constant difficulty, insofar as the consignors tend too often to rely on the carrier, whereas the main responsibilities in the transport operation are those of the consignor.

4|2|5 Analysis of the incidents

By listing and analysing the various transport incidents, ASN can identify the problems faced by the transport operators and the possible safety risks, in order to improve current practices and identify any needs for changes in the regulations.

Any deviation from the regulations or the safety files relative to the transport of radioactive materials must be notified to ASN in accordance with the events notification guide, as required by Article 7 of the TMD[3] order. This events notification guide was communicated by letter to the various stakeholders in the transport of radioactive materials on 24 October 2005 and can be consulted on the ASN web site (*www.asn.fr*). It defines the various conditions of notification and classification of transport events on the INES scale. Apart from the notification, a detailed incident report must be sent to ASN within two months.

Events declared in 2011

In 2011, 40 events rated level 0, and 3 events rated level 1 on the INES scale were notified to ASN in 2011. These figures are lower than for 2010. Graph 3 shows the trend for the number of events notified since 2001.

The drop in the number of events observed in 2011 can essentially be explained by a change in the recording of events concerning impacts on radiopharmaceutical packages in airports . To facilitate incident analysis, the corresponding notification criterion was adjusted so that only significant impacts that could affect the safety of the package are taken into account. Minor impacts having no consequences must now simply be traced, and no longer notified to ASN.

Areas of activity concerned by these events

More than half of the events are notified by the industrial stakeholders in the nuclear cycle (EDF and AREVA in particular). About 20% of the events concern the radioactive pharmaceutical products shipped by Cis Bio.

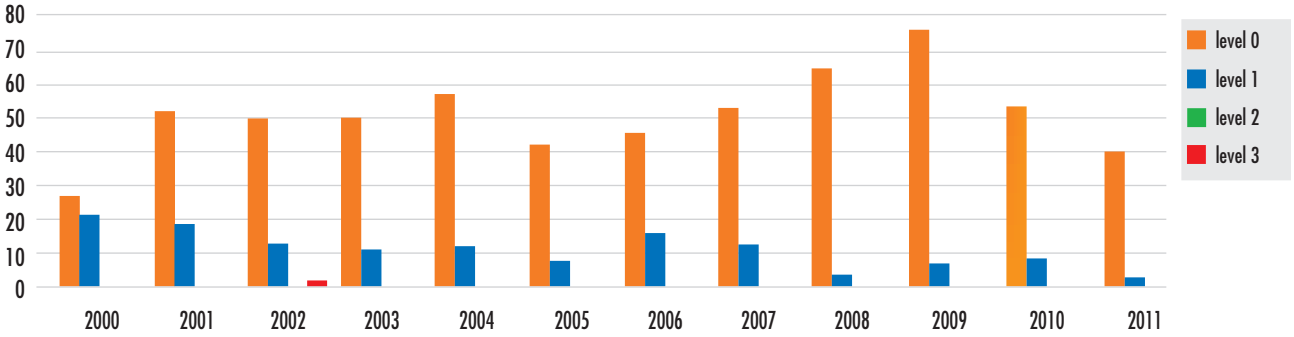
Very few transport-related event notifications are made by the conventional industry and research sectors. Analysis of the statistics nevertheless shows that this low notification level is probably due to small-scale nuclear activity professionals failing to notify events, usually due to a lack of knowledge of the events notification process.

The package contents concerned by the events notifications are extremely varied: radionuclides for medical uses, contaminated material, fuel, empty packaging, etc. Graph 4 shows the breakdown of notified transport events by content and mode of transport. It can be seen that few events concern the transport of nuclear fuel or waste.

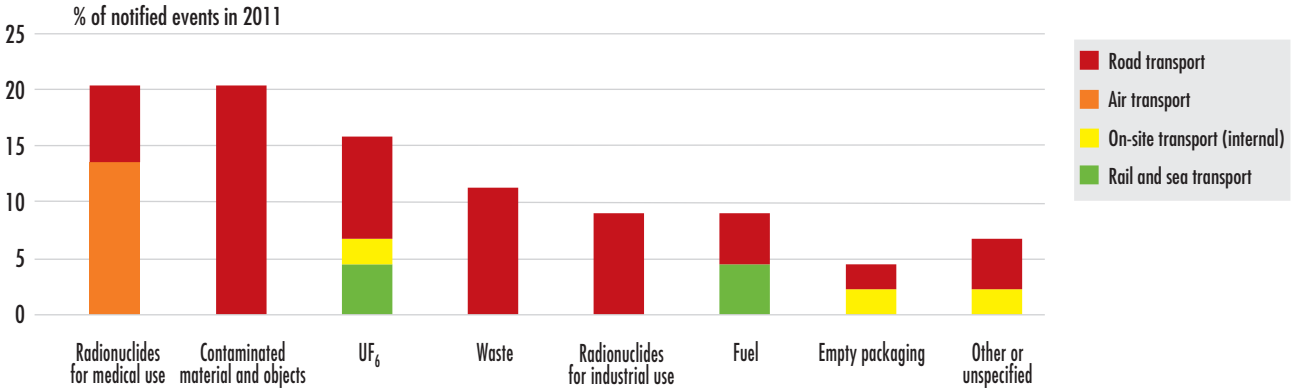
Road transport accounts for the majority of the notified events. The proportion of events concerning air transport, about 15%

3. Order of 29 May 2009 concerning the transport of dangerous goods by land, known as the "TMD order".

Graph 3: trend for the number of radioactive material transport incidents or accidents declared between 2000 and 2011



Graph 4: breakdown of notified transport events by content and mode of transport



in 2011, reflects greater awareness of the airport companies that detect deviations and are more familiar with the notification process. These events essentially involve package impacts or falls during handling, or temporary or definitive losses in transit. Few events involve rail or maritime transport. These figures are in agreement with transport movements in France.



ASN inspection of transport package maintenance instructions

Causes of events

The events notified in 2011 chiefly concern:
- losses of medical packages during transits in airports (temporary or definitive loss);
- insufficient or deficient securing of packages of material transported for EDF;
- falls or impacts during the handling of medical packages in airports;
- noncompliance with the package design approval certificates or noncompliance with the packaging maintenance manuals declared by the BNI licensees;
- exceeding the contamination and radiation intensity limits;
- noncompliance with the regulatory requirements of the applicable orders (e.g. the TMD order for land transport).

The distribution of transport events per domain is illustrated in the above figure.

In 2011 one can see an increase in the events associated with deviations in application of the requirements of the approval certificates and the utilisation or maintenance manuals. Particular attention will be focused on this point in the ASN inspections concerning the transport of radioactive materials in 2012.

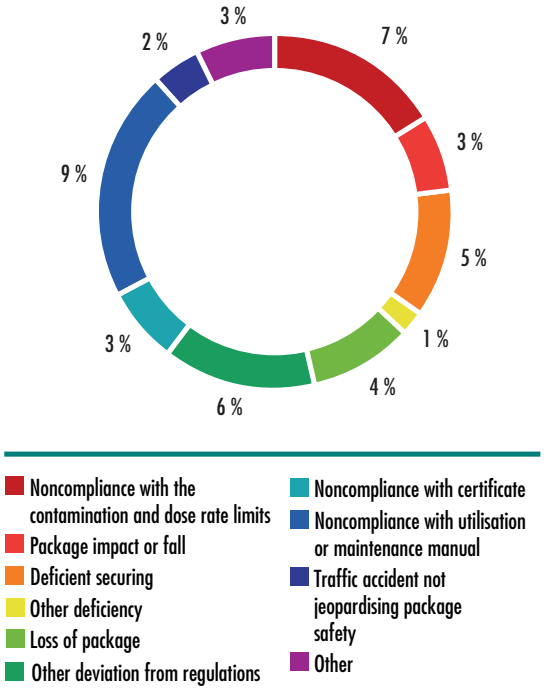
UNDERSTAND

Deviations: noncompliance with certificates or utilisation manuals

The deviations in application of the approval certificates, utilisation or maintenance manuals observed in 2011 were analysed in depth by ASN. ASN considers that any deviation of this type, whatever the associated implications for safety, must not be trivialised. The persons responsible for transport operations must remain in control of all the safety requirements relating to transport. Furthermore, experience feedback should enable the recurrence of such deviations to be prevented. By way of example, in 2011 ASN noted:

- *insufficient drying during packaging maintenance, resulting in water remaining in the packaging. This was detected before filling the packaging, which was intended to accommodate fuel. Ensuring the absence of water in fuel packaging is an important factor in demonstrating safety relative to the criticality risk (checking there is no onset of spontaneous nuclear reactions) and relative to the absence of production of hydrogenated gas by radiolysis. Unauthorised water in a contaminated tooling container could lead to dissemination of the contamination of the transported objects or corrosion of the equipment.*
- *one event relating to noncompliance with the scheduled maintenance date for a package. The packagings must undergo periodic maintenance with obligatory replacement of seal, verification of the condition of certain parts, etc. Failure to perform the packaging periodic maintenance inspections means that the design-basis behaviour cannot be guaranteed, in the event of an accident situation for example. ASN was particularly attentive to the monitoring of utilisation and maintenance manuals in its inspections in 2011, and will continue to focus on this topic in 2012.*

Graph 5: distribution of significant events notified in 2011



4|3 Participation in international relations in the transport sector

The international regulations were drafted and are implemented as a result of fruitful exchanges between countries. ASN places these exchanges in a process of continuous progress in the level of safety of radioactive material shipments, and encourages exchanges with its counterparts in other countries.

4|3|1 Participation in the work of the IAEA

ASN represents France on the Transport Safety Standards Committee (TRANSSC) which, under the supervision of IAEA, comprises experts from all countries in the field of radioactive material transport and drafted the document (TS-R-1) which underpins the regulations applicable to the transport of radioactive materials. 2011 saw the conclusion of the revising of regulation TS-R-1, which began in 2008. The new edition, planned for 2012, integrates modifications in the objective of harmonising practices with the UNO recommendations for the transport of dangerous goods. The most important changes concern criticality safety, with the modification of the configurations of materials classified as excepted fissile materials, materials for which no demonstration of criticality safety is required at present, subject to compliance with the weight limits per package and per consignment. These modifications could more particularly have an impact on the transport of waste containing fissile radionuclides, which will become subject to safety demonstration requirements

4|3|2 Participation in the work of the European Association of Competent Authorities on transport

The European Association of Competent Authorities in the transport of radioactive materials (EACA) was created in December 2008. Its purpose is to promote the harmonisation of practices in the regulation of the safety of transport of radioactive materials, and to encourage exchanges and

experience feedback between the various Authorities. The plenary meeting of May 2011, for example, provided the opportunity to work on the finalising of the content of a European inspection guide, which can be used by the inspectors of all the European Authorities. It also led to discussions on the regulations implemented by the member countries regarding the detection of radioactivity in consumer goods during their transport, a subject that turned out to be highly topical after March 2011 and the Fukushima disaster. These discussions concluded that is was necessary to rapidly develop a harmonised approach to the development of a regulation policy and the installation of detection devices at borders. Further to this, a letter setting forth a joint position of the EACA members was sent to the European Commission.

4|3|3 Bilateral relations with ASN's foreign counterparts

ASN devotes considerable effort to maintaining close ties with the competent authorities of the countries concerned by the numerous shipments to and from France. These include Belgium, the United Kingdom, Germany and the USA in particular.

Belgium

For its production of electricity from nuclear power, Belgium uses French designed containers for fuel cycle shipment. In order to harmonise practices and achieve progress in the safety of these shipments, ASN and the competent Belgium authority (Belgian Federal Nuclear Regulating Agency - AFCN) regularly exchange know-how and experiences.

Since 2005, an annual exchange meeting is held by ASN and AFCN in order to take a closer look at the safety analysis reports for the French package designs validated in Belgium. The AFCN added to these exchanges in 2011 by presenting its policy of disciplinary action for transport offenses and the results of the audits conducted with the French manufacturers of packages used in Belgium.

The United Kingdom

France and the United Kingdom use radioactive materials for the same civil applications, such as the nuclear generation of electricity, reprocessing, and for medical purposes. Consequently, ASN and the competent British authority (Department for transport – DfT) have similar levels of competence. Both France and the United Kingdom also apply the same regulations covering radioactive material transport. Both countries also underwent a review coordinated by the IAEA, demonstrating the high level of competence of the two authorities with regard to radioactive material transport, thus enhancing their mutual trust and confidence.

Against this backdrop, ASN and the DfT signed a memorandum of understanding on 24 February 2006, for the mutual recognition of the approval certificates confirming the safety of radioactive material transport.

Having successfully cooperated on the Memorandum of Understanding signed in February 2006, ASN and the DfT extended their cooperation on the following subjects, through an agreement concluded on 27 February 2008:
– licensing procedures;
– inspections;
– emergency procedures;
– guides for domestic and international transport of radioactive materials;
– radioactive material transport standards;
– quality assurance systems.

Since 2008, two discussion meetings are organised annually between ASN and the DfT, to enable them to work more closely together, in particular on reviewing the safety files relative to the package designs used in the United Kingdom and France.

Germany

The French and German nuclear authorities have decided to regularly meet to discuss certain technical files. Large quantities of shipments cross the Franco-German border. Thought is being given to implementing a Memorandum of Understanding for approval recognition, along the lines of that concluded by ASN with the British regulator. During the investigation of the safety file relative to package DN 30 for the transport of uranium hexafluoride, the drop tests of the package were carried out in Germany in August 2011 in the presence of both the French and German Authorities.

United States

Recently, on the occasion of a symposium at the International Conference On Nuclear Engineering, the American nuclear regulator (Nuclear Regulatory Commission - NRC), stated that in his opinion, the transport sector should follow the example of international technical cooperation on reactors. Subsequently, the American authorities (NRC and US Department of Transportation - DOT) contacted ASN to set up collaboration on subjects of common interest. Without waiting for this to be formalised, a close collaboration between the French and American Authorities was initiated to draw the lessons from the transport events observed on the UX-30 packaging used in the USA and Europe, which are mentioned in paragraph 4|2|2. The failures observed with this package design had effectively already been detected in the USA.

5 ASN'S OPINION ON THE SAFETY OF TRANSPORT OF RADIOACTIVE MATERIALS AND PROSPECTS

Transport safety management within the AREVA group

Experience feedback from certain inspections, and the analysis of significant events occurring in the AREVA group, has evidenced deficiencies in the overall system of transport safety management within the group (see box in paragraph 4|2|2). It has been observed more specifically that the regulatory responsibilities (shipment, transport, etc.), the mutual obligations in the case of internal contracting, especially with regard to packaging maintenance and the tracking of packaging design modifications, are poorly defined in the group's procedures. This situation often leads to a dilution of responsibilities (role of the designer, manufacturer, consignor, maintenance organisation). In this respect, ASN considers that the AREVA group entities must take corrective action and ensure better mutual coordination in applying a quality assurance system to transport operations as required by the regulations.

The AREVA group undertook to implement corrective actions during 2011 in response to these various ASN findings.

The AREVA group will be subject to inspections in the area of transport organisation in 2012, and subcontracted activities in particular.

The increase in safety requirements relating to on-site transport operations performed within the bounds of the BNIs

As part of the revision of the technical regulations for BNIs, ASN has planned to tighten the regulatory framework and the requirements concerning on-site transport operations

TO BE NOTED IN 2011

ASN gears itself to meet the public information demands concerning the last shipment of vitrified waste to Germany

The last convoy returning vitrified waste was to Germany made its journey at the end of 2011, in compliance with the intergovernmental agreement signed between France and Germany in October 2008. The convoy comprised eleven CASTOR HAW 28M packages approved by the German competent authority and validated by ASN.

ASN performed an inspection to verify compliance with the certificate of approval, the safety file and the regulatory requirements concerning the consignment, and an inspection to verify compliance with the radiation protection limits around the transport units as provided for by the regulations governing the transport of radioactive materials by rail (RID) and by road (ADR).

During the inspection at the Valognes rail terminal, equivalent dose rate measurements were taken around nine packages by experts from the IRSN and ACRO (Association for the Control of Radioactivity in the West of France), both mandated by ASN. All the gamma radiation and neutron measurements gave values below 0.2 millisievert per hour (0.2 mSv/h) in contact with the canopy, and therefore below the regulatory limit of 2 mSv/h in contact with the wagon. The equivalent dose rates measured by IRSN and ACRO at a distance of 2 metres from the wagon were below 0.073 mSv/h, and therefore below the regulatory limit of 0.1 mSv/h at a distance of 2 metres from the wagon.

In its role as consignor, AREVA NC was inspected to ensure it fulfilled its obligations with regard to material-package compatibility, the quality assurance system implemented, operator training, and pre-shipment checks.



Dose rate measurements made by IRSN and ACRO in the presence of the "STOP EPR, ni à Penly ni ailleurs" group



performed within the bounds of the BNIs. The nuclear sites concerned must take prompt action to plan the necessary forthcoming modifications to the existing baseline safety standards. The requirements will be specified in regulatory decisions in 2012, and an ASN guide should help clarify the regulatory requirements.

Monitoring the projects to develop European regulations concerning radioactive material carriers

With regard to regulatory matters, 2011 saw the European Commission adopt a draft regulation aiming at instituting a system for registering radioactive material carriers. This unique registration system, if ratified, will replace the national notification and licensing procedures stemming from application of the Euratom 96/29 directive and transcribed in France by Article R.1333-44 of the public health code. The Council of European Ministers has not yet given its decision on this regulation. In 2012, ASN will contribute to the European discussions in this area and the development of a French stance on the draft regulation.

Continuation of inspections of packages that are not subject to ASN approval

Compliance with regulatory requirements with regard to the transport of packages that are not subject to approval (see point 3) is still insufficient in ASN's opinion. Back in 2007 ASN asked for them to be brought into compliance with the regulations before the end of 2010. ASN's inspections reveal shortcomings in the content of the package design conformity justification file, and sometimes its complete absence. These inspections must still be continued, and in 2012 ASN will focus on an additional inspection of the organisations that assist the packaging suppliers in preparing the package conformity files and the certificates.

Continuation of inspections in the manufacture and maintenance of transport packages subject to ASN approval

The design of transport packages requiring ASN approval is inspected in depth during the examination of the approval request. Once ascertained that the package design complies with the regulatory requirements, its manufacture and subsequent routine maintenance in accordance with the requirements of its safety file must be verified. ASN has planned to maintain a large number if inspections in this area in 2012, particularly with regard to the maintenance of the oldest packagings.

Improvement in emergency situation preparedness and experience feedback from the Fukushima accident in the field of transport

ASN has led an initiative to draw up a guide to the drafting of emergency plans intended for the entities responsible for transport. The aim of this guide, which could be published in 2012, is to harmonise and improve the practices of those responsible for transport in this area.

The Ministry of the Interior and the major stakeholders of the French nuclear industry are moreover looking into the management of emergency situations resulting from a transport accident to improve the national response should such an event arise.

ASN also wishes to draw all the possible lessons that the Fukushima accident can bring in the field of transport. The question of how to better evaluate the margins existing in the design of transport packagings will be addressed in 2012, with a view to preventing the consequences of any type of event, even highly improbable, that could affect them, whether on the public highway or within the BNIs.

Transparency in the area of transport

Growing public and media interest in the transport of radioactive materials was observed for several international shipments organised in 2011. Consequently, ASN has made it a priority to develop the information made available to the public concerning the regulating of the safety of transport of radioactive materials. An educational file was posted on ASN's web site *www.asn.fr* at the end of 2011. At the end of the first quarter of 2012, ASN will also be publishing a new issue of its review *Contrôle*, addressing the subject of transport safety.

ASN will ensure that article L.125-10 of the Order 2012-6 of 5 January 2012, which codifies Act 2006-686 of 13 June 2006 relative to security and transparency in the nuclear field, which reclassifies the provisions of Decree 2011-1844 of 9 December 2011, is applied.

NUCLEAR POWER PLANTS

CHAPTER 12

1 OVERVIEW OF NUCLEAR POWER PLANTS 317

1.1 Description of an NPP
1.1.1 General description of a pressurised water reactor
1.1.2 Core, fuel and fuel management
1.1.3 Primary system and secondary systems
1.1.4 Cooling systems
1.1.5 Reactor containment building
1.1.6 The main auxiliary and safeguard systems
1.1.7 Other safety-related systems

1.2 Operation of a nuclear power plant
1.2.1 EDF organisational structures
1.2.2 ASN review of operating documents
1.2.3 ASN oversight of reactor outages

2 THE MAJOR NUCLEAR SAFETY AND RADIATION PROTECTION ISSUES 324

2.1 Human and organisational factors
2.1.1 Workers
2.1.2 Nuclear safety as related to organisational and human factors
2.1.3 Management of subcontracted activities

2.2 Continuous nuclear safety improvements
2.2.1 Oversight of anomaly correction
2.2.2 Examination of events and operating experience feedback
2.2.3 Periodic safety reviews
2.2.4 Approving modifications to equipment and operating rules

2.3 Integration of nuclear power plant (NPP) ageing
2.3.1 The age of the French NPPs in operation
2.3.2 Main factors in ageing
2.3.3 How EDF manages equipment ageing
2.3.4 Examination of extended operation

2.4 EPR reactors
2.4.1 The steps up to commissioning of the Flamanville 3 reactor
2.4.2 Construction oversight in 2011
2.4.3 Cooperation with foreign nuclear regulators

2.5 The reactors of the future: initiating discussions on generation IV safety

2.6 Reliance on nuclear safety and radiation protection research

3 NUCLEAR SAFETY 338

3.1 Operation and control
3.1.1 Operation under normal conditions: ensuring compliance with baseline safety standards and authorising changes to documents
3.1.2 Examination of incident or accident operating rules

3.2 Maintenance and testing
3.2.1 Regulating maintenance practices
3.2.2 Examining the qualification of scientific applications
3.2.3 Guaranteeing the use of efficient control methods
3.2.4 Authorising periodic test programmes

3.3 Fuel
3.3.1 Controlling in-pile fuel management changes
3.3.2 Monitoring fuel status in the reactor

3|4 In-depth oversight of primary and secondary systems
3|4|1 Monitoring and checking the systems
3|4|2 Monitoring of nickel-based alloy zones
3|4|3 Checking reactor vessel strength
3|4|4 Monitoring steam generator maintenance and replacement

3|5 Checking containment conformity

3|6 Application of pressure equipment rules and regulations

3|7 Ensuring hazard protection
3|7|1 Prevention of seismic risks
3|7|2 Drafting flood prevention rules
3|7|3 Preventing heatwave and drought risks
3|7|4 Taking account of the fire risk
3|7|5 Checking that the explosion risk has been considered

4 RADIATION PROTECTION, PROTECTION OF WORKERS AND THE ENVIRONMENT 349

4|1 Oversight of occupational radiation protection
4|1|1 Oversight of radiation protection in operating NPPs
4|1|2 Radiation protection requirements for NPPs in the construction phase

4|2 Oversight of application of labour legislation in NPPs

4|3 Controlling the environmental and health impacts of NPPs
4|3|1 Reviewing discharge requirements
4|3|2 Oversight of waste management
4|3|3 Increasing protection against other risks and forms of pollution

5 CURRENT STATUS OF NUCLEAR SAFETY AND RADIATION PROTECTION 352

5|1 The NPPs inspection campaign and complementary safety assessments following the Fukushima accident

5|2 Monitoring the construction of the Flamanville 3 EPR reactor

5|3 Examination of the Penly 3 creation authorisation decree

5|4 Examination of the safety options for the ATMEA 1 reactor project

5|5 Modification of the Blayais 3-4 creation authorisation decree

5|6 Continued operation of the nuclear power plants

5|7 Notable findings relating to oversight of pressure equipment

5|8 Notable findings relating to occupational health and safety inspections

5|9 Notable findings relating to radiation protection of personnel

5|10 Notable findings relating to the environmental impacts of NPPs and discharges

6 ASSESSMENTS 361

Reactors in operation
6|1 Evaluating the head offices and overall performance of NPPs
6|1|1 Evaluating nuclear safety
6|1|2 Evaluating human and organisational measures
6|1|3 Evaluating and analysing radiation protection
6|1|4 Evaluating health and safety, professional relations and the quality of employment in the nuclear power plants
6|1|5 Evaluating and analysing environmental protection measures
6|1|6 Analysing statistics on significant events

6|2 Evaluation of each site

New reactors
6|3 Evaluating EPR Flamanville 3 reactor construction

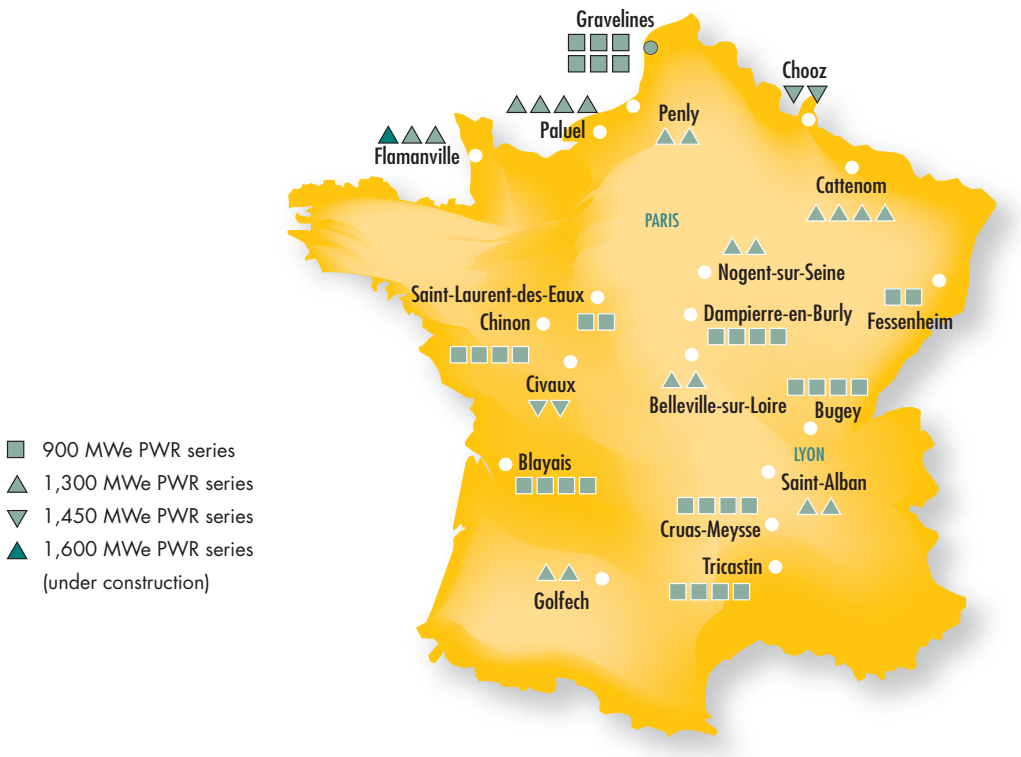
7 OUTLOOK 375

Regulating nuclear power plants (NPPs) is ASN's historical mission. The reactors in these plants, used to produce electricity, lie at the heart of the nuclear industry in France. Many other nuclear installations described in the other chapters of this report produce the fuel intended for these plants or reprocess it, are used for disposal of the waste produced by them or are used to study the physical phenomena related to reactor operation and safety. The reactors are currently operated by *Électricité de France* (EDF), which calls on the services of some 500 companies employing around 20,000 people for reactor maintenance. The standardisation of French plants, with a large number of technically similar reactors, justifies the generic presentation in this chapter.

Based on its extensive experience, ASN requires the highest of standards for regulating NPPs and adapts the standards continuously in the light of new knowledge. Ensuring control and regulation of the reactors, both operating currently and planned for the future, is the daily task of around 200 members of ASN staff working in the Nuclear Power Plant Department (DCN) and the Nuclear Pressure Equipment Department (DEP), and of the staff of the regional divisions. ASN also has the support of some 200 experts from the Institute for Radiation Protection and Nuclear Safety (IRSN). The ASN Commission meets regularly with the CEO of EDF to discuss nuclear safety and radiation protection issues. To be more effective, ASN has developed an integrated vision of control and regulation that covers not only the design of new installations, modifications, integration of feedback on events or complex maintenance problems but also, via the expertise its inspectors have built up, human and organisational factors of radiation protection and safety of workers, as well as the application of labour legislation. Lastly, ASN completes its judgement by examining the links between safety and competitiveness. This integrated approach allows ASN to develop a finer appreciation and determine its position each year with regard to the current status of nuclear safety and radiation protection in NPPs.

1 OVERVIEW OF NUCLEAR POWER PLANTS

Location of the nuclear power reactors in France



The nineteen French nuclear power plants (NPPs) currently in operation are appreciably the same. They each comprise from two to six PWRs, which in total amounts to 58 reactors. For each of them, the nuclear part was designed and built by Framatome, with EDF acting as industrial architect.

The thirty-four 900 MWe reactors can be split into:
– the CP0 series, consisting of the four reactors at Bugey (reactors 2 to 5) and two reactors at Fessenheim;
– the CPY reactors, consisting of another twenty-eight 900 MWe reactors, that can also be subdivided into CP1 (eighteen reactors at Le Blayais, Dampierre-en-Burly, Gravelines and Tricastin) and CP2 (ten reactors at Chinon, Cruas-Meysse and Saint-Laurent-des-Eaux).

The twenty 1,300 MWe reactors comprise:
– the P4 reactors, consisting of the eight reactors at Flamanville, Paluel and Saint-Alban;
– the P'4 reactors, consisting of the twelve reactors at Belleville-sur-Loire, Cattenom, Golfech, Nogent-sur-Seine and Penly.

Finally, the N4 reactors comprise four 1,450 MWe reactors, two on the Chooz NPP and two on the Civaux NPP.

Despite the overall standardisation of the French nuclear power reactors, certain technological innovations have been introduced as design and construction of plants have developed.

The CPY reactors differ from the Bugey and Fessenheim reactors (CP0) in building design and the addition of an intermediate cooling system between that used for containment spraying in the event of an accident and that containing heat sink water, along with more flexible operation.

The design of the 1,300 MWe reactor systems, core protection devices and plant buildings differs considerably from the CPY reactors. The power increase means a primary system with four steam generators (SG), so that the cooling capacity is greater than for the 900 MWe reactors equipped with three steam generators.

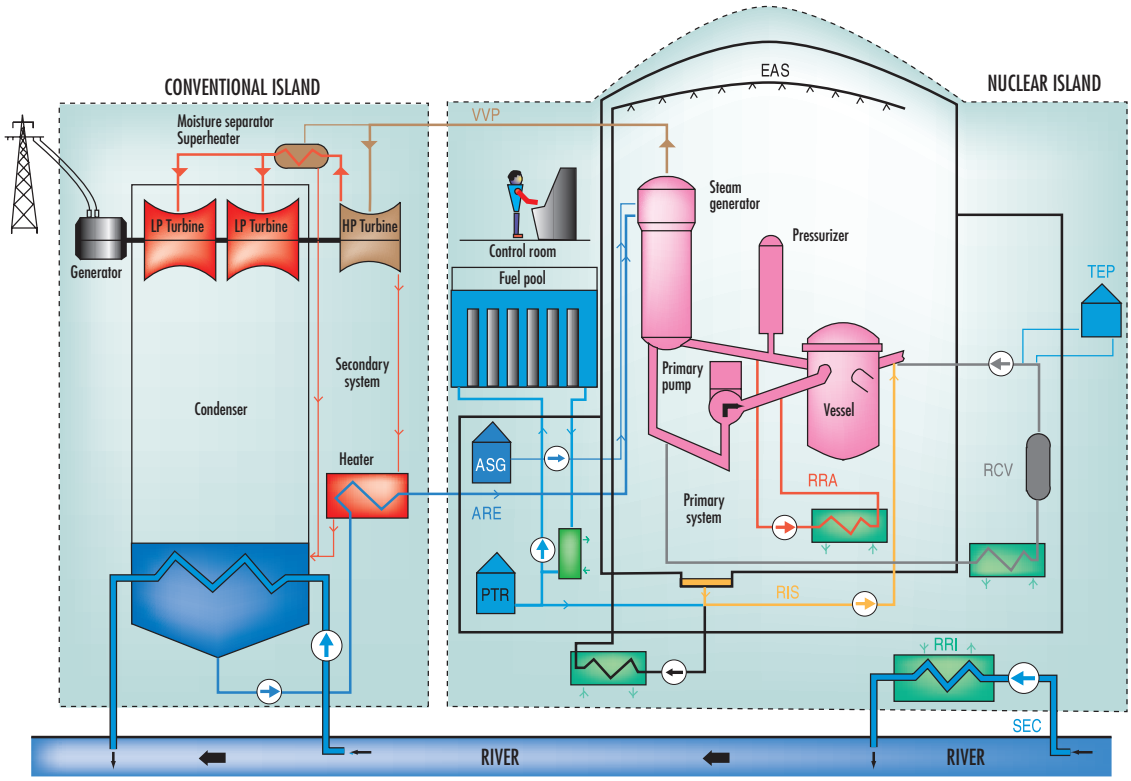
Moreover, the reactor containment consists of a double concrete-walled structure, instead of the single wall with steel liner design as with the 900 MWe reactors.

The P'4 reactors differ slightly from the P4 reactors, notably with regard to the fuel building and the design of some systems.

The N4 reactors differ from the previous reactor series in the design of their steam generators (more compact) and of their primary coolant pumps, as well as in the computerisation of the control room.

Lastly, an EPR type 1,600 MWe pressurised water reactor is being built at Flamanville, a site already housing two 1,300 MWe reactors.

Block diagram of a pressurised water reactor



1|1 Description of an NPP

1|1|1 General description of a pressurised water reactor

In passing heat from a hot source to a heat sink, all thermal electric power plants produce mechanical energy, which they then transform into electricity. Conventional plants use the heat given off by the combustion of fossil fuels (fuel oil, coal, gas). Nuclear plants use that resulting from the fission of uranium or plutonium atoms. This heat produces steam which is then expanded in a turbine to drive a generator to produce 3-phase electric current at 400,000 Volts. After expansion, the steam passes through a condenser where it is cooled on contact with tubes circulating cold water taken from the sea or a river or with an atmospheric cooling system.

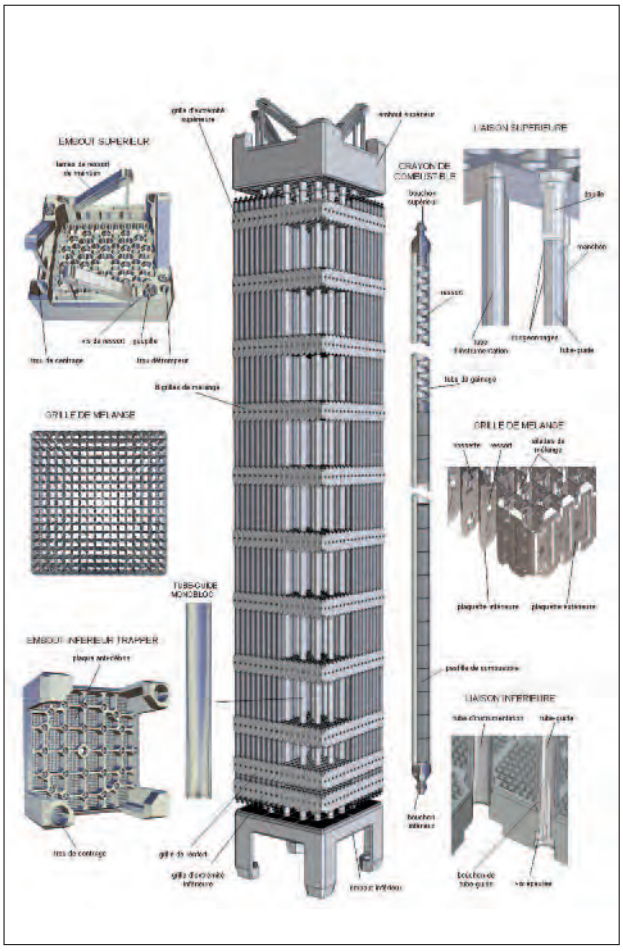
Each reactor comprises a nuclear island, a conventional island, water intake and discharge infrastructures and possibly a cooling tower.

The nuclear island mainly consists of the nuclear steam supply system comprising the primary system and the systems designed for reactor operation and safety: the chemical and volume control, residual heat removal, safety injection, containment spraying, steam generator feedwater, electrical, I&C and reactor protection systems. Various support function systems are also associated with the nuclear steam supply system: primary waste treatment, boron recovery, feedwater, ventilation and air-conditioning, backup electrical power (diesel generating sets).

The nuclear island also comprises the systems removing steam to the conventional island (VVP) as well as the building housing the fuel storage pool (BK). This building, which adjoins the reactor building, is used for storage of fuel assemblies before and during unit outages and for cooling of the unloaded fuel (one third or one quarter of the fuel is replaced every 12 to 18 months, depending on the reactor model). The fuel is kept immersed in a pool, where the water acts as a radiological barrier. The water in the pool contains about 2,500 ppm of boric acid, to continue to neutralise the neutrons emitted by the nuclei of the fissile elements, although they are too few in number to maintain nuclear fission. Moreover, each fuel element is placed inside a metal cell, both the design of which and its distance from the others prevents critical mass from being reached. The pool is cooled by the reactor cavity and spent fuel pool cooling and treatment system (PTR).

The conventional island equipment includes the turbine, the AC generator and the condenser. Some components of this equipment contribute to reactor safety. The secondary systems belong partly to the nuclear island and partly to the conventional island.

The safety of pressurised water reactors, built around the concept of defence in depth, involves a series of independent barriers, for which the safety analysis must demonstrate the effectiveness in normal and accident operating situations. There are generally three of these barriers, making up an assembly consisting of the fuel cladding (see point 1|1|2) for the first barrier, the main primary and secondary systems (see point 1|1|3) for the second barrier and the reactor building containment (see point 1|1|5) for the third barrier.



Pressurised water reactor fuel assembly

1|1|2 Core, fuel and fuel management

The reactor core consists of rods containing uranium oxide pellets or mixed uranium and plutonium oxides (fuel referred to as MOX) contained in metal tubes, referred to as the "cladding", grouped in fuel "assemblies". As a result of fission, the uranium or plutonium nuclei emit neutrons which, in turn, produce further fissions: this is known as the chain reaction. These nuclear fissions release a large amount of energy in the form of heat. The primary system water enters the core from below at a temperature of about 285°C, flows up along the fuel rods and exits through the top at a temperature of about 320°C.

At the beginning of the operating cycle, the core has a considerable energy reserve. This gradually falls during the cycle, as the fissile nuclei disappear. The chain reaction, and hence the reactor power, is controlled by:
– inserting control rod assemblies clusters, containing elements that absorb neutrons, to varying depths in the core. These enable the reactor to be started and stopped and its power level to be adjusted to the electrical power to be produced. Falling of the control rod assemblies under the effects of gravity triggers automatic reactor trip;
– the concentration of boron (which absorbs neutrons) in the primary system water is adjusted during operation as the fissile material in the fuel becomes depleted.

At the end of the cycle, the reactor core is unloaded for renewal of part of the fuel.

EDF uses two types of fuels in its pressurised water reactors:
– uranium oxide based fuels (UO_2) with uranium-235 enrichment to a maximum of 4.5%. These fuels are fabricated in several plants in France and abroad, which belong to the fuel suppliers AREVA and WESTINGHOUSE;
– fuels consisting of a mixture of depleted uranium oxides and plutonium (MOX).

The MOX fuel is produced by the AREVA MÉLOX plant. The initial plutonium content is limited to 8.65% (average per fuel assembly) and provides an energy equivalence with UO_2 fuel initially enriched to 3.7% uranium-235. This fuel can be used in those 900 MWe reactors for which the decree authorising their creation (the DAC) authorises use of MOX: i.e. 22 reactors.

Fuel management is specific to each reactor series. It is characterised in particular by:
– the nature of the fuel used and its initial fissile content;
– the maximum degree of fuel depletion at removal from the reactor, characterising the quantity of energy extracted per ton of material (expressed in GWd/t);
– the duration of an operating cycle;
– the number of new fuel assemblies loaded at each reactor refuelling outage (generally 1/3 or 1/4 of the total number of assemblies);
– the reactor operating mode, for characterising the stresses to which the fuel is subjected.

1|1|3 Primary system and secondary systems

The primary system and the secondary systems are used to transport the energy given off by the core in the form of heat to the turbine generator set which produces electricity, without the water in contact with the core ever leaving the containment.

The primary system comprises cooling loops (three loops for a 900 MWe reactor, four loops for a 1,300 MWe, 1,450 MWe, or EPR reactor), the role of which is to extract the heat released in the core by circulating pressurised water, known as the primary water. Each loop, connected to the reactor vessel containing the core, comprises a circulating, or primary pump, and a steam generator (SG). The primary water, heated to more than 300°C, is kept at a pressure of 155 bar by the pressuriser, to prevent it boiling. The entire primary system is located inside the containment.

The primary system water transfers the heat to the water in the secondary systems, via the steam generators. The steam generators are heat exchangers which contain thousands of tubes through which the primary water circulates. These tubes are immersed in the water of the secondary system and boil it, without ever coming into contact with the primary water.

Each secondary system consists, principally, of a closed loop through which water runs in liquid form in one part and as steam in the other part. The steam produced in the steam generators is partly expanded in a high-pressure turbine and then passes through moisture separator-reheaters before final expansion in the low-pressure turbines, from which it is then routed to the condenser. The condensed water is then heated and sent back to the steam generators by the extraction pumps relayed by feed pumps through reheaters.

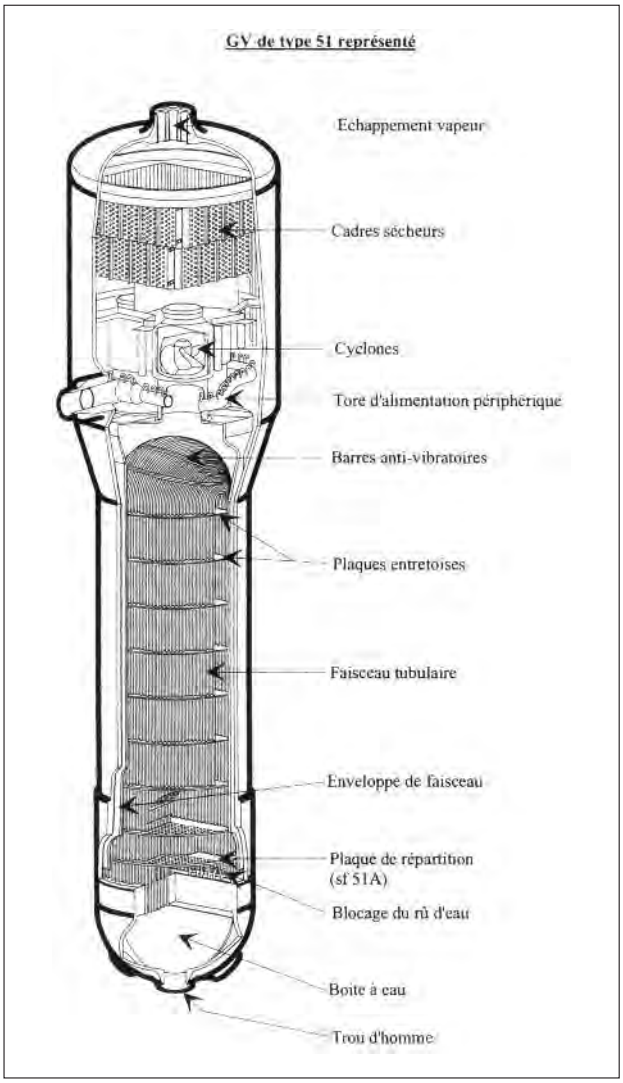
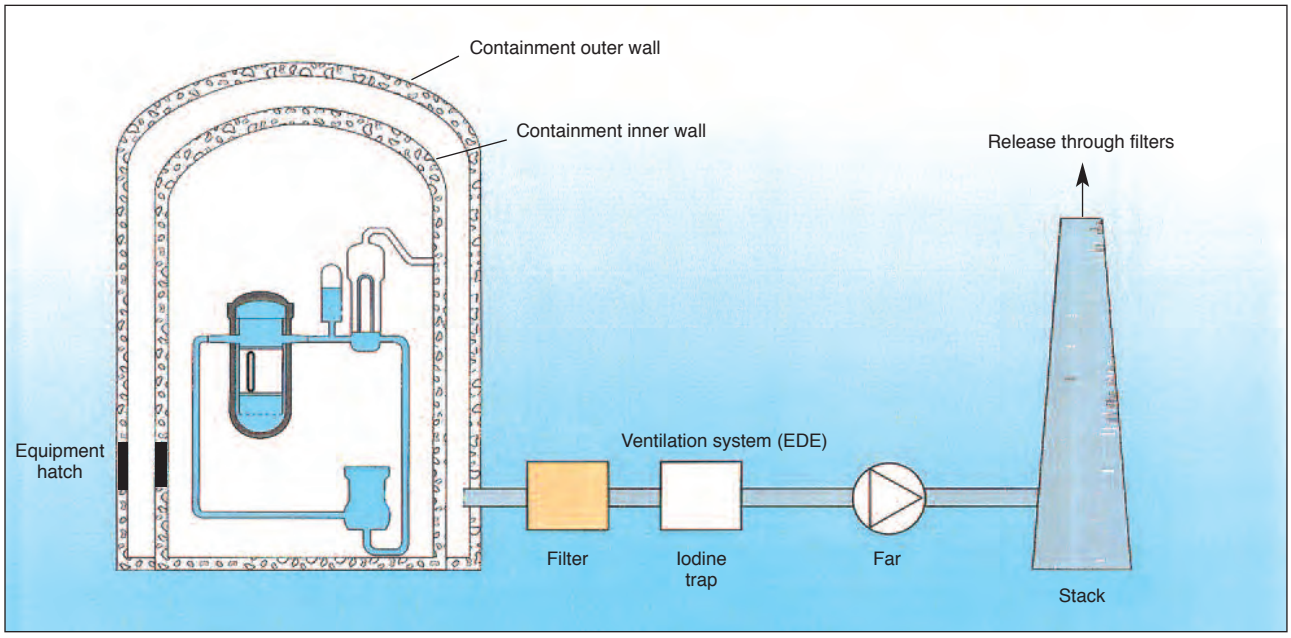


Diagram of a steam generator

1|1|4 Cooling systems

The purpose of the cooling systems is to condense the steam coming from the secondary system turbine. To do this they comprise a condenser, a heat exchanger consisting of thousands of tubes in which cold water pumped from an outside source (river, sea) circulates. When the steam comes into contact with the tubes it condenses and can be returned in liquid form to the steam generators (see point 1|1|3).

Depending on the source of the cold water circulating in the condenser, the condensers are traditionally made either of brass (for river water) or of titanium or stainless steel (for seawater). Henceforth, during renovation, the brass condensers will be replaced by stainless steel or titanium ones, thereby reducing the amounts of metals released as a result of wear (brass being the source of copper and zinc releases). However, unlike brass condensers, the renovated units do not constitute



Containment of a 1,300 MWe reactor

a toxic environment for micro-organisms and are therefore places where amoeba, potentially pathogenic micro-organisms, can develop. This can be prevented by use of biocides or other means of disinfection, e.g. ultraviolet radiation.

The cooling system water heated in the condenser is then discharged to the natural environment (open circuit) or, when the river flow is too low or heating too great in relation to the sensitivity of the environment, cooled in a cooling tower (closed or semi-closed circuit).

The conditions inside NPP's cooling towers are such that the potentially pathogenic micro-organism legionella can develop and can be propagated in the steam they discharge. The legionella concentrations in secondary system cooling systems of NPPs with cooling towers are variable and depend on a variety of factors (time of the year, scaling, quality of make-up water, use of anti-amoeba treatment, etc.).

1|1|5 Reactor containment building

The PWR containment building has two functions:
– protection of the reactor against external hazards;
– containment and consequently protection of the public and the environment against the radioactive products liable to be dispersed outside the primary system in the event of an accident; the containments were therefore designed to withstand the temperature and pressure levels that could be reached in an accident situation and to retain satisfactory leaktightness in these conditions.

The containments are of two types:
– the 900 MWe reactor containments, consisting of a single wall of pre-stressed concrete (concrete containing steel cables tensioned to ensure compression of the structure). This wall provides mechanical resistance to the most severe design accident pressure and structural integrity against external hazards. Leaktightness is assured by a thin metal liner on the inside of the concrete wall;



View of the concrete shell of the Flamanville NPP reactor building

– the 1,300 MWe and 1,450 MWe reactor containments, comprising two walls, an inner wall made of pre-stressed concrete and an outer wall made of reinforced concrete. Leaktightness is provided by the inner wall and the ventilation system (EDE) which, in the annular space between the walls, channels any radioactive fluids and fission products that could come from inside the containment as a result of an accident. Resistance to external hazards is mainly provided by the outer wall.

1|1|6 The main auxiliary and safeguard systems

In normal operation or during normal shutdown of the reactor, the role of the auxiliary systems is to provide basic safety functions: control of neutron reactivity, removal of heat from the primary system and fuel residual heat, containment of radioactive materials. This chiefly involves the Chemical and Volume Control system (RCV) and the Residual Heat Removal system (RRA).

The purpose of the safeguard systems is to control incidents and accidents and mitigate their consequences. This primarily concerns the safety injection system (RIS), the reactor building containment spray system (EAS) and the steam generator auxiliary feedwater system (ASG).

1|1|7 Other safety-related systems

The other systems necessary for reactor operation and important for safety include:
– the component cooling system (RRI), which cools a number of nuclear equipment items; this system operates in a closed loop between the auxiliary and safeguard systems on the one hand, and the systems carrying water pumped from the river or the sea (heat sink) on the other;
– the essential service water system (SEC), which uses the heat sink to cool the RRI system;
– the reactor cavity and spent fuel pit cooling and treatment system (PTR), used notably to remove residual heat from irradiated fuel elements stored in the spent fuel pit;
– the ventilation systems, which play a vital role in containing radioactive materials by depressurising the premises and filtering all discharges;
– the fire-fighting water systems;
– the I&C system, the electrical systems, etc.

1|2 Operation of a nuclear power plant

1|2|1 EDF organisational structures

Within the EDF Production and Engineering Directorate (DPI), a distinction is made between the functions of operator and designer. The designer is responsible for developing and extracting long-term value from EDF's assets, along with dismantling at the end of operation. This is the role of the Nuclear Engineering Department (DIN) and its engineering centres (for a detailed presentation, see *www.edf.com*).

The operator, represented by the Nuclear Production Division (DPN) is responsible for the short and medium-term performance of its production sites, as well as for safety, radiation protection, security, environmental, availability and daily operating costs issues.

ASN contacts

During the course of its regulatory activities, ASN has relations primarily with the DPN for the reactors in service and with the DIN for new reactors and for discharges. More specifically, the DPN head office departments are ASN's contacts in dealing with generic aspects affecting all the reactors in service. For questions specific to the safety of an individual reactor, ASN directly contacts the management of the NPP concerned. With regard to matters regarding equipment design and the corresponding design studies, ASN's primary contact is the DIN. The DIN is also ASN's primary contact for subjects regarding the periodic safety reviews, for instance via its specialised engineering departments. Matters concerning fuels and fuel management are also discussed with a third division responsible for these questions: the Nuclear Fuels Division (DCN).

1|2|2 ASN review of operating documents

NPPs are operated on a day-to-day basis in accordance with a set of documents. All those concerning safety are given particularly close attention by ASN.



Document conformity review by the ASN inspectors during the Chooz in-depth inspection – July 2010

These are first and foremost the general operating rules (RGE) applicable to the reactors in operation. They describe the operating conditions, transforming the initial hypotheses and the conclusions of the safety studies taken from the safety analysis report into operating rules.

The RGE comprise several chapters, of which those having particular safety implications are carefully reviewed by ASN:
– Chapter III describes the Technical Operating Specifications (STEs), which specify the reactor's normal operating range and in particular the allowable range for the operating parameters (pressure, temperature, neutron flux, chemical and radiochemical parameters, etc.). The STEs also specify the required reaction if these limits are exceeded. In addition, the STEs define the equipment needed according to the condition of the reactor and state what action is to be taken in the event of a malfunction or unavailability of this equipment.
– Chapter VI comprises operating procedures applicable in an incident or accident situation. It stipulates the steps required in these situations to maintain or restore the basic safety functions (reactivity control, cooling, containment of radioactive substances) and to return the reactor to a safe condition.
– Chapter IX defines the programmes of checks and periodic tests run on the safety-relaed equipment and systems, in order to ensure their availability. If the results are unsatisfactory, then the required response is specified in the STEs. This type of situation may sometimes require the licensee to shut down the reactor in order to repair the faulty equipment.
– Chapter X establishes the programme of physical tests for the reactor core that allow monitoring of the reactor in the restart and operating phases.

Secondly, there are documents describing the in-service monitoring and maintenance actions required on the equipment. On the basis of the manufacturer's recommendations, EDF has defined periodic inspection programmes for the components, or preventive maintenance programmes (see point 3|2|1), based on knowledge of the potential equipment failures. Their implementation, particularly in the case of pressure equipment, requires use of non-destructive testing methods (radiography, ultrasound, eddy current, dye penetrant, etc.) entrusted to specially qualified staff.

1|2|3 ASN oversight of reactor outages

Reactors need to be shut down periodically in order to renew the fuel, which becomes gradually depleted during the operating cycle. At each outage, one third or one quarter of the fuel is renewed. The length of the operating cycles depends on the fuel management adopted.

These outages mean that it is possible to access parts of the NPP which would not normally be accessible during operation. The outages are therefore an opportunity to verify the condition of the NPP by running checks and performing maintenance work, as well as to implement the modifications scheduled for the NPP.

There are two types of outage:
– simple refuelling outage (ASR) and partial inspection (VP) outage: these outages last a few weeks and are devoted to renewing part of the fuel and conducting a programme of verification and maintenance;
– ten-yearly outage (VD): this outage entails a wide-ranging verification and maintenance programme. This type of outage, which occurs every 10 years, is also an opportunity for the licensee to carry out major operations such as a complete inspection and hydrotest on the primary system, a reactor building containment test or incorporation of design changes decided on in the periodic safety reviews (see point 2|2|3).

These outages are scheduled and prepared for by the licensee several months in advance. ASN checks the steps taken to guarantee safety and radiation protection during the outage, and the safety of operation during the coming cycle(s).

The checks carried out by ASN mainly concern the following aspects:
– during the outage preparation phase, the conformity of the reactor outage programme with the applicable reference system. ASN will give its opinion on this programme;



Monitoring of the steam generator replacement work on the occasion of the 3rd ten-yearly inspection of the Fessenheim NPP – September 2011

– at the regular information meetings and inspections during the outage, how the various problems encountered are dealt with;
- at the end of the outage - when the licensee presents the reactor outage summary - the condition of the reactor and its suitability for restart. After this check, ASN either authorises reactor restart, or not;
– after criticality, the results of all tests carried out during the outage and after restart.

2 THE MAJOR NUCLEAR SAFETY AND RADIATION PROTECTION ISSUES

Over and above the issues brought to light by the accident at the Fukushima Daiichi nuclear power plant, the following subjects remain major topics with respect to nuclear safety.

2|1 Human and organisational factors

2|1|1 Workers

Depending on the number of reactors (2 to 6), the numbers of men and women working each day on operating a nuclear power plant varies from 800 to 2,000. The workforce consists of EDF staff and permanent outside contractors, split between various functions:
– operation: 50%;
– maintenance: 20%;
– administration and support: 30%.



Using self-evaluation during a training session on a teaching site

In addition, large numbers of service providers and subcontractors participate in maintenance and in specific operations scheduled during reactor outages. Depending on the type of outage, the number of additional participants can represent from 300 to 2,700 people.

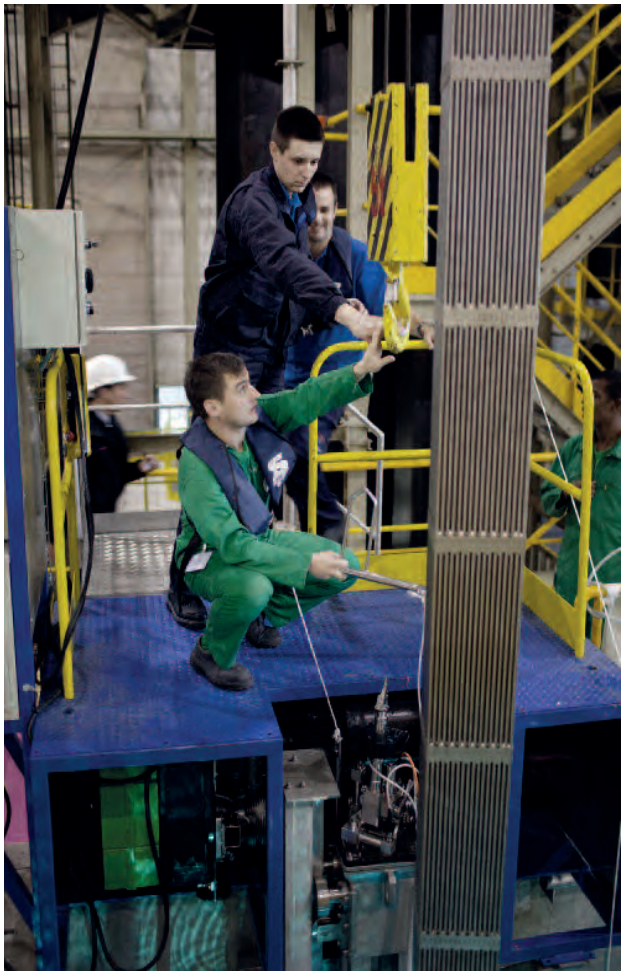
These workers are exposed on the one hand to risks common to all industries (for example, falling from heights, tripping over obstacles), and on the other to the risks linked to the use of ionising radiation.

Exposure to ionising radiation in a nuclear power reactor is due primarily to activation products and, to a lesser extent, the fission products present in the fuel. All types of radiation are present (neutrons, α, β and γ) and the risk of exposure can be either external or internal. In practice, more than 90% of the doses come from external exposure to β and γ radiation, caused by erosion and corrosion phenomena.

Eighty per cent of the doses received by workers are related to maintenance operations performed during reactor outages. In 2011, these doses were distributed over a workforce of around 45,000 people, including EDF staff, contractors and subcontractors, as shown in graphics 2, 3 and 4 below (see point 6|1|3). Monitoring of application of labour-related legislation in NPPs is addressed in point 4|2.

2|1|2 Nuclear safety as related to organisational and human factors

The contribution of man and organisations to the safety of nuclear facilities is a decisive factor in all steps of the plant lifecycle (design, commissioning, operation, maintenance, surveillance, decommissioning). ASN therefore focuses on the conditions which are favourable or prejudicial to a positive contribution by the operator and worker groups to the safety of the NPPs. All aspects of the working situation and organisation with an influence on the activity of the individuals working in an NPP are of interest to ASN as organisational and human factors (OHF) influencing safety.



Handling in the NPP operators training centre (CETIC) in Chalon-sur-Saône

The aspects considered relate to the individual and to the organisation in which he or she works, to technical arrangements and, more broadly, to the working environments (e.g., levels of heat, noise or light in the workplace, worker groups), in which the individual interacts. The variability in the characteristics of the workers (for instance, their level of vigilance which differs depending on the time of day, the level of expertise which varies according to the seniority in the post) and in the situations encountered (for example, an unexpected failure, labour tensions) explains that they constantly have to adapt their procedures so that they can perform their work efficiently. This performance must be achieved at an acceptable cost to the operators (for instance in terms of fatigue or stress) who must also benefit from it (for instance the feeling of a job well done, recognition by both peers and the hierarchy, development of new skills). Performance does not actually reflect the human cost and an operating situation achieved at very high cost to the operators is a potential source of risks: a slight variation in the working context, the group or how the work is organised, can be enough to bring down performance.

Areas for integration of OHF

ASN is counting on integration of the OHF compatible with the safety issues identified by the licensee, in the following fields of activity:

– engineering activities during design of a new installation or modification of an existing one;
– activities carried out during the operation of existing NPPs throughout their period of operation;
– activities involved in collating experience feedback from the design, construction and operation of the reactors, in particular analysis of the OHF-related causes of significant safety, radiation protection or environmental protection events and the corresponding lessons to be learned.

ASN requirements

The order of 10 August 1984 (see point 3|2|1 of chapter 3) contains the requirements to be followed by the licensee to define, obtain and maintain the quality of its installation and the conditions for its operation. These requirements in particular concern the organisation to be put into place by the operator to manage quality-related activities.

ASN asks the licensee to set up a safety management system able to maintain and continuously improve safety, for instance through the development of a safety culture. ASN considers that safety management must become a part of the company's general management system in order to guarantee the priority given to safety and to the other interests protected by the TSN Act, such as radiation protection and environmental protection.

Control of safety rests on the ability of the licensee's management system to ensure that the appropriate skills and adequate resources are available. Article 7 of the order of 10 August 1984 in particular requires that "only individuals with the required skills may be assigned to an activity affecting quality". The qualification issued by the licensee proves an individual's ability to perform given activities. ASN considers that this qualification must be based on justification of the skills required for the particular task, through training and professional experience.

ASN oversight

ASN oversight of OHF is based primarily on inspections carried out on the steps taken by the licensee to improve the way OHF are integrated into all phases of the lifecycle of an NPP. The inspections carried out by ASN concern the work done by the operators, but also the working conditions and the means made available to the operators in order to perform the work. More specifically, the quality and implementation of the EDF jobs, skills, training and qualifications management system are checked. The same applies to the resources, skills and methodology used for implementing the OHF approach. Finally, ASN checks the EDF safety management system, which must provide a framework and support for the decisions and actions which either directly or indirectly concern safety issues.

In addition to the inspections, ASN oversight is based on the evaluations it requests from IRSN and the Advisory Committee for nuclear reactors (GPR). For example, the GPR will be asked for its opinion on the management of safety and radiation protection during reactor outages.



Discussions between the ASN inspectors and the staff of the Fessenheim NPP during the 3rd ten-yearly inspection - September 2011

2|1|3 Management of subcontracted activities

The maintenance of French reactors is to a large extent subcontracted by EDF to outside contractors, with the total workforce representing about 20,000 employees. The use of subcontracting is driven by the need for outside expertise or a desire to reduce costs.

A system of prior contractor qualification was put into place by EDF. It is based on an evaluation of the technical know-how and quality organisation of the subcontractor companies and is formally written up in the "progress and sustainable development charter" signed by EDF and its main contractors. In addition, according to the order of 10 August 1984, the licensee is required to monitor its contractors' activities, or have them monitored, and use operating experience feedback for a continuous assessment of their ability to retain their qualification. Finally, the licensee must ensure the availability of a sufficient number of contractors with the expertise needed to perform the maintenance operations required to ensure safety.

ASN's expectations

ASN considers that the use of subcontracting is an industrial decision that lies with the licensee, but that this decision must not compromise the level of technical expertise that has to be retained by the nuclear licensee. ASN considers that poorly managed subcontracting is liable to lead to poor quality of work and have a negative impact on the safety of the facility and the radiation protection of the workers involved. Consequences such as these could result from the use of staff without the required skill levels, insufficient monitoring of the contractors by the licensee, degraded working conditions and so on.

ASN stressed the need for the order of 7 February 2012 to tighten up the conditions surrounding the use of subcontracting for safety-related activities.

ASN regulation

ASN carries out inspections on the conditions in which subcontracting takes place. ASN in particular checks EDF's implementation of and compliance with a process to ensure the quality of the activities subcontracted: the choice of contractors, monitoring, integration of experience feedback and adequacy of the resources for the volume of work to be done. ASN also pays close attention to worker protection, for instance compliance with health and safety rules and working and rest times, and checks the legality of the service contracts, in particular assessing the independence of the contractor from the ordering customer (absence of subordination and of supply of tools or equipment). The inspections on this topic are carried out in the nuclear power plants in operation and also within the various engineering departments responsible for the design studies of the Flamanville 3 reactor (see point 2|4|2).

In addition to the inspections, ASN oversight is based on the evaluations it requests from IRSN and the Advisory Committee for nuclear reactors (GPR). For example, the GPR was asked for its opinion on the topic of management of subcontracting.

2|2 Continuous nuclear safety improvements

2|2|1 Oversight of anomaly correction

Anomalies are detected in NPPs through the proactive measures taken by the licensee and the systematic checks required by ASN. EDF must cultivate a questioning attitude whereby it takes the initiative to look for anomalies. The root causes of anomalies may be diverse: design problems, errors during construction, discrepancies introduced during maintenance operations, deterioration due to ageing, etc. ASN considers that periodic inspections and searches for anomalies carried out continuously by licensees play an important role in maintaining an acceptable level of safety.

Systematic verification: conformity checks

EDF carries out periodic safety reviews on the nuclear reactors every ten years (see point 2|2|3). EDF thus compares the actual condition of the NPPs with their applicable safety requirements and identifies any anomalies. These verifications can be supplemented by a programme of additional investigations designed to check parts of the installation which are not covered by a specific preventive maintenance programme.

"Real time" verification

The performance of periodic test and preventive maintenance programmes on the equipment and systems also helps identify anomalies. For example, routine field visits are an effective means of discovering faults.

Informing ASN and the public

The public is informed of the most significant deviations (INES scale level 1 and higher) by means of ASN's website. An upstream system was created to ensure that ASN is



Contractors working on replacing the N4 transformer in the Civaux NPP – July 2009

specifically informed of any deviations discovered by EDF. When there is any doubt concerning the conformity of an equipment item, EDF notifies ASN accordingly. At the same time, the licensee attempts to characterise the problem encountered. The purpose of this characterisation is to determine whether there is really any deviation with regard to the safety requirements defined during the design process. If so, EDF specifies which equipment is affected and evaluates the safety consequences of the deviation. ASN is notified of the results of this characterisation. As applicable, EDF sends it notification of a significant safety event. This procedure guarantees transparency with regard to both ASN and the public.

ASN's remediation requirements

ASN requires that anomalies with an impact on safety be corrected within a time-frame commensurate with their severity. Any deviation which significantly impairs safety must be corrected rapidly, even if the remedial measures entail a large volume of work or shutdown of the reactor. This is why ASN reviews the remediation methods and time-frame proposed by EDF. To carry out this review, ASN takes into consideration the actual and potential safety consequences of the deviation. ASN cannot authorise restart of the reactor or decide to shut down the NPP until the repair has been completed. This is the case if the risk involved in operation while the deviation is present is considered to be unacceptable and if there is no appropriate remedial measure. Conversely, the time allowed for correction of a less severe deviation may be increased when so justified by particular constraints. These constraints may be the result of the time needed to prepare for remediation in conditions of complete safety. They may also arise from national and European electricity grid security objectives. For example, for earthquake resistance anomalies, one factor in assessing the urgency of the repair is the seismic level for which the equipment in question is designed. In cases in which there is only a need to restore a safety margin for an equipment item which can already withstand a large-scale earthquake, longer repair times may be granted.

2|2|2 Examination of events and operating experience feedback

The general process for incorporating operating experience feedback

Operating experience feedback is a major source of improvement in terms of safety, radiation protection and the environment. This is why ASN requires that EDF notify it of significant events occurring in NPPs. Criteria for such notification have been established in a document entitled "Guide to Notification Procedures and the Codification of Criteria Concerning Significant Events in terms of Safety, Radiation Protection or the Environment, applicable to BNIs and Radioactive Material Transport". Each significant event is therefore rated by ASN on the International Nuclear Events Scale (INES), which comprises eight levels from 0 to 7.

ASN carries out local and national examinations of all significant events reported (the report for 2011 appears in point 6|1|5). For certain significant events felt to be most important, because of their noteworthy or recurring nature, ASN has a more in-depth analysis carried out by IRSN. ASN oversees how EDF utilises operating experience feedback from significant events and uses it to improve safety, radiation protection and environmental protection. During inspections in the NPPs, ASN also reviews the organisation of NPPs and the steps taken to deal with significant events and take account of operating experience feedback. ASN also ensures that EDF learns lessons from significant events that have occurred abroad. Finally, at the request of ASN, the GPR periodically reviews operating experience feedback from the operation of pressurised water reactors.

TO BE NOTED IN 2011

Examination of operating experience feedback for the period 2006-2008

On 13th and 20th January 2011, the Advisory Committee for reactors (GPR) met to examine the notable findings for the period 2006-2008 concerning significant radiation protection, environment and reactor safety events, more particularly the deviations encountered on the steam generators (SG), the management of special systems and resources (DMP) and temporary facility modifications (MTI), post-maintenance qualification of facilities and administrative lockouts.

Following this examination, ASN considers:
• that with regard to the safety of the reactors in operation, the analyses performed and the steps taken by EDF in the light of experience feedback are satisfactory. However, the safety of the reactors in operation could be significantly improved if EDF were to pay greater attention to preparation of the maintenance and the pertinence of the maintenance schedule.
• that with regard to radiation protection, examination of experience feedback from the operation of the nuclear reactors in service for the period 2006-2008 confirms that EDF has continued to make progress, for instance in the field of gamma radiography inspections.

2|2|3 Periodic safety reviews

Article 29 of the TSN Act requires that the licensees periodically conduct a safety review of their NPPs. This review is carried out every ten years. The periodic safety review is an opportunity to conduct a detailed, in-depth examination of the condition of the facilities, to check that they are in conformity with the applicable baseline safety requirements. Its aim is also to improve the level of safety in the facilities. The requirements applicable to the existing facilities are therefore compared with those to be met by the most recent facilities, and the improvements which could reasonably be implemented are proposed by the licensee. The periodic safety reviews therefore constitute one of the cornerstones of safety in France, by obliging the licensee not only to maintain the level of safety of its facility but also to improve it.

The review process

The periodic safety review comprises a number of successive steps.

1) The conformity check: this consists in comparing the condition of the installation with the applicable safety requirements and regulations including, notably, the authorisation creation decree and ASN's requirements. This step ensures that changes to the installation and its operation, as a result of modifications or ageing, comply with applicable regulations and do not compromise the installation's safety requirements. This ten-year conformity check does not relieve the licensee of its permanent obligation to guarantee the conformity of its installations.

2) The safety review: this aims to appraise the installation's safety and to improve it in terms of:
– French regulations, and the most recent safety objectives and practices, in France and abroad;
– operating experience feedback from the installation;
– operating experience feedback from other nuclear installations in France and abroad;
– lessons learned from other installations or equipment involving a risk.

After consulting the GPR when necessary, ASN rules on the list of topics chosen for safety reassessment, during the phase referred to as the periodic safety review orientation. Following these reassessments, a batch of modifications to improve safety is defined. They will be deployed during the reactor ten-yearly outage.

3) Implementation of the improvements emerging from the safety review

The ten-yearly inspections are ideal opportunities to implement the modifications resulting from the periodic safety review, in particular those modifications based on the safety reassessment studies. To determine the ten-yearly outages calendar, EDF must take account of the hydrotesting schedule set by the nuclear pressure equipment regulations and the frequency of the periodic safety reviews as stipulated by the TSN Act.

4) Submission by the licensee of a review conclusions report: following the ten-yearly outage inspection, the licensee sends ASN a periodic safety review conclusions report. In this report, the licensee states its position on the regulatory conformity of its facility as well as on the modifications made to remedy deviations observed or to improve the safety of the facility. The review report contains information provided for in Article 24 of Decree no.2007-1557 of 2 November 2007, as amended.

The periodic safety review concerning the third ten-yearly outages for the 900 MWe reactors

In the run-up to the 900 MWe reactors' third ten-yearly outages, ASN asked EDF to present a precise account of the ageing status of each reactor concerned and to demonstrate the possibility of continuing with operation beyond 30 years in satisfactory safety conditions. EDF has drawn up a programme of work concerning management of the ageing of its 900 MWe reactors.

In July 2009, ASN issued a position statement on the generic aspects of continued operation of the 900 MWe reactors until 40 years after first criticality. ASN has not identified any element that would compromise EDF's ability to control the safety of the 900 MWe reactors over that period. ASN also considers that the new safety requirements presented in the generic safety analysis report for the 900 MWe reactors and the installation modifications envisaged by EDF are such as to maintain and improve the overall safety level of these reactors.

TO BE NOTED IN 2011

Generic significant safety event notified on 16 February 2011 concerning the emergency diesel generator sets for the 900 MWe plant series

On 22 October 2010, a periodic test carried out at the Le Blayais NPP revealed a failure of an emergency generator set. The analysis initiated by EDF and its supplier, which was forwarded to ASN, showed faster than expected deterioration of the connecting rod bushings, which are mechanical components designed to minimise friction between the moving parts of the diesel engines.

On the French NPPs, 27 electricity generating sets are equipped with bushings of the same type and liable to be affected by the same defect.

The emergency diesel generator sets supply the reactor's safety systems if the electricity supply from the national grid is interrupted. Each nuclear reactor is equipped with two emergency generator sets. In addition, a further electricity generator set is available for all the reactors of a given site. Each of these generators is able to supply the systems needed to ensure the safety of the reactor when shut down.

The corrective action plan presented by EDF comprises the installation of new bushings, the adoption of a new operating procedure for the generator sets concerned and enhanced monitoring and maintenance.
Based on the analysis performed by its technical support organisation, ASN asked EDF to:
• carry out complementary tests and inspections;
• maintain enhanced monitoring of the emergency generator sets;
• justify certain choices made for the immediate rectification of this failure;
• check the condition of the connecting rod bushings sampled from emergency generator sets.

ASN also asked EDF to continue to look for the root causes of this deviation, taking account of the experience feedback from the assessment performed on the emergency generator sets on the sites of Bugey, Tricastin and Saint-Alban. Finally, ASN asked for additional justifications concerning the reinforcement of the reliability of the electrical power supplies initiated by EDF.

In the longer term, EDF must provide a permanent solution for this deviation and thus initiate the design of connecting rod bushings which no longer comprise such defects and which will have to be qualified.

On all the EDF sites, other than Tricastin, where this type of bushing is installed (Blayais, Bugey, Chinon, Cruas, Dampierre, Gravelines and Saint-Laurent), each reactor has at least one electricity generator set, either its own or a general site set, equipped with bushings of another brand and which are unaffected by this defect. On these sites, the deviation was thus rated 1 on the INES scale by ASN.

However, the deviation was rated by ASN as a level 2 incident on the INES scale for reactors 3 and 4 on the Tricastin site, because the two electricity generator sets and the additional generator set common to all the site's reactors, are equipped with these same vulnerable bushings.

However, this generic assessment does not take account of any specific features of individual reactors. ASN therefore rules on the individual ability of each reactor to continue to operate, notably on the basis of the results of the verifications carried out during the reactor conformity check as part of the third ten-yearly outage and on the evaluation in the reactor's safety review report (see point 5|6 for ASN's 2011 position statements).

The periodic safety review concerning the second ten-yearly outages for the 1,300 MWe reactors

In 2006, ASN declared itself to be in favour of continued operation of the 1,300 MWe reactors up to their third ten-yearly inspections, provided that the modifications decided on during this review were effectively implemented. The improvements arising from this safety review will be integrated by 2014, on the occasion of the second ten-yearly outage inspections (see point 5|6).

The periodic safety review concerning the third ten-yearly outages for the 1,300 MWe reactors

In 2010, ASN established the outline for the safety review associated with the third ten-yearly outages for the 1,300 MWe reactors. In 2015, reactor 2 in the Paluel NPP will be the first to undergo a third ten-yearly outage. ASN will ensure that this periodic safety review, the first to have been prepared after the TSN Act, is in strict compliance with the requirements of the Act.

The periodic safety review concerning the first ten-yearly outage for the 1,450 MWe reactors

In 2008, ASN ruled on the provisions of the first periodic safety review for the 1,450 MW reactors, which in particular concerns the level 1 probabilistic safety studies and the hazards studies. The first ten-yearly outage inspections for these reactors began in 2009 and are at present continuing (see point 5|6).

The implications and issues of continued reactor operations beyond 40 years

In the future, the reactors operating at present will run alongside reactors of the EPR type or their equivalent, designed for a significantly higher level of safety. This raises the question of the acceptability of continued operation of reactors beyond 40 years when there is an available technology that is safer.

There are two objectives: firstly, to demonstrate the absolute conformity of the reactors with the applicable regulations. This problem includes the question of managing ageing and equipment obsolescence. Secondly, a re-evaluation of the safety level in the light of the safety required of EPR type reactors or their equivalent is necessary, with proposals for significant and relevant improvements to the reactors. R&D work in France and elsewhere is already indicating approaches that could lead to answers, and improvements that would provide significant reductions in radioactive releases in the event of a severe accident are being studied.

For ASN, the continued operation of the reactors beyond forty years, can only be envisaged if it is associated with a proactive and ambitious programme for improved safety that is in line with the safety objectives adopted for new reactors and with best international practice.

2|2|4 Approving modifications to equipment and operating rules

In accordance with the principle of continuous improvement of the safety of its reactors, but also to improve the industrial performance of its production tool, EDF periodically makes changes to equipment and operating rules. These changes can, for example, be the result of correction of nonconformities, periodic safety reviews, or of the incorporation of operating experience feedback.

The decree of 2 November 2007 clarified the requirements concerning implementation of changes by EDF and their review by ASN. In 2011, the equipment change notifications received by ASN were primarily aimed at improving reactor safety and correcting deviations.

Documentary modifications are also subject tor prior notification to ASN under article 26 of the above-mentioned decree, when they concern chapters III, VI, IX or X of the general operating rules, presented in point 1|2|2. The main documentary modifications are presented in points 3|1|1, 3|1|2 and 3|2|4.

2|3 Integration of nuclear power plant (NPP) ageing

Like all industrial installations, NPPs are subject to ageing. ASN ensures that, in line with its general operating and maintenance strategy, EDF takes account of age-related phenomena in order to maintain a satisfactory level of safety throughout the installation lifetime.

2|3|1 The age of the French NPPs in operation

The NPPs currently in operation in France were built over a relatively short period of time: forty-five reactors, representing 50,000 MWe, or three quarters of all the NPPs in service, were commissioned between 1979 and 1990 and thirteen reactors, representing a further 10,000 MWe, between 1990 and 2000. In December 2011, the average age of the reactors, calculated from the date of initial reactor criticality, was as follows:
– 29 years for the thirty-four 900 MWe reactors;
– 23 years for the twenty 1,300 MWe reactors;
– 13 years for the four 1,450 MWe reactors.

2|3|2 Main factors in ageing

To understand the ageing of a NPP, other than simply the time that has elapsed since it was commissioned, a number of factors must be looked at.

The lifetime of non-replaceable items

The design of some reactor components was based on a predetermined operating period, for reasons of the cost of their replacement but also, and indeed more so, because of the need for radiation protection of the workers who would have to carry out work. These components require close surveillance ensuring that their ageing rate is indeed as expected. This is in particular the case of the vessel, designed for a service life of at least 40 years (or the equivalent of 32 years of continuous operation at full power). The main mode of vessel ageing is irradiation, which modifies the mechanical properties of the steel of which it is made. The licensee must therefore take steps to predict changes to the vessel's properties and demonstrate that despite these changes, the equipment is able to withstand all normal or accident operating situations it is likely to encounter, taking account of the safety margins set by the regulations. The reactor vessel is thus checked by monitoring "control samples" of metal and appraising them at regular intervals (see point 3|4|3).

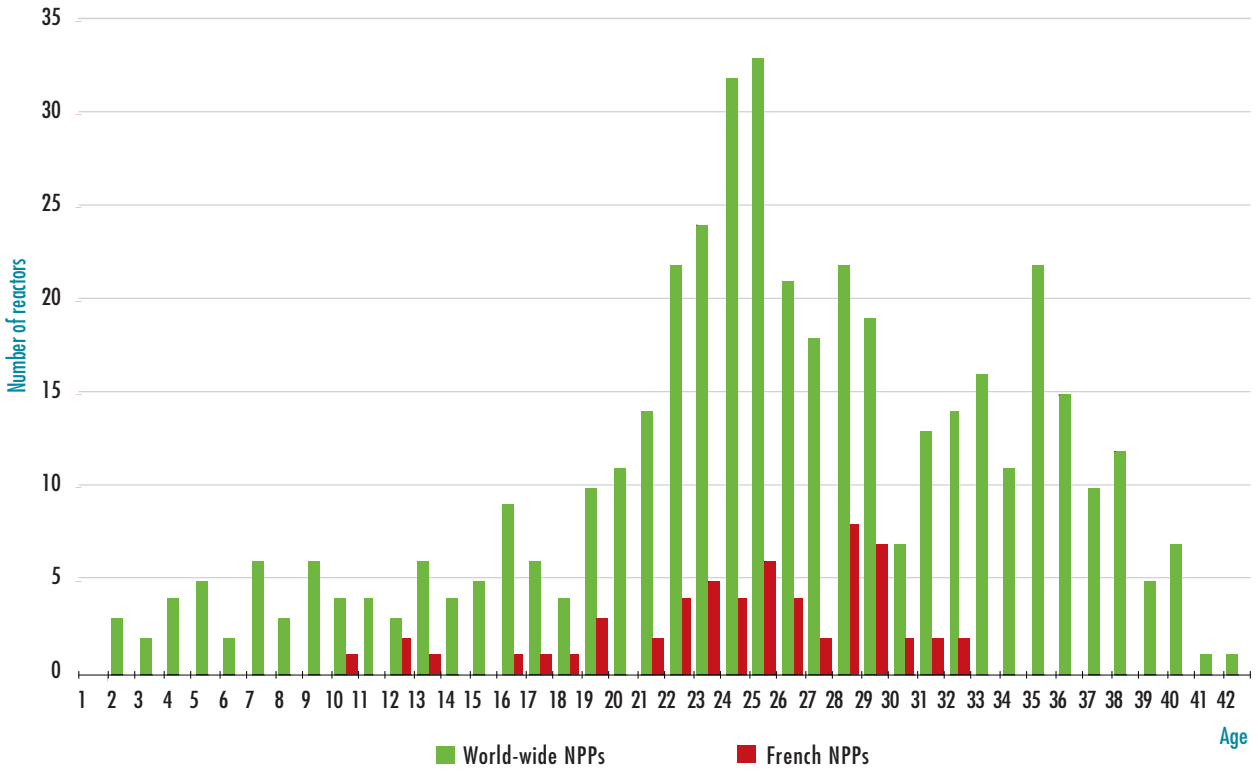
Deterioration of replaceable items

Equipment ageing is the result of phenomena such as the wearing of mechanical parts, hardening and cracking of polymers, corrosion of metals and so on. The equipment must be given particular attention during design and manufacture (in particular the choice of materials) and be the subject of a surveillance and preventive maintenance programme, with repair or replacement as necessary. It must also be possible to demonstrate the feasibility of possible replacement.

Equipment or component obsolescence

Some equipment, before being installed in the nuclear power plants, undergoes "qualification"; this is a process designed to ensure that the equipment is able to perform its functions in all the situations in which it is required, notably in accident conditions. The availability of spares for this equipment is heavily dependent on industrial production by the suppliers. Should the manufacturer cease to make certain components, or simply go out of business, this could create original part procurement problems for certain systems. The safety level of any new spares

Graph 1: age breakdown of the reactors in operation worldwide in 2009 (Source IAEA, March 2009 and CEA, Elecnuc 2008 edition)



must then be demonstrated prior to installation. This is to ensure that the equipment remains "qualified" with the new spare part. Given the length of this procedure, licensees must adopt a vigorous forward-looking policy.

The ability of the NPP to follow changes in safety requirements

Greater knowledge and technological improvements, as well as changes in the acceptability of risk in our societies, are also factors which can lead to the decision that an industrial facility requires extensive renovation work or – if this cannot be done at an acceptable cost – closure at some time in the relatively near future.

2|3|3 How EDF manages equipment ageing

This "defence in depth" type strategy is based on three lines of defence.

1) Consideration of ageing in design: during the design and manufacture of components, the choice of materials and the installation arrangements must be tailored to the intended operating conditions and take account of the kinetics of known or presumed deterioration processes.

2) Surveillance and anticipation of ageing phenomena: ageing related phenomena other than those allowed for in the design may occur during operation. The periodic surveillance and preventive maintenance programmes, the conformity checks (see point 2|2|1) or the operating experience feedback review (see point 2|2|2) aim to detect these phenomena.

3) Repair, modification or replacement of equipment likely to be affected: this type of action has to be planned in advance, given the procurement lead-times for new components, the operation preparation time, the risk of obsolescence of certain components and the loss of staff technical skills.

2|3|4 Examination of extended operation

From a strictly regulatory standpoint, in France there is no limit on the time that an NPP is authorised to operate. Conversely, Article 29 of the TSN Act requires licensees to review the safety of their installations every 10 years (see point 2|2|3). The safety review is an opportunity for an in-depth examination of the effects of ageing on the equipment.

For the reactors going through their third ten-yearly inspections, an ageing analysis must therefore be performed for all degradation mechanisms that could affect the safety-related components. Control of ageing must be demonstrated, relying on operating experience feedback, the maintenance provisions and the possibility of either repairing or replacing the components. On the occasion of the third ten-yearly inspection of each reactor, this analysis leads to the production of a file clearing the reactor for continued operation.

Furthermore, with a view to continued reactor operations beyond 40 years, ageing management and equipment obsolescence become key issues. Ambitious proposals are therefore expected of EDF. These proposals will be submitted to the GPR in early 2012 at a meeting to discuss the study programme to be launched by EDF with a view to continued reactor operation beyond 40 years (see point 2|2|3).

2|4 EPR reactors

The EPR reactor is a pressurised water reactor based on an "evolution" in design in relation to the reactors currently in service in France, enabling it to comply with stricter safety objectives.

After a period of about ten years during which no nuclear reactors were built in France, EDF in May 2006 submitted an application to the ministers responsible for nuclear safety and radiation protection for the creation of a 1,650 MWe EPR type reactor on the Flamanville NPP site, which already houses two 1,300 MWe reactors. This project was subsequently referred to as Flamanville 3.

In December 2010, EDF submitted another creation authorisation application to the Ministers for nuclear safety, for an EPR type reactor on the Penly site, which is also already home to two 1,300 MWe reactors. The work done by ASN on this creation authorisation application is specified in point 5|3. This project was subsequently referred to as Penly 3.

With regard to Flamanville 3, the Government authorised its creation by Decree 2007-534 of 10 April 2007, following ASN's favourable opinion, subsequent to the inquiry conducted with the assistance of its technical support organisations.

After issue of the authorisation decree (DAC) and the building permit, construction work began on the Flamanville 3 reactor in September 2007. The first pouring of concrete for the buildings in the nuclear island began in December 2007. Since then, the civil engineering (structural) work has continued and, for certain buildings, such as the pumping station or the buildings housing the emergency diesel generators, it is now completed. Installation of the first components (tanks, pipes, electrical cables and cabinets, etc.) is continuing. In parallel with the construction work on the Flamanville site, manufacture of the pressure equipment, in particular that of the primary systems (vessel, pressuriser, pumps, valves, pipes, etc.) and secondary systems (steam generators, valves, pipes, etc.) is in progress in the manufacturers' facilities. In the summer of 2011, EDF announced that it was planning commissioning of Flamanville 3 in 2016.



General view of the Flamanville 3 EPR construction site – August 2011

TO BE NOTED IN 2011

Examination of the accident study methods: case of the MTC 3D method

With a view to examining the Flamanville 3 reactor commissioning application, ASN reviews the methods used to produce the design studies for a number of accident transients liable to occur on the reactor. Some of these methods differ significantly from those hitherto used for the reactors in operation.

A new method, called MTC 3D, was therefore developed by EDF to study the steam line break (SLB) transients. This new method reuses the main steps of the current method used for the reactors in operation, but with three-dimensional core models.

In April 2010, after close examination by IRSN, ASN considered that:

- *the MTC 3D method could be used to study the SLB transient with operation of the reactor coolant pumps, provided that account was taken of the requests concerning validation of the calculation software required by the method and that an inter-comparison was made of the results of various software;*
- *application of this method to the SLB transients with reactor coolant pumps shutdown could not be accepted as-is, because the modelling choices made by EDF in these situations were not sufficiently representative of the physical phenomena involved.*

EDF then transmitted additional information, which was reviewed by ASN and its technical support organisation.

On 7 July 2011, considering that the additional data were not sufficient to be able to accept application of the method to SLB transients with reactor coolant pumps shutdown, ASN asked EDF to provide further details on this point or to look for other ways of performing the SLB transients study.

2|4|1 The steps up to commissioning of the Flamanville 3 reactor

Pursuant to the decree of 2 November 2007 (see point 3|1|3 of chapter 3), introducing nuclear fuel into the perimeter of the NPP and subsequent start-up, require authorisation by ASN. According to Article 20 of this same decree, the licensee must, one year before the intended commissioning date and 6 months before introducing fuel into the BNI perimeter of Flamanville 3, send ASN a file comprising the safety analysis report, the general operating rules, a study of the NPP's waste management, the on-site emergency plan and the NPP decommissioning plan.
Without waiting for transmission of the complete commissioning application file, ASN and IRSN jointly initiated an advance review of the following, to prepare for examination of the commissioning application file:
– the technical baseline reference standards necessary for demonstration of safety and for finalising the detailed reactor design;
– the detailed design of some safety-related systems presented in the safety report;
– certain elements forming part of or guiding compilation of the commissioning request file.

In parallel with this advance technical examination, ASN also checked and monitored the construction of the facility.



EPR fuel building spent fuel pool formwork panels – November 2010

Advance review of required documents

In 2011, ASN and IRSN continued (accident studies (see box)) and sometimes concluded (baseline safety standards concerning the risk of fire or on-site explosion for example) the examinations under way since 2007.

ASN reminded EDF that the detailed design of the systems and equipment installed in Flamanville were dependent on certain subjects, such as the accident studies or the I&C architecture. The Advisory Committee for nuclear reactors was thus consulted on the I&C architecture (see box in point 5|2).

Finally, the characteristics of the Flamanville 3 reactor were examined within the more general context of the complementary safety assessments initiated in the wake of the accident on the Fukushima Daiichi nuclear power plant in Japan (see point 5|1).

2|4|2 Construction oversight in 2011

For ASN there are numerous construction oversight issues relating to the Flamanville 3 reactor. They concern:

– ensuring that construction supervision complies with the new regulatory framework established by the TSN Act;
– checking the quality of construction in a manner commensurate with the safety, radiation protection and environmental protection issues, in order to be able to rule on the quality of the construction and its ability to meet the defined requirements;
– building on the experience acquired by each party concerned during the construction of this new reactor.

To do this, in addition to the usual means (inspections, etc.), ASN has established requirements for the DAC application concerning the design and construction of Flamanville 3 and for the operation of the Flamanville 1 and 2 reactors located close to the construction site. The principles and procedures for oversight of the EPR reactor construction cover the following steps:
– detailed design, during which the engineering studies define the data necessary for construction;
– the construction activities, which include site preparation after issue of the authorisation decree, manufacture, construction, qualification, erection and testing of structures, systems and components, either on the construction site or on the manufacturers' premises.

This oversight also covers control of the risks relating to construction activities on the nearby BNIs (Flamanville 1 and 2 reactors) and for the environment. As the subject is a nuclear power reactor, ASN is also responsible for occupational health and safety inspection duties on the construction site. In addition, ASN oversees the manufacture of pressure equipment that will form part of the primary and secondary systems and of the nuclear steam supply system. ASN action in this field in 2011 is described in point 5|2.

Oversight of nuclear pressure equipment manufacture

Nuclear pressure equipment (ESPN) is primarily pressure equipment specifically designed to operate in nuclear facilities. This for example includes the reactor vessel, steam generators, or piping. This equipment plays an important role in the safety of nuclear facilities, because it involves a three-fold risk in the event of failure: that linked to the energy released, owing to the pressure it contains, the risk of radioactive releases and the risk that its failure could generate a nuclear accident or prevent it from being brought under control. The regulations applicable to ESPN therefore stand at the crossroads between those applying to conventional pressure equipment and those applying to the safety of nuclear facilities. They are an integral part of the nuclear safety rules. ASN considers that the ESPN manufacturers must guarantee a particularly high level of quality for this equipment. Manufacture of these items is regulated by the order of 12 December 2005 which adds extra safety, quality and radiation protection requirements to the regulatory requirements applicable to the manufacture of conventional pressure equipment (decree of 13 December 1999).

Within this framework, ASN or inspecting organisations approved by it, evaluate compliance with regulatory requirements for each item of pressure equipment for the EPR reactor.



Start of the roofing work ending the civil engineering activities for the pumping station – April 2011



View of the south diesel building – August 2011

Oversight by ASN and its approved organisations comes into play at different stages of the design and manufacture of nuclear pressure equipment. It takes the form of examination of the technical documentation for each item of equipment and of inspections in the manufacturers' facilities as well as those of their suppliers and subcontractors. Four organisations are currently approved by ASN to evaluate ESPN conformity, one of which is situated abroad: APAVE, ASAP, Bureau Véritas and AIB Vinçotte International.

2|4|3 Cooperation with foreign nuclear regulators

To be able to share experience with other nuclear safety regulators, ASN engages in numerous technical exchanges with its foreign counterparts on the subjects of oversight of the operation, design and construction of new reactors.

Bilateral relations

ASN enjoys close relations with foreign nuclear regulators in order to share previous and current experience of authorisation procedures and regulation of the construction of new reactors. In 2011, ASN and IRSN participated in bilateral meetings on these subjects with a number of foreign nuclear safety regulators: Finland, India, United Kingdom and China.

Owing to the EPR reactor construction projects at Olkiluoto in Finland and Flamanville in France, ASN and IRSN in 2004 set up enhanced cooperation with the Finnish nuclear regulator (STUK). This enhanced cooperation resulted in a number of technical meetings being held in January and May 2011, with visits to the Olkiluoto 3 and Flamanville 3 construction sites, to look at civil engineering and mechanical erection work.

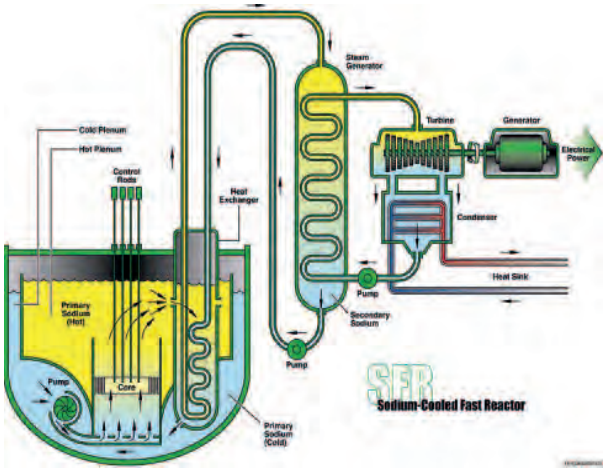
Regular discussions between STUK and ASN also take place in order to share experience of nuclear pressure equipment manufacturing.

Towards multinational cooperation

Some international bodies such as the NEA and WENRA also provide opportunities for exchanges on practices and lessons learned from overseeing reactor construction.

ASN is also a member of the Nuclear Energy Agency's Multinational Design Evaluation Programme (MDEP) (NEA, see point 2|4 of chapter 7) devoted to evaluating the design of new reactors. In 2011, ASN thus took part in the following work:

– thematic meetings and telephone conferences by the EPR detailed design working group. With the support of IRSN, ASN in particular took part in the work dealing with severe accidents, I&C, probabilistic safety studies, modelling of accidents and transients, technical specifications and on-site hazards. The plenary group also met once in May. A part of this meeting was open to the designers and future licensees (AREVA, EDF and other firms) to discuss the steps taken by these stakeholders to share their experience, the main differences between the



Schematic diagram of a sodium-cooled fast reactor

proposed designs and the steps taken to integrate the implications of the Fukushima accident. The next meeting of this plenary group is scheduled for January 2012 in Finland;
– two meetings of the technical codes and standards group. One of the meetings of this working group was opened to the various organisations in charge of developing codes and standards and involved in the comparison work launched by this working group;
– two meetings of the supplier inspection practices group.

Furthermore, in addition to the work on the EPR, a database was set up under the NEA framework recording the anomalies and discrepancies observed in recent or ongoing construction. Based on the deviations observed on Flamanville 3, ASN contributes to this database. For ASN, these international exchanges are one of the driving forces behind the harmonisation of safety requirements and regulatory practices.

2|5 The reactors of the future: initiating discussions on generation IV safety

CEA, in partnership with EDF and AREVA has, since 2000, been involved in looking at the development of the fourth generation[1] of nuclear reactors ("GEN IV"), notably through international cooperation within the framework of the Generation IV International Forum (GIF). The forum was initiated in 2000 by the US Department of Energy and brings together 13 members that include research and industrial organisations from the nuclear countries around the world. The aim of the forum is to pool R&D work and to keep open the choice of possibilities for industrial development from amongst the following six selected technologies:
• SFR: sodium-cooled fast reactor;
• GFR: gas-cooled fast reactor;
• HTR/VHTR: gas-cooled high temperature (850°C) and very high temperature (1,000°C) fast reactors;
• LFR: lead-cooled fast reactor;
• MSR: molten salt reactor;
• SCWR: supercritical water reactor.

For those promoting them, the main issue for fourth generation reactors is to ensure the sustainable development of nuclear energy by making better use of resources, by minimising waste (ability to burn plutonium and to produce it from uranium-238, ability to transmute minor actinides such as americium and curium) and by offering better risk control regarding safety, proliferation and terrorism. There is a wide consensus on these objectives amongst GIF's members. The industrial deployment of fourth generation reactors in France is being envisaged no earlier than the middle of the century. It will require prior creation of a prototype, for which the planned commissioning date is set at 2020 by the Act of 28 June 2006 on the sustainable management of radioactive materials and waste.

With this both medium- and long-term view, ASN wishes, at a stage well upstream of the regulatory procedure, to monitor the development of fourth generation reactors by French industry and the associated safety concerns – in the same way as with development of the EPR – so as to be in a position, at the appropriate time, to establish the safety objectives for these future reactors.

ASN underlines the importance it attaches to the safety justification of the plant technology chosen as compared with the others adopted by the GIF. In this context and on the basis of documents transmitted by CEA, AREVA and EDF in 2009 and 2010 at its request, ASN approached the Advisory Committee for nuclear reactors (GPR), and those responsible for plants (GPU) and waste (GPD), for their opinion on:
– the different technologies available for the fourth generation of reactors, for instance with respect to the reinforcement and the protection of the interests mentioned in I of article 28 of the TSN Act, as compared with the third-generation EPR type reactors, and the possibilities with regard to the separation and transmutation of long-lived radioactive elements, as mentioned by the planning Act of 28th June 2006 on the sustainable management of radioactive materials and waste. This step aims to present the advantages and drawbacks of each of the above-mentioned technologies, given their current state of development;
– experience feedback from the sodium-cooled fast reactors (particularly Phenix and Superphenix (RNR-Na)) and the fuel cycle associated with this technology, as well as the R&D orientations of this technology if SFR reactors were once again to be operated in France.

At the same time, CEA in 2010 initiated studies into a prototype sodium-cooled fast reactor (SFR) with the ASTRID project[2]. For CEA, this project forms part of the preparation of fourth generation reactors. Technical meetings were held in 2011 between ASN, IRSN and CEA. These meetings were held ahead of transmission of a safety orientations file, which, according to CEA, should be sent in 2012, and the safety options file (DOS) which, again according to CEA, will be

1. "4th generation" reactors as opposed to the reactors currently available to renew the installed base of so-called "3rd generation" reactors (this name itself being by comparison with the present installed base of second
2. Advanced Sodium Technological Reactor for Industrial Demonstration

drafted in 2014 on the occasion of the facility preliminary design, or well ahead of submission of the BNI creation authorisation application. Before the project starts, the main purpose of these meetings is to check that safety issues are correctly taken into account.

2|6 Reliance on nuclear safety and radiation protection research

Fundamental and applied research is one of the keys to progress in the field of nuclear safety and radiation protection, for several reasons:

– development and validation of innovative technical solutions allow the emergence of new products or processes for operation and maintenance; these solutions replace techniques or intervention methods which offer a lesser degree of protection;
– certain research work aims to improve knowledge of the risks, especially concerning severe accidents, in order to better target protective measures or even spotlight risks that had hitherto been poorly assessed: this is for example the case with experiments concerning corium-concrete interaction, the phenomena of vapour or hydrogen explosions, or studies into individual and group behaviour in stressful situations, leading to an improved evaluation of the role of human and organisational factors;
– research is useful in developing high level skills in the field of nuclear safety and radiation protection, thus helping to ensure that there is a ready supply of specialists.

Research into nuclear safety and radiation protection frequently requires the modelling of complex systems (NPPs, the physical-chemical phenomena involved, etc.). The development of increasingly sophisticated computer codes using constantly growing and changing IT resources must be mastered, from expression of requirements to validation of the tool. ASN is attentive to this validation phase, so that the demonstrations by the licensee or the appraisals by the technical support organisations are based on scientifically proven methods or results.

Knowledge of the latest research findings and those questions which still remain unanswered enable the regulatory authorities to measure how realistic their demands really are. ASN therefore keeps abreast of ongoing research work to increase the pertinence of its demands. The ability of the regulatory authorities, or their advisory expert organisations, to control the direction in which research is going, enables them to look again at safety issues that were assumed to be resolved: for example, interpretation of the experiments conducted by IRSN led to a review of the sump clogging risk.

It is also important for the licensees to make a significant contribution to the nuclear safety and radiation protection research effort, using the results to make their NPPs even safer. There are a number of driving forces behind research into nuclear safety and radiation protection, whether technological aspects or human and organisational factors:

– new reactor projects: the research work launched for the EPR reactor and that associated with the design of the fourth generation reactors, led to the development of new solutions, some of which could be implemented on the existing reactors;
– the desire of industry to improve the performance of its installations: for example, EDF's wish to improve nuclear fuel performance has, in particular, generated work on uranium oxide ceramics, fuel assembly cladding materials and design codes. This work is also a means of advancing the store of available knowledge and, in certain cases, enhancing safety, for example by improving accident study methods.

3 NUCLEAR SAFETY

3|1 Operation and control

3|1|1 Operation under normal conditions: ensuring compliance with baseline safety standards and authorising changes to documents

Changing technical operating specifications (STE)

Chapter III of the general operating rules (RGE) represents the reactor technical operating specifications (STE) (see point 1|2|2).

EDF may be required to modify the STEs to take account of its operating experience feedback, improve the safety of its installations, improve economic performance or incorporate the consequences of equipment modifications. When, in exceptional circumstances, EDF needs to deviate from the normal operation required by the STEs during an operating or maintenance phase, it must notify ASN of a temporary modification of the STEs. ASN reviews these modifications, with the technical assistance of IRSN, and may approve them, possibly subject to implementation of complementary measures if it considers that those proposed by the licensee are insufficient.

ASN ensures that the temporary modifications are justified and conducts an in-depth yearly review on the basis of a report produced by EDF. EDF is thus required:
– periodically to re-examine the reasons for the temporary modifications in order to identify those which would justify a request for permanent modification of the STEs;
– to identify generic modifications, in particular those linked to implementation of national equipment modifications and periodic tests.

Field inspection of normal operation

During NPP reviews, ASN checks:
– compliance with the STEs and, as necessary, with the remedial measures associated with the temporary modifications;
– the quality of the normal operating documents, such as the operating instructions and alarm sheets, and their consistency with the STEs;
– staff training in reactor operations.

3|1|2 Examination of incident or accident operating rules

The condition-based approach (APE)

In the event of an incident or accident on the reactor, the personnel have operating documents at their disposal, designed to enable them to return the reactor to and maintain it in a stable condition.

The steps to be taken in the event of an incident or accident use the condition-based approach (APE). The APE consists in defining operating strategies according to the identified physical condition of the nuclear steam supply system, regardless of the events that led to this condition. Should the condition deteriorate, a permanent diagnosis enables the procedure or sequence in progress to be aborted and a more appropriate one to be applied. These operating documents are drafted on the basis of incident and accident operating rules, as presented in chapter VI of the RGE. ASN must be notified of any use or modification of these documents.



ASN inspection of the control room during the ten-yearly inspection of the Tricastin NPP – May 2009

ASN examines the modifications of these operating rules and, notably, approves application of the files relating to reactor safety review. Some modifications to the APE procedures are the result of equipment modifications that will be incorporated during the ten-yearly outages, while others are the result of operating experience feedback or a response to ASN requests for improved safety.

To prepare the review of the commissioning application for the Flamanville EPR, the principles of operation in incident or accident conditions, which will be contained in the general operating rules relative to a safety incident or accident, will be subject to advance review.

Regular inspections are organised on the subject of incident and accident operation. During these inspections, particular attention is paid to examination of management of the operating documents of Chapter VI of the RGE, to management of special equipment used for accident operation and to training of operating staff.

Reactor operation in severe accident situations

If the reactor cannot be brought to a stable condition after an incident or accident and the scenario resulting from a series of failures leads to core deterioration, the reactor is said to be entering a severe accident situation. In such a highly hypothetical situation, various steps are taken to allow the operators, supported by emergency teams, to preserve the containment so as to minimise the consequences of the accident. The emergency teams may in particular use the severe accident management guidelines (SAMG).

3|2 Maintenance and testing

3|2|1 Regulating maintenance practices

ASN considers that maintenance policy is an essential line of defence in preventing the occurrence of anomalies and in maintaining the conformity of an installation with its safety requirements. Since the mid-1990s, EDF has been implementing a policy to reduce the volume of maintenance. Its aim is to enhance the competitiveness of the nuclear reactors in service, while maintaining the level of safety. This chiefly involves focusing the maintenance effort on equipment which, if it were to fail, would entail the highest safety, radiation protection or operational risks. This policy has led EDF to make changes to its organisation and adopt new maintenance methods. As is already the case in the aeronautical and military industries, EDF has developed the "reliability-centred maintenance" method. Based on a functional analysis of a given system, this method enables the type of maintenance required to be defined according to the contribution of its potential failure modes to the safety, radiation protection or operational consequences.

ASN considers that the methods for optimisation of the maintenance programmes for safety-related equipment are acceptable. Giving precedence to equipment monitoring, these methods reduce the risks relating to operations on equipment and limit the dose received by operators. However, ASN has reminded EDF that the methods may lead to a failure to detect a new or unforeseen fault, and has therefore asked EDF that their deployment be accompanied by continued systematic periodic inspections for certain items of equipment. ASN has also reminded EDF of the necessity of questioning the validity of the pilot equipment approach in the event of discovery of deterioration or in the case of repairs that could call into question the uniformity of a family of equipment.

ASN also reminded EDF that the use of these maintenance methods for pressure equipment on the main primary and secondary systems of nuclear reactors must comply with the requirements of the order of 10 November 1999 concerning the supervision of the operation of these systems and thus only concern areas in which no known deterioration is likely. ASN has also strictly defined the conditions for the use of such an approach, stressing the fact that this monitoring would need to be extended if a defect were to be discovered.

In 2010, EDF announced to ASN its intention to move in the near future towards a new maintenance doctrine, AP913. This methodology was developed in 2001 by the Institute of Nuclear Power Operations (INPO) working with American licensees. ASN intends to analyse the conditions for implementation of this approach on the EDF nuclear reactor fleet.

3|2|2 Examining the qualification of scientific applications

The computer software used for the safety cases are subject to the requirements of the order of 10 August 1984. One of the key requirements is qualification, which consists in ensuring that all software concerned can be used in complete confidence within a specific field.

In 2011, ASN continued with its examination of the qualification of the software to be used for the EPR reactor safety studies. ASN has also decided to start work on drafting guidelines aimed at defining the principles and methods to be used for the qualification review of the computer software used in the safety case demonstrations.

3|2|3 Guaranteeing the use of efficient control methods

Article 8 of the order of 10 November 1999 specifies that the non-destructive test processes used for in-service monitoring of nuclear reactor main primary and secondary system equipment must, before they are used for the first time, undergo qualification by an entity of proven competence and independence.

The role of this entity, called the Qualification Commission (accredited by COFRAC since 2001), is to evaluate the representativeness both of the models used for the demonstration and of the faults introduced into them. On the basis of the qualification results, it confirms that the performance of the examination method is as expected. As applicable, the aim is either to



Ultrasonic inspection of a weld join

demonstrate that the inspection technique used allows detection of deterioration as described in the specifications, or to explain the performance of the method.

At an international level, the qualification requirements differ appreciably from one country to another, with regard to both the procedures and the tests. The licensees are granted transitional periods of varying lengths for implementation of their respective programmes.

To date, 90 applications have been qualified by the in-service inspection programmes. New applications are currently undergoing development and qualification to address new requirements, especially concerning the Flamanville 3 reactor, for which forty-one applications must be qualified for the pre-service inspection.

Owing to the radiological risks linked to gamma radiography, ultrasound applications are preferred over radiography applications.

3|2|4 Authorising periodic test programmes

In order to check the correct operation of safety-related equipment and the availability of the back-up systems that would be called on in the event of an accident, tests are periodically conducted in accordance with the programmes of chapter IX of the RGE. These periodic checks make it possible to decide on the ability of an equipment item or a system to fulfil its role with regard to the design safety objectives assigned to it.

ASN is called on regularly to decide on the modification notifications for the periodic test programmes and reviews the design of periodic tests for the EPR.

3|3 Fuel

3|3|1 Controlling fuel management changes

In order to enhance the availability and performance of reactors in operation, EDF, together with the nuclear fuel industry, researches and develops improvements to fuels and their use in the reactor; this is known as "fuel management" (for more information on this concept, see point 1|1|2).

ASN ensures that each new mode of fuel management is the subject of a specific safety case for the reactors concerned, based on the specific characteristics of the new fuel management. When a change in the fuel or its management model leads to EDF revising an accident study method, this requires prior review and cannot be implemented without ASN approval. Since 2007, when major changes were made to the fuel management mode, fuel use has been regulated by an ASN decision comprising technical prescriptions.

3|3|2 Monitoring fuel status in the reactor

Fuel behaviour is an essential element of the safety case for the core in normal or accident condition operation and its reliability is of prime importance. The leaktightness of the fuel rods, of which there are several tens of thousands in each core and which constitute the first confinement barrier, are therefore the subject of particular attention. During normal operation, leaktightness is monitored by EDF by means of continuous measurement of the activity of radioelements in the primary system. A rise in this activity above predetermined thresholds is a sign of a loss of fuel assembly tightness. If the activity level becomes too high, application of the RGE leads to reactor shutdown before the end of the normal cycle. During this shutdown, EDF must look for and identify the assemblies containing leaky rods, which must not then be reloaded. These assemblies must be

TO BE NOTED IN 2011

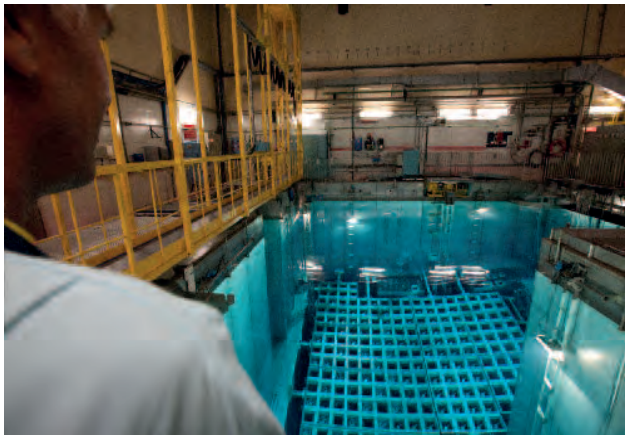
Review of fuel operating experience feedback

On 23rd June 2011, the Advisory Committee for nuclear reactors met at the request of ASN to review experience feedback concerning fuel, including the control rod clusters, for the period between 2003 and 2009.

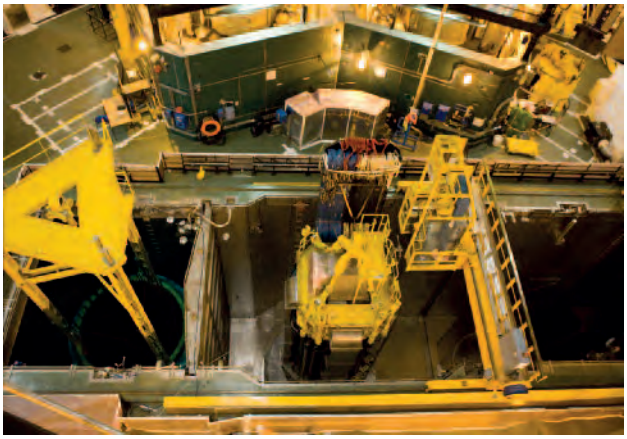
The Advisory Committee more particularly examined questions concerning:
– operating incidents linked to fuel and control rods,
– the safety case for mixed cores, that is cores loaded with assemblies of different types,
– the reassessment of the Zircaloy 4 corrosion model and the impact of the reassessed corrosion thickness on the safety demonstration,
– the safety demonstration provided for new fuel loads.

The period 2003-2009 was marked by increased diversification of the types of fuel assemblies used in the EDF reactors, leading to more widespread use of Westinghouse fuel assemblies in addition to the AREVA fuel assemblies, to the use of new cladding materials and to the greater presence of mixed cores in the 900 MWe and 1,300 MWe reactors.

ASN considers that EDF has taken satisfactory account of experience feedback concerning the behaviour of the fuel assembles and control rod clusters during the period 2003-2009. However, ASN does believe that the safety demonstration prior to use of the fuel assemblies in the cores must be supplemented, in particular for the mixed cores.



Fuel building pool in the Bugey NPP



View of the fuel handling pool for unit 2 of the Belleville-sur-Loire NPP during the ten-yearly inspection – June 2009

repaired by replacement of the leaky rods before they could possibly be reused.

ASN ensures that EDF analyses the causes of the leaks observed and that it implements means to examine leaking rods to determine the cause of the failure and to remedy this as soon as possible. Failure may be due to an incompatibility between the design and manufacture of the assemblies and the loads actually sustained or to the presence of foreign bodies in the primary system which could damage the cladding. Preventive and remedial measures may therefore affect the design of assemblies or their manufacture, or the reactor operating conditions. Furthermore, the conditions of handling of assemblies, the loading and unloading of the core and the prevention of foreign bodies in the systems and pits are also the subject of operating requirements, some of which contribute to the safety case and with which EDF's compliance is verified by ASN. ASN also conducts inspections to ensure that EDF carries out adequate monitoring of fuel assembly suppliers in order to guarantee that assembly design and manufacture comply with the rules established. Lastly, ASN calls on the GPR periodically with regard to lessons learned from operating feedback on fuel.

3|4 In-depth oversight of primary and secondary systems

The reactor main primary and secondary systems (CPP and CSP), collectively referred to as the nuclear steam supply system (NSSS) and presented in point 1|1|3, are fundamental components of a reactor. They operate at high temperature and high pressure and as they contribute to all fundamental safety functions – confinement, cooling and reactivity control – they are the subject of extensive surveillance and maintenance by EDF and in-depth monitoring by ASN. Monitoring of the operation of these systems is regulated by the order of 10 November 1999, mentioned in point 3|6 of chapter 3.

3|4|1 Monitoring and checking the systems

ASN makes sure that the licensee carries out appropriate monitoring and maintenance of the main primary and secondary systems. To do this, the licensee draws up monitoring programmes which are submitted to ASN. After reviewing these documents, ASN can submit requests. The licensee is required to take account of these requests. In addition to these documentary reviews, ASN carries out thematic inspections on equipment maintenance, primarily during the reactor outages. ASN also examines the inspection results transmitted at the end of each outage. In addition to the monitoring carried out on its systems by the licensee during each outage, ASN checks the good condition of this equipment every ten years, on the occasion of periodic post-maintenance testing. Periodic post-maintenance testing comprises three distinct phases: inspection of the equipment, involving numerous non-destructive tests, pressurised hydrotesting and verification of the good condition and correct operation of the over-pressure protection accessories. Post-maintenance testing of the primary system is performed during the ten-yearly outages. During the course of 2011, nine main primary systems underwent periodic post-maintenance qualification. This concerned the reactors of Cattenom 3, Bugey 4 and 5, Dampierre 1, Penly 1, Civaux 1, Tricastin 2, Gravelines 1 and Fessenheim 2.

3|4|2 Monitoring of nickel-based alloy zones

Several parts of a pressurised water reactor are made from nickel-based alloys:steam generator s tubes, steam generators partition plate, primary side coating of the steam generators tubesheet, vessel closure head adapters, vessel bottom-mounted instrumentation penetrations, vessel internals lower guide support welds, steam generators 1,300 drains and repaired vessel nozzle areas.

The use of this type of alloy is justified by its resistance to generalised or pitting corrosion. However, in reactor operating conditions, one of the alloys adopted, Inconel 600, proved to be susceptible to stress corrosion. This particular phenomenon occurs when there are high levels of mechanical stress. It can lead to the appearance of cracking, sometimes rapidly as seen on the steam generator tubes in the early 1980s, or on the 1,300 MWe reactor pressuriser instrumentation taps at the end of the 1980s.

ASN asked EDF to adopt an overall monitoring and maintenance approach for the zones concerned. Several main primary system zones made of Inconel 600 alloy are thus subject to



ASN inspection of a steam generator weld during hydrotesting of the primary system of the Cattenom NPP

special monitoring. For each one, the in-service monitoring programme, defined and updated annually by the licensee, has to meet requirements concerning the inspection objectives and frequencies. In addition, the SGs are the subject of a major replacement programme (see point 3|4|4).

In 2004, cracks attributed to stress corrosion were observed on an SG partition plate separating the hot leg from the cold leg, for circulation of primary fluid in the lower part of the SG. International operating experience feedback and the discovery of cracks on this part of the SG which EDF had in principle considered to be immune to this type of damage, led ASN to ask EDF to adapt its overall maintenance strategy for Inconel 600 zones, to take account of this damage. All the SGs equipped with an Inconel 600 alloy partition plate will thus be checked before the reactor third ten-yearly outage inspections.

The checks carried out in 2011 on the SG partition plates revealed no further signs of stress corrosion cracking. At the end of 2011, 10 SG partition plates were affected by stress corrosion and are being particularly closely monitored. To date, these monitoring checks have shown no significant variation in the stress corrosion indications.

In September 2011, cracks attributed to stress corrosion were discovered on a bottom mounted instrumentation penetration on Gravelines reactor 1. This was the first time that this type of damage had been observed on a French reactor. (see point 5|7).

3|4|3 Checking reactor vessel strength

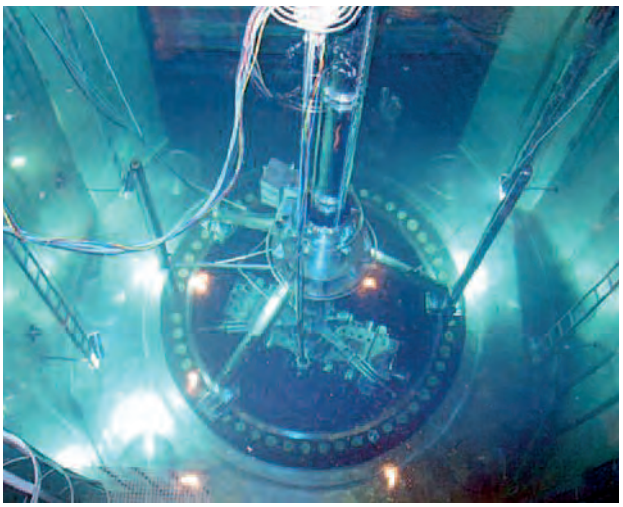
The reactor vessel is one of the essential components of a PWR. This component, 14 m high and 4 m in diameter, with a thickness of 20 cm (for the 900 MWe reactors), contains the reactor core and its instrumentation. The 300 t vessel is entirely filled with water in normal operation and can withstand a pressure of 155 bar at a temperature of 300°C.

Regular and accurate monitoring of the state of the reactor vessel is essential for the following two reasons:
– vessel replacement is not envisaged, for reasons of technical feasibility and economics;
– rupture of this component is not included in the safety studies; this is one of the reasons why all steps must be taken, right from the design stages, to ensure its strength throughout the reactor's operational life.

In normal operation, the vessel's metal slowly becomes brittle, under the effect of the neutrons from the fission reaction in the core. This embrittlement makes the vessel particularly sensitive to pressurised thermal shocks or to sudden pressure surges when cold. This sensitivity is also aggravated when defects are present, which is the case of some of the 900 MWe reactor vessels that have manufacturing defects under their stainless steel liner.

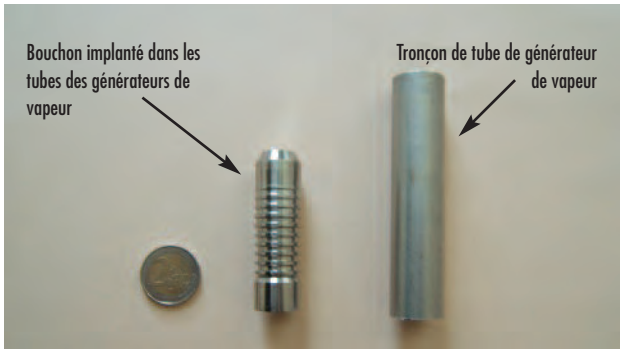
To protect against all risk of rupture, the following measures were taken as of commissioning of the first EDF reactors:
– a programme was introduced to monitor the effects of irradiation: test specimens of the same metal as the reactor vessel were placed inside the reactor. Some of these are regularly removed by EDF for mechanical testing. The results give a good picture of the ageing of the vessel metal and can even be used to anticipate it, inasmuch as the specimen capsules located near the core receive more neutrons than the metal of the reactor vessel;
– periodic checks verify that there are no defects or, in the case of vessels containing manufacturing defects, check that they are not getting worse.

ASN carries out regular examination of the documents on vessel in-service behaviour forwarded to it by EDF, so as to ensure that



In-service vessel inspection machine in an inspection situation

the demonstration provided by EDF regarding vessel in-service behaviour is sufficiently conservative and that it complies with regulations. Thus the document concerning the in-service behaviour of the 900 MWe reactor vessels for the ten years following their third ten-yearly outage inspections was presented to the Advisory Committee for nuclear pressure equipment in June 2010. ASN declared itself to be in favour of operating these vessels for the period concerned, provided that EDF complies with a number of requests and submits additional data. ASN is at present examining the first answers supplied by EDF on this matter and is preparing to examine the file concerning the in-service strength of the 1,300 MWe reactor vessels beyond their third ten-yearly outage inspections



Mechanical plug inserted at the ends of the steam generator tubes

3|4|4 Monitoring steam generator maintenance and replacement

The steam generators are exchangers of heat between the water of the primary system and that of the secondary system. The exchange surface consists of a tube bundle comprising from 3,500 to 5,600 tubes, depending on the model. These tubes contain the primary system water and exchange heat while preventing any contact between the primary and secondary fluids.

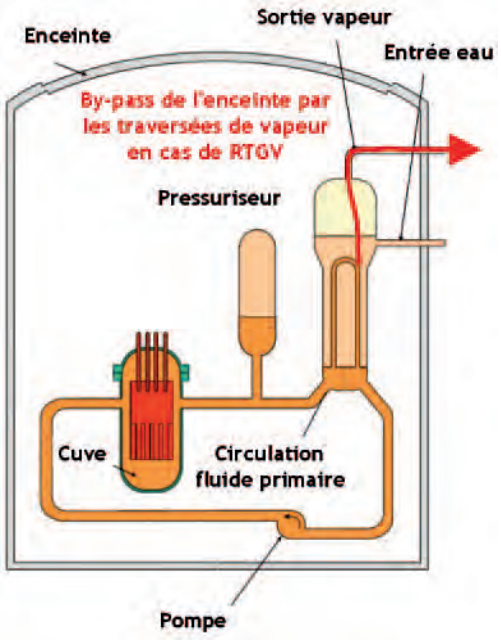
Integrity of the steam generator tube bundles is a major safety issue, since deterioration of a bundle can cause leaks from the primary to the secondary system. Furthermore, a break in one of the bundle tubes (SGTB) would lead to bypassing of the reactor containment, which is the third confinement barrier. Steam generator tubes are subject to several types of deterioration such as corrosion or wear.

The steam generators are the subject of a special in-service monitoring programme, established by EDF, reviewed periodically and examined by ASN. After inspection, tubes that are too badly damaged are plugged to remove them from service.

Chemical cleaning of steam generators

The iron contained in the NPP secondary system feedwater system builds up in the SGs and forms layers of magnetite on the tubes and on the surfaces of the internals. The layer of deposits that forms on the tubes reduces the heat exchange capacity. By narrowing or plugging the foliate water channels, the deposits also affect the flow on the tube support plates and prevent the free circulation of the water-steam mixture, thus creating a risk of damage to the tubes and SG internals (loads on the internals during certain transients, tube vibration, etc.) and can degrade the operation of the SG (water inventory, fluctuations, etc.). To prevent or minimise such effects, some of the deposits that have built up can be eliminated by remedial or preventive chemical cleaning. Conditioning of the secondary system with a higher pH is also a means of minimising metal deposits.

After deploying remedial processes to restore the operation of the SGs degraded by these deposits, the last two operations being in 2011, EDF has now adopted a strategy involving



By-pass of the concrete containment in the event of an SG tube rupture (SGTR) accident



Installation of equipment for chemical cleaning of the steam generators



Inspection of an SG weld during the 3rd ten-yearly inspection on the Fessenheim NPP – September 2011

regular use of preventive processes. This strategy must contribute to maintaining a satisfactory level of SG cleanness.

Steam generator replacement

Since the 1990s, EDF has been running a programme (RGV) to replace the SGs in which the tube bundles are the most seriously damaged, for instance those made of inconel 600 and not heat treated (600 MA). The RGV campaign for the 900 MWe plant series with a tube bundle made of 600 MA will be completed in 2014 with the RGV on Blayais 3. The SGs in the 900 MWe reactors initially equipped with this type of steam generator will thus have been replaced.

Over and above these replacements scheduled for no later than the third ten-yearly outage inspection, EDF is already preparing to replace the SGs for the 900 and 1,300 MWe plants in which the tube bundle is made of heat-treated nickel-based alloy (600 TT), owing to the high proportion of cracking in the transition zone. The first RGV for the 900 MWe plant series is that of Cruas 4 in 2014, to be followed by Cruas 1 in 2015 and Gravelines 5 and 6 in 2016. For the 1,300 MWe plant series, the first scheduled is Paluel 2 in 2015, to be followed by Flamanville 1 and Paluel 3 in 2017 and Flamanville 2 in 2018, the others being programmed between VD3 and VD4.

An inspection is also systematically performed by ASN on each steam generator replacement.

3|5 Checking containment conformity

The containments undergo inspections and tests to check their conformity with the safety requirements. Their mechanical performance in particular must guarantee a good degree of reactor building tightness, in the event of its internal pressure exceeding atmospheric pressure, which can happen in some types of accident. This is why these tests, at the end of construction and then during the ten-yearly outages, include a pressure rise in the inner containment.

The results of the ten-yearly outage tests for the 900 MWe reactor containments have so far shown leak rates that comply with the regulations. Their ageing was reviewed in 2005 as part of the 30-year periodic safety review, to assess their leaktightness and mechanical strength for a further 10 years. This review brought to light no particular problem liable to compromise the length of the service life. As part of this review process, EDF carried out studies to check the correct operation of the reactor building equipment access hatch in an accident situation. The studies and the modifications identified by EDF were examined during the GPR meeting of 20 November 2008 to close the thirty-year safety review of the 900 MWe reactors.

The results of the ten-yearly outage tests on the 1,300 MWe and 1,450 MWe reactor containments showed that the leak rate from the inner wall of some of these containments was rising. This was primarily the result of the combined effect of concrete deformation and the loss of pre-stressing of certain cables. Although account was taken of these phenomena at the design stage, they were sometimes underestimated. Consequently, in the event of an accident, certain wall areas would be liable to crack, leading to leaks. To counter this phenomenon, EDF implemented a repair programme using a resin liner, in order to restore the leaktightness of the most severely affected areas. Work was therefore carried out on all twenty-four reactors concerned.

Finally, a GPR meeting is planned for late 2012 to look at the issues of 1,300 MWe and 1450 MWe reactor containment, in particular in the run-up to the third ten-yearly outage inspections for the 1,300 MWe reactors.



Containment of a Fessenheim NPP reactor building

3|6 Application of pressure equipment rules and regulations

Owing to the energy that it could release in the event of failure, irrespective of the possibly hazardous nature of the fluid (liquid, vapour or gas) that would then be released, pressure equipment entails risks that must be kept under control.

This equipment (containers, exchangers, piping, etc.) is not specific to the nuclear industry and is used in many industrial sectors such as chemistry, oil refining, paper-making and refrigeration. It is therefore subject to regulations set by the minister for Industry, who imposes the requirements with a view to guaranteeing the safe manufacture and operation of this equipment.

The equipment items in this category liable to emit radioactive releases in the event of a failure are called nuclear pressure vessels and are regulated by the order of 12 December 2005. In addition to the requirements applicable to conventional pressure equipment and existing texts covering reactor primary and secondary systems, this order imposes additional in-service inspection requirements on nuclear pressure equipment that came into force on 22 January 2011. In 2011, ASN continued its analysis of the dossiers and guidelines drawn up by the licensees to define their methods for monitoring and repair of nuclear pressure equipment. This work also involved the third-party inspection bodies approved by ASN, which carry out the regulation checks on this equipment on its behalf. These requirements will allow greater in-service monitoring of the nuclear pressure equipment installed in the NPPs.

Application of the section regarding in-service monitoring also entails consultation with all the stakeholders in order to produce guidelines for implementation of this order, which should be issued in 2012.

ASN is also responsible for monitoring the enforcement of the regulations concerning the operation of the non-nuclear pressure equipment in NPPs. This monitoring consists, especially through on-site checks, in ensuring that EDF is implementing the measures required of it. ASN actions in 2011 include audits and monitoring visits of the NPP inspection departments. These departments, under the responsibility of the licensees, are tasked with carrying out inspections to ensure the safety of pressure vessels. However, EDF has decided that these departments will initially only deal with non-nuclear pressure equipment. Their competence could be extended to nuclear pressure equipment, once the requirements associated with this equipment, especially those corresponding to its safety roles, have been correctly defined. Of the 2011 audits, that performed at Saint-Alban led to the withdrawal of the approval of this department, owing both to the inadequate staffing levels for its required duties and its persistant lack of recognition by the management, observed since the previous audit. The loss of approval of the inspection department means that it could no longer define the nature and frequency of the equipment periodic inspections. Consequently, EDF had to carry out advance checks on its equipment.



View of a seismic monitoring device (accelerometer) installed in an NPP

3|7 Ensuring hazard protection

ASN strives to constantly strengthen the baseline safety standards designed to protect the NPPs against hazards. In addition to this approach, and as part of the CSAs, EDF required an evaluation of the ability of the NPPs to withstand situations going beyond these baseline standards (see point 5|1).

3|7|1 Prevention of seismic risks

Buildings and equipment important for the safety of NPPs are designed to withstand earthquakes of an intensity greater than the most severe earthquakes that have ever occurred in the region of the NPP, based on historical and scientific data. The rules for dealing with the seismic risk are reviewed regularly in order to take account of new knowledge and are applied on a case by case basis during the safety reviews. Although there is not a particularly strong seismic risk in France, this topic is the subject of considerable effort on the part of EDF and of sustained attention by ASN.

Design rules

Basic safety rule (RFS) 2001-01 of 31 May 2001 defines the methodology for determining the seismic risk to surface BNIs (except for radioactive waste long-term repositories).

RFS V.2.g on seismic calculations for civil engineering structures was reviewed and published in 2006 in the form of guidelines (Guide no.2/01 of 26 May 2006) for the inclusion of the seismic risk in the design of civil engineering structures for surface BNIs except for radioactive waste long term repositories). It is the result of several years of work by experts in the seismic engineering field. For surface BNIs and based on NPP data, this text defines the seismic design requirements for civil works and the acceptable methods for:

– determining the seismic response of these works, by considering their interaction with the equipment they contain and assessing the associated loads to be used in the design;
– determining the seismic movements to be considered for the design of the equipment.

ASN also takes part in a working group set up by the General Directorate for the Prevention of Risks (DGPR), which includes IRSN and the French Geological and Mining Research Office

(BRGM). The aim of this working group is to compare the contingencies taken into account and the construction design of both installations classified on environmental protection grounds (ICPEs) and BNIs.

Seismic design reviews

Within the framework of the current periodic safety reviews (see point 2|2|3), the seismic design review in particular consists in updating the level of the earthquake to be taken into account, under application of RFS 2001-01. For the safety reviews associated with the third ten-yearly outages of the 900 MWe reactors, ASN asked EDF to examine the seismic design of the electrical buildings of CPY reactors and to analyse the risk the turbine hall represents for the electrical buildings. For CP0 reactors, ASN asked EDF to study the seismic design of the nuclear island buildings and the turbine hall. The studies led to the definition of reinforcement changes for equipment and structures, with work beginning in 2009 during the ten-yearly outages of the Tricastin 1 and Fessenheim 1 reactors. The conclusions of these studies and the modifications identified by EDF were reviewed at the GPR meeting of 20 November 2008 dedicated to completion of the third ten-yearly outages of the 900 MWe reactors. With regard to the safety review associated with the second ten-yearly outages of the 1,300 MWe reactors, EDF studied the earthquake stability of the reactor turbine hall and the strength of the civil works of the electrical building and backup auxiliaries. These studies brought to light the fact that the original design is able to guarantee the resistance of these reactors to the earthquakes reassessed in accordance with RFS 2001-01, subject to additional justification that the turbine hall does not constitute a hazard for the electrical building and for the reactor safeguard auxiliaries of the P'4 plant series.

To prepare for the next seismic design reviews (forty year review for the 900 MWe reactors and thirty years for the 1,300 MWe reactors), a working group was set up, including EDF, IRSN and ASN, to study the reference earthquakes to be considered. For the 1,300 MWe reactors, EDF sent ASN a technical notice proposing to update the seismic levels to be considered for the safety review associated with the third ten-yearly outages. ASN asked EDF to explain the elements taken into account in the implementation of RFS 2001-01 concerning the uncertainties linked to the methodology. EDF is required to propose and initiate a programme of work to this effect. Every six months, EDF is also required to report on the progress of the R&D programme engaged with other partners.

3|7|2 Drafting flood prevention rules

Following the flooding of the Le Blayais NPP in December 1999, EDF began to reassess the off-site flooding risk and the protection of its NPPs against this risk. This reassessment mainly concerns a revision of the maximum design flood level (CMS: maximum water level considered when designing the plant's protection structures). The revised CMS takes account of the additional causes of flooding, such as particularly heavy rain, failure of on-site water storage tanks and rising groundwater. The measures to be taken for the reactors in the event of a rise in the water level were also reassessed. A file was produced for each NPP and works to improve protection of the sites have been defined. In October 2007, EDF completed the work made necessary by the flood risk reassessment, with regard to the risks of water ingress.



Aerial view of Le Blayais NPP, on the right bank of the Gironde estuary

In order to finalise the overall approach to the off-site flooding risk for EDF reactors, but also for other NPPs, ASN asked the Advisory Committee for nuclear reactors (GPR) and the Advisory Committee for laboratories and plants (GPU) for their opinions. ASN followed their recommendations and issued six particular demands concerning the risk of dam, system or equipment failure, the flooding risk, protection against rainfall and protection of the Tricastin site. A problem was raised on this occasion: the safety of certain installations with regard to off-site flooding depends to a large extent on the behaviour of off-site structures not belonging to EDF, in particular with regard to the Cruas-Meysse and Tricastin nuclear power plants. Evaluating the robustness, the monitoring and the maintenance of such structures entails taking action governed by a decision-making process that involves the concession-holders for the structures, the public authorities and EDF. Given this situation, ASN reminded EDF of its responsibilities as licensee and asked it to continue its exchanges with the concession-holders for the structures concerned and to keep it informed of progress.

Since then, for the Cruas-Meysse and Tricastin NPPs, a convention was signed in 2011 between EDF and the Compagnie nationale du Rhône (CNR) concerning the countermeasures to be deployed.

At the same time, a working group of experts (in particular from IRSN), licensees' representatives and ASN undertook a review of RFS I.2.e on integration of the flooding risk. The new guide for BNI protection against the flooding risk will concern the choice of hazards liable to lead to flooding of the site, the methods for characterising them all and the flooding risk design

and protection principles. This draft guide from the working group was the subject of consultation in 2010. The remarks received were discussed at review meetings in 2011 in preparation for GPR and GPU meetings in 2012. ASN plans to publish this new guide in 2012.

3|7|3 Preventing heatwave and drought risks

The heatwave in the summer of 2003 had considerable consequences for the environment of the NPPs: some water courses saw a reduction in flow rate and significant warming. However, this water is the heat sink for some of the NPPs, which need it for cooling purposes. The heatwave also resulted in increased air temperatures, causing a temperature increase within the NPPs. The rise in the air temperature raises the question of the correct short to medium-term operation of certain heat-sensitive equipment items. During this period of heatwave and drought some physical limits that had hitherto been applied to NPP design or imposed by the RGE were reached.

EDF therefore proposed a set of "intense heatwave" baseline requirements examining and reassessing the operation of installations under more severe conditions than those envisaged in the design, applying higher hypothetical air and water temperatures. EDF proposed a version of these requirements for the 900 MWe reactors and a version for the 1,450 MWe reactors. The requirements for the 1300 MWe reactors will be forwarded for the safety review associated with the reactors' third ten-yearly outages. In 2009, ASN adopted an initial stance concerning the baseline safety requirements for the 900 MWe reactors. With the help of its technical support organisation, ASN is currently examining EDF's responses to the comments and requests for additional information issued in 2009, as well as the hardware modifications leading to a permanent strengthening of the robustness of the reactors to extreme heat. ASN will reach a decision on these new elements by early 2012.

At the same time, the deployment of certain improvements and the implementation of operating practices to optimise the cooling capacity of the equipment and increase the resistance of the equipment sensitive to high temperatures began in 2004 at the most vulnerable sites and is being extended to all sites according to an optimised calendar.

ASN takes part in the national heatwave watch and EDF has initiated an in-house climate monitoring process in order to anticipate climate changes which could compromise the hypotheses adopted in the "extreme heat" baseline safety standards. As part of the safety review associated with the third ten-yearly outages of the 1,300 MWe reactors, ASN will give its judgement on the adequacy of the organisation put in place by EDF to observe climate trends and to ensure the validity of the hypotheses used in the baseline requirements.

3|7|4 Taking account of the fire risk

The fire risk in nuclear power plants is handled using the principle of defence in depth, based on three levels: installation design, prevention and fire-fighting.

The NPP design rules should prevent the spread of any fire and limit its consequences. This is primarily built around:

– the principle of dividing the NPP into sectors in order to keep the fire within a given perimeter, each sector being bounded by sectoring elements such as doors, fire-walls, fire-dampers, etc., offering a fire resistance rating specified in the design;
– protection of redundant equipment performing a fundamental safety function.

Prevention primarily consists in:
– ensuring that the types and quantities of combustible materials in the NPPS – whether present permanently or temporarily – remain below the hypothetical levels used in the sectoring design;
– identifying and analysing the fire risks. In particular, for all work liable to cause a fire, a fire permit must be issued and protective measures must be taken.

Fire-fighting should enable a fire to be tackled, brought under control and extinguished within a time compatible with the fire resistance rating of the sectoring elements.

ASN checks that the fire risk is taken into account in the NPPs, notably through an analysis of the licensee's baseline safety standards, monitoring of significant event notifications made by the licensees and inspections performed on the sites.

In 2011, ASN and its technical support organisation, IRSN, concluded their review of the baseline safety requirements for protection against the risk of on-site fire in the Flamanville 3 EPR.

ASN also looked at the steps being taken by EDF following the deviations that occurred in 2011 on the NPPs in service, in particular with regard to the problem of fire sectorisation breaks.

Finally, ASN carried out inspections on fire risk management, in particular with respect to the electrical power transformers connecting the plant to the national electricity grid.

3|7|5 Checking that the explosion risk has been considered

Amongst the accidents that could occur in an NPP, explosion represents a major potential risk. Explosions can damage elements that are essential for maintaining safety or may lead to failure of the containment with the dispersal of radioactive materials into the NPP or into the environment. Steps must therefore be taken by the licensees to protect the sensitive parts of the BNI against the risk of explosion.

ASN checks the prevention and monitoring measures taken with regard to the risk of explosion. It in particular ensures that this risk is included in EDF's baseline safety requirements and organisation.

ASN closely monitors implementation by EDF of the provisions of the prescriptions concerning management of the explosion risk as laid out in decision 2008-DC-0118 of 13 November 2008. These provisions can be organisational (creation of an organisation designed to guarantee compliance with the explosion risk regulations, examination of the conformity of all the explosive fluid lines and in-depth review of integration of the explosion risks) or material (replacement of lines carrying hydrogen, etc.).

In 2011, ASN and its technical support organisation, IRSN, also examined the baseline safety requirements for protection

against the risk of on-site explosion for the EPR during the advance examination of the Flamanville 3 reactor commissioning application.

Finally, ASN ensures compliance with the "explosive atmospheres" (ATEX) regulations with respect to occupational worker protection. The ASN inspectors check the effectiveness and pertinence of EDF's organisation for management of the ATEX risk, during their on-site inspections.



Fire service training exercise on the Civaux NPP

4 RADIATION PROTECTION, PROTECTION OF WORKERS AND THE ENVIRONMENT

4|1 Oversight of occupational radiation protection

One of the duties of ASN concerning basic nuclear installations, as stipulated by article 4 of the TSN Act[1], is to check compliance with the regulations relative to protection of workers liable to be exposed to ionising radiation in NPPs. In this context, ASN's responsibility extends to all workers on the sites, the staff of EDF and of service providers throughout the service life of an installation.

4|1|1 Oversight of radiation protection in operating NPPs

Radiation protection in operating NPPs is subject to control by ASN in two main ways:

– by carrying out inspections: These inspections can be carried out:
  • focusing specifically on radiation protection, scheduled once or twice per year and per site;
  • during reactor outages;
  • subsequent to incidents involving exposure to ionising radiation;
  • in the head office departments responsible for radiation protection doctrine.
– by examination of the files relative to occupational radiation protection. This examination can be performed with IRSN and can concern:
  • significant radiation protection event notifications provided by EDF;
  • maintenance or modification files with national implications, produced under the responsibility of EDF;
  • documents produced by EDF concerning the implementation of radiation protection regulations.

In addition, ASN provides EDF with an annual presentation of its evaluation of the status of radiation protection in the operating NPPs. This annual report allows comparison of ASN's assessment with that of the licensee, in order to identify possible areas of progress.

Finally, meetings are also held periodically to review the progress of technical or organisational projects under study or to be implemented in the NPPs.

4|1|2 Radiation protection requirements for NPPs in the construction phase

When examining the files relative to new reactors, and in particular to the EPR, ASN has asked EDF to learn lessons from the operating nuclear installations in France and from similar technology installations operating in other countries, with a view to reducing the collective dose as far as reasonably achievable.

To this end, ASN, working with IRSN, examines the design and construction procedures intended to reduce the collective dose and the individual doses of the most exposed workers.

ASN also carries out radiation protection inspections for workers on construction sites, especially during non-destructive testing using radioactive sources (see point 6|1|3).

4|2 Oversight of application of labour legislation in NPPs

Pursuant to Article 57 of the TSN Act and the Labour Code (Article R 8111-11), ASN is responsible for labour inspection duties in the NPPs. The health, safety, working conditions and quality of employment of the employees of EDF, its contractors and their subcontractors, along with the safety of the NPPs, are now checked on a coordinated basis by ASN. These checks concern the construction, operation and decommissioning of NPPs.

The main duties of the ASN officers in charge of labour inspection are:

– to ensure compliance with the labour regulations, by checking that they are effectively and correctly applied, by all means at its disposal, but also by helping EDF to assimilate and implement the requirements of these regulations;
– to investigate work accidents and ensure that the licensee is taking the necessary steps to guarantee worker safety;
– to take decisions concerning the organisation of work (working or rest time waivers) and professional relations;
– to identify and whenever possible monitor labour disputes as part of its conciliation duties;
– to inform and advise the employees, their representatives and the employers and to take part in meetings of the committee for health, safety and working conditions (CHSCT);
– to inform ASN of any shortcomings or abuses not covered by labour legislation and of the situation in the establishments inspected.



General view of the Bugey NPP

3. The 13 June 2006 Act on transparency and security in the nuclear field.



Water intake and discharge structures on the Loire river for the Dampierre en Burly NPP

This means that some 20,000 EDF employees and as many contractor employees, either permanent or on temporary work sites (for reactor maintenance outages for example), are covered by ASN's labour inspection duties at the 19 operating NPPs, at the 9 reactors being decommissioned and at the Flamanville reactor construction site.

As of 31 December 2011, ASN had 12 labour inspectors performing labour inspection duties, including 3 full-time, allocated to the regional divisions and working closely with the sites, plus a central director coordinating the network of labour inspectors and handling interfacing with the Ministry for Labour. Coordination with the General Directorate for Labour of the Ministry for Labour was thus the subject of a cooperation agreement signed on 1 March 2011. In the regions, this agreement is implemented locally through regional agreements signed by the ASN divisions and the Regional Directorate for Enterprises, Competition, Consumption, Work and Employment (DIRECCTE).

Finally, since 2009, the links between the labour inspection measures taken and the other NPP monitoring and inspection activities have been consolidated in order to achieve the integrated view of control sought by ASN.

4|3 Controlling the environmental and health impacts of NPPs

4|3|1 Reviewing discharge requirements

Act 2006-686 of 13 June 2006, and in particular its Article 29, gives ASN the competence to define the prescriptions concerning water intake and discharges by basic nuclear installations (see point 3|1|3 of chapter 3).

Where NPPs are concerned, ASN's objective is a review of most of the existing discharge requirements in order to attain better harmonisation between the different sites. The new discharge requirements now take the form of two decisions:
– the first of these, subject to approval by the ministers responsible for nuclear safety, sets the discharge limits;
– the second defines the prescriptions concerning discharges, intake and consumption of water.

ASN applies the following principles when requests for a discharge permit renewal or modification are received:
– with regard to radioactive discharges, ASN is tending to lower the regulation limits. ASN sets new limits based on experience feedback concerning actual discharges, while taking account of any unforeseen circumstances that could arise from routine operation of the reactors;
– for non-radioactive substances, ASN has decided to establish discharge requirements for substances that were not previously regulated, in order to control virtually all of the discharges and to adopt an approach that is more in line with heightened awareness of environmental issues.

ASN sets discharge limits as low as possible, in the light of current technical knowledge and the economic situation, ensuring at the same time that they do not have significant impacts on people or on the environment, while allowing the installation to operate normally.

Lastly, it should be noted that technological progress has made it possible to alter limits and decision thresholds, guaranteeing better determination of actual discharges (see point 6|1|5).

TO BE NOTED

Radiological impact of discharges

The calculated radiological impact of the maximum discharges given in the EDF licence applications for the most exposed population group, still remains well within the dosimetric limit acceptable for the public (1 mSv/year).

The annual effective dose delivered to the population reference group (group subject to maximum radiological impact) that appears in the EDF effluent discharge and water intake licence applications is thus estimated at from a few microsieverts to several tens of microsieverts per year, depending on the particular site.

For example, the annual effective dose, including all exposure routes and all radionuclides, corresponding to the limit values requested by EDF for renewal of the licences for the Dampierre NPP, was evaluated at 2 microsieverts per year.

4|3|2 Oversight of waste management

Management of the radioactive waste produced by the NPPs operated by EDF is covered by the general framework for management of waste from BNIs, presented in Chapter 16 of this report. ASN ensures consistency between the management of waste from NPPs and of that from other BNIs. For this type of waste, and for non-radioactive wastes, ASN has the licensee's study reference documents, as required by regulations, described in Chapter 3, point 3|5|1.

The baseline documents cover the following themes:
– a review of the existing situation, recapitulating the different wastes generated and their quantities;
– waste management procedures;
– organisation of waste transport;
– waste zoning;
– the status of current disposal options.

Each site sends ASN the details of the waste it generates annually, indicating the chosen disposal routes, an analysis of trends in comparison with previous years, a report on any discrepancies observed and on the functioning and organisation of the site for waste management, as well as any unusual occurrences. The outlook is also addressed. EDF currently classifies its waste as process waste, maintenance waste and other waste, distinguishing between waste from controlled areas and others. Meetings are held regularly between the licensee and ASN to allow exchanges of information and views regarding waste and its management, especially via annual reports.

These elements and the regulations constitute the basis ASN uses to regulate management of waste by EDF. During inspections, inspectors review the organisation of sites in terms of waste management and various other points such as the handling of anomalies, and visit areas where waste is stored temporarily or treated.

4|3|3 Increasing protection against other risks and forms of pollutions

Controlling the bacterial risk

The cooling towers (see point 1|1|4) function by means of circulation of water, with cooling in an air flow, and are therefore particularly favourable to the development of legionella.

To strengthen prevention of the risk of legionella arising from cooling tower operation (see point 1|1|4) ASN, together with the General Directorate for Health (DGS), required in 2005 that EDF comply with new maximum legionella concentration limits in the cooling systems and introduced installation surveillance requirements.

In 2008, ASN called upon the French Agency for Environmental and Occupational Safety (AFSSET) to better ascertain the health and environmental risks surrounding this issue. On the basis of opinions given by AFSSET, ASN requested that EDF develop and implement preventive or remedial means to reduce the risk arising from micro-organisms, whilst also seeking to minimise the discharges of chemicals resulting from biocidal treatments. Because in some reactors, the legionella concentrations are still above the shutdown threshold in force for ICPEs, implemented following the outbreak of legionnaire's disease in Harnes in late 2003 (105 colony forming units per litre of water), ASN is closely monitoring the progress of the action plan, asking EDF to explore all alternative solutions for regular chemical treatments and all methods and techniques able, as applicable, to attenuate the impact of these treatments. By examining files and carrying out field inspections, ASN verifies the progress and the results of actions to combat legionella.

UNDERSTAND

Legionella concentration levels in the large NPP cooling towers

The legionella concentrations not to be exceeded in the secondary system cooling systems are 5.10^6 CFU/l for NPPs with large cooling towers (about 150 m high), and 5.10^5 CFU/l for the Chinon NPP with its smaller cooling towers (28 m). For systems other than the secondary system cooling systems (air-conditioning, etc.), application of the current requirements on installations classified for environmental purposes (ICPE) is requested.

5 CURRENT STATUS OF NUCLEAR SAFETY AND RADIATION PROTECTION

5|1 The NPPs inspection campaign and the complementary safety assessments following the Fukushima accident

Following the nuclear accident in Fukushima, ASN considered that a complementary safety assessment (CSA) of the French civil nuclear facilities with respect to the type of events which led to the Fukushima accident, should be initiated. The CSAs are the response to the requests made by the Prime Minister on 23 March 2011 and the European Council on 24 and 25 March 2011. ASN also carried out a series of inspections targeting the issues identified by experience feedback from the Fukushima accident.

Targeted inspections

These inspections, carried out on all the nuclear facilities felt to be high-priority, comprised field checks on the conformity of the licensee's equipment and organisation with the existing baseline safety standards.

The topics covered by these inspections were as follows:
– protection against off-site hazards, in particular seismic resistance and protection against flooding,
– loss of heat sinks,
– loss of electrical power supplies,
– operational management of radiological emergencies.

19 inspections were carried out between June and October 2011 by teams comprising several ASN inspectors accompanied by the IRSN. This inspection campaign represented 74 days of inspection. For each site, this took the form of in-depth inspections lasting several days, allowing spot-checks to be run on all the topics mentioned above.

The inspections revealed that the five subjects targeted by the programme were not always in conformity with the existing baseline safety standards. The main measures to be implemented by EDF are summarised below.

1. Concerning the seismic topic, ASN considers that the inspections revealed shortcomings on several sites and that on the whole progress is needed on all the sites. It is important to carry out exercises simulating an earthquake so that the planned procedures can be implemented and the staff are prepared for this type of situation. ASN also considers that greater account must be taken of the "seismic interaction" problem in the day to day operation of the units. Finally, EDF will have to ensure compliance with RFS I.3.b concerning seismic instrumentation, for instance with regard to the staff's familiarity with the equipment, its upkeep and its calibration. Overall, ASN considers that the subject requires permanent vigilance on the part of EDF, to prevent the potential implications of this hazard being gradually forgotten during the day to day operation of the reactors.

2. With regard to the topic of flooding, the conclusions of the inspections vary from site to site. ASN considers that the organisation in place to manage the flooding risk is satisfactory and meets its expectations. However, ASN considers that the management of volumetric protection has to be improved on several sites. ASN also considers that EDF should define and carry out exercises to test the equipment and teams in this type of situation and take account of the experience feedback from these exercises. Finally, ASN considers that progress is required on the following topics:
– rigorous application by the sites of the special operating rules in the event of flooding;
– monitoring of meteorological, high water and tidal parameters;
– the schedule for the work decided on as a result of the experience feedback from the partial flooding of the Le Blayais site in 1999;
– management of the mobile pumping resources.

3. ASN considers that the heat sink requires particular vigilance. Its vulnerability was highlighted by the recent events of heat sink clogging and partial loss at Cruas-Meysse and at Fessenheim in December 2009, which led EDF to initiate an action plan to increase its robustness. ASN asked EDF to conduct a design review of all its heat sinks. ASN will ask EDF for detailed conclusions of this site-by-site design review, along with a plan of action with completion dates.

The inspections carried out by ASN in 2011 found that the general state of the facilities was generally satisfactory, although there are a number of deviations on certain sites. As a general rule, rigorous operation and maintenance, equipment and structure condition monitoring, and exhaustive application of national directives, are areas for improvement on numerous sites. On many sites, maintenance of the SEC system needs to be improved.

4. With regard to electrical power supplies, the inspectors felt that the EDF sites were on the whole satisfactory but could be improved, especially concerning the following points:
– rigorous operating and maintenance documents (filling out of operational documents, updating of maintenance programmes);



ASN inspection of the Cruas NPP pumping station

– physical condition of certain equipment used for storage of fuel oil (piping corrosion, ingress of water);
– management of fluids required by the electricity generator sets (periodic analyses);
– periodic checks associated with the combustion turbine (TAC) on certain sites.

5. Accident situation operations can be improved. The PUI organisation adopted by the sites is satisfactory. ASN considers that EDF needs to improve its management of the fall-back centres and certain agreements concluded with off-site organisations.

Complementary Safety Assessments

On 5 May 2011, ASN instructed EDF to carry out complementary safety assessments on the robustness of the facilities when faced with exceptional situations such as those which led to the Fukushima accident. They complement the safety approach adopted permanently by the facilities.

On 15 September 2011, EDF submitted one file per plant, in accordance with the methodology approved by ASN. These files were discussed at a meeting of the Advisory Committees for reactors and for laboratories and plants on 8, 9 and 10 November 2011.

Following the complementary safety assessments on the nuclear power reactors, ASN considers that the safety of these reactors is such that none of them needs to be immediately shut down. At the same time, ASN considers that their continued operation does however require that their robustness to extreme situations be increased beyond their existing safety margins, as rapidly as possible.

Therefore:
• **ASN will be requiring the creation of a "hard core" of material and organisational measures** able to manage basic safety functions in extreme situations, for all the facilities addressed in the CSA report. Before 30 June 2012, the licensees must submit to ASN the content and the specifications of the "hard core" for their specific facilities.
• **As of this year, ASN will be requiring gradual implementation of the "Nuclear Rapid Intervention Force (FARN)"** proposed by EDF, a national emergency arrangement combining specialised teams and equipment, able to **intervene in less than 24 hours on a site affected by an accident**.
• **ASN will be requiring the implementation of reinforced measures to reduce the risk of "uncovering" of the fuel** in the fuel pools in the various facilities.
• **ASN will be requiring the performance of feasibility studies for additional measures to protect underground and surface waters in the event of a severe accident** in the NPPs or the La Hague facilities.

To do this, ASN will be issuing a series of prescriptions requiring that EDF implement these measures.

ASN considers that social, organisational and human factors are a key element of safety. ASN **will therefore remain attentive to renewal of the licensees' workforce and skills.** ASN in particular considers that monitoring of the subcontractors working in the nuclear facilities must not be delegated by the licensee when this concerns safety-related activities.

The order stipulating the general rules concerning basic nuclear installations, prepared by ASN together with the ministries responsible for nuclear safety, was also signed on 7 February 2012. ASN considers that it will make a significant contribution to improving safety.

Finally, on the basis of the detailed experience feedback from the Fukushima accident, ASN **will be reinforcing the baseline safety standards for the nuclear facilities,** in particular with regard to the "seismic", "flooding" and "risks linked to other industrial activities" aspects.

TO BE NOTED IN 2011

Complementary Safety Assessments

The key steps in the process are as follows:
- *3 May 2011: favourable opinion from the HCTISN concerning the CSA draft specifications.*
- *5 May 2011: 12 decisions by the ASN Commission asking the various nuclear facility licensees to produce a "complementary safety assessment" (CSA) report complying with precise specifications.*
- *1 June 2011: each licensee sends ASN a note presenting the methodology adopted for the complementary safety assessment of its facilities, as well as the organisation adopted in order to meet the stipulated completion dates.*
- *19 July 2011: ASN issues a position statement on the methodology notes presented by the licensees.*
- *15 September 2011: the licensees send ASN their complementary safety assessments for the high-priority facilities.*
- *4 November 2011: IRSN sends ASN its analysis of the complementary safety assessment reports forwarded by the licensees.*
- *8 to 10 November 2011: meeting of the Advisory Committees with submission of their opinion on the licensee reports to ASN.*
- *3 January 2012: ASN submits its report and its opinion on the CSAs to the Prime Minister, who forwards it to the European Commission.*
- *January to April 2012: European level peer reviews of the national reports.*
- *End April 2012: review and approval by ENSREG of the report on the European peer review conclusions.*
- *28 -29 June 2012: presentation by the European commission to the European Council of its report on the stress tests.*

5|2 Monitoring of the construction of the EPR Flamanville 3 reactor

Detailed design review for Flamanville 3

The detailed design review is carried out by ASN with the technical support of IRSN on the basis of a documentary review. In 2011, ASN and IRSN mainly continued their examination of the installation's control and instrumentation system (see box) and civil engineering, and initiated examination of the detailed design of some systems that are important for reactor safety, focusing on innovative systems and those involved in reactor protection and safeguard or in maintaining the three safety functions.

In addition to the detailed design technical review carried out with the support of IRSN, ASN in 2011 conducted nine inspections in the engineering departments in charge of carrying them out and of monitoring manufacturing at the suppliers. ASN thus checked implementation in the project management system of the requirements of the order of 10 August 1984. These checks in particular concerned the requirements relating to the management and monitoring of contractors, the identification and management of quality-related activities, management of deviations and management of experience feedback. One of these inspections was an in-depth inspection of the conformity of the Flamanville 3 design and construction work subcontracted by EDF to AREVA. (see box p. 354). Furthermore, some of the contractor management inspections were performed at the manufacturers' premises.

Oversight of construction activities on the FA3 NPP

With IRSN's support, ASN performed 25 inspections on the construction site in 2011. These in particular concerned the following technical topics:
– civil engineering, including activities relating to the construction of the inner containment wall, the reactor and fuel building pools, the corium catcher and the airplane crash shell;
– the mechanical assembly activities, including initial pipe welding (see box p. 354) and the tank fabrication activities;
– electrical system assembly activities;
– non-destructive testing and occupational radiation protection;
– the organisation and management of safety on the construction site and within the operating team for the future Flamanville 3 nuclear reactor;
– the impact of the construction site on the safety of the Flamanville 1 and 2 reactors.
– the environmental impact of the construction site.

More specifically, in 2011, ASN paid particular attention to the following subjects:
– installation of a pre-stressing system for the reactor inner containment wall. Since 2008, ASN has been informed of a number of positioning anomalies with portions of pre-stressing ducting. In June 2011, ASN considered that the repetitive nature of these anomalies indicated a lack of preparation, competence and safety culture among the workers concerned and shortcomings in the monitoring of its subcontractors by EDF. On 23 June 2011, ASN therefore asked EDF to suspend concreting work on the inner containment wall and to present an action plan designed to avoid any further anomaly with the positioning of the pre-stressing cable ducts. In the following days, EDF presented its action plan and in particular the steps taken to improve the competence of the teams in charge of installing the pre-stressing cable ducts and the monitoring of these teams.
On 1 July 2011, considering that the steps taken by EDF were such as to allow correct performance of the pre-stressing cable duct installation activities, ASN authorised EDF to resume concreting work on the inner containment wall. An unannounced ASN inspection was made to check implementation of the EDF action plan, its findings being that the technical and organisational measures were satisfactory.
– concreting of very high structures with a high rebar density. In July 2011, EDF informed ASN that it had discovered honeycombing in certain walls of the pools in the reactor and fuel buildings. The concrete walls thus comprise local concentrations of aggregate and a lack of cement, which requires repair. Over and above processing of occasional anomalies, for which repairs were already programmed, and at the request of ASN, EDF initiated additional training, reinforced the preparation of the activities by including more detailed risk analyses, and reinforced the inspections. ASN will carry out inspections on this topic in the near future, in order to check compliance with these additional requirements.

Occupational health and safety inspection on the FA3 reactor construction site

ASN has been responsible for labour inspectorate duties since the creation authorisation decree was signed. On 24 January and 11 June 2011, the Flamanville 3 construction site was marked by two fatal accidents. The exact circumstances of these accidents, involving falls from height, although completely unrelated, led to a detailed inquiry by the ASN labour inspectors. They forwarded their conclusions to the public prosecutor's office.

The other action taken in 2011 consisted in:
– carrying out safety checks on the construction site;
– conducting inquiries into the accidents that occurred on the construction site;
– participating in meetings of the Inter-firm Health, Safety and Working Conditions Committee (CISSCT) and the departmental anti-fraud operational committee (CODAF);
– answering direct requests from the employees.

In 2011, the ASN labour inspectors in particular checked compliance with the provisions of the Labour Code by the contractors working on the construction site, with regard to the conditions of assignment of foreign workers, the notification of labour accidents and the risks involved in contractors working alongside each other.

Oversight of nuclear pressure equipment manufacture

During the course of 2011, ASN continued with its evaluation of the conformity of the EPR reactor's primary and secondary system equipment (vessel, reactor coolant pumps, control rod drive mechanisms, pressuriser, steam generators, as well as some of the pipes, valves and cocks), with the assistance of the



IRWST pool for the SIS system before sheeting

approved third-party inspection bodies it specifically mandated for the performance of conformity assessment. Manufacturing has already begun on all the major equipment items and most types of valve. In addition to the review of the technical documentation concerning the design and manufacture of ESPN, ASN and the approved third-party inspection bodies performed more than 400 inspections to check the manufacture of this equipment, corresponding to being present for more than 700 days in the plants of the manufacturer AREVA NP, and its suppliers and their subcontractors. In early 2012, initial assembly of the ESPN making up the NSSS will begin on the Flamanville site.

5|3 Examination of the Penly 3 creation authorisation decree

At the end of 2010, EDF submitted a creation authorisation application to the Ministers for Nuclear Safety, for an EPR type reactor on the Penly site, pursuant to article 29 of Act 2006-686 of 13 June 2006, as amended, on transparency and security in the nuclear field. These ministers asked the ASN for its opinion on the acceptability of the various elements of the dossier, detailed in article 8 of decree 2077-1557 of 2 November 2007.

ASN, with the support of the IRSN, examined the dossier submitted by EDF. Their conclusion was that additional data were needed for a detailed technical examination to be carried out. These additional data requests primarily concern the preliminary safety report, the risk management study and the impact assessment.

Within its scope of competence, the environmental authority also issued an opinion on 13 April 2011. This is available under reference no.2011-06, at the following web address: *www.cgedd.developpement-durable.gouv.fr.*

UNDERSTAND

ASN validation of the instrumentation and control (I&C) architecture

I&C of the Flamanville 3 EPR reactor comprises two platforms:

- *the Téléperm XS platform, specifically developed for the nuclear industry and dedicated to reactor protection functions in incident or accident situations;*
- *the SPPA T2000 platform, of "conventional industrial" origin, is used for normal reactor operations and for certain reactor protection functions in incident or accident situations.*

In response to the ASN request in a letter dated 9 July 2010, EDF presented an alternative design to that initially envisaged. These new design provisions for example consist in grouping within a "hard core" system certain safety functions hitherto not installed on the Téléperm XS platform. These measures make it possible to deal with total loss of the SPPA T2000 platform combined with certain accident situations.

At the same time, together with the designers and manufacturers concerned, EDF deployed significant efforts to prove that certain safety functions could be installed on the SPPA T2000 platform.

At the request of ASN and on the basis of an analysis performed by the IRSN, the Advisory Committee for nuclear reactors (GPR) examined these elements at its session of 16th June 2011. The GPR considered that the answers provided by EDF were on the whole satisfactory. ASN will shortly be issuing a position statement on this subject. The GPR opinion and the ASN position statement, like all those issued by ASN following consultation of the GPR, will be made public on www.asn.fr.

In-depth inspection of the conformity of the Flamanville 3 design and construction work subcontracted by EDF to AREVA

A team consisting of ten inspectors from ASN, four staff members from the Institute for Radiation Protection and Nuclear Safety (IRSN) and one observer from the British nuclear safety regulator (ONR) carried out an in-depth inspection of design and construction work on the Flamanville EPR reactor, on 1st March and on 9th and 10th May 2011.

This inspection was carried out to check implementation of the provisions of the order of 10th August 1984 (referred to as the "quality order") on these activities, entrusted to AREVA by EDF. EDF, the licensee of the Flamanville EPR reactor, is responsible for the safety of its facilities. EDF must therefore define and implement the necessary measures to comply with the requirements laid out in the order.

These inspections took the form of document reviews, visits to the workshops of the subcontractors and interviews with employees of both EDF and its subcontractors. Inspections were held at the AREVA premises and at those of some of its subcontractors. They concerned:

- *the performance of studies to demonstrate the safety of the facility (accident design studies);*
- *the manufacture of components of particular importance for safety, such as the accumulators of the safety injection system (SIS) or components specific to the EPR reactor, such as the filters located in the IRWST (SIS system pool), the SIS and EVU systems (reactor building ultimate heat removal system in a severe accident situation), or the reactor vessel internals;*
- *the manufacture of items considered to be "conventional" with respect to the NPPs in operation (flow restrictors, diaphragms or electrical cables).*

Following this in-depth inspection, the inspectors concluded that the measures taken were appropriate and meet the requirements set in the "quality order". They also observed that these measures were applied throughout the subcontracting chain. However a number of weak points were identified and led the inspectors to ask EDF to ensure that no irreversible steps were taken for the DN500 venturis of the steam generators feedwater flow control system (ARE), the IRWST filters and the SIS accumulators, before the quality of construction of these items, which are essential to the safety of the facilities, has been demonstrated. Other deviations were also observed: these concern the identification of activities important for the safety of the facilities, the definition of requirements and prior conditions for performance of these activities and their monitoring by EDF.

ASN oversight of work by AREVA NP to guarantee the conformity of the Flamanville EPR reactor vessel head

AREVA NP informed ASN that two major quality deviations had been detected during manufacture of the vessel head for the Flamanville 3 EPR reactor. The processing of these deviations led AREVA NP in July 2011 to propose a wide-ranging repair solution to ASN, involving complete performance of several steps in the vessel head manufacturing process a second time.

The deviations concerned:

- *first of all, in autumn 2010, detection of a large number of defects in the welds on the vessel head, at the adapters. This deviation was made available on www.asn.fr in April 2011;*
- *secondly, in June 2011, during repair operations to correct the previous deviation, detection of insufficient thickness in the buttering metal layer located under these welds.*

Owing to their small size, most of the defects observed in the welds on the adapters were not particularly detrimental, but their large number indicates a problem with the welding process, which justifies repeating the welds with particular precautions. However, welds may have been made on an insufficient buttering thickness, which may have created cracks in the vessel head, under the buttering. A detailed inspection of the condition of the base metal under the butterings concerned, followed by their repair, was thus necessary.

ASN asked AREVA NP for a detailed analysis of the potential risks involved in these large-scale repair operations and for the proposal of special measures to guarantee the final quality of the vessel head. After examining the response and the opinion of the Advisory Committee for nuclear pressure equipment, ASN agreed that AREVA NP could proceed with repair of the vessel head, with enhanced monitoring by ASN and APAVE.

Prior to the performance of each step in the repair process, AREVA NP must demonstrate that all necessary steps have been taken to manage the risks and guarantee that any deviation or drift will be detected. In any case, this vessel head may only be installed on the Flamanville 3 EPR reactor if expressly declared by ASN as conforming with the technical requirements of the regulations. ASN will rule on the acceptability of the vessel head once all the manufacturing operations are completed.

Even though it had already updated its dossier in the summer of 2011, EDF stated in October 2011 that further additional amendments were needed, in particular before it could be submitted to the public inquiry. This position was consistent with ASN's assessment of the version of the dossier it examined in the summer of 2011.

ASN will resume its examination of EDF's application on receipt of the announced amendments, so that it can issue an opinion on the creation authorisation for this reactor.

5|4 Examination of the safety options for the ATMEA 1 reactor project

The ATMEA company, a joint venture formed between AREVA (France) and Mitsubishi Heavy Industries (MHI, Japan), approached ASN for a review of the safety features[4] for a new pressurised water reactor known as ATMEA 1. According to ATMEA, this medium power reactor (1,100 MWe) is mainly intended for export.

ASN responded favourably to ATMEA's request and in 2010 signed an agreement specifying this review.

This safety options review, performed with the support of the Institute for Radiation Protection and Nuclear Safety (IRSN), aimed to assess whether the safety options are in conformity with the French regulations and related texts (RFS, etc.) currently in force. It was carried out in conditions similar to those which would be used if the ATMEA 1 reactor were to be built in France. This review was started in 2010 and continued in 2011, via consultations with the Advisory Committee for nuclear reactors (GPR) and its Advisory Committee for "nuclear pressure equipment" (GPESPN). Five GPR sessions and one GPESPN session were thus devoted to examining the safety options for the ATMEA 1 reactor.

ASN made the conclusions of this review process public in early 2012. ASN considered that the safety features for the ATMEA 1 reactor are on the whole satisfactory and in conformity with the French requirements.

At the detailed design stage, the ATMEA company will need to be particularly vigilant with regard to optimisation of occupational exposure to ionising radiation, to the steps necessary for the "practical elimination" of certain accidents or the preclusion of breaks in certain pipes and, of course, the continued integration of the lessons learned from the accident which struck the Fukushima Daiichi nuclear power plant (Japan).

The safety features review will also allow ASN, if necessary, to assist the regulators in the countries building the reactors.

5|5 Modification of the Le Blayais 3-4 creation authorisation decree

Application for authorisation to use MOX fuel in reactors 3 and 4 of the Le Blayais NPP

MOX (mixed oxide) fuel is a fuel that contains plutonium oxide and depleted uranium oxide. Using it in reactors is a means of recycling a part of the spent fuel from the NPPs. It can thus replace the enriched uranium based fuel in the 900 MWe plants; this requires making a number of technical modifications to the reactors (for example adding extra control rod clusters).

As part of the process to recycle spent fuel, EDF on 29 April 2010 requested authorisation to use MOX fuel in Le Blayais reactors 3 and 4. At present, twenty-two 900 MWe reactors in France (including reactors 1 and 2 at Le Blayais) have already received this authorisation.

As the creation authorisation decree (DAC) for reactors 3 and 4 at Le Blayais makes no provision for the use of fuel containing plutonium, a modification of this decree is necessary.

Pursuant to Article 31 of decree 2007-1557 of 2nd November 2007 concerning basic nuclear installations and the control, in terms of nuclear safety, of the transport of radioactive materials, the DAC modification procedure is similar to that used for the creation of a new BNI. Within its area of competence, ASN thus examines the form and content of the application on behalf of the Ministers responsible for nuclear safety.

Once ASN had the application file completed and corrected, the environmental authority issued its opinion on 20 July 2011.



View of Le Blayais NPP

4. The safety features file, compiled by the operator, is used to present ASN with the main characteristics and general design choices made in terms of safety. The file, prepared in the reactor preliminary design phase, presents, notably:
– the safety objectives for the reactor;
– the safety approach applied in design;
– the overall description of the reactor and of the processes and systems used;
– the operating conditions envisaged as well as key parameters of the installation;
– accidents and attacks considered in design, and methods for dealing with these.
This step is specified in article 6 of decree 2007-1557 of 2nd November 2007.

This document is available under reference no.2011-31, at the following web address: *www.cgedd.developpement-durable.gouv.fr.* The public inquiry was held from 14 November to 14 December 2011.

5|6 Continued operation of the nuclear power plants

The licensee of a nuclear facility must conduct a periodic safety review of its facility every ten years (see point 2|3|4).

The periodic safety review concerning the third ten-yearly outages for the 900 MWe reactors

On 4 November 2010, following the third ten-yearly outage inspection of Tricastin NPP reactor 1, ASN ruled on the reactor's conformity with the applicable safety requirements and on the conditions necessary for continued operation for a period of up to 40 years. In addition, on 27 May 2011, an ASN decision set new technical requirements for the reactor, in order to take account of more recent safety standards and the latest technical advances.

On 4 July 2011, ASN ruled on the continued operation of the Fessenheim 1 reactor following its third ten-yearly outage inspection. ASN considered that, subject to the forthcoming conclusions of the complementary safety assessments (CSA) initiated following the Fukushima accident and in the light of the results of the third periodic safety review, this reactor was suitable for operation for a further ten years after this third periodic safety review, provided that a list of requirements was followed, in particular the two key specifications below:

– reinforce the reactor basemat before 30 June 2013, to increase its corium resistance in the event of a severe accident with vessel melt-through;
– before 31 December 2012, implement emergency technical measures for long-term removal of residual heat in the event of loss of the heat sink.

In 2012, ASN will rule on the conditions for continued operation of the next 900 MWe reactors undergoing their third ten-yearly outage inspection.



The two production units of the Fessenheim NPP

The periodic safety review concerning the third ten-yearly outages for the 1,300 MWe reactors

After the Belleville 1 and Nogent 2 reactors in 2010, the Penly 1 and Cattenom 3 reactors in 2011 integrated the improvements resulting from the periodic safety review linked to their second ten-yearly outage inspections.

The periodic safety review concerning the third ten-yearly outages for the 1,450 MWe reactors

After the Chooz reactors in 2009 and 2010, Civaux reactor 1 in 2011 integrated the modifications resulting from the periodic safety review performed on the occasion of its first ten-yearly outage inspection. As for the 900 and 1,300 MWe reactors, ASN will send the ministers responsible for nuclear safety its decision regarding the continued operation of each of these reactors, after reviewing the conclusions report submitted by EDF.

5|7 Notable findings relating to oversight of pressure equipment

Cracks detected in the bottom-mounted instrumentation penetrations on Gravelines 1

The bottom-mounted instrumentation (BMI) penetrations are used for the insertion of core instrumentation. The BMI examination on Gravelines reactor 1 during the 3 ten-yearly outage inspection revealed cracking of one penetration (also see point 3|4|2). These longitudinal branching cracks were detected using an ultrasounds inspection process. They are apparent on the inner side, are 40 mm length and run through virtually the entire thickness. They apparently propagated from manufacturing defects detected during inspections in 2001.

EDF implemented a repair solution consisting in plugging the BMI penetration by means of a removable plug. This solution enables the BMI penetration to be isolated from all contact with the reactor coolant fluid, thus preventing subsequent evolution of the defect. At the request of ASN, EDF also installed a humidity detection system in the penetration concerned.

ASN considered that these steps would allow safe operation of the reactor for the coming cycle but nonetheless informed EDF that processing of this matter beyond such a period would require detailed examination, in particular of the means for replacing and monitoring the penetration. ASN also asked EDF to reinforce the monitoring of the penetrations on its other reactors.

5|8 Notable findings relating to occupational health and safety inspections

Monitoring of health and safety regulations

ASN's main labour inspectorate activity in 2011 was monitoring of the implementation of the regulations concerning health and safety in the workplace. Workers in NPPs are not only exposed to risks relating to the "nuclear" aspects of their activity, but also

to "conventional" risks such as those from electrical installations, pressure equipment, chemicals, explosion (in hydrogen systems), asphyxiation (from nitrogen), working at height or handling of heavy loads.

In 2011, labour inspection activities covered the following areas:
– systematic inquiries in the event of serious occupational accidents, in particular the three fatal accidents that occurred in 2011. In these latter cases, the labour inspectors found deviations from the regulations concerning working equipment;
– particularly close monitoring of construction site activities, with attention to lifting work which generates a large percentage of accidents, as well as the risks linked to several contractors working alongside each other;
– activities involving the use of carcinogenic, mutagenic or reprotoxic chemical products, asbestos removal, as well as the presence of lead. EDF and its contractors were urged to take measures complying with the prevention principles: first of all, eliminate the risk, or limit worker exposure to these products, or find less dangerous alternative products;
– the performance of work inside the reactor containment while the reactor is at power, both in terms of exposure to ionising radiation and heat and in terms of stress;
– participation in the campaign by the Ministry for Labour concerning road accident risks, in particular for subcontractor maintenance staff required to travel around the entire country.

The regular presence of inspectors on the hygiene, safety and working conditions committees (CHSCT), allows the inspectors to follow the activity of these bodies and to be regularly informed about relevant subjects, notably concerning occupational accidents and stress risk factors.

Monitoring working hours

ASN's labour inspectors carried out inspections on compliance with regulations on working hours as well as on daily and weekly rest periods specifically during reactor shutdown for maintenance. In 2011, albeit to a lesser extent than in previous years, they again observed deviations concerning compliance with the maximum daily and weekly working hours and rest periods. The infringements observed relate to periods of high activity (maintenance during reactor outage). A policy of advance preparation of the work to be done during reactor outages was encouraged, jointly with the Ministry for Labour and in consultation with the staff representatives, so that EDF can plan ahead and request the necessary waivers in strict compliance with the provisions of the Labour Code.

On 9 June 2011, the magistrate's court of Montélimar sentenced the director of the Tricastin NPP to 8 fines of 500 € each, for "employment of staff without complying with the minimum daily rest requirement", the events having taken place between 1 March 2009 and 30 September 2009, as recorded in the report from the ASN labour inspector. This decision reminds EDF of its obligations to comply with the maximum working hours in a nuclear power plant, both to protect worker safety and for broader reasons of nuclear safety.

Subcontracting

Detailed investigations have been carried out into the use of contractors, for instance in the service sector. Inquiries were also held on the Flamanville 3 site, concerning services contracted out to foreign contractors. The goal was to ensure application of the minimum wage rules enshrined in the collective agreements applicable in France and the application of employment rules.

Finally, the labour inspectors took part in 12 inspections jointly with the nuclear safety inspectors, to look at the quality of the work done by the contractors.

Other areas

The labour inspectors were required to examine subjects raised by the staff representative bodies, primarily to settle disputes over the CHSCT's right of alert concerning a serious and imminent danger.

The labour inspectors also participate in joint work within the operational committee for the prevention of illegal labour (CODAF) led by the Public prosecutor's office, especially where the EPR construction site is concerned.

Penal procedures

ASN's labour inspectorate issued six notifications of violation on the NPPs to the relevant jurisdictions. Three of these related to violations that led to fatal occupational accidents.

5|9 Notable findings relating to radiation protection of personnel

In-depth radiation protection review

From 6 to 14 June 2011, ASN carried out an in-depth review on conformity with the radiation protection regulations by the four NPPs in the Loire Valley and on the interfacing between these NPPs and the EDF head office departments. Seven ASN radiation protection inspectors carried out this inspection, with the assistance of two experts from the Institute for Radiation Protection and Nuclear Safety (IRSN).

They were divided into three teams and in parallel examined several radiation protection related topics (the organisation and management of radiation protection, utilisation of the ALARA approach, radiological cleanness, worker monitoring, management of radioactive sources, etc.).

The inspectors found that the radiation protection organisation defined and implemented on the four NPPs is on the whole satisfactory. However, it was clear that efforts are still needed in deploying the organisation selected by EDF to all the reactors in operation, for instance with regard to its impact on resources, as well as on deployment in the field of experience feedback and good radiation protection practices.

5. The ALARA (As Low As Reasonabely Achievable) approach implements one of the radiation protection principles enshrined in the Public Health Code, that is the optimisation principle, whereby any justified exposure must be carried out at the lowest possible dosimetric cost.

Periodic review of EDF's radiation protection actions

In 2004, following consultation of the Advisory Committee for reactors (GPR) on the state of occupational radiation protection in the French NPPs, ASN asked EDF to improve its organisation, by monitoring the areas for progress identified by the GPR. Since then, ASN has periodically carried out an overall assessment of the radiation protection results and practices in the NPPs. Any requests it issues are then the result of its analysis of significant radiation protection events, technical review of the files produced by EDF (modification files, etc.) and inspections carried out during the period in question.

In this respect, in 2007, ASN issued a letter to which EDF's answers were considered to be on the whole satisfactory. In 2011, ASN once again carried out an official assessment and issued requests for renewed impetus with regard to the ALARA approach at EDF and to the "radiation protection culture" and management of contamination at source.

Examination of the Flamanville 3 EPR file

With regard to radiation protection, ASN is also continuing to examine the EPR commissioning process, in particular concerning activities where radiological issues are of great importance and the "two rooms" concept, which involves a new area in the reactor building enabling certain maintenance operations to be carried out while the reactor is operating. The general examination of the EPR reactor is presented in point 2|4 of this chapter.

5|10 Notable findings relating to the environmental impacts of NPPs and discharges

Review of discharge requirements

In 2011, ASN completed its examination of the effluent discharge and water intake files concerning the NPPs of Dampierre, Civaux and Cruas-Meysse:

– Dampierre: Effluent discharges and water intake on the site are now regulated by ASN decisions 2011-DC-0210 and 2011-DC-0211, dated 3 March 2011 and published in the ASN official bulletin on its website. Decision 2011-DC-0210 setting the environmental discharge limits was approved by the order of 6 May 2011 from the ministers responsible for nuclear safety and radiation protection.
– Civaux: the decisions regulating effluent discharges and water intake were updated by ASN modifying decisions 2011-DC-0233 and 2011-DC-0234 of 5 July 2011 and published in the ASN official bulletin on its website. Decision 2011-DC-0233 setting the environmental discharge limits was approved by the order of 2 August 2011 from the ministers responsible for nuclear safety and radiation protection.
– Cruas-Meysse: the order of 7 November 2003 regulating effluent discharges and water intake was temporarily modified owing to the climatic conditions in the spring and summer of 2011 by ASN decision 2011-DC-0237 of 28 July 2011. This decision temporarily set new effluent discharge requirements.

Experience feedback from the SOCATRI event

Following the July 2008 events in the BNIs operated by SOCATRI (in Tricastin) and by FBFC (in Romans-sur-Isère) respectively, ASN asked EDF to check the condition of all the circuits and ultimate retention systems that could contain toxic, radioactive, inflammable, corrosive or explosive (TRICE) fluids and to carry out any necessary repairs as rapidly as possible. In response to this request, EDF drafted a verification programme at the end of 2008, which was implemented in 2009.

ASN analysed the conclusions of this programme and the national summary presented by EDF, along with the environmental events that have occurred on the NPPs since 2008 and the conclusions of its environmental inspections, in order to determine areas in which EDF could still make improvements.

ASN issued a number of requests in a letter dated 1 March 2011, for instance concerning the need to consider all the products liable to cause water and soil pollution, in the same way as the "TRICE" products, the need to reconsider the means of monitoring groundwater and the importance of integrating this experience feedback when building new reactors.

EDF answered the ASN requests in a letter which is currently being analysed.

6 ASSESSMENTS

Reactors in operation

6|1 Evaluating the head office departments and overall performance of NPPs

The following general assessment provides a thematic summary of ASN's evaluation of the head office departments and of the performance of EDF NPPs in terms of nuclear safety, radiation protection and the environment.

Evaluation is based on the results of checks carried out by ASN in 2011, particularly through inspections, oversight of reactor outages and analysis of how EDF handles significant events, as well as on the extent to which the inspectors are familiar with the NPPs they inspect. In 2011, ASN conducted 493 inspections in the nuclear power plants in service and in EDF head offices.

The general assessment represents ASN's view of the year 2011 and acts as a guideline for ASN regulation and inspection actions for 2012.

6|1|1 Evaluating nuclear safety

Reactor operations

The documents needed for operation are on the whole satisfactorily managed. They cover the various phases of operation and give a good representation of the actual status of the facility. Anomalies in application of the rules for periodic testing are less numerous than in previous years.

Management of operating personnel training and authorisations is on the whole satisfactory. However, improvements are expected with respect to training of the shift crews.

Improving the rigorousness of operations remains a key priority for EDF. However, ASN did observe a slight deterioration in this area in 2011. ASN considers that the efforts made on this subject in recent years must be continued.

Efforts were made by EDF in 2011 to identify, manage and remove "particular equipment and devices" and temporary modifications that have remained in place on reactors for several years. These efforts should be continued.

Conversely, preparation for servicing work remains a weak point once again this year. Although ASN notes the beneficial effects of implementation of practices to improve reliability, these remain under-exploited and the shift crew managers do not have the time needed to correctly fulfil their duties, especially during reactor outages. As in 2010, oversight of the control room operators needs to be improved, to be able to detect any operating problems as early as possible.

The interfaces between operating and maintenance or testing personnel are often the source of anomalies, resulting from communication errors or misunderstandings. Actions to improve this situation must be identified and implemented.

As in 2010, ASN noted some progress in the management of equipment lock-outs, but numerous deviations persisted in this area in 2011, as well as with respect to line connection of systems. There is a lack of rigour and oversight where these operations are concerned.

Finally, rigorous application of the operating baseline safety requirements and management of temporary operating instructions is deteriorating and improvements are required.

Emergency and fire situations

ASN considers that EDF's management of emergency situations is satisfactory. Relations between ASN and EDF at national level have been strengthened in recent years, notably via meetings and discussions concerning the new baseline safety standards for EDF's on-site emergency plans (PUI). These new PUI are currently being deployed to the sites, with the aim of having them implemented on all sites by 15th November 2012.

During the course of 2011, the inspections conducted on the topic of emergency management showed that the PUI organisation adopted by the sites is satisfactory. However, the sites must improve a certain number of points, including management of the fall-back premises and certain agreements concluded with external organisations.

Even if a number of improvements were observed in 2011, ASN considers that the emergency response organisation in the event of an ammonia release, implemented on sites with a monochloramine treatment facility, is still not satisfactory and is not operational on most of the sites concerned.

Through its inspections in 2011, ASN noted that there was overall progress in the field of fire-fighting, even if there are discrepancies between sites. However, the situation with respect to fire loads and the conformity of fire sectors has not improved. In this respect, ASN considers that the anomalies affecting the availability of certain fire dampers (isolating devices contributing to compartmentalisation of buildings in the event of a fire) need to be corrected. Efforts also still need to be made in the drafting and utilisation of fire permits. Finally, ASN is remaining attentive to the deployment on the sites of corrective measures or improvements following experience feedback concerning the transformer fires in 2010 and 2011.

Maintenance activities

With regard to maintenance, ASN observed that in the past, EDF had not sufficiently anticipated certain problems nor taken sufficient account of international experience feedback, which led EDF to review its strategy, now focused on preventive measures, for example preventive chemical cleaning of the steam generators and the steam generator replacement policy. However, ASN noted that this forward planning approach was not adopted for all the problems.

ASN notes that the areas made of Inconel 600 type alloy are susceptible to certain corrosion phenomena (see point 3|4|2), damage that has been observable for several years. However, EDF has not really anticipated the appearance of such defects on the bottom-mounted instrumentation penetrations made of the same material. Today, EDF still does not have a process for repairing or replacing these penetrations that is qualified and accepted by ASN (see point 5|7).

Regarding the implementation of the maintenance policy on sites, ASN feels that EDF must be careful to ensure that adequate human and material resources are available.

Where implementation of maintenance methods on the sites is concerned, ASN considers that there is room for improvement in EDF's situation and that some recurring shortcomings remain:
– the maintenance baseline standards documents are in a state of continual flux in a variety of forms. The resulting complexity is a factor that aggravates the persistent delays in integration observed on all NPPs and tends to lead to disparate requirements;
– the quality of risk analysis in the preparation of maintenance operations remains unsatisfactory. It needs to be significantly improved on virtually all sites. Management of spare parts should also be improved;
– lastly, the quality of maintenance operations also requires greater consideration of human factors in the preparation stages of these operations.

Equipment condition

Equipment maintenance and replacement programmes, the safety review process and correction of conformity anomalies identified contribute to keeping NPP equipment in a generally satisfactory condition.

However, ASN believes that EDF should address the problem of obsolescence with regard to some items of equipment. In addition, EDF must reinforce the way it manages the way the qualification of equipment is maintained for accident conditions, whether during preventive maintenance operations or when replacing equipment. ASN notes that in 2011, EDF launched an action plan for management of the requirements regarding qualification of equipment and spare parts for accident conditions; ASN will closely monitor effective implementation. Overall, ASN considers that EDF must continue its efforts to qualify equipment and manage obsolescence.

The first barrier

ASN considers that in 2011, the situation regarding the first barrier is on the whole satisfactory but could be improved. The long-term actions undertaken by EDF have still not restored optimum status for the first barrier and, in 2011, ASN once again observed leaks in fuel assemblies, damaged support grids and the presence of numerous foreign bodies in the primary system.

In 2011, loss of leaktightness on RFA fuel assemblies in some 900 MWe reactors was associated with fretting of these 900 MWe RFA fuel assemblies which are of an old design without spacer grid. The design modifications made to these assemblies would seem to indicate gradual disappearance of these leakage sources. The number of these assemblies present in the reactors will fall in 2012 and will be insignificant within a few years.

ASN also considers that EDF needs to step up its efforts to reduce foreign bodies in the systems. The measures taken by EDF since 2008 continued in 2011, but implementation could be further improved.

Finally, EDF needs to continue to make progress in applying maintenance programmes for fuel handling equipment, which can be the cause of fuel assembly damage.

Pressure equipment and the second barrier

ASN considers that the situation of the fleet regarding pressure equipment is deteriorating. The main reasons for this deterioration are insufficient assimilation of the ESPN regulations applicable since January 2011, for instance failure to draft equipment maintenance and monitoring programmes (POES) sufficiently far in advance.

ASN also noted that several events that occurred on pressure equipment in 2011 reflect a lack of rigour in the preparation and performance of maintenance operations and in the operating conditions:
– presence of foreign materials accidentally introduced into the steam generator tube bundles during maintenance operations;
– damage to the flange and vessel head of several vessels when refitting the vessel head after reactor outages;
– insufficiently thorough preparation of certain equipment pressure tests, leading to the observation of parasitic leakage during the preparation for or performance of the test;
– occurrence of several "pressure hammer" type dynamic transients at reactor restart, highlighting equipment deviations or failure to abide by the operating instructions: these transients led to unanticipated loadings of certain equipment items.

Finally, ASN observed the appearance of signs indicating a fall in the quality of the work done by the recognised inspection departments (SIR), responsible for ensuring that each site implements the regulations concerning pressure equipment. ASN considers that in certain cases, these problems can be partly attributed to the fact that the SIR does not have enough staff to handle the duties assigned to it. The difficulties observed with certain SIR led in May 2011 to the decision by the *Préfet* of the Isère *département*, on the advice of ASN, not to renew its recognition of the inspection department on the Saint-Alban site.

The third barrier and the containment

As in previous years, it is considered that the condition of the containment, in particular the third barrier and its components, could be improved in 2011. ASN in particular notes that the number of events concerning the containment remained stable.

The results of ten-year testing of the reactor containments conducted in 2011 all complied with the criteria established in the operating rules. The results of the containment test on Bugey reactor 5, which meet the criteria set by the operating

rules, are nonetheless not as satisfactory as those of the previous test 10 years ago. The licensee has undertaken to conduct checks to detect the origin of the rise in the containment leak rate and perform an additional test in 5 years time.

With regard to the 1,300 and 1,450 MWe reactors, EDF presents technical solutions to ASN to guarantee the long-term tightness performance of the containments, despite their ageing. The analysis of these proposals will be presented to the Advisory Committee for nuclear reactors as of 2012.

6|1|2 Evaluating human and organisational measures

Integrating organisational and human factors (OHF) into operating activities

ASN considers that the specific actions taken to improve the integration of OHF into operations, and how this is organised, differ from one site to another. The organisation set up by EDF to integrate human factors makes provision for a position as a "human factors" (HF) consultant for two reactors. ASN notes satisfactory professional training of the HF consultants, who generally come from the field. On the other hand, ASN has in recent years observed that the resources made available to the HF consultants are inadequate. It was for instance noted that the HF consultant post sometimes remained vacant on certain sites. In addition to the HF consultants, some sites have a network of HF correspondents within the technical sections, but they are often only allowed to devote very limited amounts of time to this function. Moreover, on most sites, the members of the HF correspondents network rarely receive any training. ASN therefore considers that the position of the HF consultants and correspondents in the site organisation must continue to be improved, so that the OHF viewpoint can continue to become increasingly firmly anchored in the management system.

ASN notes the considerable efforts made by EDF to develop implementation of practices to improve the reliability of operations within the framework of the national "human performance" project and considers that it must be continued. The managers are thus reinforcing their presence in the field, even if these field visits sometimes tend to be more to check the condition of the facilities as part of the "obtain exemplary condition of facilities (OEEI)" project, rather than to observe working situations, as proposed in the "human performance" project. ASN also specifies that application of the "human performance" project by the sites should not be to the detriment of other measures specific to the sites to improve the consideration given to "HOF" aspects during operation and of safety management on the sites, but should be considered to be complementary. Even on sites where reliability improvement practices are well-integrated into the usual practices of the workers, there are still "human" or "organisational" components in the errors responsible for the occurrence of significant events.

Finally, ASN observed that HF measures primarily aim to disseminate and implement managerial policies and requirements, but as yet pay too little attention to improved assimilation of the realities in the field by the site management.

Analysis of experience feedback from the OHF viewpoint

The HF consultants are not always incorporated into the experience feedback analysis process. They sometimes support the various disciplines, usually at their request, to help them analyse an event from the human factors standpoint. ASN considers that the HF consultants must be more naturally and systematically consulted by the site management when analysing events. When the technical sections comprise networks of human factors correspondents, they are sometimes involved in analysing events. However, there is a still a problem with the effective follow-up by the HF consultant of the action taken following the findings of the event analyses.

Working conditions

Once again in 2011, on several NPPs, ASN found numerous inadequacies concerning operational documents and the human-machine interfaces. ASN was thus able to observe equipment poorly suited to the tasks to be performed, cramped premises, inappropriate, incomplete or relatively inaccessible documents, marking defects, signs that are hard to read and which may sometimes have led to significant events.

ASN emphasises the fact that ergonomic problems adversely affect operatives' activities since the conditions under which they work and the calm atmosphere they should enjoy are jeopardised by the constraints of organisation of work, changes in planning and problems of coordination between sites that cause delays or postponement of activities. ASN observed several situations generating workload for the operators, leading to a risk to their health and a potential source of safety risks.

Management of skills and qualifications

The skills and qualifications management in place on the sites is satisfactory and the management processes well documented and coherent. Inadequacies on certain sites are however still being found by ASN during the inspections, concerning the forward planning of jobs and skills management (GPEC) so as to be able to prepare for renewal of skills. Failure to anticipate large scale departures from certain disciplines was therefore observed on a few sites. The relative balance observable hitherto could be jeopardised by a significant transition between generations and the high levels of work required as a result of the CSAs.

Training programmes are generally implemented satisfactorily and the establishment of "academies" for the different professional disciplines is highlighted as a strong point for the training of newcomers to the sites. Deviations are however still found during inspections or following significant events, in particular in the fields of transport of radioactive materials, radiation protection and environmental protection. In general, ASN observed that staff professionalisation logs were well kept and found few errors in operating staff qualifications.

Incorporating HOF when modifying reactors in operation

In the engineering centres, the OHF integration organisation defined and implemented would appear to be satisfactory. In

the centres inspected, the inspectors therefore found a well-structured and documented action plan and an organisation in place, for instance with the creation of an SOH committee and the appointment of an SOH coordinator.

Evaluating arrangements concerning contractors in the operational activities

With regard to the process for selection of contractors for awarding of contracts, whether in terms of buying policy (for example, possible use of criteria unrelated to price, increase in the average duration of on-site maintenance contracts, etc.), or the qualification system, the inspections revealed no significant anomalies. ASN does however consider that EDF needs to begin to look again at its industrial maintenance and contracting policy, in particular with respect to the adequacy of the industrial fabric for meeting the industrial needs required to ensure the safety of the facilities, and to maintaining the in-house skills needed for essentially subcontracted activities.

With regard to the monitoring of subcontracted activities, ASN considered that EDF has ceased to make any further progress in contractor monitoring since 2009. Significant and repeated deviations have been observed, on the one hand in EDF monitoring of the contractors (tier 1) and on the other in contractor monitoring of the subcontractors (tier 2 or higher). The inspections thus revealed that EDF monitoring of the contractors was sometimes non-existent, in particular during workload peaks. Similarly, the inspections revealed that there were gaps in EDF verification of contractor monitoring of the subcontractors, which was sometimes absent altogether. The quality of the monitoring programmes, designed to ensure the traceability of the monitoring actions (check points and other measures) differs from site to site. Finally, EDF needs to check that the resources allocated to monitoring, in terms of both quantity and quality, are adequate to the activities subcontracted. ASN thus considers that the monitoring of the activities performed by the contractors and subcontractors needs to be rapidly improved and reinforced, in the light of the implications of these activities for safety, radiation protection and environmental protection.

However there is still room for improvement in the organisation of work and the working conditions of the contractor staff. As in the previous years, ASN observed that the material resources made available to the contractors are frequently insufficient or inappropriate which, in certain cases, may have led to a deterioration in the quality of the work and the working conditions, with respect to safety and radiation protection. Furthermore, the life of the contractor staff on the sites is not always made easier, for example, by unsatisfactory conditions on certain sites (for example, cloakrooms with no working showers, no heating in certain premises, etc.). The preliminary check-out meetings, which must be systematic and, prior to any work being done, ensure that the resources available for the work are compatible with the specified requirements, are not always effective enough. Finally, the minimum period of 4 months for placing of orders is not always met, even if certain sites are taking steps to keep the contractor companies informed, at least verbally, of the volume of activity envisaged.

6|1|3 Evaluating and analysing radiation protection

In 2011, ASN carried out twenty-nine specific inspections on the subject of radiation protection, five of which were part of an in-depth review of how the four NPPs on the banks of the Loire integrate radiation protection and the interface between these NPPs and the EDF head office departments (see graphs 2, 3 and 4).

In the light of the various ASN findings during these inspections and the analyses of significant radiation protection events, ASN considers that the radiation protection results of the NPPs in operation have been improved but could be better.

Generally speaking, ASN considers that the radiation protection organisation defined and implemented by the NPPs is on the whole satisfactory.

ASN in particular notes that the industrial radiography operations are well prepared and that the efforts made by EDF since 2010 to give renewed impetus to the ALARA approach on the sites have been maintained.

ASN does however note that the collective dosimetry per reactor rose in 2011 because of a large number of reactor ten-yearly outage inspections. The volume of maintenance work will remain high and may even increase in the coming years. ASN therefore considers that during the future reactor outages, ASN must enhance its efforts to continue to optimise collective and individual dosimetry.

ASN also observes that the prohibited areas access process could still be further improved: accidental entry or failure to lockout prohibited areas are still observed.

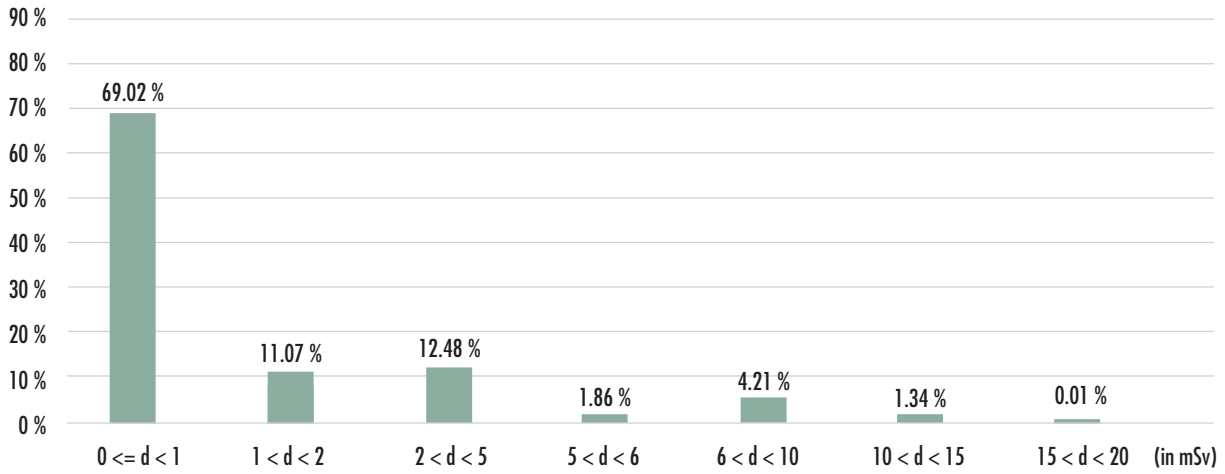
Finally, ASN recalls that EDF needs to improve the quality and the integration of risk analyses, its management of contamination in controlled areas, monitoring of application of radiation protection rules, adequate staffing levels of the radiation protection department present in the field and deployment of experience feedback and good practices to the intervention personnel.

6|1|4 Evaluating health and safety, professional relations and the quality of employment in the nuclear power plants

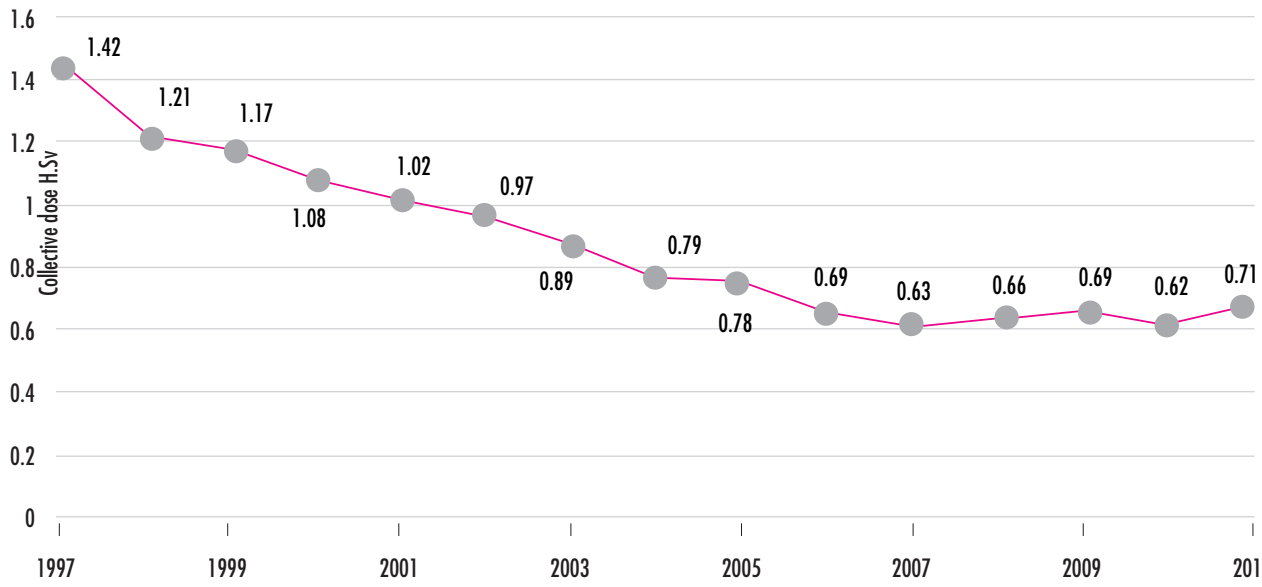
In 2011, the ASN labour inspectorate carried out 580 interventions during the course of about 256 days of inspection in the field, on nuclear power plants under construction, in operation or undergoing decommissioning. It made 1,258 observations and sent six reports to the public prosecutor's offices concerned.

In the field of worker health and safety, the ASN labour inspectorate observed a disparity between EDF workers and subcontractor workers, most of whom work on construction sites and carry out maintenance work, and are more exposed to conventional risks: the frequency of occupational accidents (number of accidents with time off work per million hours of work) for 2011 for all the reactors, was 3.5 for EDF and 4.2 for the subcontractors. However, it should be pointed out that the gap between these frequencies has tended to shrink in recent years (significant drop in the frequency at the subcontractors)

Graph 2: breakdown of the population per dose range over the year 2011 (EDF data)



Graph 3: mean collective dose per reactor (EDF data)



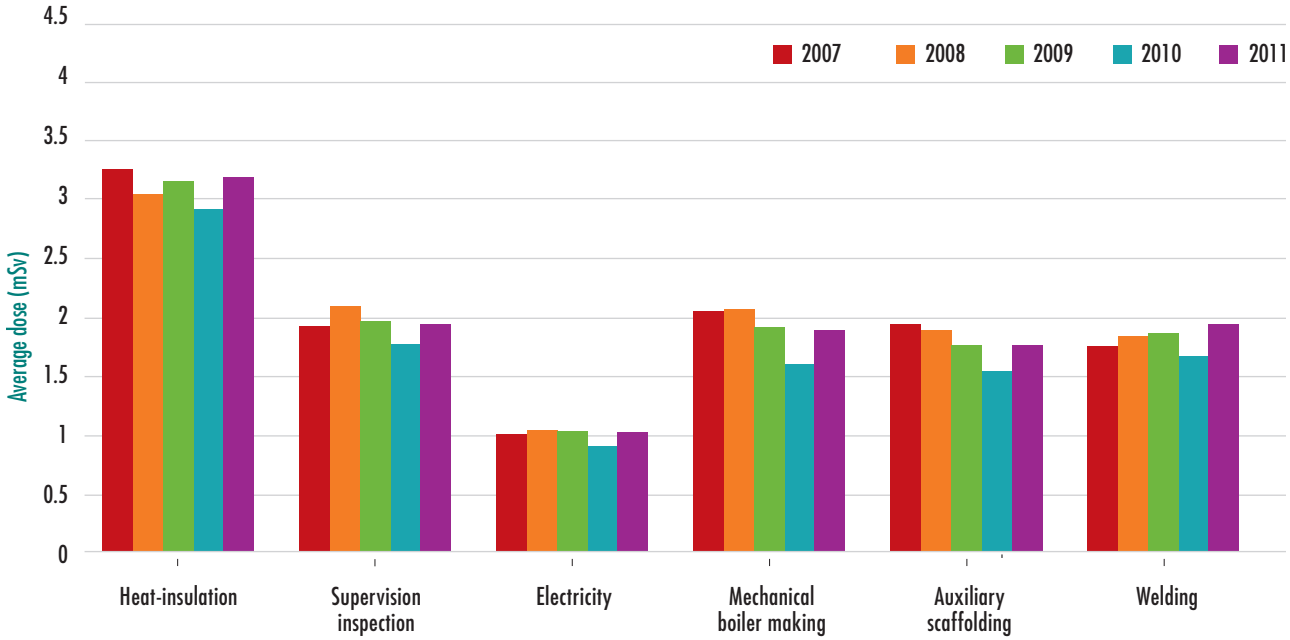
and that these results, which are comparable to those of activities in the service sector, are significantly lower than the average observed in the industry. The ASN labour inspectorate observed noteworthy initiatives on subjects such as lifting or entry into the reactor building with the reactor at power, but considers it essential that EDF develop its occupational risk prevention policy as applicable to work by employees of outside contractors and the prevention plans stipulated by the regulations.

Similarly, in terms of employment, ASN observes differences between EDF employees and those of the subcontractors. It draws the attention of EDF to situations potentially involving abusive subcontracting and illegal loaning of labour, in particular when the services to be performed are inadequately defined with respect to duration or in the event of unforeseen circumstances.

With regard to the evaluation of psycho-social risks (stress), ASN is pleased to note that EDF has begun a nationwide initiative to comply with the regulations. Occasionally and on a limited number of sites, situations resulting from the level of stress generated may be the origin of risks to the level of safety of the facilities and the health of workers.

On the EPR construction site, ASN regrets the inadequate level of safety coordination and supervisory staff given the complexity of the present and future activities, as well as violations with regard to under-notification of occupational

Graph 4: evolution of mean individual dose according to categories of workers involved in reactor maintenance (EDF data)



accidents and concealed work, or following occupational accidents.

With respect to professional relations, the ASN labour inspectorate notes that the institutions representative of the personnel function correctly on the whole, but does however note significant differences across the fleet, with social dialogue sometimes being extremely difficult. Numerous CHSCT use their right of alert in the event of severe and imminent danger during periods of tension: ASN considers that this measure should be reserved for dangerous situations and that EDF does not take sufficient account of alerts and feedback concerning the social climate.

During reactor outages, the working plan adopted to meet the completion deadlines regularly leads to all the sites exceeding the maximum working hours and failing to comply with the rest periods. The ASN labour inspectorate repeatedly observed this type of situation, already notified in formal reports.



Maintenance in the reactor building on the Flamanville site during the reactor 2 outage

Although EDF has made significant efforts to rectify the situation in 2011, by implementing regulation administrative authorisation procedures, its policy must consider all the staff, including the management.

Generally speaking, the situation of the NPPs as seen by the ASN labour inspectorate is felt to be heterogeneous and all aspects could be improved.

6.1.5 Evaluating and analysing environmental protection measures

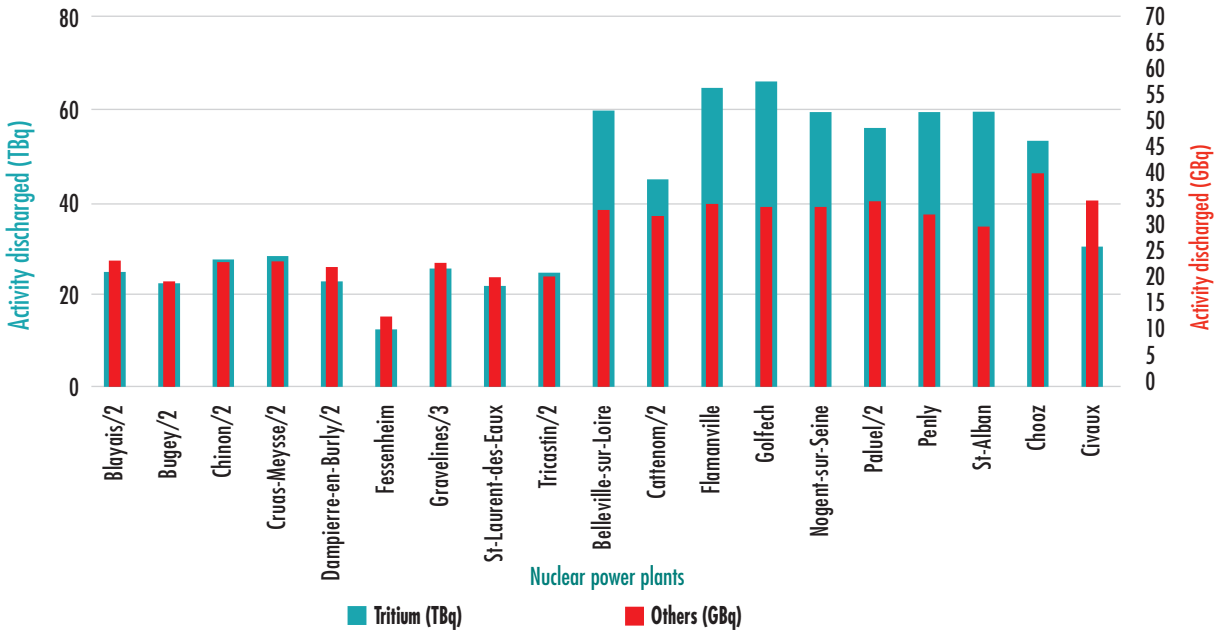
Despite positive moves already noted in 2010 by ASN and a satisfactory environmental organisation on most of the sites, ASN still observes numerous deviations on all the NPPs in operation and performance could be further improved.

In fact, deviations in compliance of installations, in implementation of corrective actions and in monitoring of contractors' activities were all highlighted this year. Furthermore, ASN inspectors observed several discrepancies in the application of the discharge orders and the amended order of 31 December 1999[6], as well as anomalies in the management of waste.

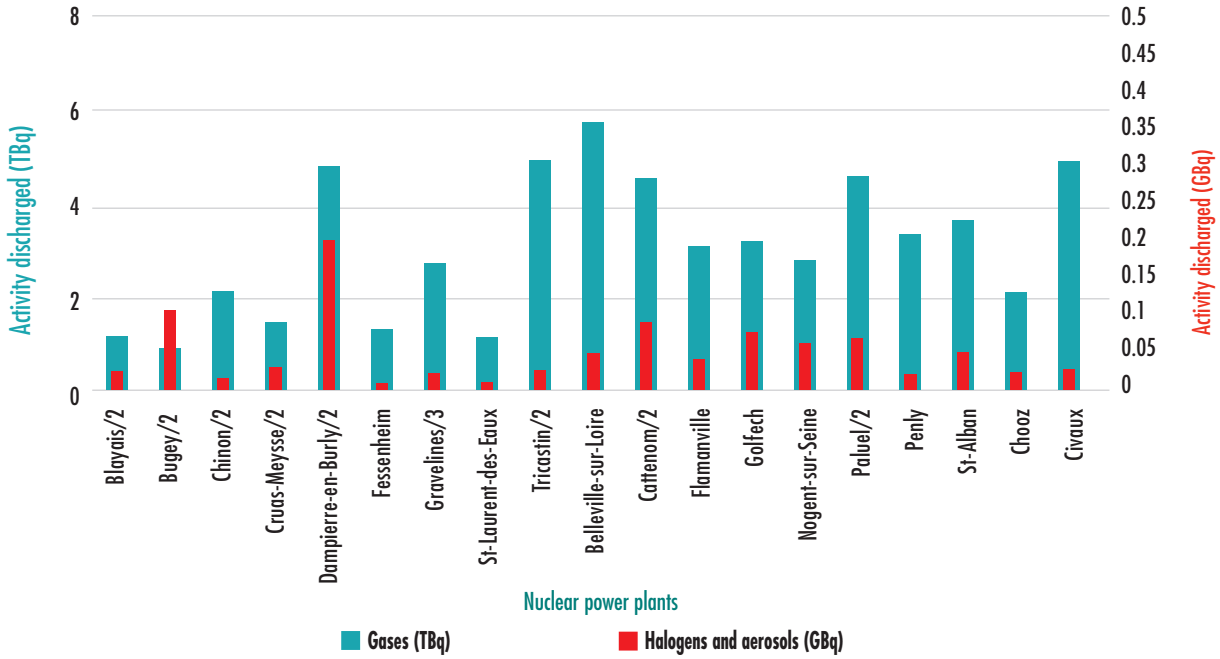
ASN also notes that the steps taken by EDF to improve management of the chiller units does not enable the coolant fluid discharges to atmosphere to be eliminated.

6. The order of 31 December 1999 stipulating the general technical regulations designed to prevent and mitigate the harmful effects and external hazards resulting from operation of basic nuclear installations.

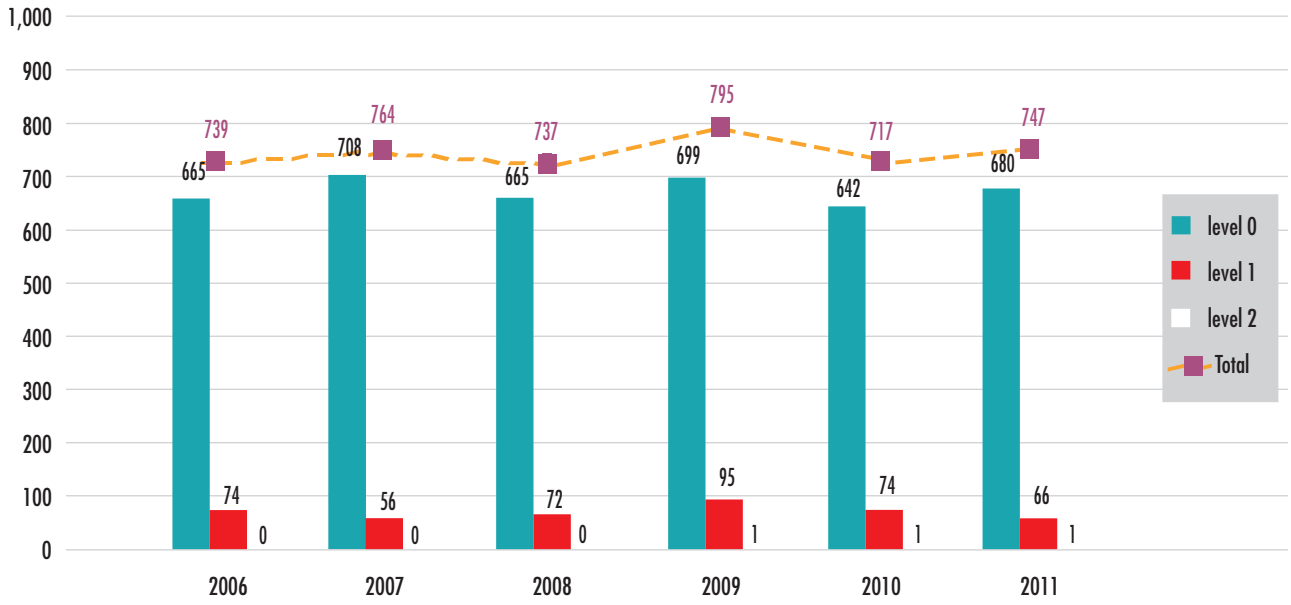
Graph 5: liquid radioactive discharges for the NPPs in 2011



Graph 6: gaseous radioactive discharges for the NPPs in 2011



Graph 7: evolution of the number of significant events rated on the INES scale in EDF nuclear power plants from 2006 to 2011



Radioactive release values

The licensee regularly sends ASN its discharge results. These data are closely examined and cross-checked against reactor operation during the period considered. Anomalies detected give rise to requests for additional information from the licensee.

The 2011 results concerning radioactive effluent discharges are presented in graphs 5 and 6. Graph 5, "liquid radioactive discharges", presents the 2011 discharges of liquid tritium and others (carbon-14, iodine-131, nickel-63 and other beta and gamma emitting radionuclides) per pair of reactors. Graph 6, "gaseous radioactive discharges", presents the 2011 discharges of gases (carbon-14, tritium and rare gases) as well as halogens and aerosols (iodines and other beta and gamma emitting radionuclides) per pair of reactors.

6|1|6 Analysing statistics on significant events

Significant events in 2011

Under the rules on notification of significant events in the areas of safety, radiation protection and the environment, in 2011 EDF reported 639 significant safety events (ESS), 91 significant radiation protection events (ESR) and 115 significant environmental events (ESE) (involving neither nuclear safety nor radiation protection). 747 events were rated on the INES scale.

Graph 7 shows the trends in the number of significant events reported by EDF and rated on the INES scale since 2006.

Graph 8 shows the trends since 2006 in the number of significant events per area concerned by the notification (ESS, ESR and ESE).

The number of ESS declared increased by about 3% over 2010 and a generic ESS was rated level 2 on the INES scale (see box in point 2|2|2).

The number of ESR is stable in relation to 2010 but down overall since 2007. This is mainly due to continuous improvement in the resources used for protection against ionising radiation. As the body responsible for radiation protection in the NPPs, EDF must oversee the protection and the maintaining of a safety culture amongst its staff as well as amongst contractors' staff.

The number of ESE is up on last year and remains high in relation to other years. Protection of the environment must remain a central concern for EDF.

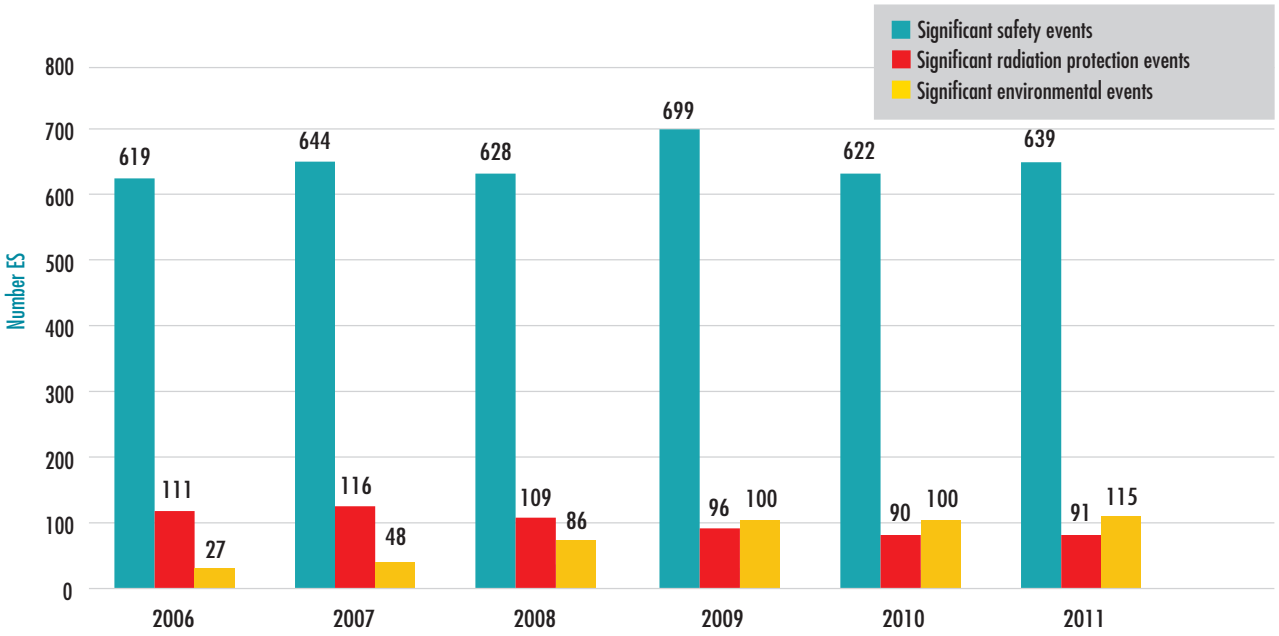
Graph 9 shows the average number of significant events in 2011, rated at levels 0 and 1 on the INES scale, and per standardised plant series. The slightly higher average for the N4 series is mainly due to the fact that reactor outages were more numerous for this series in 2011. The increased amount of maintenance and activity during the outage periods generally contributes to a rise in the number of events.

6|2 Evaluation of each site

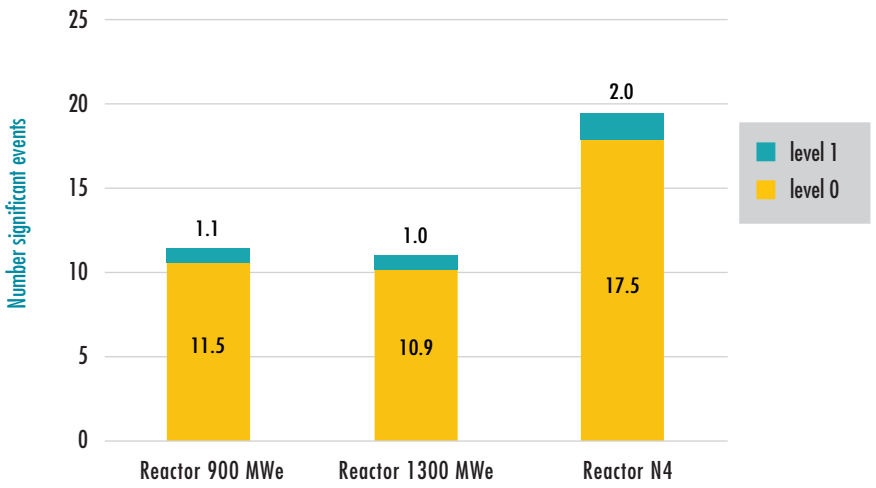
Belleville-sur-Loire

ASN considers that the performance of the Belleville-sur-Loire site is on the whole in line with the general assessment of EDF's nuclear safety, radiation protection and environmental protection. It considers that on the whole, the safety progress made in 2011 must be continued, in particular with regard to operation of the facilities and the rigorous attitude to maintenance work. With regard to radiation protection, the site

Graph 8: evolution of the number of significant events per domain in EDF nuclear power plants from 2006 to 2011



Graph 9: mean number of significant events rated on the INES scale in EDF NPPs per type of reactor and per year, for 2011



has implemented a number of action plans designed to reinforce the protection measures. These measures were deployed during the outage of reactor 1, during which fuel rod leaks were detected.

Finally, in the field of environmental protection, ASN notes that the performance of the site must progress further, despite the significant measures taken in recent years. The application of the requirements applying to facilities liable to have an impact on the environment must be more rigorous.

During the course of the ASN inspection on the Belleville site as part of the Fukushima experience feedback process, one particular observation was that even if the planned organisation for preventing the risk of flooding appears to be satisfactory, it should nonetheless be tested by means of exercises. With regard to earthquakes, the organisation must also be consolidated by experience feedback from the performance of complete exercises.

Blayais

ASN considers that the nuclear safety and radiation protection performance of the Blayais site on the whole matches ASN's general assessment of EDF, and that the radiation protection

performance stands out positively. This is because ASN considers that the site has shown rigour in this area, particularly in the management of controlled areas and dosimetry.

ASN considers that the site must be more rigorous in the preparation, performance and inspection of operating and maintenance activities. Consequently, application of the reliability enhancement practices must be improved.

Finally, despite improved control of discharges, the site must be more rigorous in the tracking and maintenance of the equipment that contributes to environmental protection and monitoring, in order to guarantee compliance with the regulatory requirements.

Following the inspections carried out in response to the Fukushima accident, the overall impression is satisfactory with regard to the "flooding", "cooling – loss of heat sink" and "emergency response organisation and resources" topics. However, the way the "seismic" risk is covered needs to be improved.

Bugey

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Bugey NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

With regard to nuclear safety, ASN notes that in 2011, the quality of operations on the Bugey site showed signs of weakness, as in 2010. ASN in particular considers that significant improvements must be made with respect to lock-out, circuit configuration and compliance with technical operating specifications.

In 2011, the site had to deal with a considerable reactor outage workload, in particular comprising the third ten-yearly inspections for reactors 4 and 5, which lasted 5 and 6 months respectively. The restart of reactor 5 was disrupted by a number of operational incidents related to system configuration deviations delaying reactor production restart by a month.

With regard to radiation protection, ASN notes a slight improvement in the dosimetry of the staff working on the site.

In terms of environmental protection, ASN considers that the site needs to make progress in waste management.

Generally speaking, ASN hopes to see significant progress on the Bugey site in 2012, in terms of operational rigor, following two years marked by large-scale works programmes.

The inspection carried out from 19 to 21 September 2011 following the Fukushima nuclear accident, on the topics of "earthquake", "flooding", "electrical power supplies", "heat sink", "cooling", "on-site emergency plan" and "operational management of emergency situations", proved to be on the whole satisfactory.

Cattenom

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Cattenom NPP is, on the whole, in line with ASN's general assessment of EDF's performance. ASN in particular considers that occupational radiation protection is improving thanks to the steps taken by the site.

ASN considers that the site is well-prepared for emergency situations. During the site inspection conducted by ASN from 2 to 5 August 2011 to take account of the experience feedback from Fukushima, the management of mobile emergency equipment was found to be satisfactory and the exercises showed good forward planning on the part of those involved. This inspection left a satisfactory impression overall with regard to all the other subjects inspected.

In November 2011, the IAEA carried out a operational safety review (OSART mission) of the Cattenom NPP, the second on the site after that of 1994, which confirmed ASN's opinion of the site.

Chinon

ASN considers that the environmental protection performance of the Chinon NPP is on the whole in line with ASN's general assessment of EDF but that the site's nuclear safety and radiation protection performance need to be improved.

ASN considers that, unlike the rest of the fleet, the Chinon site has made no progress in radiation protection and several significant events and inspection findings have revealed shortcomings in intervention preparation. On several occasions, ASN observed inconsistencies in the limited stay area access permits and in the work site documents. Moreover, the lack of stringency in the performance of operations and in application of the baseline requirements and operating procedures is a point that could be improved. In this respect, a proactive action plan was implemented by the site's management.

During the ASN inspection on the Chinon site, in the presence of two members of the CLI, to take account of experience feedback from Fukushima, prevention of the consequences of and organisation of the response to an earthquake appeared to be tenuous, particularly with respect to the documentation. Heat sink management appeared to be satisfactory. Moreover, the perimeter of the "flooding" exercises needs to be extended, for example to include several reactors.

Chooz

ASN considers that the nuclear safety and radiation protection of the Chooz NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

ASN considers that the Chooz site stands out with regard to compliance with the regulations on pressure equipment, especially concerning the main primary and secondary systems.

However, ASN believes that the Chooz site must remain attentive to fuel assembly deformation phenomena.

ASN considers that environmental protection performance is below that of its general assessment of the EDF fleet. The Chooz site must in particular exercise greater stringency in monitoring and operating its air cooling tower monochloramine treatment facility and, more generally, the way it considers the risks linked to the use of chemical products.

Following the inspections carried out in response to the Fukushima accident, in the presence of members of the CLI and the Belgian safety regulator, ASN considers that the Chooz NPP needs to improve the organisation of its response to an earthquake. The other topics left a satisfactory impression overall.

Civaux

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Civaux NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

With regard to nuclear safety, ASN notes that certain improvements are required in the preparation and reliability of interventions on the site. It also observes recurrent conformity deviations on earthquake-qualified equipment.

Furthermore, ASN notes that the collective dosimetry remains low despite the numerous work programmes conducted during the 10-year inspection. It nevertheless expects to see improvements in the conditions of implementation of the EVEREST initiative (entry into controlled areas wearing standard working overalls).

ASN considers that the site must remain vigilant in the management of its discharges during low water periods.

Although the inspection carried out following the Fukushima accident did not reveal any major deviations from the applicable baseline requirements in the fields concerned, ASN considers that the Civaux NPP must improve the organisation of its response to an earthquake.

Cruas-Meysse

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Cruas-Meysse NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

With regard to nuclear safety, the site must continue the efforts made to improve the stringency of operations, in particular by reinforcing its practices to improve reliability during interventions.

With regard to radiation protection, the site once again presented widely contrasting results in 2011: although the gamma radiography inspection results were satisfactory, control of access to limited stay areas needs to be reinforced. ASN also considers that the radiological cleanness of the site needs to be improved.

With regard to environmental protection, ASN once again in 2011 observed that greater account needs to be taken of environmental issues resulting from modifications to the facilities.

In 2011, ASN observed a considerable deterioration in occupational safety conditions and expects tangible measures in this respect in 2012.

Finally, in the light of the delays observed in the training plans, ASN considers that the Cruas-Meysse site needs to improve its skills management processes. Furthermore, monitoring of the contractors working on the site needs to be significantly reinforced.

The inspection carried out from 19 to 21 October 2011 following the Fukushima nuclear accident, on the topics of "earthquake", "electrical power supplies", "heat sink", "cooling", "on-site emergency plan" and "operational management of emergency situations", proved to be on the whole satisfactory.

The extent to which the flooding risk is taken into account by the Cruas-Meysse site does however need to be reinforced.

Dampierre-en-Burly

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Dampierre-en-Burly NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

However, the efforts made to improve the stringency of operations must be continued. In 2011, quality deviations in the preparation for and performance of maintenance operations were also detected.

With regard to occupational safety and radiation protection, breaches of the regulations were once again observed. However, ASN did note the good results achieved by the site and the drop in the number of significant radiation protection events.

The site still stands out in its management of the impact of the facilities on the environment. Optimisation of chemical and radioactive discharges continued in parallel with the use of new discharge and intake licenses.

During the course of the inspection carried out following the Fukushima accident, management of the flooding risk appeared to be on the whole satisfactory. However, the monitoring of nuclear island protection against water ingress does not conform to the applicable rules. Moreover, management of the seismic risk by the Dampierre NPP did not appear to be satisfactory.

Fessenheim

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Fessenheim NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

During the course of a particularly busy 2011, in particular with the third ten-yearly inspection of reactor 2 and the corresponding outage of reactor 1, ASN observes progress in the maintenance of the facilities and monitoring of the contractors. The licensee took account of the experience feedback from the previous outages.

ASN notes that a considerable amount of equipment was replaced in order to improve the condition of the facilities. Compliance with the technical prescriptions issued by ASN following the third ten-yearly outage inspection of reactor 1 will help raise the level of safety, so that continued operation of this reactor up to 40 years could be envisaged.

However, ASN considers that occupational worker protection is not improving, despite the proposed action plan following ASN's findings in 2010.

Finally, the inspection carried out by ASN from 27 to 30 September 2011 following the Fukushima accident left a highly satisfactory impression with respect to all the topics inspected.

Flamanville

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Flamanville NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

ASN considers that the site must continue its efforts in terms of organisation and safety culture. ASN observes significant progress in dealing with the backlog of maintenance work and improving the condition of the facilities. The site must achieve progress in managing reactor outages with respect to reactivity and anticipating technical subjects with safety implications.

The "Fukushima experience feedback" inspection is satisfactory with respect to four of the five topics inspected (management of emergency situations, flooding, electrical power supplies and cooling), but the site needs to improve the way it deal with the "earthquake" topic.

Golfech

ASN considers that the nuclear safety performance of the Golfech NPP is on the whole in line with ASN's general assessment of EDF and that the site's environmental protection and radiation protection performance stand out positively with respect to ASN's general assessment of EDF.

ASN considers that the site must be more rigorous in the preparation, performance and second-level inspection of control operations and in the monitoring of maintenance activities performed by outside contractors. Furthermore, ASN considers that integration of the seismic risk and emergency situation management need to be improved.

ASN notes that the site continues the good radiation protection performance it has displayed for several years now, and ensures satisfactory contamination management in the controlled areas.

Following the "Fukushima experience feedback" inspection, ASN is on the whole satisfied with the electrical power supplies and satisfied with heat sink management.

Gravelines

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Gravelines NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

However, ASN considers that the site must progress in the stringency of both the detection and analysis of significant safety events and the maintenance and operation of the reactors. ASN for example asked the licensee to rapidly rectify the deviations on certain equipment items contributing to reactor cooling and which could be affected in the event of an earthquake.

In 2011, EDF initiated the programme of the third ten-yearly outage inspections for the Gravelines NPP. ASN is currently reviewing the results of the checks carried out on reactor 1. The checks highlighted cracking on a reactor vessel bottom-mounted instrumentation penetration, which is the first occurrence of this type for the French NPP fleet (see point 5 | 7).

As part of the Fukushima experience feedback process, the ASN inspection of the Gravelines site, in the presence of members of the CLI, highlighted areas for improvement in the earthquake resistance of certain equipment items and protection against the risk of flooding of the facilities.

ASN notes positive moves by EDF to take account of industrial hazards in the site environment. These efforts should be continued.

2011 was also marked by a fatal occupational accident which occurred when work was being carried out at height.

Nogent-sur-Seine

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Nogent NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

ASN observes that in the Nogent NPP, operational stringency is no longer progressing. 2011 was marked by errors in reading the facility operating rules and failures in the management of equipment lock-outs. ASN also considers that the dissemination of experience feedback among the operating teams needs to be improved.

ASN also considers that contractor monitoring during reactor outages could be better, in terms of both overall management and the resources allocated in the field.

With regard to the environment, ASN considers that efforts were made in 2011, although the progress achieved would seem to be tenuous. Most of the persistent shortcomings concern liquid effluent containers.

The inspections carried out following the Fukushima accident left a satisfactory impression overall. A number of deviations still need to be corrected, mainly concerning the topics of earthquake and flooding.

Paluel

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Paluel NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

ASN nonetheless considers that several significant event notifications issue by the site reveal a deterioration in the stringency of operation and maintenance. These deviations reflect inadequacies in the monitoring of activities, the safety culture of the staff and the preparation of interventions involving reactor operations, in particular during the transient shutdown and restart phases.

The topics examined during the "Fukushima experience feedback" inspection are on the whole covered satisfactorily.

ASN considers that the site needs to improve the monitoring and maintenance of the chiller units in the light of the recurring releases of coolant fluids.

Penly

ASN considers that the Penly NPP's nuclear safety performance stands out positively in relation to ASN's general assessment of EDF's performance and that its results for protection of the environment and for radiation protection are on the whole in line with ASN's general assessment of EDF's performance.

The site is continuing the positive developments of previous years and ASN's inspection did not reveal any particular difficulty in the areas of nuclear safety, radiation protection or protection of the environment.

The "Fukushima experience feedback" inspection is satisfactory, but the "earthquake" issue needs to be better addressed.

In the last quarter, reactor 1 underwent its second ten-yearly outage inspection, including regulation hydrotesting of the main primary system and the containment tightness test.

Saint-Alban

ASN considers that, overall, the Saint-Alban NPP is under-performing in relation to ASN's general assessment of EDF's performance.

In 2011, ASN observed that the fundamental requirements issued by EDF at a national level were not being correctly implemented by the site and that the delay built up over the past 3 years in this area is not being made up. ASN also considers that the activation of the independent safety entity and the consideration given to its analyses and recommendations by the site's main decision-making bodies are insufficient.

Concerning the monitoring of pressure equipment, the *Préfet* of the Isère, on the advice of ASN, decided not to renew the approval of the site's inspection department in 2011.

Where radiation protection is concerned, ASN considers that the site's overall performance is in line with ASN's general assessment of EDF's performance. Although access to limited stay and prohibited areas is satisfactory, control of contamination on the worksites during reactor outages needs to be improved.

With regard to environmental protection, ASN considers that the site is under-performing with respect to ASN's general assessment of EDF, as the site for example lacks rigor in its operation of installations classified on environmental protection grounds.

Generally speaking, ASN considers that the Saint-Alban site rapidly needs to take proactive, tangible measures on a scale commensurate with the nature of the problems it has identified.

The inspection carried out from 27 to 29 June 2011 following the Fukushima nuclear accident, on the topics of "earthquake", "flooding", "electrical power supplies", "heat sink", "cooling" and "on-site emergency plan", proved to be on the whole satisfactory. The Saint-Alban site's organisation of operational management of emergency situations nonetheless needs to be reinforced.

Saint-Laurent-des-Eaux

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Saint-Laurent-des-Eaux NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

However, in terms of safety, ASN considers that the site needs to continue its efforts to remedy the various weak points identified since 2010. In particular, improvements are still needed regarding the quality of the technical checks and the preparation and coordination of the various interventions.

With respect to radiation protection, ASN considers that the site stands out positively concerning its implementation of the EDF baseline standards. ASN also underlines the implementation of complementary requirements in this field by the site. Finally, although the site confirms its progress in terms of management of the radiological cleanness of the work sites, the inspections have shown that the radiation protection culture of the workers involved could still be improved.

During the ASN inspection of the Saint-Laurent site, in the presence of two members of the CLI and with regard to integrating experience feedback from Fukushima, one particular finding was that certain parts of some of the documents concerning the flood risk needed to be completed. It was considered that the organisation set up to analyse and utilise the recordings characterising an earthquake, to evaluate the level of an earthquake and to implement the appropriate measures could be better.

Tricastin

ASN considers that the Tricastin site stands out positively with regard to its nuclear safety performance in relation to ASN's general assessment of EDF's performance.

ASN does however consider that progress needs to be made in the activation of the independent safety entity and in the quality of the risk analyses associated with requests for temporary waivers to the general operating rules.

Where radiation protection is concerned, ASN considers that the site's overall performance is in line with ASN's general assessment of EDF's performance. Progress is however still needed concerning the regulation checks on radiation protection measuring instruments.

With regard to environmental protection, ASN in 2011 observed deviations concerning compliance with its decisions relative to the operation of site equipment, in particular including installations classified on environmental protection grounds. In 2012, ASN also expects significant progress in responsiveness when an anomaly is detected.

In 2011, ASN noted an improvement in the occupational safety results, which were found to be clearly inadequate in 2010. ASN however considers that site progress in this area remains tenuous.

Finally, ASN notes that in February 2011, Tricastin notified an event rated 2 on the INES scale concerning the premature wear of certain parts of the diesel emergency generator sets.

The inspection, carried out from 3 to 5 October 2011 following the Fukushima nuclear accident, on the topics of "earthquake", "flooding", "electrical power supplies", "heat sink", "cooling" and "on-site emergency plan", proved to be on the whole satisfactory. The Tricastin site's organisation of the operational management of emergency situations nonetheless needs to be reinforced.

New reactors

6|3 Evaluating EPR Flamanville 3 reactor construction

Quality management associated with construction activities on the Flamanville 3 site

Following the inspections carried out in 2011 and the review of the deviations notified by EDF, ASN considers that EDF's organisation on the Flamanville 3 construction site is on the whole satisfactory. ASN in particular notes that the action plan initially implemented to guarantee the quality of welding of the liner has gradually been extended to cover other welding activities on safety-related equipment and has produced satisfactory results so far. ASN has a positive opinion of the quality of the technical exchanges during the inspections.

ASN does however note that some of the more complex civil engineering activities led to a higher number of repairs and anomalies than the more routine activities. These deviations were in particular due to shortcomings in the risk analysis of these activities, a lack of safety culture on the part of the workers involved and shortcomings in EDF's monitoring of these activities. ASN considers that EDF was able to provide satisfactory answers and evidence in response to ASN's requests. ASN does however also consider that EDF must ensure that all the action plans implemented on the construction site at ASN's request following deviations, are particularly closely monitored so that the actions defined are maintained on a long-term basis, to ensure the quality of the construction of the EPR reactor.

Quality management associated with design and manufacturing activities in the workshops of the structure, system and component suppliers

During its inspections, ASN observed that the organisation put into place in the various EDF departments, whether for engineering or the teams in charge of monitoring the activities performed by its contractors, was on the whole satisfactory and showed signs of improvement with respect to previous years. Anomalies were nonetheless observed relating to identification of quality-related activities and errors in the traceability of monitoring actions carried out by EDF. Based on ASN observations in 2010, EDF took various steps: overall review of quality-related activities, action plan to improve monitoring of the design office to which EDF entrusts the detailed civil engineering design and manufacturing studies for the systems and components not used in the construction of the NSSS, and analysis of experience feedback about the organisation put into place for examination and centralisation of deviations and technical code waivers. EDF has undertaken to present a summary of these measures to ASN in the very near future.

Moreover, in the light of the conditions in which certain system and component manufacturing operations are initiated by the subcontractors, ASN considers that EDF will need to make considerable efforts to demonstrate that the equipment manufactured meets the requirements of the safety demonstration. This subject is dealt with in more detail as part of management of the follow-up to the in-depth inspection of activities subcontracted to AREVA (see point 5|2 of chapter 12).

Organisational and human factors

ASN sought the opinion of the advisory committee for reactors (GPR) regarding the principles of organisation and the human resources planned by EDF for operation of the Flamanville EPR reactor. The results of EDF's first test campaigns on a simulator in 2010 are inconclusive with regard to some of the essential elements of the safety demonstration and will be supplemented by another campaign.

During its 2011 inspections, ASN also checked the training and safety culture awareness-raising measures from which the construction site workers benefited. ASN considers that care must be given to ensuring that the workers are aware of the importance of the quality of construction and the steps that contribute to this quality, for example when technically particularly demanding. On two occasions in 2011, ASN thus asked EDF to improve the training and awareness-raising measures from which the workers benefited.



EPR simulator

7 OUTLOOK

With regard to NPPs, ASN's regulatory and inspection duties in 2012 will be primarily concerned with the subjects presented below:

7|1 Regulation of the EPR and actions relating to new reactors

Regulation of the EPR reactor

Surveillance of construction of the Flamanville 3 EPR will continue until authorisation for commissioning of the installation. EDF at present anticipates initial operation at rated power in 2016. Between now and then, ASN will be continuing its monitoring of occupational accident risk prevention, EDF's surveillance of the quality of construction, both for the work done on the site and for the manufacturing work done by EDF suppliers and the manufacturing of nuclear pressure equipment. At the same time, ASN will be continuing its advance review of certain elements of the commissioning application file, together with the Advisory committee for reactors and, for the reactors in operation, will examine the hard core requested by ASN further to the complementary safety assessments. ASN will develop the regulation tools necessary for managing the preparation and inspection of the facility start-up tests and the final review of the commissioning authorisation application file. ASN will carry out these steps jointly with its counterparts also involved in the project.

Other actions relating to new reactors

Subsequent to the statement by WENRA published in November 2010 on the safety objectives for new reactors, ASN will contribute to actions aiming to promote these objectives in the worldwide thinking on these subjects initiated by the IAEA or within the MDEP framework. Moreover, ASN will continue to work within WENRA on the development of common positions on subjects resulting from these safety objectives and that warrant clarification.

7|2 Labour inspection

ASN will ensure that labour inspection officers are regularly present in the field, in particular for construction and maintenance site activities.

Following the deviations observed on the sites since 2009 with regard to the maximum working hours overruns and the insufficient rest periods, but also EDF's 2011 implementation of a policy of early planning of working hours during reactor outages, ASN will be particularly attentive to tangible measures affecting working hours, in particular for the management. It will continue its inspections in this area to evaluate the undertakings, assess their actual implementation and penalise any deviations observed.

ASN will focus on implementing the measures defined in the 2012 action plan from the Ministry for Labour concerning labour inspection duties, as well as in the national occupational health and safety plan, by emphasising health and safety, quality of employment, social dialogue and combating illegal labour. In the second half of the year, it will be taking part in the European campaign to prevent stress-related risks.

Finally, with a view to developing an integrated view of safety, the ASN labour inspectors will be associated and coordinated with other ASN regulation and monitoring actions, for example in the field of subcontracted maintenance.

7|3 Radiation protection and protection of the environment

Radiation protection

ASN expects of EDF that it strengthen its radiation protection policy with, notably, better preparation of interventions and progress in controlling contamination at source.

The Authority will be attentive to compliance on these different aspects in the files it will be examining, and during on-site inspections. Following on from the wide-ranging inspection carried out in 2011 on the four Loire Valley sites (Belleville-sur-Loire, Dampierre, Saint-Laurent-des-Eaux and Chinon), ASN will carry out further in-depth inspections in order to continue with its detailed assessment of the radiation protection measures taken by EDF.

Environmental Protection

In 2012, once it has received the files from EDF, ASN will begin its review of the effluent discharge and water intake license renewal files for the Bugey and then Fessenheim sites, the provisions of these licenses being currently specified in relatively old orders. ASN will ensure that the discharge limits are set for these two sites according to the best available techniques and taking account of experience feedback from the NPPs in operation.

ASN will continue to review the effluent discharge and water intake modification files for Cruas-Meysse and Belleville and will begin those of Saint-Alban, Cattenom and Paluel.

It will continue to work with the licensee to optimise discharges, in accordance with the measures decided on following the meeting of the Advisory Committee for reactors in 2006 concerning the management of radioactive effluents and chemical effluents associated with the French NPPs in operation. ASN will continue to review the files concerning steam generator cleaning, management of cleaning effluents and the fate of the used generators.

It will also devote efforts in the field to checking that the measures envisaged by EDF to tackle legionnaire's disease, but also to reduce coolant fluid emissions and to replace chiller units, are actually implemented on the sites.

Finally, ASN will continue to ensure that account is taken of the experience feedback from the SOCATRI and FBFC events, by

analysing the further steps taken by EDF and by means of targeted inspections.

7|4 Hazard prevention

Preventing fires and explosions

ASN will check compliance with the requirements concerning management of the fire and explosion risks in the files it will be reviewing and in its site inspections.

With regard to checking integration of the fire risk, ASN will be particularly attentive to the steps taken by EDF with regard to management of fire sectoring and management of fire loads.

With regard to the explosion risk, ASN will for example be carrying out inspections to continue to monitor the steps taken by EDF following the ASN decision concerning management of the risk of NPP on-site explosions (decision 2008-DC-0118 of 13 November 2008), as well as compliance with the requirements of the regulations concerning occupational safety in an explosive atmosphere (ATEX).

Flood prevention

In 2012, ASN will submit the draft guidelines on protection of BNIs against external flooding to the advisory committees for reactors, laboratories and plants. These draft guidelines were produced by a working group which, between 2006 and 2009, brought together ASN, IRSN, the nuclear industry licensees and experts from the field of hydrology. Public consultation on this project was organised in 2010.

7|5 1,300 MWe and 1,450 MWe reactor containment

A GPR meeting is planned for late 2012 to look at the issues of the 1,300 MWe and 1,450 MWe reactor containment, in particular in the run-up to the third ten-yearly outage inspections for the 1,300 MWe reactors. The GPR will in particular examine the double-wall containment, the double-wall containment internal ventilation system, the containment penetrations, the containment extensions and the corresponding bypass risks, as well as the behaviour of the auxiliary buildings.

7|6 Review of safety associated with ten-yearly outages

In 2012, ASN will attentively continue its examination of the safety reviews of NPPs that are associated with the ten-yearly outages. ASN considers this step to be crucial in gaining a precise understanding of the condition of the reactors, but also for continuously improving the safety of the facilities. One year after the end of each ten-yearly inspection, ASN will issue its opinion on the ability of each reactor to continue to operate and, as necessary, will specify the technical requirements needed to manage and monitor this continued operation. In 2012, ASN will make its position known following the third ten-yearly inspections of Bugey reactors 2, 4 and 5, Dampierre 1 and Tricastin 2.

7|7 Continuing operation beyond 40 years

As EDF has indicated its desire to extend the operating life of its reactors up to 60 years, ASN will pursue its examination of the possible conditions for extension of their operation. In 2012, following a meeting of the GPR concerning the programme of study and work proposed by EDF with a view to extending reactor operations, ASN will make its position known. For ASN, extension of reactor operations beyond forty years can only be envisaged if it is associated with a proactive and far-reaching programme for improved safety that is in line with the safety objectives adopted for new reactors and with best international practice.

7|8 Complementary safety assessments following the Fukushima accident

ASN will issue technical requirements to EDF as a result of its analysis of the complementary safety assessments. The purpose of these requirements will be to cover all the technical topics resulting from the analysis of the Fukushima accident, for example with regard to the robustness of the facilities to earthquake and flooding, to loss of electrical sources or heat sink, severe accident management, consideration of human and organisational factors and subcontracting.

In addition, the action taken further to the 2011 inspections in response to this accident will be checked in 2012, either as part of the normal programme of ASN inspections, or during the course of specific inspections.

ASN will draw the conclusions of the ongoing European peer-reviews, in which it is a participant and one objective of which is to compare the requirements stipulated by the safety regulators or the measures proposed by the foreign licensees.

It will take part in international experience feedback on the subject, paying particular attention to understanding of the accident, management of the operations to regain control of the facility, decommissioning and decontaminating the facility and making it safe.

ASN will make modifications to its programme to update the baseline safety requirements applicable to the design of new nuclear facilities, but also, as part of the periodic safety reviews, for the facilities currently in operation.

ASN will contribute to the expression of R&D requirements to be added in the medium term to the applicable baseline safety requirements for the prevention of this type of accident and to improvements in the understanding of severe accidents and post-accident management.

NUCLEAR FUEL CYCLE INSTALLATIONS

1 **MAIN INSTALLATIONS IN OPERATION** 379

1|1 **The uranium conversion, processing and enrichment plants in operation at Tricastin**

1|1|1 AREVA NC TU5 facility and W plant

1|1|2 The EURODIF gaseous diffusion enrichment plant

1|1|3 The Georges Besse II ultracentrifugation enrichment plant project

1|2 **Nuclear fuel fabrication plants in Romans-sur-Isère and Marcoule**

1|2|1 The FBFC and CERCA uranium-based fuel fabrication plants

1|2|2 The MÉLOX uranium and plutonium-based fuel fabrication plant

1|3 **AREVA NC reprocessing plants at La Hague**

1|3|1 Presentation

1|3|2 Plant modifications

2 **INSTALLATIONS IN CLOSURE PHASE** 389

2|1 **Older AREVA NC La Hague installations**

2|1|1 Recovery of legacy waste

2|1|2 Final shutdown of the UP2 400 plants, the STE2 facility and the ELAN IIB unit

2|2 **COMURHEX uranium hexafluoride preparation plant**

3 **REGULATING CONTROLLING THE NUCLEAR FUEL CYCLE FACILITIES** 392

3|1 **Regulating the main steps in the life of nuclear facilities**

3|2 **Monitoring the organisation of the licensees of the cycle nuclear installations other than nuclear power plants**

3|3 **Ensuring the consistency of the cycle**

3|4 **Promoting operating experience feedback from the fuel cycle BNIs other than the NPPs**

3|4|1 Dealing with incidents

3|4|2 Taking account of organisational and human factors

3|4|3 Controlling the fire risk in nuclear facilities

3|4|4 Controlling the criticality risk in nuclear facilities other than nuclear power plants

4 **INTERNATIONAL ACTION** 396

5 **EXPERIENCE FEEDBACK FROM THE FUKUSHIMA DAIICHI ACCIDENT** 397

6 **OUTLOOK** 398

CHAPTER 13

France opted for the reprocessing of its nuclear fuel in the late 1960s, when nuclear power generation first began. Today, France, the United Kingdom and Japan are the only countries that reprocess nuclear fuel on an industrial scale.

The fuel cycle involves all the fuel manufacturing, reprocessing and recycling facilities. Recycling is achieved by using fuel based on a mixture of uranium oxides and plutonium, the plutonium having been generated when the fuel based on natural enriched uranium gets irradiated in the power reactors.

The main facilities of the fuel cycle – COMURHEX, AREVA NC Pierrelatte (TU5/W), Eurodif, GB II, FBFC, MELOX, AREVA NC La Hague – belong to the AREVA Group.

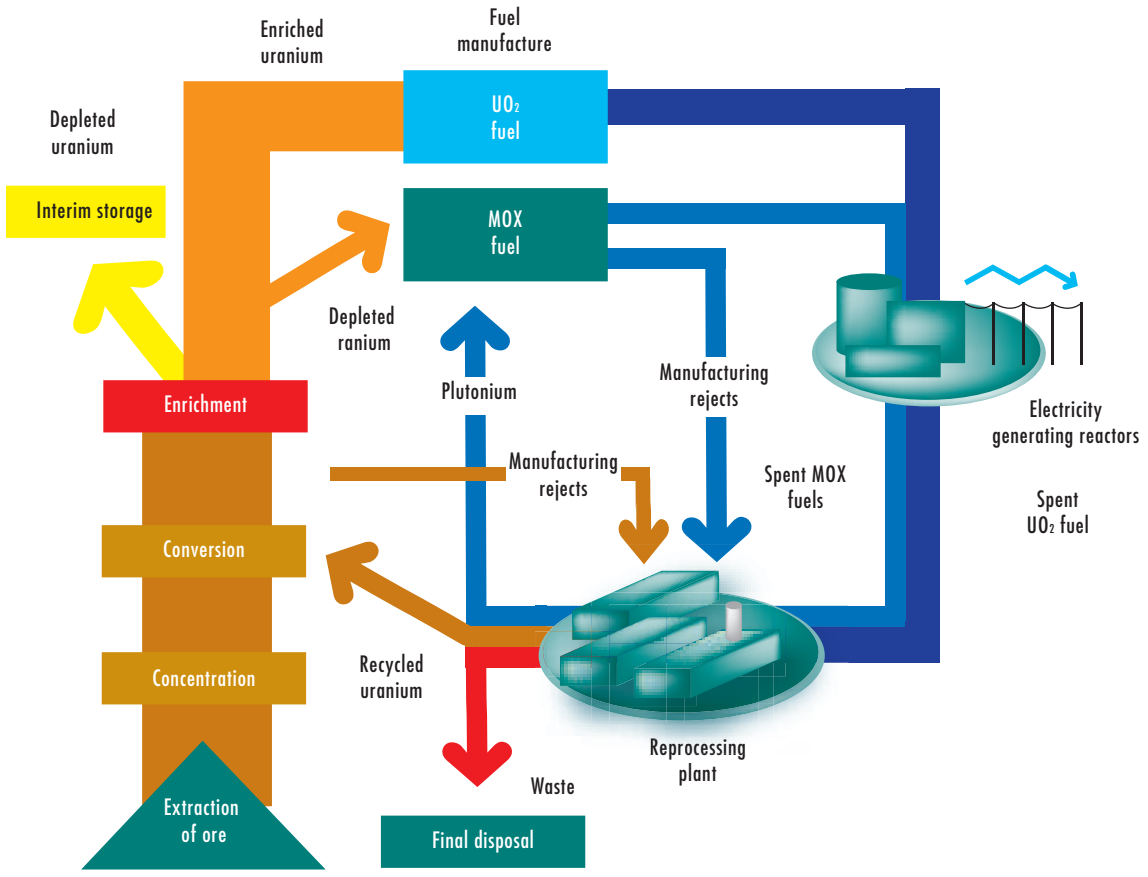
ASN regulates these industrial facilities independently with a view to monitoring a fleet of installations where safety and radiation protection must be managed along common lines. Today ASN expects AREVA to ensure high-quality management of safety and radiation protection in its facilities, rooted in the daily and on-ground activities of all the group's players, commensurate with AREVA's stated ambitions.

The fuel cycle chiefly comprises the fabrication of the fuel and its subsequent reprocessing after it has been used in the nuclear reactors. However, conventionally the cycle begins with extraction of the uranium ore and ends with disposal of a range of radioactive wastes arising from the spent fuel.

The uranium ore is extracted, then purified and concentrated into "yellow cake" on the mining sites. The solid yellow cake is then converted into uranium hexafluoride gas (UF_6) in the conversion operation. The raw material which will subsequently be enriched is fabricated by the COMURHEX plants in Malvési (Aude *département*[1]) and Pierrelatte (Drôme *département*). The facilities in question - which are not regulated under the legislation for basic nuclear installations (BNIs) but under that for installations classified on environmental protection grounds (ICPEs) - use natural uraniumin which the uranium 235 content is around 0.7%.

The existence of nuclear facilities whose activity is necessary for the operation of the BNIs mentioned above must also be noted, such as SOCATRI which ensures the maintenance and decommissioning of nuclear equipment, and the processing of nuclear and

The fuel cycle



1. Administrative region headed by a *Préfet*

industrial effluent from the AREVA companies in Tricastin, or SOMANU in Maubeuge, which ensures the servicing and repair of certain nuclear components outside their original facility.

Most of the world's NPPs use uranium which is slightly enriched with uranium 235. For example, the pressurised water reactor (PWR) series requires uranium enriched to between 3 and 5% with isotope 235. Raising this proportion of uranium 235 from 0.7% to between 3 and 5% is ensured by the EURODIF plant in Tricastin, which separates the uranium hexafluoride (UF_6) using a twin-stream gaseous diffusion process, with one stream becoming enriched in uranium 235 while the other becomes depleted during the process. The ultracentrifuging process currently entering service in the Georges Besse II plant will ultimately replace the gaseous diffusion process.

The process used in the FBFC plant at Romans-sur-Isère transforms the enriched UF_6 into uranium oxide powder. The fuel pellets manufactured with this oxide are clad to make up the fuel rods, which are then combined to form the fuel assemblies. These assemblies are then placed in the reactor core where they release power by fission of the uranium 235 nuclei.

After about three to five years, the spent fuel is removed from the reactor and cooled in a pool, firstly on the plant site and then in the AREVA NC reprocessing plant at La Hague.

In this plant, the uranium and plutonium from the spent fuels are separated from the fission products and the other actinides. The uranium and plutonium are packaged and then stored for subsequent reuse. The radioactive waste produced by these operations is disposed of in a surface repository if it is low-level waste, otherwise it is placed in interim storage pending a final disposal solution.

The plutonium resulting from reprocessing is used either to manufacture fuel for fast neutron reactors (as was done in the ATPu in Cadarache), or, in the MELOX plant in Marcoule, to manufacture the MOX fuel (mixture of uranium and plutonium oxides) used in particular in the French 900 MWe PWR reactors.

Map showing the location of the fuel cycle plants

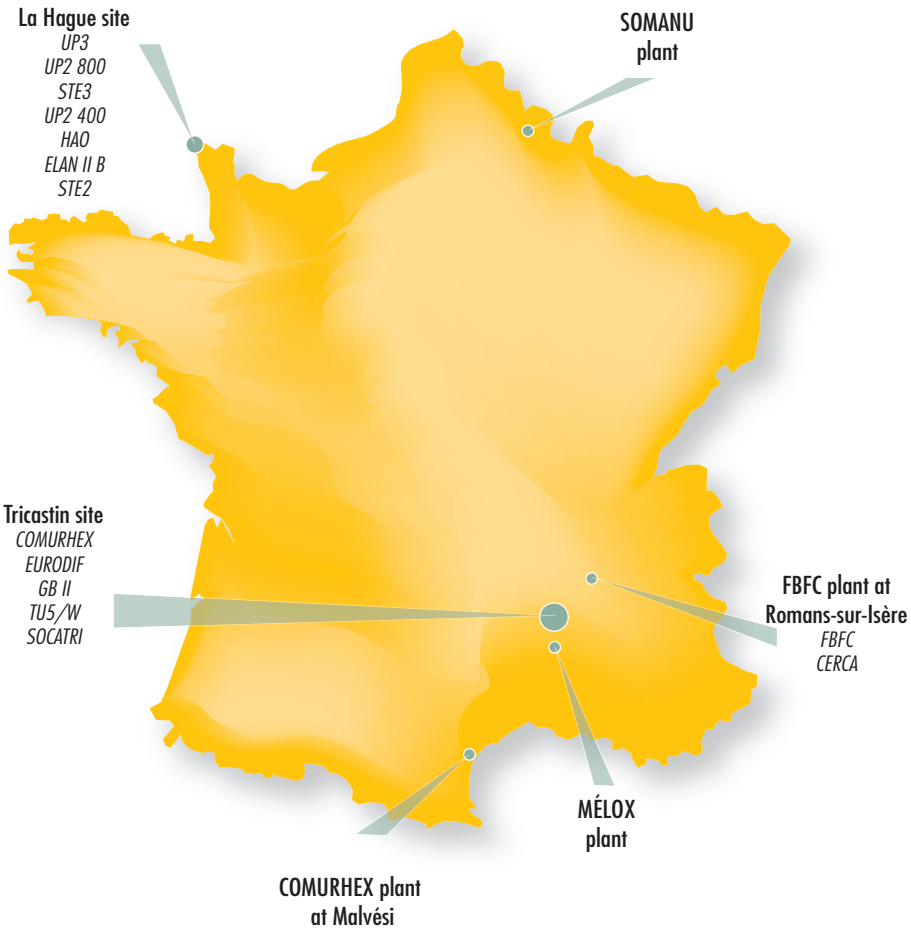


Table 1: fuel cycle industry movements in 2011

Installation	Origins	Material processed	Tonnage (unless otherwise specified)	Product obtained	Tonnage (unless otherwise specified)	Destination	Tonnage (unless otherwise specified)
COMURHEX Pierrelatte[2]	Installation in shutdown status	$UO_2(NO_3)_2$ (derived from reprocessed uranium)	0	UF_4 UF_6 U_3O_8	0	Installation in shutdown status	0
AREVA NC Pierrelatte TU5 plant	**AREVA NC** La Hague	$UO_2(NO_3)_2$ (derived from reprocessed uranium)	2,801	U_3O_8	837	Interim storage TU5	837
AREVA NC Pierrelatte W plant	**URENCO** **EURODIF**	UF_6 (based on depleted uranium)	11,181 8,205	U_3O_8	8,917 6,552	Interim storage W plant	8,917 6,552
EURODIF Pierrelatte	Converters and EURODIF Production	UF_6 (derived from natural and depleted uranium)	6,420	UF_6 (depleted uranium)	5,636	Defluorination and re-enrichiment of tailings	7,281
	Re-enrichment of tails	UF_6 (based on enriched uranium)	184	UF_6 (enriched uranium)	956	Fuel manufacturers	983
FBFC Romans	**EURODIF** **TENEX** **URENCO**	UF_6 (based on enriched natural uranium)	632	UO_2 (powder)	194	FBFC, Dessel (Belgium)	194
				Fuel elements	387	EDF	387
					52	Tihange+Doel (Belgium)	52
	COMURHEX	UF_6 (based on natural uranium)	4.5		30	KOEBERG (South Africa)	30
	AREVA NC	UF_6 (based on enriched natural uranium)	74	Fuel elements	72	EDF	72
	EURODIF	UF_6 (based on depleted uranium)	6	Models	0.5	AREVA	0.5
MÉLOX Marcoule	**AREVA NC** Pierrelatte	UO_2 (based on depleted uranium)	134.4 ML[3]	MOX fuel elements	138.6 ML[3]	CNPE EDF	118.1 ML[3]
						FBFC-Dessel	12.8 ML[3]
	AREVA NC La Hague	PuO_2	12.6 ML[3]			AREVA NC La Hague (Japan)[3]	1.7 ML[3]
AREVA NC La Hague	EDF BORSELLE reactors	Spent fuel elements UOX + MOX $(U+Pu)_{init}$ on UP3	550.35	Vitrified waste	339 CSD-V packages	Interim storage La Hague	38 CSD-V packages
	BR2 MOL	Reprocessed spent fuel elements $(U+Pu)_{init}$ sur UP3	0.03	Vitrified waste		Germany	301 CSD-V packages
	EDF reactors $(U+Pu)_{init}$ on UP2 800	Spent fuel elements UOX + MOX	494.63	Vitrified waste	272 CSD-V packages (including 76 CSD-B packages)	Interim storage La Hague	272 CSD-V packages (including 76 CSD-B packages)
	All origins	Spent fuel elements on UP3 et UP2 800		$UO_2(NO_3)_2$	809.97	AREVA NC Pierrelatte	809.97
				PuO_2	12.30	MELOX	150.08
				Compacted waste	1,342 CSDC packages	Interim storage La Hague	1,038 CSD-C packages
						Belgium, Holland, Switzerland	304 CSD-C packages
	EDF, TRINO BORSELLE reactors	Spent fuel elements UOX/MOX $(U+Pu)_{init}$				Elements unloaded into pool	1243.75
	CELESTINS, OSIRIS et ILL	Reprocessed spent fuel elements RTR $(U+Pu)_{init}$					

(1) The table only deals with the movements inside fuel cycle BNIs, including those in the AREVA NC W plant, which is an ICPE (installation classified on environmental protection grounds) located within the boundary of a BNI.
(2) The installations are in final shutdown status. They did not receive, ship or convert any material in 2011.
(3) Heavy metal.

1 MAIN INSTALLATIONS IN OPERATION

1|1 The uranium conversion, processing and enrichment plants in operation at Tricastin

To produce fuels that can be used in the reactors, the uranium ore must undergo a number of chemical transformations, from the preparation of the "yellow cake" through to conversion into uranium hexafluoride (UF_6), the form in which it is enriched. These operations are mainly carried out on the Tricastin site, also known as Pierrelatte.

All the BNIs on the site underwent a complementary safety assessment (CSA) in 2011 further to the ASN decision of 5 May 2011 (see point 5).

Following the joint review of these CSAs by the Advisory committee of experts for laboratories and plants, the IRSN (Institute of radiation protection and nuclear safety) and ASN, ASN will issue requirements relative to 1) the creation of a hard core of structures, systems and components that must be reinforced beyond the current design basis, 2) the development of the operating baseline standard, 3) emergency management, 4) reduction of the scale of a chemical accident, and 5) complements to the submitted CSAs.

1|1|1 AREVA NC TU5 facility and W plant

On the Pierrelatte site, AREVA NC operates:
– the TU5 facility (BNI) for conversion of uranyl nitrate (UO_2)(NO_3)$_2$ produced by reprocessing spent fuel into uranium sesquioxide U_3O_8;
– the W plant (ICPE within the BNI perimeter) for conversion of depleted UF_6 into U_3O_8, a solid compound which offers safer storage conditions and recycling of the hydrofluoric acid.

The installation TU5 can handle up to 2,000 tonnes of uranium per year.

The uranium from reprocessing is partly placed in storage on the AREVA NC Pierrelatte site and partly sent abroad for enrichment and reuse in the fuel cycle.



The TU5 facility on the Tricastin site

The dry radioactive material recycling unit was put into service in June 2011, which improves the safety of the storage sites.

1|1|2 The gaseous diffusion enrichment plant EURODIF

The isotope separation process used in the Georges Besse I (GBI) plant of EURODIF is based on gaseous diffusion. The plant comprises 1,400 cascaded enrichment modules, divided into 70 sets of 20 modules grouped in leak-tight rooms.

The principle of gaseous enrichment consists in repeatedly diffusing the gaseous UF_6 through porous barriers. These barriers allow preferential passage to the uranium 235 isotope contained in the gas, thereby increasing the proportion of this fissile isotope in the UF_6 at each passage. The UF_6 is introduced in the middle of the cascade, with the enriched product drawn off at one end and the depleted residue at the other.

The licensee plans stopping plant operation in mid-2012. The final shutdown and decommissioning operations should take about ten years. The EURODIF plant will be replaced by the Georges Besse II plant (GBII), in which the enrichment process is based on ultracentrifuging technology.

ASN regularly examines the licensee's studies on the EURODIF shutdown conditions and took a stance on the safety issues associated with plant shutdown in a letter addressed to the Director-General for Energy and Climate (DGEC) on 23 April 2010. The decommissioning operations must be planned for (inventories, characteristics) given the masses of materials to be recovered – the diffusers, for example, represent 150,000 tonnes of steel – in order to optimise the treatments, dismantling operations, transport and disposal routes.

In the first quarter of 2011 the licensee submitted an application for a modification to its creation authorisation decree corresponding to the PRISME operations (Project for intensive rinsing followed by EURODIF venting) which will consist in repeatedly rinsing the barriers with chlorine trifluoride (ClF3) to recover virtually all the deposited uranium and enable the metal to be recycled in nuclear routes. These operations gave rise to a public inquiry from 19 December 2011 to 20 January 2012.

To technically underpin its application for cascade rinsing and to optimise the operations as a whole, the licensee - with the agreement of ASN – conducted several air venting tests of various diffusion units. The efficiencies were improved.

Following the PRISME operations, the licensee will submit a final shutdown and decommissioning application (MAD-DEM) for the installation, a procedure that also entails a public inquiry.

In 2010 ASN conducted an inspection on the subject of outside contractor monitoring that revealed deficiencies. The licensee implemented a plan of action that ASN monitored attentively in 2011.

Further to the experience feedback from the SOCATRI incident of July 2008, the licensee had undertaken a plan of action at the request of ASN. Although substantial measures were



ASN inspection on the EURODIF plant site – March 2010



External view of the REC II facility under construction at the GEORGES BESSE II plant – October 2011

undertaken to bring the retention areas into conformity, ASN observed defects in the ground surfacing finish beneath the overhead pipes conveying chlorinated solvents. ASN asked the licensee to rapidly establish a periodic inspection programme for the retention areas, and this is continuing today.

The year 2011 was marked by three significant events which had no impact on safety but were each rated level 1 on the INES scale:
– an upwelling of liquid UF_6 in a crystalliser due to the simultaneous pouring of two crystallisers in the same unit;
– non-compliance with a container docking procedure in a depleted UF_6 emission oven, leading to a rise in the container pressure;
– non-locking, due to a technical failure, of a protective cover on the valve of a liquid UF_6 container stored in an outside yard; this finding was made by an ASN inspector.

These events revealed organisational deficiencies, for which the remedial measures taken will be monitored by ASN in 2012.

1|1|3 The Georges Besse II ultracentrifugation enrichment plant project

The GBII plant (BNI 168) operated by the *Société d'Enrichissement du Tricastin* (SET), uses the ultracentrifugation process and will ultimately replace the EURODIF plant. The principle of this process involves injecting uranium hexafluoride (UF_6) into a cylindrical bowl rotating at very high speed. The centrifugal force concentrates the heavier molecules (containing uranium 238) on the periphery, while the lighter ones (containing uranium 235) are recovered in the centre.

This process has two major advantages over the gaseous diffusion process currently used by EURODIF: it consumes substantially less energy (75 MW compared with 3,000 MW for an equivalent level of production) and it is safer. This is because the quantities of nuclear material present in the cascades and centrifuges are reduced and used in gaseous form at a pressure below atmospheric pressure.

Creation of the GEORGES BESSE II plant (GBII), which comprises two separate enrichment facilities (South and North) and a support facility (REC II), was authorised by a decree on 27 April 2007.

The review carried out by ASN and its technical support organisations - IRSN and the Advisory Committee for laboratories and plants - revealed that the low level of UF_6 stocks in the enrichment modules and the operating conditions of the centrifugation process contribute to a high level of control of the risk of radioactive and chemical material dissemination. ASN considered that the safety and radiation protection arrangements presented by the licensee for commissioning of the South facility are satisfactory, and in early 2009 it authorised commissioning of the facility. This commissioning authorisation is dependent on a number of requirements governing the start-up and operating conditions of the centrifugation plant.

In March 2010, ASN supplemented this framework with a decision whereby it prescribes a set of conditions relative to the safety tests prior to the first introduction of UF_6 into the plant. The plant commissioning process continued in 2011 in this framework with, at the end of the year, entry into production of a complete plant unit of the South unit, which represents 25% of this unit's production capacity.

Besides this, in January 2008 SET filed an application to modify the GBII BNI creation decree to allow the use of uranium resulting from spent fuel recycling in the REC II support facility, and the adaptation of the perimeter of the installation.

The ensuing procedure included a public inquiry that ran from 22 December 2008 to 30 January 2009. The results of this inquiry led to the production of a draft decree which was submitted to the petitioner for comments, in accordance with the regulatory provisions. Acting on referral from the ministers, and considering the remarks of the applicant, ASN gave a favourable opinion for this project on 28 July 2011.

1|2 Nuclear fuel fabrication plants in Romans-sur-Isère and Marcoule

On completion of the uranium enrichment stage, the nuclear fuel is manufactured in various installations, depending on the type of reactor for which it is intended. The fabrication of fuels for electricity generating reactors implies transforming UF_6 into uranium oxide powder. In the FBFC plant, this powder is used

to fabricate pellets which will be made into fuel rods, which in turn will be grouped to form fuel assemblies. As for experimental reactors, some of them use highly enriched uranium in metal form. These fuels are manufactured by FBFC in the CERCA plant at Romans-sur-Isère.

The MELOX plant in Marcoule is specialised in the fabrication of MOX (mixed oxide) fuels.

The FBFC and MELOX plants underwent a complementary safety assessment in 2011 further to the ASN decision of 5 May 2011 (see point 5).

The CERCA plant will undergo a complementary safety assessment in 2012.

1|2|1 The FBFC and CERCA uranium-based fuel fabrication plants

CERCA and FBFC, the two BNIs located on the Romans-sur-Isère site, are operated by FBFC, a company in the AREVA group. As far as the regulations are concerned, FBFC is the sole nuclear licensee for the site.

FBFC nuclear fuel fabrication facility

The FBFC plant production, consisting of uranium oxide powder or fuel assemblies, is intended solely for light water reactors (PWRs or BWRs).

Operation of this plant is regulated by a decree authorising its creation, dating from 1978 and modified in 2006 to allow an increase in production capacity.

The renewal of the facility's industrial plant, which began in 2005, is now completed.

The year 2011 was marked by the discovery – at several points in the fuel manufacturing process (ventilation filters, pneumatic transfer system for uranium powder, uranium powder storage cylinders) – of a larger mass of uranium-containing materials than was expected. None of these events presented a criticality risk as the masses of uranium in question were low. Each of these discoveries resulted in a significant event notification, of level 1 for the filters and 0 for the others. Corrective measures were immediately applied, but the analysis of the root causes is still to be carried out. The licensee has undertaken an in-depth examination of the human and organisational causes that led to these incidents.

CERCA fuel element fabrication plant

The CERCA plant comprises a series of facilities for the manufacture of highly enriched uranium based fuel for experimental reactors.

The CERCA plant, one of France's oldest nuclear installations, was put into service before the BNI regulations were introduced. The Government was therefore simply notified of this installation in 1967.

To improve the regulatory framework governing the activities carried out in the facility, the drafting of instructions - provided for by Act 2006-686 of 13 June 2006 (now codified in books I and V of the environment code by Order 2012-6 of 5 January 2012) has been started. These technical instructions were finalised in 2011. They have been examined by the ASN commission and forwarded to the licensee for observations.

The year 2011 was marked by CERCA receiving formal notice from the Defence and Security High Official on 11 May 2011. The subject of this formal notice was the transfer of the highly enriched uranium-containing materials stored on the Romans site to a place where the civil engineering is more robust and the access better protected than the place used at present. The measures for conforming to this formal notice were taken during the summer of 2011. This transfer appreciably improves not only the security of the stored materials but also the safety of storage (better earthquake resistance).

1|2|2 The MÉLOX uranium and plutonium-based fuel fabrication plant

The MÉLOX plant located in Marcoule is today the only French nuclear installation producing MOX fuel, which consists of a mixture of uranium and plutonium oxides.

In a decree of 20 March 2007, the MÉLOX plant was authorised to raise the production level of its Marcoule plant to 195 tons of heavy metal.

As this increase does not entail any significant modifications to the industrial plant, ASN remains particularly attentive to ensuring that the organisation adopted for operation is appropriate and sufficient and that radiation protection optimisation measures are reinforced.

The application filed in 2008 to transfer the status of nuclear licensee - hitherto held by AREVA NC - to MELOX SA, was examined and approved by ASN, with the publication of the decree in the *Official Journal* on 3 September 2010.

The ASN decision enabling this authorisation to become effective was made on 7 December 2010 under the conditions set out in article 29 of the decree of 2 November 2007.



Fuel rod fabrication line in the FBFC plant at Romans-sur-Isère

Through this decision, ASN confirms that the licensee has indeed complied with the obligations of article 20 of the "Waste Act" of 28 June 2006, concerning the provision of guarantees to cover the financial cost of decommissioning nuclear facilities and the management of radioactive waste.

The process for defining the elements to be taken into consideration in the facility's periodic safety review, instituted in article 29 of the TSN act, continued in 2010, culminating in the transmission of the facility's safety review file in October 2011. ASN referred the appraisal of this document to the IRSN.

With regard to safety, the event of 28 June 2011 which was rated level 1 on the INES scale (see point 3) must be borne in mind.

During a fuel rod assembly operation performed in manual mode on a bench, five rods impacted a mechanical part of the bench, leading to their rupture. The shop in which the operation was being carried out was contaminated, along with several adjacent rooms. The decontamination work was started immediately and continued until the end of October 2011.

The analysis of the causes of this event - in relation with the non-routine nature of the manual mode – revealed the need to improve the ergonomics of this drawing bench and to reinforce the safety system. The shortcomings implicating the human and organisational factors that were brought to light will lead the licensee to review the operating procedures for this production station. This event, through its duration (the assembly and interim storage shops were out of service for several weeks), falls into the category of contingencies that can affect the fuel cycle (see point 3|2).

Moreover, further to ASN's various findings (deficiencies in the computerised production management system, inconsistencies between the authorised baseline standard and practices on the ground) relative to prevention of criticality and the notification of about ten significant events concerning criticality and organisational aspects in less than two years, ASN organised an in-depth inspection on these topics within the facility in June 2010 and examined the plans of action developed by the licensee to address these points. The implementation of this plan continued in 2011.

ASN observes a more pronounced commitment of plant senior management to the management of organisational and human factors within the plant, which has led to substantial modification efforts since 2010. They aim at increasing the presence of engineers on the ground and improving operating team responsiveness to unplanned situations. Nevertheless, although things are moving in the right direction, ASN considers that the means deployed today still fall short of the stated objectives of plant management.



Backup control panel in the MELOX plant. The "utilities" operations supervisor supervises the periodic inspections and tests

1|3 AREVA NC reprocessing plants at La Hague

1|3|1 Presentation

The La Hague plant for reprocessing fuels irradiated in the power reactors (UNGG GCRs, then PWRs) is operated by AREVA NC.

The various facilities of the UP3 and UP2 800 plants and of the effluent treatment station STE3 were put into service from 1986 (reception and storage of spent fuel) to 1994 (vitrification facility), with most of the process facilities entering in service in 1989-1990.

The decrees of 10 January 2003 set the individual capacity of each of the two plants at 1,000 tons per year of metal before passage in the reactor (U or Pu), and limit the total capacity of the two plants to 1,700 tons per year.

The discharge limits and conditions were revised by the order of 8 January 2007.

The reprocessing of irradiated fuels in plant UP2 400 has been stopped since 1 January 2004 (see point 2).

The plants of the AREVA NC La Hague site form part of the installations examined in 2011 as part of the experience feedback from the Japanese nuclear accident of Fukushima Daiichi in March 2011 (see point 5).

Operations carried out in the plant

The main processing chain of these facilities comprises reception and storage installations for spent fuel, plus facilities for shearing and dissolving it, chemical separation of fission products, purification of the uranium and plutonium, treatment of effluents and conditioning of waste.

The first operations to take place in the plant are reception of the transport containers and storage of the spent fuel. Upon arrival at the reprocessing plant, the containers are unloaded, either underwater in a pool, or dry in a leak-tight shielded cell. The fuel is then stored in the pools.

The installations at La Hague

• BNI 80:	*High activity fuel*
HAO/North:	*Facility for underwater unloading and spent fuel storage*
HAO/South:	*Facility for shearing and dissolving of spent fuel elements*
• BNI 33:	*UP2 400 plant, the first reprocessing facility*
HA/DE:	*Facility for separation of uranium and plutonium from fission products*
HAPF/SPF (1 to 3):	*Facility for fission product concentration and storage*
MAU:	*Facility for uranium and plutonium separation, uranium purification and storage in the form of uranyl nitrate*
MAPu:	*Facility for purification, conversion to oxide and initial packaging of plutonium oxide*
LCC:	*Central product quality control laboratory*
• BNI 38:	*STE2 facility: collection, treatment of effluents and storage of precipitation sludge, and AT1 facility, prototype installation currently being decommissioned*
• BNI 47:	*ELAN II B facility, CEA research installation currently being decommissioned*
• BNI 116:	*UP3 plant*
T0:	*Facility for dry unloading of spent fuel elements*
D and E pools:	*Pools for storage of spent fuel elements*
T1 :	*Facility for shearing of fuel elements, dissolving and clarification of solutions obtained*
T2:	*Facility for separation of uranium, plutonium and fission products, and concentration/interim storage of Fission products solutions*
T3/T5:	*Facilities for purification and storage of uranyl nitrate*
T4:	*Facility for purification, conversion to oxide and packaging of plutonium*
T7:	*Facility for vitrification of fission products*
BSI:	*Facility for plutonium oxide storage*
BC:	*Plant control room, reagent distribution facility and process control laboratories*
ACC:	*Hull and end-piece compaction facilities*
AD2:	*Technological waste packaging facility*
ADT:	*Waste transit area*
EDS:	*Solid waste storage area*
D/E EDS:	*Storage/removal from storage of solid waste*
ECC:	*Storage and recovery facilities for technological waste and conditioned structures*
E/EV South East (EEVLH extension):	*Vitrified waste storage facility*
• BNI 117:	*UP2 800 plant*
NPH:	*Facility for underwater unloading and storage of spent fuel elements in pool*
C pool:	*Pool for storage of spent fuel elements*
R1:	*Fuel elements shearing, dissolving and resulting solutions clarification facility (including the URP: plutonium re-dissolution facility)*
R2:	*Uranium, plutonium and fission product separation, and fission product solution concentration facility (including the UCD: alpha waste centralised processing unit)*
R4:	*Facility for purification, conversion to oxide and first packaging of plutonium oxide*
SPF (4, 5, 6):	*Facilities for storage of fission products*
BST1:	*Facility for secondary packaging and storage of plutonium oxide*
R7:	*Facility for fission product vitrification*
AML – AMEC:	*Packaging reception and maintenance facilities*
• BNI 118:	*STE3 facility: effluent recovery and treatment and storage of bituminised packages*
D/E EB:	*Storage of alpha waste*
MDS/b:	*Mineralisation of solvent waste*

After shearing the rods, the spent fuel is separated from its metal cladding by dissolution in nitric acid. The pieces of cladding, which are insoluble in nitric acid, are removed from the dissolver, rinsed in acid and then water, and transferred to a packaging unit. The solutions taken from the dissolver are then clarified by centrifugation.

The solution separation phase consists in separating the uranium and plutonium from the fission products and other transuranium elements, then separating the uranium from the plutonium.

After purification, the uranium, in the form of uranyl nitrate $UO_2(NO_3)_2$, is concentrated and stored. It is intended for conversion into a solid compound (U_3O_8) in the Pierrelatte TU5 installation.

After purification and concentration, the plutonium is precipitated by oxalic acid, dried, calcined into plutonium oxide, packaged in sealed boxes and placed in storage. The plutonium can be used in the manufacturing of MOX fuel.

The production operations, from shearing through to the finished products, use chemical processes and generate gaseous and liquid effluents. These operations also generate the so-called "structure" waste.

The gaseous effluents are given off mainly during cladding shearing and during the boiling dissolving operation. These discharges are processed by washing in a gas treatment unit. Residual radioactive gases, in particular krypton and tritium, are checked before being released into the atmosphere.

The liquid effluents are processed and generally recycled. Certain radionuclides, such as those of iodine and less active products are checked, then directed to the off-shore marine discharge pipe. The others are sent to facilities for encapsulation in a solid matrix (glass or bitumen).

Solid waste is packaged on the site. Two methods are used: compacting and encapsulation in cement.



Aerial view of the spent fuel reprocessing plant at La Hague

The solid radioactive waste from irradiated fuel from French reactors is sent to the low-and intermediate-level, short-lived waste repository at Soulaines (see chapter 16) or stored pending a final disposal solution.

The solid radioactive waste from irradiated fuel from French reactors is sent to the low-and intermediate-level, short-lived waste repository at Soulaines (see chapter 16) or stored pending a final disposal solution.

In accordance with Article L. 542-2 of the Environment Code concerning radioactive waste management, radioactive waste from irradiated fuels of foreign origin must be shipped back to its owners. In order to guarantee fair distribution of the waste among its various customers, the licensee proposed an accounting system for monitoring items entering and leaving the La Hague plant. This system was approved by order of the minister responsible for energy on 2 October 2008.

On this account, in 2011 the licensee returned standard compacted waste containers (CSD-C) to Switzerland, Belgium and the Netherlands, and standard containers of vitrified waste to Germany.

1|3|2 Plant modifications

The plant authorised operating framework

The creation authorisation decrees of 12 May 1981 for the nuclear installations on the La Hague site were revised in 2003, particularly to allow changes in installation activities to be made under satisfactory conditions of safety and environmental protection.

The cold crucible project

Between 1966 and 1985, the processing of UNGG (Uranium Naturel Graphite Gas) GCR (Gas Cooled Reactor) fuels of type UMo (alloy of uranium and molybdenum) and UMoSnAl (alloy of uranium, molybdenum, tin and aluminium) generated fission product concentrates with a high concentration of molybdenum and phosphorus, elements which are hard to incorporate into an aluminoborosilicate vitreous matrix. The concentrates were stored in tanks in the SPF2 unit, pending possible incorporation into a glass matrix. AREVA NC research into a packaging process led to the development of a vitroceramic type aluminosilicophosphate matrix which would be able to incorporate a large mass of molybdenum oxide (MoO_3) while offering good resistance to leaching. This glass is produced in a cold crucible. The glass poured into this crucible is induction heated, with the metal structure of the crucible being externally cooled, allowing the formation of a protective auto-crucible with high temperatures being obtained at its centre.

By decision of 22 December 2009 and subject to compliance with its prescriptions, ASN authorised use of the cold crucible vitrification process on line B of the R7 unit. The line configured accordingly was put into operation on 17 June 2010.

By its decision of 14 June 2011, ASN authorised the cold crucible to be supplied with fission product solutions containing molybdenum from legacy waste, which will enable significant progress to be made in the recovery of legacy waste (RCD) from the site (see point 2|1|1).

Periodic safety reviews

Article 29 of Act 2006-686 on transparency and security in the nuclear field requires the licensee to conduct a safety review of its BNIs every ten years, taking account of the best international practices.

In 2008, ASN examined the conclusions of the periodic safety review for BNI 118, which includes the effluent treatment station (STE3), the solvent mineralisation facility (MDS-B) and the sea discharge outfall pipe. ASN is paying particularly close attention to the schedule for the licensee's implementation of the commitments it undertook during this periodic safety review. ASN observes that, on the whole, the licensee has fallen behind in its initial undertakings regarding both the response times and their implementation, particularly in performing the installation conformity reviews and the treatment of legacy waste.

In 2010, the licensee completed the periodic safety review of BNI 116 (UP3 plant) and started that of BNI 117 (UP2 800 plant). When it established the periodic safety review guideline document, ASN specified the main requirements pursuant to decree 2007-1557 of 2 November 2007. The periodic safety reviews of the La Hague plants will focus more particularly on the verification of installation conformity and the identification and complete inventorying of safety-related equipment.

ASN has asked its technical support organisation, IRSN, to examine the relevance and quality of the licensee's periodic safety review of the UP3 plant. The result of IRSN's appraisal will be presented to the Advisory Committee of experts for laboratories and plants from mid-2012 to 2014. The result will be communicated in an ASN report to the ministers in charge of nuclear safety and radiation protection.

Internal authorisation systems for minor modifications

The licensee requested the setting up of an internal authorisations system in 2008, as provided for by article 27 of decree 2007-1557 of 2 November 2007. ASN approved this system by its decision of 14 December 2010, which is applicable as of 1 January 2011. This system provides for two internal authorisation levels, depending on the extent of the operations and the associated radiation protection and safety implications. Before a planned operation or modification is authorised, it is assessed - depending on its assigned level - by either a safety specialist independent of the requesting operating unit, or, for the most extensive operations, an internal authorisations assessment committee (CEDAI).

ASN has verified the operation of this system during specially dedicated inspections. Once a year it examines the forward-looking programme of operations that are authorised by this system.

Construction of an extension to a vitrified waste package storage facility

The production programmes for standard vitrified waste containers (CSD-V) and the end of the returning of containers attributed to AREVA NC's foreign customers (contracts signed before 2001) mean that the storage capacity on the La Hague site (R7, T7 and EEVSE) will become saturated by the first half of 2012.

AREVA NC therefore decided to build an extension to the EEVSE storage facility called the "glass storage building extension on the La Hague site" (EEVLH), in order to increase the storage capacity of the existing facility. The extension reuses the main design options of the EEVSE facility.

Further to ASN's decision of 15 June 2010, AREVA NC sent ASN the safety report for the construction and commissioning of this storage facility. The file is currently being reviewed and will give rise to prescriptions from ASN. In this context, by a decision dated 16 June 2011, ASN has required the installation of thermocouples for monitoring the temperature of each well of the envisaged storage extension.

The new facilities planned

With the current growth in material recycling activities, the AREVA NC La Hague site reprocesses non-irradiated plutonium-containing materials existing as fuel assemblies, pellets or powder. As the reprocessing capacities of the units in service may not be compatible with the needs of the coming years, AREVA NC envisages putting into service a "plutonium-containing material reprocessing" unit (TMP) in the T4 facility.



Construction site of the glass storage building extension on the La Hague site (EEVLH)



Glove box in the R4 facility at La Hague

The licensee submitted the corresponding safety options file to ASN in 2009, the examination of which was completed in 2010.

This addition will form the subject of an application to modify the creation authorisation decree for BNI 116, and the file will be subject to a public inquiry.

Besides this, AREVA has submitted the safety file for the development project to enable the R4 facility to perform oxalic acid co-precipitation of uranium and plutonium. This new process will directly give a powder of mixed uranium and plutonium powder for use in the manufacture of MOX fuel. The R4 facility civil engineering modification work began in 2011 with a view to starting industrial operation in 2012; this will give rise to prescriptions and is subject to ASN authorisation due to its impact on the interests protected by the TSN Act. A draft decision was communicated to the licensee in November 2011, and the licensee has two months to submit its remarks to ASN. Decision 2012-DC-0262, requiring prior ASN agreement for certain operations relative to the implementation of a uranium and plutonium coprecipitation process in the R4 facility of the UP2 800 plant (BNI 117) on the AREVA NC site in La Hague, was signed by the ASN commission on 21 February 2012.

In the framework of the recovery of the sludge stored in the STE2 facility (see point 2|1|2), AREVA NC envisages integrating a new unit for conditioning this sludge by drying then compacting as pellets conditioned in a package filled with an inert material such as sand (C5 package). This project will necessitate a modification of the creation authorisation decree for BNI 118 (STE3) and the file will be subject to a public inquiry. AREVA envisages submitting its application file at the beginning of 2012.

AREVA NC has submitted to ASN a project for the complete renewal of the fleet of boilers that produce the energy necessary for operation of the La Hague plants. AREVA NC plans to replace them with one wood biomass boiler and two new oil-burning boilers. These installations are subject to licensing as individual ICPEs, and to notification as equipment items necessary for the operation of a BNI. AREVA effectively indicated in its file that the oil-burning boilers were sufficient to provide the energy necessary for safe operation of the plants, and that in the event of failure of the biomass boiler, the oil-burning boilers would immediately take over.

2 INSTALLATIONS IN CLOSURE PHASE

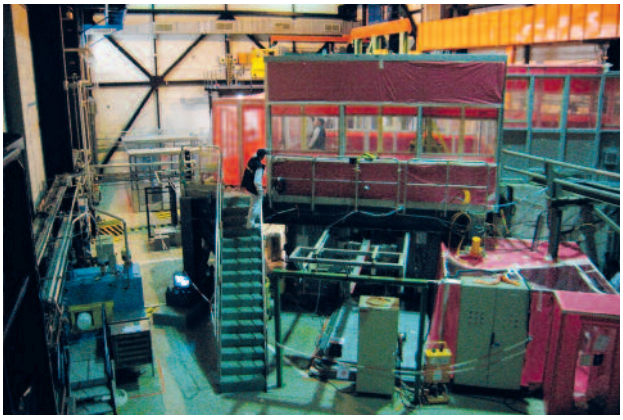
2|1 Older AREVA NC La Hague installations

The older plants of the AREVA NC La Hague site form part of the installations examined in 2011 as part of the experience feedback from the Japanese nuclear accident of Fukushima Daiichi in March 2011 (see point 5).

2|1|1 Recovery of legacy waste

This point is also covered in chapter 16.

Recovery of legacy waste from the La Hague site is monitored particularly closely by ASN, mainly because of the strong safety and radiation protection implications associated with it. Furthermore, recovery of the site's legacy waste is one of the AREVA group's major commitments, taken in the framework of the ministerial authorisations to start up new treatment plants (UP3 and UP2 800) in the 1990s; this waste recovery involves major technical difficulties and induces high costs. Work has therefore fallen behind the initial schedule. In spite of this, the deadlines must no longer be pushed back, because the buildings in which this legacy waste is stored are aging and no longer comply with current safety standards. Lastly, the solutions for elimination routes or new intermediate storages must be definitively decided upon, because their implementation involves large-scale projects: further postponement would jeopardise compliance with the deadlines set by the "waste" act of 28 June 2006, which states that the owners of medium-activity long-lived waste produced before 2015 must package it by 2030 at the latest.



Decommissioning of the HAO/North facility – September 2011

Unlike the new UP2 800 and UP3 plants, most of the waste produced during operation of the first plant, UP2 400, was placed in storage without packaging for disposal. The operations involved in recovering this waste are technically difficult and require the use of considerable resources.

The difficulties associated with the age of the waste, in particular its characterisation prior to any recovery and reprocessing, confirm ASN's approach which, for any project, requires the licensees to assess the corresponding production of waste and plan for processing and packaging as and when the waste is produced.

Further to the November 2005 review of the waste management policy for the La Hague site by the Advisory Committee of experts for laboratories and plants (GPU) and for waste (GPD), ASN confirmed the need to undertake as rapidly as possible the recovery of the sludges stored in the STE2 silos, the wastes from the HAO (high activity oxide) silo and the Building 130 silo, and the drums of predominantly alpha waste stored in Building 119 of BNI 38, whose safety level does not meet current safety requirements.

STE2 sludge

In recent years, processing of STE2 sludge has been the subject of research and development work, in particular with a view to determining the methods for recovery and transfer required prior to any packaging. The process then chosen consisted in bituminisation of the sludge using a process employed in the STE3 facility.

Following on from experiments and the GPU's review in December 2007 of the proposed packaging process, ASN issued a decision on 2 September 2008, banning the bituminisation of STE2 sludges in the STE3 facility.

Pursuant to this decision, the licensee submitted a preliminary safety analysis report on 1 January 2010 corresponding to the modifications necessary for implementation of a new STE2 sludge packaging process, along with the characteristics of the corresponding waste package, called the C5 package. In June 2011, ASN gave its agreement on the dismantling of the unused bituminisation line so that the new process can be installed in its place later on. Pursuant to the provisions of the "waste" law of 28 June 2006, recovery of these sludges must be completed no later than 31 December 2030.

HAO silo

The HAO silo contains various wastes comprising hulls, end-pieces, fine dust coming mainly from the shearing, resins and technological waste resulting from operation of the HAO facility from 1976 to 1997. Decommissioning of this silo requires prior dismantling of the equipment installed on the silo slab, construction of the recovery cell and qualification of the equipment to be used. The initial dismantling work has already been done.

The detailed preliminary decommissioning studies were reviewed by ASN in 2007. In 2010, the licensee optimised its initial scenario: waste recovery from the optimised hull storage (SOC) should be carried out at the same time as waste recovery from the HAO silo. The hulls and end-pieces from the HAO silo will be packaged then stored in the D/E EDS facility before being compacted in the hulls and end-pieces compaction facility (ACC). ASN remains attentive to the effective implementation times of the waste recovery and packaging operations which must be completed by 31 December 2022 at the latest, in accordance with the provision of decree 2009-961 concerning the final shutdown and decommissioning of the HAO facility.

Silo 130

Further to the licensee's postponement of waste recovery from the silo because of its outdated design and uncertainties as to the resistance of its structure over time, ASN issued requirements on 29 June 2010 imposing compensatory safety measures on the licensee, to be implemented before mid-2012 along with the submittal of a file detailing the waste preparation and recovery operations.

The project submitted by the licensee comprises four phases. The first is to transfer the GCR waste before storage in the D/E EDS facility. The second phase is to drain and treat the effluents in the silo in the STE3 installations. The last two phases will enable the waste to be recovered from the bottom of the silo, along with the rubble.

These files were submitted to ASN in December 2010 and are currently being examined. ASN has set 1 July 2016 as the deadline for starting the recovery and packaging operations for all the wastes, and the end of 2014 as the deadline for submitting the approval application file for the package for packaging waste containing graphite.

Old fission product solutions stored in the SPF2 unit in the UP2 400 plant

To package fission products from reprocessing of GCR (gas-cooled reactor) fuel, in particular containing molybdenum, the licensee has opted for cold crucible vitrification (see point 1|3|2).

Entry of the cold crucible into operation with these old solutions was authorised by ASN decision of 20 June 2011, and began in June 2011, with the objective of packaging the solutions between 2011 and 2017.

Removal from storage in Building 119 of BNI 38

The licensee has implemented an overall strategy to treat in priority the drums of alpha waste that are still stored in building 119, a building that does not meet current safety requirements.

These drums are reconditioned before being transferred for treatment in the alpha waste conditioning unit (UCD) of the R2 facility. This treatment consists firstly in mechanical sorting of the alpha waste to identify the waste fraction for which chemical leaching – another step in the treatment - to recover the plutonium, is appropriate.

The rate of chemical treatment of the alpha drums has dropped considerably since 2009, due to an incident that affected the facility, and to operating difficulties. This being said, the transfers from building 119 to the alpha waste conditioning unit (UCD) of the R2 facility continued with the aim of treating and removing all the stored waste from building 119 by the end of 2013, in accordance with the commitment taken by AREVA.

2|1|2 Final shutdown of the UP2 400 plants, the STE2 facility and the ELAN IIB unit

On 1st January 1967, the UP2 400 plant for reprocessing the spent fuels from the GCRs entered into industrial operation jointly with the effluent treatment station STE2 for treating the liquid effluents before their discharge into the sea. In 1974, UP2 400 was licensed to reprocess fuels from the light water reactors.

On 30th December 2003, the licensee notified its decision to stop processing spent fuel in the UP2 400 facility as of 1st January 2004. This notification was accompanied by a file presenting the operations planned in the phase of preparation for final shutdown (MAD) of the various units in this plant, and the associated effluent treatment station. The Elan IIB facility dedicated to the fabrication of caesium 137 and strontium 90 sources between 1970 and 1973 has also been shut down since 1973.

During the course of 2009, the licensee entrusted the ORCADE project relative to the final shutdown operations of the UP2 400 units and the legacy waste recovery programmes, to an entity on the site under the responsibility of the AREVA value development business unit. This unit, created at the end of 2008, handles all the group's decommissioning projects and promotes the sharing of operating experience feedback between the various AREVA facilities (UP1 plant in Marcoule, ATPu in the CEA/Cadarache centre, SICN in Veurey-Voroise).

At the end of 2008, AREVA NC submitted a final shutdown and decommissioning (MAD/DEM) safety file for the BNIs corresponding to the UP2 400 plant, the STE2 facility and the Elan IIB facility, i.e. BNIs 33, 38 and 47. The public inquiry was held in October 2010 (see chapter 15).

The final shutdown and decommissioning decree no. 2009-961 for the HAO (high activity oxide: the former facility for fuel reception, shearing and dissolution of the UP2 400 plant), which corresponds to BNI 80, was published on 31 July 2009 (see chapter 15). The north section of the HAO facility will nevertheless continue, to receive, until 2015, the fuels that cannot be received in the head workshops of the UP3 and UP2 800 plants.

2|2 COMURHEX uranium hexafluoride fabrication plant

COMURHEX, a 100% subsidiary of the AREVA Group, has been established on the Tricastin site since 1961, where it mainly produces the uranium hexafluoride (UF_6) for nuclear fuel fabrication needs. Alongside this main activity, COMURHEX produces various fluorinated products such as chlorine trifluoride (ClF3). This production activity uses the excess fluorine resulting from the hydrolysis of hydrofluoric acid (HF).

UF_6 is produced from natural uranium in a part of the plant that constitutes an ICPE; the UF_6 production from reprocessed uranium in a part of the plant constituting a BNI was stopped in 2003.

This latter part, BNI 105, chiefly comprises two facilities:
– the 2000 unit, which transformed reprocessed uranyl nitrate $UO_2(NO_3)_2$ into uranium tetrafluoride (UF_4) or uranium sesquioxide (U_3O_8) ;
– the 2450 unit, which transformed the l'UF_4 (whose uranium 235 content is between 1 and 2.5%) from the 2000 unit into UF_6. This UF_6 was used to enrich the reprocessed uranium for recycling in the reactor.

On 13 October 2008, the licensee notified ASN of final shutdown of BNI 105 on 31 December 2008. At the end of July 2009, in accordance with article 37 of decree 2007-1557 of 2 November 2007, it also transmitted the decommissioning plan for this facility. ASN judged the file incomplete and asked the licensee to supplement it by including in particular the clean-out and final state of the floors of the BNI and the ICPE and of the adjacent grounds.

The licensee postponed submission of the final shutdown and decommissioning decree application file, initially announced for mid-2010, until May 2011. ASN considered the file incomplete due to significant shortcomings in the impact study.

Moreover, the coexistence on the same site of a BNI and various ICPEs housed in highly interspersed buildings, with associated risks and possessing a number of common equipment items, considerably complicates administrative tracking and regulation of the facilities, currently ensured by the DREAL (regional directorate for the environment, planning and housing) for the ICPEs, and ASN for the BNI. In addition, this situation is not in conformity with the TSN act, which in such situations provides for all the facilities to be included within the perimeter of the BNI and regulated by ASN. Consequently, ASN proposed by deliberation 2001-DL-0026 of 22 November 2011, a draft decree to the ministers responsible for nuclear safety, modifying the perimeter of BNI 105 in order to include all the site's facilities in it.

In the second half of 2010, the licensee sent an updated version of its safety baseline standard, better suited to the current status of the facilities. ASN validated this in June 2011, subject to certain reservations, which the licensee has now taken into consideration.



The COMURHEX plant at Tricastin

Besides this, at the end of 2008 COMURHEX lodged an application file for a license to operate a new installation, COMURHEX II, regulated by the ICPE system. This project consists in replacing the existing conversion units, also classified as ICPEs, which will then be shut down and decommissioned. The file was the subject of a public inquiry and a joint review by ASN and the Rhône-Alpes DREAL, which led to prefectural order 10-3095 of 23 July 2010 licensing the ICPEs currently in operation, which will be shut down, and those in the course of construction.

The COMURHEX installations are included among those examined in 2011 as part of the experience feedback from the Japanese nuclear accident of Fukushima Daiichi in March 2011 (see point 5).

3 REGULATING THE NUCLEAR FUEL CYCLE FACILITIES

ASN regulates the fuel cycle facilities at different levels. It regulates:
– the main steps in the life of nuclear facilities;
– the organisation of the licensees through inspections conducted on the ground;
– the fuel cycle consistency;
– the operating experience feedback from the fuel cycle BNIs other than the NPPs.

3|1 Regulating the main steps in the life of nuclear facilities

Examining the licensing or modification applications for installations in operation

ASN works at several levels to regulate the AREVA group's nuclear facilities.

ASN is responsible for regulating the main steps in the life of these facilities when they are modified (in 2011, introduction of uranium reprocessing in the REC II facility of GBII, PRISME project of EURODIF) and proposes the decrees that accompany these changes to the Government; ASN also draws up the provisions that establish the regulatory framework for these major steps.

These provisions specify the technical requirements relative to safety as well as those relative to the safety and radiation protection policy and management of the BNIs. These provisions, produced in particular for the commissioning of GBII, are ultimately to be extended to all the facilities of the AREVA Group. ASN has thus prepared a draft prescription for the CERCA facility. The licensee has been consulted and can submit its comments before the decision is finalised.



ASN inspection on the La Hague site – September 2011

ASN also reviews the safety files specific for each BNI, paying attention to their integration in the broader framework of laboratory and plant safety. In this respect, it ensures that the safety requirements are applied appropriately to all these facilities and that they are regularly updated, particularly on the occasion of the ten-year periodic safety reviews.

Examination of the periodic safety review files

In 2009 and 2010, the orientation files (DOR) for the periodic safety reviews of the AREVA Group's facilities, and particularly those of the La Hague and MÉLOX, were examined. The examinations focused more particularly on the organisation of the reviews, in order to give them their full weight as vectors for improving safety, for taking account of the aging of the facilities, and for identifying and listing the safety-related equipment.

The periodic safety review file for MÉLOX, prepared along these lines, was submitted in October 2011, while that for La Hague underwent additions concerning the updates of the unit safety reports. The SOMANU orientation file (DOR) has been finalised and the licensee submitted the safety review file at the end of 2011. In 2010, the SOCATRI file had undergone an admissibility review by ASN and IRSN. The content of the safety review file had been considered insufficient; it was supplemented, particularly with regard to the facility's 10-year development prospects and its resistance to external hazards. Analyses of the civil engineering structure resistance remain to be submitted.

All these files shall be presented to the GPU between 2012 and 2014.

Regulating the conditions of final shutdown of the facilities

At shutdown of the AREVA Group's industrial facilities, ASN also ensures that each of them complies with the requirements of decree 2007-1557 of 2 November 2007, with regard both to

informing ASN about the dates of shutdown and to the quality of the files, particularly regarding the taking into account of the risks due to the operating changes. In 2009 and 2010, the shutdown files for EURODIF, UP2 400 and COMURHEX led ASN to clarify its expectations on this subject.

Examining the measures taken by the head office departments in terms of safety

ASN's regulatory action also covers the AREVA head office departments, which are responsible for the group's safety, radiation protection and environmental protection policy (D3SE). ASN looks at how they draft and facilitate the implementation of this policy in the various establishments within the group. In 2011, the main subjects concerned the development of the CSAs required by ASN decision further to the Fukushima Daiichi accident.

Particular regulatory actions conducted in consultation with the Defence nuclear safety authority (ASND)

With the prospect of ASN taking over responsibility for regulation and inspection of the entire Pierrelatte site in the medium term, ASN and the Defence Nuclear Safety Authority (ASND) are focusing on maintaining complete coherence in the application of the safety and radiation protection requirements to facilities for which each of them is responsible on the Tricastin site. Most of the facilities under the responsibility of ASND have been shut down or are being decommissioned, and should shortly be considered to be civil facilities. The facilities that will not be decommissioned are those currently treating the effluents and wastes for the site as a whole, and all the uranium storage facilities. Some of these facilities are obsolete and must be replaced by new facilities which will then be placed under the authority of ASN. In a joint letter dated 29 September 2011, ASN and ASND asked the Chairman of the AREVA board of directors to propose a substitute project for the Tricastin waste treatment station, currently situated on the secret basic nuclear installation (BNIs), as an alternative to the planned relocating of its activities in a former civil facility that does not meet the safety requirements.

ASN and ASND have set up a working group to clarify the steps of ASN's takeover of the regulation of the safety of activities on this site. It has been decided that the takeover would take place progressively, as and when the regulatory situation of each facility is clarified, after its periodic safety review. The working group reported its conclusions to the two regulatory bodies at the end of 2010. The delicensing process has been started for the first step. This process should end by the year 2018.

3|2 Monitoring the organisation of the licensees of the cycle nuclear installations other than nuclear power plants

Nuclear installation safety is primarily based on the supervision carried out by the licensee itself. In this respect, for each installation, ASN verifies that the organisation and resources deployed by the licensee enable it to assume this responsibility.

It is not the role of ASN to impose a particular organisational model on the licensees. ASN can nevertheless express an opinion or give recommendations regarding the chosen organisation, and possibly directives on specific identified points if it considers that they present shortcomings in terms of internal inspection of safety and radiation protection, or that they are inappropriate.

ASN therefore primarily observes the working of the organisations put into place by the licensees through inspections, including those devoted to safety management. The main points examined in this context concern, for example, the possible under-staffing of certain departments that play a key role in safety, or the balance between duties and available resources in other departments. These situations can make it difficult for them to accomplish their duties, and can result in production requirements taking priority over other considerations, notably in terms of safety.

Given this context, ASN initiated a safety management review process within the AREVA Group, for the BNIs operated by the Group. AREVA submitted its review results file in January 2010; it was examined by the GPU in December 2011, and ASN is currently drafting its opinion on it.

3|3 Ensuring the consistency of the cycle

ASN monitors the overall consistency of the industrial choices made with regard to fuel management, from both the safety and the regulatory aspects. The issue of long-term management of spent fuel, mining residues and depleted uranium is examined taking account of the unforeseen variables and uncertainties attached to these industrial choices. In the short and medium terms, ASN intends ensuring that saturation of the spent fuel storage capacities in the NPPs - as has been observed in other countries - is foreseen and prevented, so that the licensees do not use old facilities with lower safety standards as a remedial solution. ASN is assisted in this approach by the ministry in charge of energy, which it consults in particular to obtain information relative to movements of materials or industrial constraints that could have consequences on safety, for example.

EDF was asked to undertake a forward-looking study in cooperation with the fuel cycle companies, presenting elements demonstrating compatibility between changes in fuel characteristics and their management, and developments in fuel cycle installations.

The data presented and reviewed to date provide a clarification of how the fuel cycle operates and the safety issues involved, indicating the technical and regulatory limits that could be modified - subject to adequate justification - by the changes in fuel management policies.

In order to maintain an overall and constantly appropriate view of the fuel cycle, these data must be periodically updated. For any new utilisation of the fuel, EDF must demonstrate that it has no unacceptable effect on the fuel cycle installations.

At the end of 2008, EDF reached an important agreement with AREVA for managing reprocessing-recycling traffic and, allowing for unforeseen variables, for developing a long-term

vision for forward-looking management of the fuel cycle plants, including end-of-life operations.

An overall revision of the "Impact Cycle" file was submitted in 2008. This file was examined on 30 June 2010 by the GPU and GPD on the basis of a report presented by the IRSN. The DGEC (General Directorate for Energy and Climate) and members of the Advisory Committees of experts for nuclear reactors (GPR) and for transport (GPT) took part in this analysis.

On completion of this review, ASN tightened the monitoring of the coherence of the fuel cycle and its changes, by demanding biennial update reports and requiring EDF to submit an updated "cycle" file by 2016. ASN underlined four major points in its letter of 5 May 2011:
– the need to carry out a true sensitivity study, to take into account, among other things, the variability of the electricity grid power demands;
– the need to assess the margins in the underwater spent fuel storage capacity, until the year 2020 and beyond;
– the development of EDF's fuel management strategies, particularly after the virtually complete abandoning of "high combustion rate" fuel management options;
– the change in the radiological content of the materials used, when they come from the reprocessing of spent fuel.

ASN also wanted the following to be put into perspective:
– the storage capacities for depleted uranium (due to the increase in the enrichment capacity) and for reprocessed uranium, as the saturation of available surface areas is not totally excluded in this latter case;
– the availability of the different packages proposed for the transport of radioactive materials.

Furthermore, ASN considered that the first lessons had to be drawn from the Fukushima Daiichi NPP accident in March 2011, by asking EDF to specify whether any factors were likely to confirm - or make it modify - its spent fuel management strategy.

3|4 Promoting operating experience feedback from the fuel cycle BNIs other than the nuclear power plants

3|4|1 Dealing with incidents

The detection and processing of significant events that have occurred during operation of the installations play a fundamental safety role. The lessons learned from these events lead to new requirements applicable to safety-related equipment and to new operating rules. Licensees must therefore set up reliable systems for detecting, correcting and integrating the experience feedback from safety-related events.

Examination of these events by ASN and their management by the licensees serve notably to identify:
– events recurring on the same installation;
– events necessitating integration of the experience feedback by other facilities, when the events are of a generic nature, that is to say affecting or likely to affect several facilities of one or more licensees.

After dropping in 2010, the number of significant events notified by the nuclear facilities other than the nuclear power plants has risen, reaching a total of 246 significant events. ASN does not think that there is any particular explanation linked to the facilities. This increase could be explained by the licensees being more attentive to the notification process and the integration of experience feedback, and greater vigilance on the part of ASN, particularly during inspections, on the detection and notification of significant events.

The year 2011 was marked by an incident that occurred on 12 September 2011 in the CENTRACO facility operated by Socodei. An explosion occurred in a smelting furnace that treats very-low-activity metals from nuclear facilities. This accident had severe human consequences, causing the death of one employee and injuring four others, one very seriously. The radiological consequences were very limited, since no radioactive releases were detected in the site environment. The accident was rated level 1 on the INES scale. Three investigations are under way further to this accident: a judicial inquiry and two administrative investigations, of which one is conducted by the labour inspectorate.

ASN was closely involved in the management of this accident, activating its emergency centre as soon as the alert was raised, and sending people to the site very rapidly after the accident. It thus followed the development of the situation, taking into account the information provided by the IRSN, the licensee and the specialist public fire-fighting services, to analyse its development and inform the public. In the exercise of its oversight responsibilities, ASN observed that the activity of the waste present in the furnace at the time of the accident had been underestimated, and asked the licensee to take the measures necessary to review its emergency management procedures in order to ensure that the data transmitted, especially the figures, are always verified beforehand. An inspection was conducted in this framework. ASN is analysing the possible causes of the accident with the other competent services (see chapter 16).

ASN has moreover taken a decision requiring the restarting of the activities of the smelting unit and the incineration unit to be subject to ASN authorisation in order to ensure that the necessary safety conditions are fulfilled. The following elements are required in particular:
– the results of the pre-restart verification operations, focussing in particular on the condition of the safety-related equipment of the incineration furnace;
– a report presenting the conclusions of a review of the situations introducing an explosion risk in the incineration unit, and the technical and organisational measures for preventing such situations from occurring.

On 31 December 2011, authorisation to restart operation had not been given.

3|4|2 Taking account of organisational and human factors

Formalisation of the way human and organisational factors (HOF) are taken into account actually began in 2005-2006 for the fuel cycle installations, with the drafting of internal policies specific to each licensee. This approach began to be centrally applied within the AREVA Group as from 2008, which is when

the Group's head office departments started employing HOF specialists. Since then, a national policy has been developed and is being gradually deployed among the group's licensees. ASN considers that this approach must be continued for it to fully bear fruit.

The various licensees within the AREVA Group are now staffed with persons competent in HOF. Nevertheless, ASN is still not sure that all the licensees are devoting sufficient resources to this subject.

Furthermore, the analysis of significant event reports and the technical files reviews indicate that fuller integration of the HOF is required. The specialists on the subject are not yet systematically consulted with regard to issues with strong implications in terms of human reliability or workstation ergonomics.

3|4|3 Controlling the fire risk in nuclear facilities

Controlling the fire risk is of major importance in the control of accidents that can affect the laboratories and plants. Indeed, widespread fire is often taken as a design-basis accident for these facilities.

Control of the fire risk is taken into account in the current regulations by the order of 31 December 1999, amended. The revision of the regulations undertaken in application of the TSN Act gave ASN the opportunity to take them to greater depth and update certain points. A working group was created, including representatives from ASND and the IRSN, with a view to developing a draft decision on controlling the fire risk, based on the best practices available.

3|4|4 Controlling the criticality risk in nuclear facilities other than nuclear power plants

In 2009, events had revealed significant deficiencies in prevention of the criticality risk[2] in several nuclear facilities of the AREVA Group.

Moreover, two events that occurred that year in the laboratories and plants and had been rated level 2 on the INES scale concerned the limitation of the mass of fissile materials:



Radiation protection inspection on the glove boxes in the cladding room in the MOX fuel manufacturing plant at Bagnols-sur-Cèze

2. Criticality: capacity of fissile materials to be able to trigger and sustain, under certain conditions, a nuclear reaction. Criticality depends on three main parameters: the quantity of fissile materials brought together in a given place, the geometry of that quantity of materials, and the presence of "moderator" materials (mainly materials that contain hydrogen atoms).

– during an exceptional operation at MÉLOX, for which the use of the appropriate mass monitoring software was not planned, the introduction of a mass of fissile materials into a workstation led to the maximum authorised mass being exceeded;
– an incorrect estimation in the ATPu (see chapter 15) of the residual masses of fissile materials in certain workstations (undetected accumulation of deposits during operation), that could have led to the maximum authorised mass being exceeded in several of those workstations.

ASN considers that it is important to check the measures taken, that they are appropriate for all the plausible situations, and that the requirements in terms of safety-criticality and operator training are met. It is also essential to underline the importance of the share of human and organisational factors in the events relative to the criticality risk, as many checks on the control of this risk require human interventions.

Further to these events, ASN decided to revise the fundamental safety rule relative to the criticality risk, dating from 1984, in order to introduce the national and international experience feedback from 25 years of operation, the change in the dedicated calculation codes and the principle of defence in depth in the approach to this risk, and extend its application to the reactors outside the constituted cores. A working group comprising representatives from ASN, IRSN, the licensees' criticality engineers and a number of experts (IAEA) was set up in early 2011 to revise this text. This revision will lead to the joint drafting of an ASN guide on prevention of the criticality risk in the BNIs and in transport, and an enforceable decision. It will be presented to the GPU, the GPR, and the criticality-safety commission of ASND.



The firemen of the local security organisation (FLS) on the Tricastin site

4 INTERNATIONAL ACTION

Since June 2009, ASN has launched a bilateral cooperation programme with the NRC (United States Nuclear Regulatory Commission) for nuclear fuel cycle facilities and more particularly those involved in reprocessing-recycling. The reason is that the United States, which opted a long time ago for an open cycle and final disposal of spent fuel without reprocessing, is now confronted with the public opposition to the Yucca Mountain nuclear waste repository. The United States authorities are therefore currently examining the closed cycle option. This context has spurred NRC to initiate in advance the drafting of the regulations that would be applicable to future fuel reprocessing and recycling plants if the closed cycle option were to be adopted. It expressed its interest in having discussions with ASN on its experience feedback on the regulation of this type of installation. Seminars and visits to facilities were therefore organised during 2010. The subjects addressed included the regulatory licensing process, the risk analysis methodologies, the criteria for determining elements important for safety, management of safety, radiation protection and waste, and the transport of radioactive materials. The cooperation continued in 2011, particularly on the issues relating to waste and security.

In addition to this, ASN received the Canadian Nuclear Safety Commission (CNSC) in April 2011 to inform it of the changes in the French regulations pursuant to the TSN Act; ASN also explained the way in which the fuel cycle facilities, particularly those in the early stages of the cycle, similar to the facilities of this type in Canada, are regulated and monitored.

ASN also took part in a seminar in Russia in order to initiate the setting up of bilateral exchanges concerning the safety of the reactors and the plants in the fuel cycle (August 2011).

ASN also received the Norwegian Radiation Protection Authority (NRPA) in response to a question posed by the Norwegian government further to a WISE organisation publication concerning the storage of fission product solutions in the plants of the AREVA NC La Hague site, particularly the oldest ones. The Norwegian authority was able to visit the La Hague site plants, a visit which was followed by an ASN presentation of the licensing and regulation rules for these facilities and the waste produced in them. Bilateral exchanges and an accident information agreement are going to be established.

Lastly, in September 2011, ASN took part in the WGFCF (Working Group for Fuel Cycle Facilities) seminar of the OECD / NEA in Toronto (Canada), relative to the integration of operating experience feedback from fuel cycle facilities. The main subject addressed was how the feedback from the March 2011 accident on the Fukushima Daiichi nuclear site in Japan is integrated in each participant country, along with the question of the methodologies used to assess the safety of the fuel cycle facilities.

5 EXPERIENCE FEEDBACK FROM THE FUKUSHIMA DAIICHI ACCIDENT

At the end of the prioritisation process for the nuclear facilities other than nuclear reactors (see the pages devoted to Fukushima in the introduction to this report), it was decided that virtually all the sites and facilities operated by the AREVA group should provide complementary safety assessments (CSAs) for September 2011: all the facilities on the La Hague and Tricastin sites, the MELOX plant and the FBFC plant in Romans-sur-Isère.

AREVA submitted its methodology in June 2011. It was examined by the GPR and GPU on 6 July 2011. ASN considered that the methodology was globally satisfactory on condition that the licensee meets its commitments and replies to the questions formulated by ASN.

The CSAs required by the ASN decisions of 5 May 2011 were sent on 15 September 2011 in accordance with the terms of these decisions. They were examined by the Advisory committee of experts on 8, 9 and 10 November 2011. These Advisory committees, comprising French and foreign experts, submitted their opinion to ASN dated 10 November 2011.

On completion of the CSAs of the priority nuclear facilities, ASN considers that the level of safety of the facilities examined is sufficient for it not to demand the immediate shutdown of any one of them. At the same time, ASN considers that their continued operation does require that their robustness to extreme situations be increased beyond their existing safety margins, as rapidly as possible.

Consequently, at the beginning of the second quarter of 2012, ASN will impose on the licensees a set of measures comprising the following in particular:
– the establishing of a "hard core" of material and organisational measures to control the fundamental safety functions in extreme situations; the licensees will submit the content and specifications of the "hard core" for each facility to ASN before 30 June 2012;
– for the spent fuel pools of the different facilities: implementation of reinforced measures to reduce the risk of the fuel becoming exposed;
– for the La Hague site silos: feasibility studies with a view to setting up technical arrangements, such as geotechnical containment or having an equivalent effect, with the aim of protecting the underground and surface water in the event of a severe accident;
– for the Tricastin and Romans-sur-Isère sites operated by AREVA, ASN will ask the licensee to study and implement complementary means for mitigating the consequences of a toxic product leak (gaseous hydrogen fluoride, uranium hexafluoride, chlorine, chlorine trifluoride, etc.);
– measures relative to emergency management and organisational and human factors.

The experience feedback from the Fukushima accident will be taken into account in the following manner for the other facilities:
– the CERCA plant on the Romans-sur-Isère site must submit a complementary safety assessment in September 2012;
– the COMURHEX Malvési BNI, consisting of pools, shall be examined later;
– the SICN site, which is in the final phase of decommissioning, will not be concerned.

6 OUTLOOK

Cross-disciplinary aspects

In 2012, ASN will continue the work started in 2011, in particular to examine the license or major modification applications for the fuel cycle facilities, and to set the framework for these operations: application to modify the conditions of operation of the GBI plant with a view to its final shutdown, application to modify the conditions of operation of the La Hague installations (BNI 116 and 118). In addition, it will continue the analysis of the safety review files, particularly those concerning the La Hague facilities.

ASN also initiated in September 2010 the overall review of the safety and radiation protection management process within the AREVA Group. This file was presented to the Advisory groups of experts on 14 December 2011.

ASN notes that efforts must be made to implement the group's organisational and human factors policy in all the facilities, and to involve the outside contractors in this as a matter of course. ASN will demand tracking of the development of subcontracting data and closer monitoring of outside contractors. It will in particular demand improvements in the monitoring of project management, including when this is ensured by a subsidiary of the group.

National long-term management of all activities relating to safety and radiation protection comes out as an essential factor in safety management.

In addition, ASN considers that new more representative "safety" indicators must be developed and implemented within the AREVA group. Lastly, AREVA must present an assessment of the use of the new aids for processing events and experience feedback.

Continuing in line with the actions taken in 2011, ASN will be particularly attentive to the integration of experience feedback by the AREVA group licensees, and to the implementation of the internal authorisation systems.

Lastly, ASN will specifically monitor the implementation of the complementary safety measures required further to the CSAs, the submittal of the required complementary studies, and will examine them.

Tricastin site

Pollution prevention and progress with the projects concerning the site's effluent and waste treatment stations remain the major issues for this site in 2012. In the framework of the CSAs performed further to the Fukushima Daiichi accident, ASN will closely monitor the implementation of measures to reinforce the safety of the site facilities that handle large quantities of UF_6 and hydrofluoric acid, particularly the reinforcing of the earthquake resistance of certain ICPEs and the integration of the chemical risk in the emergency plans of the Tricastin site licensees.

Romans-sur-Isère site

In 2012 on the Romans-sur-Isère site, ASN will closely monitor confirmation of the progress already achieved in terms of safety. It more particularly expects to see better control of containment in certain premises, and of the fire risk in the FBFC plant. It will be attentive to the actions taken following the safety reassessment of the facilities belonging to the company CERCA. It will also be attentive to ensure the implementation of the improvements planned under the CSAs.

MÉLOX plant

ASN will be vigilant as to the means adopted to accompany the changes in materials used with regard to requirements in terms of safety and radiation protection. In this context, management of dosimetry and the ability to prevent organisational and human factor risks and the criticality risk will remain regulation and inspection priorities.

The periodic safety review file for the MÉLOX plant was handed over to the ministers and ASN in late September 2011. Its examination will be a key step in the life of the facility. It will enable the conformity of the facility with the applicable regulations and its baseline safety standard to be verified, while at the same time setting a safety improvement programme for the next ten years in the light of the best available practices. This safety review will also consider the important question of the role of the computerised production management system, which today ensures both prevention of the criticality risk and nuclear material accounting management.

La Hague site

ASN considers that efforts must be continued in the La Hague plants, particularly in the integration of operating experience feedback and the notification of significant events. In the framework of the periodic safety reviews of the facilities, 2012 should see the implementation of the safety-related equipment identification procedure and the improvement of the general operating rules of these plants. Regarding the periodic safety reviews, ASN has asked IRSN to examine more particularly the conformity reviews of the UP3 plant and the effects of aging on the structures and equipment.

As regards the recovery of legacy waste, ASN will be attentive to ensure that turnarounds in industrial strategy do not significantly delay the recovery and disposal of the waste from Silo 130 or the sludge from STE2 and HAO. ASN already gave instructions, to this end, in 2010 for silo 130 and will oversee the programme more closely in 2012.

Lastly, ASN will closely monitor the implementation of the system of internal authorisations at the La Hague site.

NUCLEAR RESEARCH FACILITIES AND VARIOUS NUCLEAR INSTALLATIONS

CHAPTER 14

1 **THE FRENCH ALTERNATIVE ENERGIES AND ATOMIC ENERGY COMMISSION'S INSTALLATIONS** 401

1|1 **Generic subjects**
1|1|1 Experience feedback from the Fukushima Daiichi accident
1|1|2 Management of nuclear safety and radiation protection at CEA
1|1|3 Monitoring of CEA's compliance with its main nuclear safety and radiation protection commitments
1|1|4 Periodic safety reviews
1|1|5 Monitoring of sub-criticality
1|1|6 Management of sealed sources of ionising radiation
1|1|7 Revision of water intake and discharge licences
1|1|8 Assessment of seismic hazards
1|1|9 Management of civil engineering projects
1|1|10 Research reactor cores and experimental systems

1|2 **Topical events in CEA research facilities**
1|2|1 CEA centres
1|2|2 Research reactors
1|2|3 Laboratories
1|2|4 Fissile material stores
1|2|5 The POSEIDON irradiator
1|2|6 Waste and effluent storage and treatment facilities
1|2|7 Installations undergoing decommissioning

2 **NON-CEA NUCLEAR RESEARCH INSTALLATIONS** 411

2|1 **Large national heavy ion accelerator (GANIL)**
2|2 **Laue-Langevin Institute (ILL) high flux reactor**
2|3 **European organization for nuclear research (CERN) installations**
2|4 **The ITER (international thermonuclear experimental reactor) project**

3 **IONISERS, THE PRODUCTION OF RADIONUCLIDES FOR PHARMACEUTICAL USE, THE MAINTENANCE UNITS AND THE OTHER NUCLEAR FACILITIES** 413

3|1 **Industrial ionisation installations**
3|2 **The radio-pharmaceutical production facility operated by CIS bio international**
3|3 **Maintenance facilities**
3|4 **Chinon irradiated material facility (AMI)**
3|5 **Inter-regional fuel warehouses (MIR)**

4 **INTERNATIONAL ACTIONS** 416

5 **OUTLOOK** 417

This chapter presents ASN's appraisal of the safety of nuclear research installations and of installations not linked directly to the nuclear electricity generating industry. The installations in question are, essentially the basic nuclear installations (BNIs) belonging to the civil part of the CEA – the French Alternative Energies and Atomic Energy Commission, (research reactors, irradiation reactors, laboratories, nuclear material storage facilities, waste and effluent treatment plants, etc.), BNIs belonging to other research establishments (the Institut Laue-Langevin reactor) and some other BNIs (facilities producing radiopharmaceuticals, particle accelerators, etc.), which are neither power reactors nor facilities involved in the nuclear fuel cycle (fuel manufacture and reprocessing).

In spite of the wide diversity which characterises these installations - and the resulting need to bear in mind the specific nature of each of them when considering risks and hazards - the principles of nuclear safety that apply to them and ASN's actions in that regard remain identical.

1 THE FRENCH ALTERNATIVE ENERGIES AND ATOMIC ENERGY COMMISSION'S INSTALLATIONS

The French centres belonging to the Alternative Energies and Atomic Energy Commission (CEA) include BNIs devoted to research (experimental reactors, laboratories, etc.) as well as supporting installations such as waste storage facilities and effluent treatment plants. Research at CEA focuses on areas such as the lifetime of operating power plants, future reactors, nuclear fuel performance and nuclear waste.

Point 1|1 below summarises the generic subjects that marked the year 2011. Point 1|2 describes topical events in the various CEA facilities currently in operation. The facilities undergoing clean-out or decommissioning are covered in chapter 15 and those devoted especially to storage or to waste treatment and spent fuel reprocessing are covered in chapter 16.

1|1 Generic subjects

ASN identifies generic subjects via inspection campaigns and analysis of lessons learned from operating experience, and consults CEA on these topics. This process can lead ASN to issue requests or to adopt a position after examination of the relevant file. Generic subjects on which ASN focused in 2011 were:
– the integration of the experience feedback from the Fukushima Daiichi accident;
– management of civil engineering works in installations under construction or being renovated;
– control of the criticality risk;
– the progress of the CEA's major commitments (see point 1|1|2).

On 6 September 2011, the ASN Commission gave a hearing to the CEA General Administrator, as in previous years. The ASN more particularly asked the CEA to provide information on:
– the actions conducted as part of the experience feedback from the Fukushima accident, and in particular the report on the complementary safety assessment for the CEA facilities;
– the tracking of the files relating to certain facilities with strong implications for nuclear safety and radiation protection;
– CEA's safety management, and notably the results of risk control for the year 2010.

In this respect, the CEA presented a more detailed account of the incident that occurred on 4 November 2010 at the Valduc site exit, for which the experience feedback led to the implementing of complementary measures on all the sites to reinforce the pre-exit checks on equipment.

1|1|1 Experience feedback from the Fukushima Daiichi accident

Further to the Fukushima Daiichi accident, ASN launched a complementary safety assessment (CSA) procedure for the civil nuclear facilities. The complementary safety assessments concern the power reactors in priority. They do nevertheless also concern the other nuclear facilities, for which an analysis was conducted beforehand to assess the risks with respect to the possible consequences associated with:
– the seismic risk;
– the risk of flooding;
– extreme climatic conditions;
– loss of the electrical power supplies;
– loss of cooling;
– the above two losses combined.

The "potential source term" (quantity of radioactive or hazardous products that can be implemented) was also taken into account. Given the diversity of the nuclear fleet, each facility must be examined individually.

Three categories of CEA facilities have thus been defined:
– the five highest priority facilities, assessed in 2011 on the same schedule as the power reactors: this concerned the OSIRIS, PHÉNIX and MASURCA reactors, the Jules Horowitz Reactor (JHR), and the plutonium technology facility (ATPu) currently being decommissioned;
– nine facilities and two sites (Cadarache and Marcoule) assessed in 2012;
– for the other facilities, the experience feedback will be taken into account according to the ongoing or future requests, particularly in the framework of the periodic safety reviews.

On 3 January 2012, ASN gave its opinion on all the complementary safety assessments carried out in 2011. ASN will notably require the licensees:
– to implement a "hard core" of material and organisational measures to control the fundamental safety functions in extreme situations;
– for the spent fuel pools in the different facilities, the implementation of reinforced measures to reduce the risks of fuel exposure.

Where the current baseline safety requirements are concerned, the CEA will address the deviations, particularly those found during the targeted post-Fukushima inspections. The in-depth experience feedback from the Fukushima accident will lead to the reinforcing of the baseline safety requirements of the nuclear facilities, particularly with regard to the "earthquake", "flood" and "risks associated with other industrial activities" aspects.

On completion of examination of the reports submitted by the CEA, ASN considers that the complementary safety assessment is satisfactory on the whole. The CEA has thus identified certain lines for improvement that it could follow. This approach will be supplemented in 2012 by the analysis of the common means of the Cadarache and Marcoule sites in particular, in accordance with the ASN decision of 5 May 2011.

1|1|2 Management of nuclear safety and radiation protection at CEA

ASN monitors management of safety at CEA at several levels:
– working with the General Administrator, ASN verifies CEA's compliance with its major commitments, in particular with regard to planned new installations, upgrading of older installations and waste management, especially in terms of compliance with the specified time-frames, and handling of safety and radiation protection issues in CEA's overall management;
– with respect to the Nuclear Safety and Protection Division (DPSN) and the General and Nuclear Inspection Division (IGN), ASN develops a national global approach to "generic" subjects concerning several installations or centres; ASN also examines how the DPSN develops CEA's safety and radiation protection policy and assesses internal supervision work performed by the IGN;
– within the CEA centres, and as appropriate, ASN reviews the safety analysis files specific to each of the CEA BNIs, paying particular attention to their integration into the more general framework of CEA's safety policy. In this respect, it examines the conditions in which safety management is carried out; the main contacts are the directors of the centre and the head of the installation concerned.

In 2011, ASN adopted a position with regard to the file concerning safety and radiation protection management at the CEA, which had been assessed by the Advisory committees of experts in 2010.

The examination showed that CEA had made considerable progress since the last examination on the same theme (1999), especially regarding the inclusion of human and organisational factors and the integration of safety and radiation protection into its projects. ASN noted actions under way to improve skills management and management of safety and radiation protection regarding services (setting up of an acceptance commission for companies involved in radioactive clean-up and a centralised base for supplier evaluation).

1|1|3 Monitoring of CEA's compliance with its main nuclear safety and radiation protection commitments

In 2006, ASN stated that it wanted to see effective monitoring of CEA's compliance with its safety and radiation protection commitments, by means of an efficient control tool that offered transparency for the ASN, in particular with regard to the decision-making process. CEA therefore presented ASN in 2007 with a list of nineteen major safety and radiation protection commitments.

Out of the thirteen commitments remaining in the updated list of July 2011, eight should be carried out within the planned times.

The most significant schedule delays concern the Cadarache site:
– the removal from storage of the waste drums and fuel from the PEGASE facility (BNI 22);
– the removal from storage of the radioactive waste from the Cadarache site storage yard (BNI 56);
– the commissioning of the AGATE effluent treatment station (BNI 171).

CEA reports to ASN on compliance with these commitments, on a formal basis during regular meetings. During the hearing of the CEA General Administrator, ASN restated that the major commitments approach is worth pursuing.

The results of the four years of application of this system show several positive points. The system allows targeted tracking of priority actions, which have a clearly set deadline. Any extension to the deadline must therefore firstly be duly justified, and secondly be discussed with ASN. This latter point could nevertheless be improved, as the CEA does not always provide ASN with all the information necessary to assess the situation. Thanks to the attention devoted to these major commitments, ASN notes that progress for the majority of them is generally satisfactory.

1|1|4 Periodic safety reviews

Many current CEA installations began operating in the early 1960s. The equipment in these installations, of older design, may now be timeworn. Furthermore, the installations have also undergone modifications on several occasions, sometimes without any overall review of their safety. In 2002, ASN informed licensees that it considered a review of the safety of the older installations to be necessary every 10 years. This provision is now written into the TSN act on "transparency and security in the nuclear field" of 13 June 2006 (now codified in books I and V of the environment code by order 2012-6 of 5 January 2012). The periodic safety reviews for CEA's installations have been scheduled according to a calendar approved by ASN. All of the installations are to be reviewed by 2017 at the latest, then every 10 years.

The periodic safety reviews often entail extensive upgrading work in areas where safety regulations and requirements have changed significantly, in particular regarding compliance with seismic loading requirements, fire protection and containment. ASN oversees all the work and requalification procedures, in accordance with principles and a schedule that it itself approves. Lastly, further to the periodic safety reviews, ASN can define requirements, as provided for by the TSN Act.

In 2011, ASN examined the conclusions of the periodic safety review of the EOLE, MINERVE and CHICADE installations. ASN also informed the ministers in charge of nuclear safety of its opinion concerning the continuation of operation of the OSIRIS and ORPHEE installations following their periodic safety reviews, which were analysed in 2010.

1|1|5 Monitoring of sub-criticality

An incident notified on 6 October 2009 in the ATPu facility, currently being decommissioned (see chapter 15), indicated that CEA should further intensify its efforts on criticality risk prevention. In 2010, as part of the feedback procedure, ASN asked CEA to conduct investigations in all of the installations concerned by criticality risk.

From 11 to 13 July 2011, ASN conducted a "tightened" inspection on this theme on the Cadarache site as a whole, and about ten installations more particularly. More detailed information is provided in chapter 8.

1|1|6 Management of sealed sources of ionising radiation

At the request of ASN, CEA updated its ionising radiation source management rules in 2007. The new rules, which apply in all CEA facilities, incorporate the regulations in force, in particular the fact that, since 2002, CEA has no longer enjoyed exemption from the need to hold a licence for possession and utilisation of sources of ionising radiation.

In 2007, CEA also submitted several authorisation application files, to extend the sealed source utilisation period beyond the regulatory 10 years. In application of the order of 23 October 2009 approving the ASN decision defining the technical criteria for extending the sealed radioactive source utilisation time, ASN examined these applications and delivered an extension authorisation for some of the sources. For the other sources, the CEA submitted additional information to ASN at the end of 2011 so that it could pursue its examination. The administrative situation of all the sources requiring an extension of their utilisation time was in order by the end of 2011.

Furthermore, in 2010, CEA forwarded its used sealed source management strategy which will be considered by ASN within the more general framework of the strategy for management of radioactive wastes and effluents produced by CEA's civil nuclear installations.

1|1|7 Revision of water intake and discharge licences

The water intake and discharge licenses of the CEA Fontenay-aux-Roses centre are governed by ministerial orders dating from 1988. In view of the obsolescence of these texts, which do not include the changes in the status of the existing BNIs, in their activities and the changes in the induced discharges, ASN has asked the CEA to submit an intake and discharge requirements modification file by the fourth quarter of 2012.

With regard to the Marcoule site, the discharge license modification application file for the INBS (secret BNI) which currently treats all the liquid discharges from the site, was submitted at the beginning of 2009. The same applies for the ATALANTE facility. These files were supplemented in September 2010 by an overall impact study of the discharges from the CEA site, and from the CENTRACO and MÉLOX facilities, whose licenses will also change. These applications are being examined, and have been subject to a public information procedure (from 5 November to 5 December 2011). In the development of the decisions governing discharges, a revised study of the environmental and health impact induced by the chemical and radioactive discharges from the CEA Marcoule centre was sent to the two authorities (ASN and ASND, its defence counterpart) in January 2012 (see chapter 8, p. 238).

1|1|8 Assessment of seismic hazards

ASN devotes constant attention to the potential seismic risk. This risk is especially re-assessed during the periodic safety reviews conducted on each installation, in order to take account of scientific progress in characterising the risk, and changes in the design rules.

In response to an ASN request to supplement knowledge concerning the seismic risk at the Cadarache centre, the CEA proposed a method for taking particular site effects into account, developed under "CASHIMA", a study programme, conducted jointly with the ILL (Laue Langevin Institute) in Grenoble and involving several international partners and experts. ASN gave its conclusions on the CEA's approach in December 2011. This approach has brought progress, particularly in the geological knowledge of the Cadarache site environment, but it needs to be implemented in greater depth in order to be operational and allow the dimensioning of the facilities. ASN has encouraged the CEA to pursue the ongoing actions.

Alongside this, an overall assessment of integration of the seismic risk is continuing on the Marcoule site.

In addition, a study of the general resources of the Cadarache nuclear site that would be necessary in the event of an earthquake, established by CEA at ASN's request, has been under examination since the end of 2009.

1|1|9 Management of civil engineering projects

A number of projects for the construction of new installations or renovation of existing ones continued during the course of 2011, in particular at the Cadarache centre. To facilitate monitoring of progress on the construction of the installations in question, the CEA, at ASN's request, sends ASN a quarterly update of the works schedule, including a presentation of the planned annual progress of operations as well as details for the coming quarter. This document makes it possible to identify activities or particular points that ASN wishes to include in its spot checks during inspections.

The inspections carried out by ASN in 2011 particularly concerned the integration of the requests and remarks formulated further to previous inspections on the construction/civil engineering theme, or further to the examination of the design files relative to the pouring of certain concrete structures on the AGATE and JHR facilities. More specifically, two inspections were conducted on the JHR construction site to check the correction of anomalies detected on removal of the formwork of the upper raft on the reactor building side (see point 1|2|2 below).

1|1|10 Research reactor cores and experimental systems

The cores of some experimental reactors are regularly modified, owing to the experiments conducted in them. Others are fitted with specific experimental systems for carrying out certain types of experiments. One of the issues for ASN is to allow the regular performance of new experiments, while ensuring that they take place in appropriate conditions of safety.

In January 2007, the CEA drafted a technical guide defining the requirements relative to the conditions of design, production and radiation licensing for experimental systems. ASN plans analysing application of this guide, as much in the framework of the periodic safety reviews (application by the CEA to an experimental device of the OSIRIS reactor in Saclay) as in the context of the design of a new device (application to a device among those intended to be irradiated in the future Jules Horowitz reactor (JHR) in Cadarache); the corresponding safety files were received at the beginning of 2012.



ASN inspection of the reinforcing of the JHR containment – December 2011

1|2 Topical events in CEA research facilities

1|2|1 CEA centres

Cadarache Centre

The Cadarache Centre is located at Saint-Paul-lez-Durance, in the Bouches-du-Rhone *département*. It employs about 5,000 people (all contractors included) and occupies a surface area of 1,600 hectares. As part of CEA's strategy of specialising its centres as "centres of excellence", the Cadarache site deals mainly with nuclear energy. It comprises 20 BNIs, including two for the industrial operator AREVA (ATPu and LPC), while two others are used for IRSN research programmes (CABRI and PHEBUS). The purpose of these Cadarache centre installations is R&D to support and optimise existing reactors and to design new-generation systems. The Cadarache centre also plays a part in launching new projects, as it will house the future Jules Horowitz experimental reactor, for which the decree authorising its creation was published in 2009. The international ITER facility, whose commissioning is planned for 2018 subject to delivery of the authorisation decree, is under construction nearby.

ASN considers that the Cadarache centre's management maintained a good level of involvement in safety and radiation protection in 2011. Particular vigilance will be required with regard to supervision of service providers, given the increasing use being made of subcontracting. The renovation of the centre's electrical installations, scheduled from 2008 to 2015, must receive the necessary attention so as not to fall behind schedule. ASN will remain vigilant in this respect.

The construction of new facilities and the renovation of older ones, currently in progress at the centre, will also be a key issue for CEA in the coming years. ASN will continue to exercise close monitoring and control over this point.

Saclay Centre

The Saclay centre is located about 20 km from Paris in the Essonne *département*. It occupies an area of 223 hectares, including the Orme des Merisiers annex, and some 6,000 people work there. In 2006, the CEA head offices moved from their Paris premises and relocated at CEA Saclay.

This centre has been devoted to material sciences since 2005 and therefore plays an active role in the Saclay plateau development, as part of the Île-de-France master plan for regional development and land planning master plan.

The centre's activities range from fundamental research to applied research in a wide variety of fields and disciplines,

such as physics, metallurgy, electronics, biology, climatology, simulation, chemistry and ecology. The purpose of applied nuclear research is to optimise the operation and safety of the French nuclear power plants and to develop future nuclear systems.

The centre also houses an office of the National Institute for Nuclear Science and Technology (INSTN), whose role is training, and two industrial companies: Technicatome, which designs nuclear reactors for naval propulsion systems; and CIS bio international, specialising in medical technologies, especially the radiolabelling of molecules, manufacturing of radio-pharmaceutical products used in nuclear medicine for therapy and imaging and in vitro medical diagnosis and molecular screening (see point 3 | 2).

ASN considers that the following points warrant particular attention at the Saclay centre:
– maintaining the nuclear safety performance of the BNIs in a centre focused primarily on non-nuclear activities;
– including nuclear safety in decisions concerning the development of future activities in the centre;
– control of urban development around the centre in a context of development of the Saclay plateau, in connection with the length of service life of BNIs envisaged by CEA.

ASN expects to see progress in safety management at the Saclay centre, which still houses a large number of different installations:
– research reactors (point 1 | 2 | 2): ULYSSE, ORPHÉE, OSIRIS;
– laboratories (point 1 | 2 | 3): LECI;
– irradiators (point 1 | 2 | 5): POSÉIDON;
– effluent and waste treatment facilities (chapter 16): liquid effluents management zone and STELLA project;
– waste storage facilities (chapter 16): solid waste management zone;
– one installation undergoing final shutdown or decommissioning (chapter 15): LHA.

Marcoule centre

The Marcoule centre is the CEA's centre of excellence for the back-end nuclear fuel cycle and in particular for radioactive waste. It plays a major role in the research being conducted pursuant to the Bataille Act of 1991 and the Programme Act of 28 June 2006 on the sustainable management of radioactive materials and waste. Civil and defence nuclear facilities are installed here, along with the CEA's two civil facilities in Marcoule, i.e. ATALANTE (research laboratory) and PHÉNIX (reactor).

The site moreover accommodates two other civil BNIs not operated by the CEA, namely MÉLOX (see chapter 13) and CENTRACO (see chapter 16). A third installation, the GAMMATEC irradiator, is under construction (see point 3 | 1).

The overall impact study for the Marcoule site is undergoing joint ASN-ASND examination. A public information meeting was organised on this subject in November 2011. In this context, the conditions of effluent discharge from the ATALANTE facility will be the subject of an ASN decision in 2012.

Further to the seismic risk conference of 7 December 2010 organised by ASN and ASND, an information meeting on this subject was held with the CLI (local information committee) on 20 May 2011.

Fontenay-aux-Roses centre

All the BNIs in this centre are currently being decommissioned (see chapter 15). Only the effluent and waste treatment facilities are still operating.

Grenoble centre

All the CEA's BNIs in this centre are currently being decommissioned (see chapter 15).

1 | 2 | 2 Research reactors

Experimental nuclear reactors make an essential contribution to scientific and technological research and to supporting operation of the country's nuclear power plants. Each reactor is a special case for which ASN has to adapt its monitoring while ensuring that safety practices and rules are applied. The last few years have seen the development of a more generic approach to the safety of these facilities, inspired by the rules applicable to power reactors, and more particularly the method of safety analysis by "postulated initiating events" and the safety classification of the associated equipment. This has led to significant progress in terms of safety. This approach is now used for the periodic safety reviews of existing installations as well as for the design of new reactors.

Despite the ageing of these installations, ASN is keen to ensure that they continue to operate with a high and constantly improving level of safety. Thus, all the installations in operation undergo periodic safety reviews intended not only to ensure that the installations are in conformity with the safety objectives initially set for them, but also to determine any improvements that could be made in order to keep pace with advances in knowledge and available technologies.

Critical mock-ups

• MASURCA reactor (Cadarache)

The MASURCA reactor, whose construction was authorised by a decree dated 14 December 1966, is intended for neutron studies, chiefly on the cores of the fast neutron reactor, and the development of neutron measurement techniques. This installation, for which the last periodic safety review was discussed at a meeting of the Advisory Committee of experts for nuclear reactors in March 2006, has been shut down for conformity work since 2007. The reactor core has been completely unloaded and the fuel has been stored since then in the fissile materials storage and handling building (BSM). In 2010 the licensee announced its decision to keep this reactor in operation and to build a new BSM.

The CEA's complementary safety assessment confirmed the need to build a new BSM and, in the meantime, to transfer the fissile material to the MAGENTA facility, which is built to earthquake design standards.

• ÉOLE and MINERVE reactors (Cadarache)

The ÉOLE reactor, whose construction was authorised by a decree of 23 June 1965, is intended for neutron studies of light water reactor cores. On a very small scale, it can be used to reproduce a high neutron flux using experimental cores

representative of pressurised or boiling water power reactors. The MINERVE reactor, whose transfer from the Fontenay-aux-Roses research centre to the Cadarache research centre was authorised by decree 77-1072 of 21 September 1977, is situated in the same hall as the ÉOLE reactor. It is devoted to the measurement of the cross sections by sample oscillation, allowing the measurement of the variation in reactivity. According to the conclusions of CEA's strategic reflection on the long-term operation of its installations, CEA reportedly will stop the operation of these two reactors in 10 years at the most, and would keep certain items of equipment for reuse in the PHÉBUS installation (BNI 92) as part of the research into "Generation IV" reactors.

With these prospects in view, the periodic safety review has been carried out by the licensee and examined by the Advisory committee of experts. ASN will state its position in the near future. If it turns out that the reinforcement strategy defined by the licensee is not sufficient, ASN could demand final shutdown of these facilities in the nearer term.

Irradiation reactors

• The OSIRIS reactor and its ISIS critical mock-up (Saclay)

The OSIRIS pool-type reactor has an authorised power of 70 MWth. It is primarily intended for technological irradiation of structural and fuel materials for various power reactor technologies. It is also used for a few industrial applications, in particular the production of radionuclides for medical uses. Its critical mock-up, the ISIS reactor with a power of 700 kWth, is essentially used for training purposes today. These two reactors were authorised by a decree of 8 June 1965. Pursuant to ASN decision 2008-DC-0113 of 16 September 2008, the CEA will definitively stop operation of the OSIRIS reactor in 2015 at the latest.

In view of the periodic safety review file submitted in 2009 in accordance with the abovementioned ASN decision, and the renovation work finalised in 2010, such as the implementation of a backup ventilation system, ASN considered that the two reactors could continue operating (until 2015 in the case of the OSIRIS reactor). This was the subject of ASN opinion no. 2011-AV-0121 of 27 May 2011. In accordance with the decision of 16 September 2008, the CEA submitted a document in December 2011 presenting the measures it intended taking in preparation for shutdown of the OSIRIS reactor; these measures will be examined by ASN in the near future.

The complementary safety assessment report submitted by the CEA on 15 September 2011 in the framework of the actions following the Fukushima nuclear power plant accident, takes the OSIRIS reactor into consideration. The CEA has proposed improvements in this respect. Some of them, particularly as concerns defining a hard core of material and organisational provisions with regard to the seismic risk or the management of primary systems breaks, could give rise to ASN requirements in 2012. The complementary safety assessment of the ISIS reactor will be carried out during its next periodic safety review. This reactor also underwent a 2-day inspection on 5 and 6 July 2011 in the context of the experience feedback from the Japanese nuclear accident.

• The JHR (Jules Horowitz reactor) project (Cadarache)

The construction of a new reactor was deemed necessary by CEA, with the support of a number of foreign partners, in view of the ageing of the currently operating European irradiation reactors, which will be shut down in the medium or short-term.

The JHR will in particular be able to carry out activities similar to those performed today with the OSIRIS reactor. It will however comprise a number of significant changes with regard to both the possible experiments and the level of safety.

Further to the authorisation decree signed on 12 October 2009 (published in the Official Journal of 14 October 2009), ASN - by its decision 2011-DC-0226 of 27 May 2011 - set the technical specifications for the design and construction of the BNI. The aim is to freeze certain analytical elements used to draft the creation authorisation decree of 12 October 2009 and to establish stopping points for the performance of certain operations with potentially high consequences. Targeted provisions have also been made for the regular transmission of information to ASN.

Following the first excavation, preparation and concrete pouring work in 2009, embedding of the aseismic bearing pads, reinforcement and concreting of the upper raft of the nuclear unit (UN) in 2010, the civil engineering works continued in 2011 with the construction of the walls of the nuclear auxiliary building. The construction of the first walls of the reactor containment (reactor building), for which the concrete pouring was subject to prior ASN approval in application of the abovementioned decision of 27 May 2011, was authorised by ASN decision 2011-DC-0232 of 5 July 2011. Applying the same principle, the pouring of the first concrete for the reactor pool, which started in December, was approved by ASN by decision 2011-DC-0251 of 1 December 2011.

This construction site underwent 5 inspections in 2011. Two inspections were carried out after the CEA detected, early in the year, an anomaly on the underside of the upper raft on the reactor building side when removing the formwork of that structure. These two inspections did not reveal any differences with respect to the CEA's diagnosis, or anything that went against the CEA treating this anomaly in the planned manner. Treatment of the anomaly was completed in May 2011.

In addition, ASN is continuing its ongoing dialogue with CEA to facilitate monitoring of the measures requested following analysis of the preliminary safety report and in preparation for the review of the future commissioning authorisation application, currently scheduled for 2013.

Although the JHR is of a very recent design that integrates the operating experience feedback from the other experimental reactors, the CSA process has resulted in the CEA identifying possibilities for improvements that could be implemented relatively easily, as it is in the construction phase. ASN has thus considered that some of the proposals made by the CEA, which are likely to make the facility more robust, should be implemented. Moreover, making these improvements at the design/construction stage favours prevention, rather than

mitigation, of the consequences of possible accident situations.

Neutron source reactors

• ORPHÉE reactor (Saclay)

The ORPHÉE reactor, with an authorised power of 14 MWth, is a pool-type research reactor using heavy water as the moderator. It is equipped with nine horizontal channels, tangential to the core, enabling 19 neutron beams to be used. These beams are used to conduct experiments in fields such as physics, biology and physical chemistry. The reactor also has ten vertical channels for the introduction of samples to be irradiated in order to produce radioisotopes or special materials and to carry out analysis by activation. The neutron radiography installation is used for non-destructive testing of certain components. The ORPHÉE reactor was authorised by a decree of 8 March 1978. Its first divergence was in 1980.

On completion of the second periodic safety review that was conducted in 2009-2010, the Advisory committee of experts in charge of reactors considered that operation of the reactor could continue subject to the application of recommendations and the licensee meeting its commitments. The CEA has committed itself to a major programme to replace the experimental devices that are subject to irradiation aging. Improvements are also expected with regard to the fire risk. In the near future, ASN will give its opinion to the ministers in charge of nuclear safety.

The complementary safety assessment of the ORPHÉE reactor, following the Fukushima NPP accident, is to be submitted in September 2012.

Test reactors

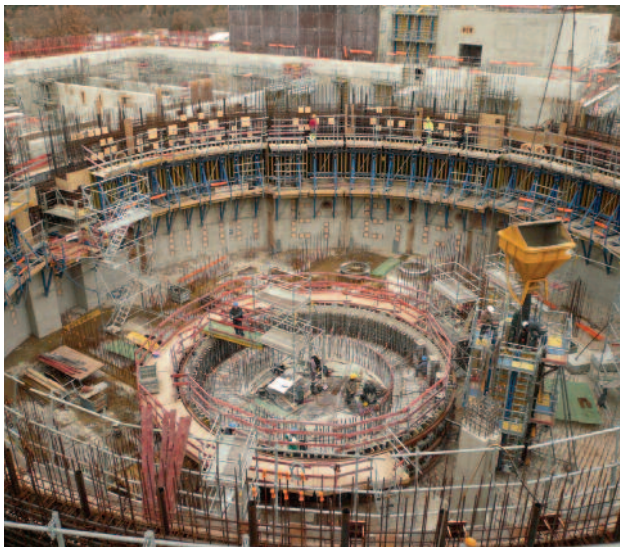
• CABRI reactor (Cadarache)

The CABRI reactor, created on 27 May 1964 is mainly used for experimental programmes aimed at better understanding nuclear fuel behaviour in the event of a reactivity accident. The reactor is operated by the CEA for the purposes of tests designed by IRSN and involving a number of French and foreign partners (nuclear licensees, safety authority technical support organisations, etc.).

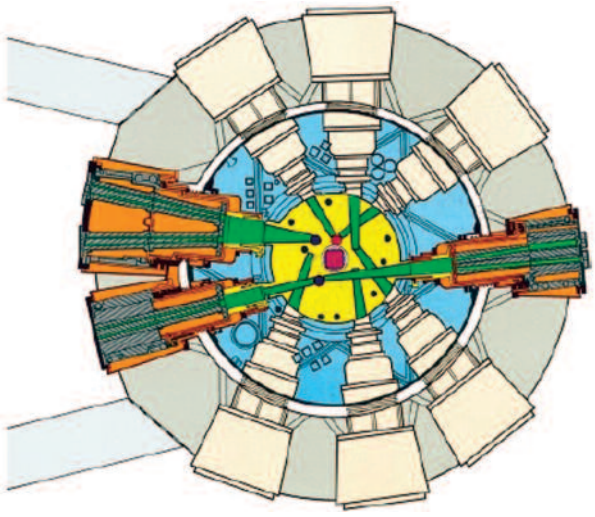
The facility was modified by decree 2006-320 of 20 March 2006 for the needs of new research programmes: the reactor's sodium loop was replaced by a water loop in order to study the behaviour of high combustion rate fuels in accident situations representative of those that could be encountered in a pressurised water reactor. The first criticality of the modified installation and performance of the first experimental test will be two steps that require ASN authorisation. Before doing so, ASN will examine the conditions in which the commissioning tests are to take place and will then ensure that their results confirm the installation's conformity with its safety demonstration file. This means that the licensee must have satisfactorily responded to the demands made of it for the modification of the facility. Over the last few years ASN has reminded the CEA several times that it must ensure that files are submitted in times compatible with their examination, given the scheduling targets. In 2011, ASN continued its examination of the CEA's application for authorisation to refuel the reactor core, which focused notably on the verification of the checks and any repairs, and reinforcements of the equipment required for these operations. With regard to the first criticality, examination of the corresponding file is continuing.

• PHÉBUS reactor (Cadarache)

The PHÉBUS reactor, whose creation was authorised by decree 77-801 of 5 July 1977, was one of the aids for studying the severe accidents that could affect pressurised water reactors (PWR), on the basis of tests devised and financed by the IRSN. CEA has announced that it wishes to stop conducting any new programmes with this reactor. Clean-out and decommissioning of the experimental systems used in the last experiment have been under way since 2004.



Concreting of the JHR containment and pool – December 2011



View of the reactor pile block and the irradiation channels of the ORPHÉE reactor

Further to the last event of 9 March 2011 relative to the unexpected presence of tritium in the gaseous effluents of the facility, the CEA identified the last campaign of experiments (PHÉBUS PF program), completed in 2004, as being the cause of the leak. ASN has asked the CEA to inform it of the measures it will adopt accordingly, the plan of action and the schedule for the associated operations.

ASN is still waiting for the CEA's strategy regarding the future of this BNI, so that it can start the appropriate regulatory procedures (decommissioning or modification of the installation).

Whatever the case, ASN remains attentive to the operations conducted in this installation, which the CEA has said could receive certain items of equipment from the Eole and Minerve installations as part of the research into the "Generation IV" reactors.

Teaching reactors

• ISIS reactor (Saclay)

The ISIS reactor, with the OSIRIS reactor, constitutes one of the two reactors of BNI 40 (see below).

• ULYSSE reactor (Saclay)

The ULYSSE reactor was mainly devoted to teaching and practical work. In February 2007, the installation entered the final shutdown preparation phase. The decommissioning authorisation application for the installation was submitted in summer 2009. The file, judged admissible, was sent to the prefecture of the Essonne département in October 2011, for the public inquiry to be launched.

Prototype reactors

• PHÉNIX reactor (Marcoule)

The PHÉNIX reactor, built and operated by CEA jointly with EDF, is a demonstration reactor of the sodium-cooled fast neutron type. Authorised by a decree of 31 December 1969, the reactor's first criticality took place in 1973. Its initial nominal power of 563 MWth was reduced to 350 MWth in 2002. The nuclear power plant definitively stopped power operation coupled to the electricity grid in early 2009. Tests corresponding to the end of operation, called end-of-life tests, were then carried out until the beginning of 2010. These tests were intended to supplement knowledge of sodium-cooled fast neutron reactors in view of the development of the "Generation IV" electricity production process, and also entered into the framework of the studies of the installation prototype mentioned in article 3 of act 2006-739 of 28 June 2006 on radioactive materials and waste management.

The decommissioning authorisation application file was submitted to ASN at the end of 2011. The decommissioning programme will include, in particular, the implementation of sodium treatment facilities. Preparatory work is currently under way, prior to the decommissioning authorisation decree.

The complementary safety assessment report submitted by the CEA on 15 September 2011, further to the Fukushima nuclear power plant accident, includes the PHÉNIX power plant. In this context, the CEA has taken several commitments concerning the risks related to flooding and a sodium fire. An inspection was also carried out in this context on 6 September 2011 (see chapter 8).

1|2|3 Laboratories

The irradiated materials and spent fuel assessment laboratories

These laboratories, also called "hot laboratories", are key experimental tools for the main nuclear licensees. There used to be a large number of these laboratories but they are now concentrated in two centres: one, in Saclay, devoted to irradiated materials and the other, in Cadarache, dealing with fuel. From the safety viewpoint, these installations must meet the standards and rules of the large fuel cycle nuclear installations, but this safety approach has to be proportionate to the specific risks.

• Active fuel examination laboratory (LECA) (Cadarache)

The LECA, which was commissioned in 1964, is a laboratory carrying out destructive and non-destructive testing on spent fuel taken from various types of nuclear power or experimental reactors and on irradiated structures and equipment from these technologies.

Further to the periodic safety review carried out in 2001, a major upgrading programme was undertaken. It included works to improve the seismic resistance of the civil engineering. This work will end with the dismantling of the building called "UO_2", initially scheduled for 2008 and postponed to 2012, thereby reducing the interactions between buildings in the event of an earthquake.



Acceptance of immersion heaters on the PHÉNIX installation

The CEA has moreover indicated its intention to extend the operating life of the LECA, whose shutdown was hitherto envisaged in 2015. For this, it will have to demonstrate the resistance of the buildings to a reference earthquake called the "safe shutdown earthquake" (SSE), at the next periodic safety review planned for 2013.

• LECA's treatment, clean-out and reconditioning station (STAR) (Cadarache)

The STAR facility is a high-activity laboratory comprising shielded cells. It was designed for the stabilisation and reconditioning of irradiated fuel rods with a view to storing them in the CASCAD facility. It also performs destructive and non-destructive examinations of irradiated fuel from various processes (PWR, research reactors, experimental reactors).

Its creation was authorised by a decree of 4 September 1989 and its definitive commissioning was declared in 1999.

On completion of the analysis of the periodic safety review file in June 2009, ASN indicated that it had no objection to the continuation of operation of the facility, and authorised the extension of its operating range, thereby enabling the CEA to recondition new types of fuel. ASN periodically checks that the licensee is meeting its commitments taken under the periodic safety review, and carried out two progress assessments in 2011.

Moreover, ASN authorised the commissioning of the VERDON laboratory within the STAR facility in 2011. This laboratory intends studying early releases and deposits of fission products from the new fuels.

In order to reduce the risks of items being dropped during handling operations, a new "truck loading chamber" is under construction. The licensee has undertaken to commission it in 2014.



Clean-out work in the "UO2 building" before dismantling

• Laboratory for research and experimental fabrication of advanced nuclear fuels (LEFCA) (Cadarache)

LEFCA is a laboratory responsible for performing basic engineering studies on plutonium, uranium, actinides and their compounds in all forms (alloys, ceramics or composites) with a view to application to nuclear reactors, the performance of ex-pile studies necessary for the interpretation and understanding of fuel behaviour in the reactor and at the various stages in the cycle, as well as the manufacture of irradiation test capsules or experimental assemblies.

This laboratory was commissioned in 1983.

In the framework of its last periodic safety review in 2003, the CEA undertook to carry out seismic reinforcement work on the building. This work was completed in 2010. However, with regard to the risk of liquefaction failure of the ground beneath the facility in the event of an earthquake, ASN took a decision introducing a technical requirement imposing the implementation of a system for preventing this risk before 29 June 2012 (decision 2010-DC-0186 of 29 June 2010). The corresponding work started at the beginning of 2011.

In addition to this, in 2011 ASN examined the programme for the next periodic safety review planned for 2013.

• Spent fuel testing laboratory (LECI) (Saclay)

The spent fuel testing laboratory (LECI – BNI 50) was the subject of a declaration on 8 January 1968, and a creation authorisation decree for the PELECI extension dated 30 May 2000. This facility comprises three buildings on the Saclay site, and groups shielded lines, one glove-box line and a shielded bunker, in which the various fuel constituents used in the nuclear reactors are analysed to determine how their properties evolve with irradiation. This facility also accommodates a shielded cell (Célimène, building 619) which has not been used since the end of 1993. Commissioning of the three lines of shielded cells was staggered between 1959 and 2005. The next periodic safety review is planned for 2013. In 2011, ASN gave its opinion on the initial note defining the programme for the periodic safety review.

Research and development laboratories

• Alpha facility and laboratory for transuranian elements analysis and reprocessing studies (ATALANTE) (Marcoule)

The main purpose of the ATALANTE facility, created in the 1980's, is to conduct research and development activities concerning:
– nuclear fuel recycling;
– ultimate waste management;
– exploration of new concepts for fourth-generation nuclear systems;
– studies, production and recycling of actinides.

The changes to the facility since its creation and its periodic safety review have been examined by the Advisory group of experts for plants in 2007. On this basis, ASN authorised the "definitive" commissioning of the facility in June 2007 (the

various laboratories were commissioned as and when required since the creation of the facility). The licensee's commitments in this context are periodically monitored by ASN, particularly with regard to the prevention of fire risks. ASN carried out two progress assessments on this account in 2011. Despite a few postponements, the assessments show progress to be satisfactory.

In 2011, ASN examined the commissioning file for the hydrothermal oxidation (HTO) process in laboratory L21. This process is part of the DELOS facility, dedicated to the treatment of contaminated organic effluents. It corresponds to the last treatment stage of these effluents, the other stages having been authorised by ASN in 2009.

Lastly, ASN has examined the revision of the facility's discharge limits and requirements that will lead to an ASN decision in 2012.

• The CHICADE facility (Cadarache)

The CHICADE (waste chemistry and characterization) facility carries out research and development work on low level and intermediate level waste.

This work mainly concerns:
– the destructive and non-destructive characterisation of radioactive objects, waste sample packages and irradiating objects;
– the development and qualification of nuclear measurement systems;
– the development and implementation of chemical and radiochemical analysis methods;
– the assessment and monitoring of waste packaged by the waste producers.

Creation of the facility was authorised by a decree of 29 March 1993 and its definitive commissioning was authorised in 2003.

In 2011, ASN gave its opinion on the periodic safety review file, and formulated no objection to the continuation of operation of the facility. The licensee must nevertheless respond to ASN's demands and meet the commitments it gave further to the periodic safety review of the facility. They notably concern waste management and additional demonstrations of resistance to external hazards (aircraft crash, earthquake).

The licensee moreover wants to put the CADECOL cell into service as from 2012. It will be devoted to destructive testing of waste packages, enabling appraisals to be carried out for ANDRA, for example.

1|2|4 Fissile material stores

• The central fissile material warehouse (MCMF) (Cadarache)

Built in the 1960's, the MCMF is a storage warehouse for enriched uranium and plutonium. Its main duties are reception, storage and shipment of non-irradiated fissile materials (U, Pu) pending reprocessing, whether intended for use in the fuel cycle or to remain temporarily unused.

Given that the MCMF cannot guarantee fulfilling its safety functions in the event of an earthquake, the licensee has been asked to transfer the nuclear material from this facility to the MAGENTA facility. It is noteworthy that with regard to the mass of plutonium-containing materials stored in the MCMF, about 98% of the reference stock was removed at the end of 2011.

• The MAGENTA facility (Cadarache)

The MAGENTA facility, intended to replace the MCMF, is dedicated to the storage of non-irradiated fissile material and the non-destructive characterisation of received nuclear materials.

The MAGENTA creation authorisation decree was signed on 25 September 2008. ASN authorised the facility's commissioning by decision 2011-DC-0209 of 27 January 2011.

MAGENTA's licensee received the first package from the MCMF in February 2011.

However, commissioning of the glove-box lines for the physical characterisation of materials and the changing of primary conditioning is envisaged for a later date, subject to prior ASN agreement.

1|2|5 The POSEIDON irradiator

The POSÉIDON facility at Saclay, created by decree of 7 August 1972, is an irradiator consisting of a cobalt 60 source storage pool, surmounted over half its surface area by an irradiation bunker. The facility also features a submersible chamber called CALINE and a test cell called CESAR. The Poseidon facility is used for research and development activities relating to the behaviour of materials under radiation.

The main ongoing examination subject concerns the facility's waste zoning.

1|2|6 Waste and effluent storage and treatment facilities

The CEA has effluent and waste treatment and packaging facilities on its sites at Fontenay-aux-Roses, Grenoble, Cadarache and Saclay. They are generally equipped with characterisation facilities to enable measurement-based checks to be made on



View of the MAGENTA facility at Cadarache

the declarations made by producers of waste and checking of compliance of packaged wastes with their acceptance specifications, prior to their streaming to the appropriate disposal route. The treatment and packaging facilities handle mainly liquid and solid wastes from the CEA centres in which they are located. They may occasionally process waste from other sites (CEA or others) depending on its specific characteristics.

The waste and effluent storage and treatment facilities are addressed in chapter 16.

1|2|7 Installations undergoing decommissioning

CEA has undertaken the final shutdown and decommissioning of some installations which have reached the end of their lives or whose continued operation is not desired and, more generally, when sites are located in the immediate vicinity of major urban centres (which is the case of the Fontenay-aux-Roses and Grenoble centres, for which the complete delicensing process is under way). These aspects are dealt with in chapter 15.

2 NON-CEA NUCLEAR RESEARCH INSTALLATIONS

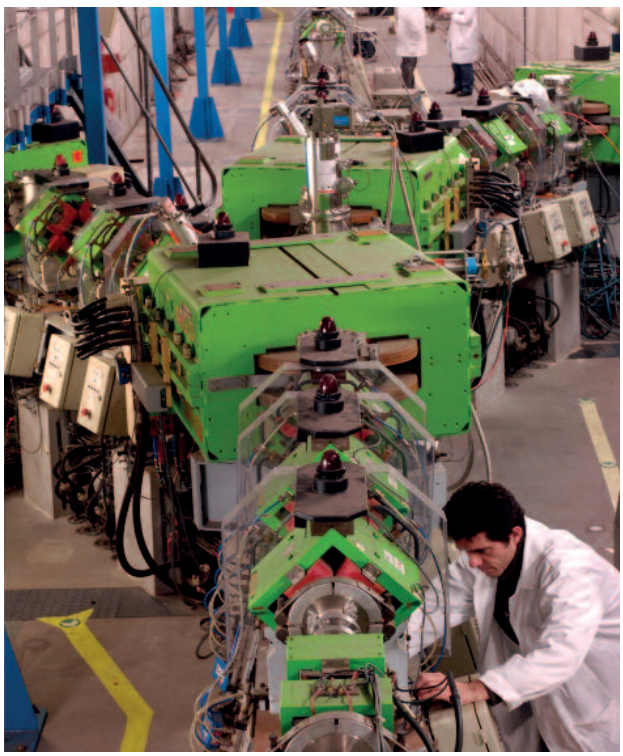
The main subjects of interest in 2011 concerned:
– the continuation of the examination of the modification of the GANIL facility decree;
– examination of the complementary safety assessment of the high-flux reactor (RHF), which was considered to be a priority on the same account as the nuclear power reactors and 5 of the CEA's installations;
– the entry into force of a new tripartite agreement concerning the CERN (European Organisation for Nuclear Research), between the French Government, the Swiss Federal Council and European Organisation for Nuclear Research, relating to protection against ionising radiation and the Safety of the Organisation's facilities;
– examination of the creation authorisation application for the ITER installation.

2|1 Large national heavy ion accelerator (GANIL)

The GANIL (large national heavy ion accelerator) GIE (economic interest grouping) situated in Caen (Calvados *département*), is a laboratory researching into the structure of the atom, which was authorised by a decree of 29 December 1980 to create an accelerator, and, by a decree of 6 June 2001, to operate an extension. The purpose of this research facility is to produce, accelerate and distribute beams of ions with different energy levels. The intense high-energy beams produce strong fields of ionising radiation when they circulate in the rooms, and even after the beams have stopped, which constitutes the main risk.

In order to be able to produce exotic heavy-ions, in July 2009 the GANIL applied for a modification to the authorisation decree for its facility so that it could set up the SPIRAL 2 project for the production of exotic ions in it (linear accelerator and building housing the associated experimental areas, exotic ion production buildings). This application, which comprises two phases, is currently being examined. The excavation work for construction of the phase 1 buildings began in January 2011, and the civil engineering work in August 2011.

The report submitted further to the public inquiry concludes with a favourable opinion for phase 1 and for the modification of the perimeter of BNI 113 to include the SPIRAL 2 project. ASN aims to give an opinion on a draft amending decree relative to phase 1 of the SPIRAL 2 project in the first quarter of 2012; the GANIL wants commissioning - which will be subject to prior ASN authorisation - to take place in mid-2013. ASN has also started examining the periodic safety review. Phase 2 of the SPIRAL 2 project will be examined later on, with commissioning desired for 2016.



The "fishbone" in the GANIL, which guides the beams in the experiment halls

2|2 Laue-Langevin Institute (ILL) high flux reactor

The high flux reactor (RHF) at the Laue-Langevin Institute (ILL) in Grenoble constitutes a neutron source mainly used for experiments in the field of solid-state physics, nuclear physics and molecular biology. The maximum power of the reactor, initially authorised by a decree of 19 June 1969 amended by decree no.94-1042 of 5 December 1994, is 58.3 MWth. The reactor core is cooled by heavy water contained in a reflective tank, which itself is immersed in a light water pool. 13 vertical channels and 4 sloping channels direct the neutrons to the experiment halls. Vertical tubes are also used to irradiate samples.

In 2002, ASN requested major seismic reinforcement work on the installation. The majority of this work ended in late 2007, although further improvements concerning more particularly the handling crane, the gaseous effluent management system, and the system for reflooding the reactor core in the event of a severe accident, are still in progress.

The RHF underwent a complementary safety assessment in 2011, in the framework of the actions following the Fukushima nuclear power plant accident. In this respect, the ILL endeavoured to deploy the entire margin evaluation procedure in depth, and has made many commitments to reinforce the robustness of the facility with respect to the seismic risk and the flood risk. An inspection was also carried out in this framework on 5, 6 and 7 September 2011 (see chapter 8).

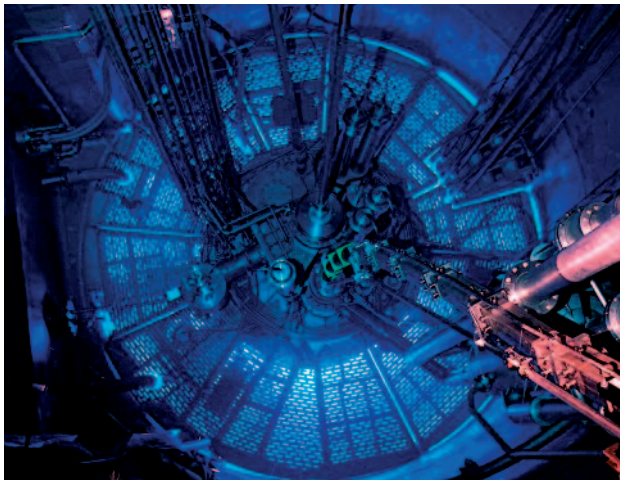
The update of the RHF safety report is expected in 2012. The licensee has implemented a new method of analysis by "postulated initiating events".

Lastly, in the context of the complete delicensing of the CEA centre in Grenoble, situated in the immediate vicinity of the RHF, ASN has asked the ILL to examine the shutdown of the RHF on the current site. ASN has reiterated its wish for a shutdown date to be defined. It underlines in this respect that by defining a shutdown date and studying a medium-term replacement strategy, the various actions required can be planned in advance.

2|3 European organization for nuclear research (CERN) installations

The European Organisation for Nuclear Research (CERN) is an international organisation whose role is to carry out purely scientific and fundamental research programmes concerning high-energy particles.

A tripartite agreement signed by France, Switzerland and CERN entered into effect on 16 September 2011. Prior to this, the safety and radiation protection of the facility were governed by bilateral agreements. ASN actively participated in the work leading to the signing of this tripartite agreement, which covers the fields of nuclear safety and radiation protection; for the first time, the agreement constitutes a legal basis common to the two host countries. It is now a question of publishing all the rules mentioned in this agreement.



RHF reactor pool

In 2011, ASN conducted surveillance visits focusing on periodic tests, maintenance and radioactive source management.

2|4 The ITER (international thermonuclear experimental reactor) project

The ITER project concerns an experimental installation, the purpose of which is scientific and technical demonstration of controlled thermonuclear energy obtained with a deuterium-tritium plasma magnetic confinement, during long-duration experiments with a significant power level (500 MW for 400 s). This international project benefits from financial support from China, South Korea, India, Japan, Russia, the European Union and the United States. The Headquarters Agreement between ITER and the French Government, signed on 7 November 2007, was published in the Official Journal of the French Republic by decree on 11 April 2008.

A first version of the creation authorisation application file for the ITER BNI was submitted at the end of January 2008. ASN had indicated to the ITER Organisation, however, that its file was not admissible such as it was submitted. The revised file was submitted to ASN in April 2010. This file was presented for public inquiry from 15 June to 4 August 2011, after which a favourable opinion, accompanied by recommendations, was issued on 9 September 2011. The CLI (local information committee) also gave its opinion on 21 July 2011. This includes a number of requests concerning the impact of chemical and radioactive discharges, environmental monitoring, the detritiation of effluents, and the management of waste during operation and decommissioning. With regard to decommissioning, the CLI wishes to be informed of the development of the costs of decommissioning.

The Advisory committees of experts met on 30 November and 7 December 2011. The Advisory committees of experts considered that, subject to implementation of the commitments (about 180) made by the licensee, and the 21 recommendations they proposed, the measures adopted by the licensee in the file supporting its creation authorisation application, are on the whole satisfactory. The Advisory committees of experts thus

gave a favourable opinion for the creation of this facility. The licensee must nevertheless further reinforce the design of certain items of equipment and provide many additional elements within one to two years. ASN will give its opinion on a draft creation authorisation decree for ITER in 2012.

ITER Organisation aims to obtain the first hydrogen plasma in 2019 and the first deuterium-tritium plasma in 2026.

The civil engineering work, particularly the tokamak foundations, began in 2011. The ASN inspection in July 2011 in this area showed that the licensee had a robust organisation that could ensure satisfactory management of the civil engineering operations inherent to the construction of the nuclear facility.

The complementary safety assessment of ITER, required as part of the experience feedback from the Fukushima NPP accident, is to be submitted in September 2012.



ASN inspection on the ITER construction site – July 2011

3 IONISERS, THE PRODUCTION OF RADIONUCLIDES FOR PHARMACEUTICAL USE, THE MAINTENANCE UNITS AND THE OTHER NUCLEAR FACILITIES

The main focus of ASN in 2011 concerned the continuation of examining the periodic safety review of the CIS bio international facility. The conclusions of this review will be known in 2012.

3|1 Industrial ionisation installations

The irradiators are intended primarily for the sterilisation of medical devices, foodstuffs, pharmaceutical raw materials, etc., by irradiating them with gamma rays emitted from sealed cobalt-60 sources. The irradiation cells are made from reinforced concrete, designed to protect the environment. The sources are stored in pools under a depth of water that guarantees the protection of the workers in the cells. The main risk in these facilities is irradiation of the personnel.

The IONISOS group, created in 1993, operates three industrial ionisation facilities (Dagneux BNI 68, Pouzauges BNI 146, Sablé-sur-Sarthe BNI 154). Further to an ASN demand, IONISOS has requested the implementation of an additional verification of pool tightness by acoustic emissions; this request is currently being examined. Furthermore, in agreement with the licensee, ASN has organised the scheduling of the periodic safety reviews for these three facilities, which must be carried out by November 2017 at the latest, as required by decree 2007-1557 of 2 November 2007. The first periodic review is planned for 2014, and will in principle concern the Sablé-sur-Sarthe site.

ISOTRON France operates the GAMMASTER irradiator (BNI 147). ISOTRON France wishes to relaunch its project to build a new irradiator: GAMMATEC (BNI 170) on the Marcoule site, for which the creation authorisation decree dates from 2008. This project had been provisionally suspended by the licensee, but it is now targeting commissioning by the end of 2012. In view of the two-year interruption in the project and a minor change in the construction permit, ASN will ensure that this new facility remains in compliance with its creation authorisation decree and that the Fukushima experience feedback has been integrated.

3|2 The radio-pharmaceutical production facility operated by CIS bio international

CIS bio international is a key player on the French market for radiopharmaceutical products used for both diagnosis and therapy. Most of these radionuclides are produced in BNI 29 at Saclay. The decree no.2008-1320 authorising CIS bio international to operate BNI 29 in place of the CEA was signed on 15 December 2008.

In July 2008, the CEA - the licensee at the time - submitted the periodic safety review file for BNI 29. This file was supplemented in 2009. This supplemented file was examined in 2010, and presented to the Advisory committee of experts for plants (GPU) on 7 July 2010. However, the documents provided in this file did not enable the sustainable nature of facility operation to be confirmed, particularly owing to the lack of a conclusive conformity analysis. This initial examination thus consisted in taking stock of knowledge on the safety of the facility and identifying the priority lines for improvement. It was therefore decided that the GPU would meet a second time to reach a conclusion on this periodic safety review file and the continuation of operation of the facility.

Production of artificial radionuclides for medical purposes

Radionuclides, or radioactive markers, are used for the diagnosis and treatment of many diseases. These radionuclides for medical uses are notably produced by irradiating sources in French BNIs, either in research reactors or using cyclotrons. They are then processed and conditioned in dedicated facilities. The BNIs concerned by these manufacturing processes are:

- *the OSIRIS research reactor operated by the CEA in Saclay, which produces molybdenum-99, iridium-192, yttrium-90, erbium-69, and rhenium-186;*
- *the ORPHÉE research reactor operated by the CEA in Saclay, which produces iridium-192, yttrium-90, erbium-69, and rhenium-186;*
- *the UPRA (artificial radionuclide production plant) operated by CIS bio international in Saclay, which has two cyclotrons and radionuclide processing and conditioning facilities. It essentially produces molybdenum/technetium generators, iodine-131, thallium-201, yttrium-90, and samarium-153.*

The JHR reactor will also contribute to the production of radionuclides. This reactor is currently under construction on the CEA Cadarache site.

The safety status of the abovementioned BNIs is presented in this chapter.

Metastable technetium-99 is the most commonly used radionuclide in medical imaging. It is produced by decay of molybdenum-99, which is itself obtained by reactor irradiation of enriched uranium targets. The world's production of molybdenum-99 is ensured by the following reactors:

- *NRU in Canada;*
- *HFR in the Netherlands;*
- *Safari in South Africa;*
- *BR2 in Belgium;*
- *OSIRIS in France (less than 10%).*

It should not be forgotten that the world production of molybdenum-99 dropped in 2007 and 2008 - due mainly to the outages of the NRU reactor in Canada, the HFR in the Netherlands, and the IRE facility in Belgium - leading to shortages in supplies of technetium-99m. As the research reactors involved in this production process are "old", and the OSIRIS reactor shutdown is set for the end of 2015 under the ASN decision of 16 September 2008, such difficulties could arise again. Given this context, the international nuclear safety authorities met in 2009. ASN then estimated, in its "position statement" of 16 September 2009, that the solution was not to extend the operation of the old reactors, which would jeopardise the safety of these facilities, but to concentrate on optimising the use of technetium-99m, particularly by seeking alternative production solutions and studying the use of alternative medical imaging methods.



New production line for radiopharmaceuticals at CIS bio

It must be emphasised that, on completion of its analysis of the periodic safety review file for the OSIRIS reactor, ASN confirmed, through ASN opinion no. 2011-AV-0121 of 27 May 2011, its position - first mooted in 2004 - on the shutdown of this reactor in 2015.

To this end, ASN decision 2011-DC-0207 of 27 January 2011 set the deadlines for sending the replies to the commitments made by CIS bio international and the demands formulated by ASN at the end of this first examination stage. However, further difficulties arose in 2011. Firstly, the content of some required additional information, notably concerning the fire risk, was still insufficient, and secondly, some information was sent late, in spite of several chase-ups by ASN. The conclusions of the periodic safety review file examination are expected at the beginning of 2012.

However, in view of the conclusions of the first stage of the examination, and to reduce the radiological consequences of a potential accident as quickly as possible, the iodine-131

inventory of the facility was progressively reduced in 2011 pursuant to the abovementioned ASN decision.

Lastly, ASN notes that difficulties also arise with the facility modification application files, which are often incomplete.

The complementary safety assessment of CIS bio international, required as part of the experience feedback from the Fukushima NPP accident, is to be submitted in September 2012.

3|3 Maintenance facilities

Three basic nuclear installations specifically handle nuclear maintenance activities in France. They are:

The SOMANU (nuclear maintenance company) facility in Maubeuge (Nord département*)*
Authorised by a decree of 18 October 1985, this facility is specialised in the repair and appraisal of material coming mainly from the primary cooling systems of pressurised water reactors and their auxiliaries, excluding fuel elements. This BNI belongs to the AREVA group. In compliance with the requirements of article 29 of the TSN Act, the licensee has engaged in a process that should lead, by the end of 2011, to providing ASN and the ministers responsible for nuclear safety with an initial report on the ten-year periodic safety review of the licensee's installation. The licensee proposed addressing the complementary safety assessments required on account of the experience feedback from the Fukushima Daiichi accident in the framework of this safety review, which was accepted.

*The SOCATRI (*Société auxiliaire du Tricastin*) clean-out and uranium recovery facility situated in Bollène (Vaucluse* département*)*
Its activities encompass the maintenance, storage and clean-out of material from the nuclear industry and waste storage on behalf of ANDRA. The operating company, SOCATRI, is part of the AREVA group and was licensed by a decree of 22 June 1984, amended. Its authorisations for water intake and liquid and gaseous discharges were modified for the last time by ministerial order of 16 August 2005. Further to an uncontrolled release that occurred on 7 July 2008, the facilities were satisfactorily reconditioned; ASN nevertheless underlined the persistence of shortcomings in operating rigour. On 30 September 2011, the appeal court of Nîmes requalified the offence of pollution as an "offence of discharging substances into the groundwater, surface water or the sea leading, even temporarily, to significant modifications to the normal water supply and to restrictions on the use of bathing waters", and reversed the initial judgement of 14 October 2010 to declare the company guilty of this charge. The court moreover confirmed the conviction for omission to give immediate notification of the incident that occurred on its premises, as required under articles 48 and 54 of the Act of 13 June 2006. SOCATRI was fined €300,000 for criminal liability and €250,000 for civil liability. AREVA has lodged an appeal with the supreme court of appeal. As for the consequences of the event on the environment, the extended monitoring put in place confirmed the absence to date of an environmental impact associated with the incident. SOCATRI nevertheless remains obliged to monitor the groundwater of the site and the river Lauzon with which it communicates.

In a sector bounded by the Donzère-Mondragon canal and the Gaffière, Lauzon and Rhone rivers, legacy contamination of the groundwater - unrelated to this incident - was identified; some thirty private boreholes have thus been monitored by AREVA NC.

The IRSN conducted a study of this contamination that identified more precisely the extent of the phenomenon. It was monitored by the CLIGEET (Tricastin major energy facility local information committee), the ARS (regional health agencies) of the Vaucluse, and AREVA NC.

The study gave rise to a public meeting on 22 September 2010 in which ASN participated. Further to this meeting, it was decided that monitoring of the private boreholes by AREVA NC would be taken over by the environmental monitoring network of the Tricastin site.

During 2009, SOCATRI started the periodic safety review of its facility, and submitted the corresponding files to ASN in 2010. After examining the file, ASN addressed the licensee a request for additional information. The technical examination of the file began at the end of 2011 after receiving the last files.

In addition, SOCATRI undertook major works to be able to handle the effluents generated by preparatory operations for the final shutdown of the EURODIF plant and the maintenance units of certain equipment items of GBII.

Lastly, the SOCATRI facility underwent a complementary safety assessment in 2011 further to the ASN decision of 5 May 2011.

Tricastin operational hot unit (BCOT)

The BCOT was licensed by a decree of 29 November 1993. Also situated in Bollène, it performs maintenance operations and storage of contaminated material from the PWRs, with the exception of fuel elements. This BNI is operated by EDF.

In 2011 the BCOT continued the shipment of the old reactor vessel heads to ANDRA; the last vessel head should be shipped in 2013. The BCOT has also started, with ASN authorisation, to install a unit for cutting up the end-of-life guide tubes from the EDF fleet.

During 2010, the BCOT licensee had initiated a periodic safety review of its installation. It completed it in 2011, for examination by ASN in 2012. The licensee should carry out the complementary safety assessments taking account of the experience feedback from the Fukushima Daiichi accident in the framework.

3|4 Chinon irradiated material facility (AMI)

This facility situated on the nuclear site of Chinon (Indre-et-Loire *département*) was declared and commissioned in 1964, and is operated by EDF. Its main purpose is to carry out examinations and appraisals of activated or contaminated materials from PWR reactors.

2006 was marked by a change in strategy on the part of the licensee with regard to the future of the installation. As ASN considered that the renovation project presented in 2004 did not enable long-term continued operation to be envisaged,

EDF presented a new strategy, including final shutdown of the installation no later than 2015.

In 2008, EDF had indicated its aim of commissioning a new laboratory by 2011 also on the site of Chinon. Preparatory work began in 2009. If the schedule presented is met, the AMI's examination and appraisal work will wind down in 2012, and the preparatory operations for installation decommissioning will be able to begin.

Furthermore, the work to ensure the safety of the installation until its final shutdown was completed at the beginning of 2010.

The sorting and packaging operations for the legacy waste from the installation, currently stored in a pit, continued in a dedicated unit. Some of this waste was taken away to the disposal centres.

Lastly, in October 2010, EDF lodged a file applying for a modification of the limit values for liquid and gaseous radioactive discharges into the environment for the entire EDF Chinon site. In this framework, the modification application for the requirements setting the AMI discharge conditions is currently being examined. This modification project was submitted at the end of July 2011 to the CODERST (Departmental Council for the Environment and for Health and Technological Risks) of Indre-et-Loire, as provided for decree no.2007-1557 of 2 November 2007.

3|5 Inter-regional fuel warehouses (MIR)

EDF has two inter-regional fuel warehouses, on the Bugey site in the Ain *département* and at Chinon in the Indre-et-Loire département. These facilities were respectively authorised by decrees of 2 March 1978 amended, and 15 June 1978 amended. EDF uses them to store nuclear fuel assemblies (only those made of naturally occurring uranium oxide) pending loading into the reactor. Having reconsidered the organisation of its supply chain, EDF finally renounced on definitively shutting down the Chinon warehouse, and since April 2011 it is once again being used to store fresh fuel assemblies. ASN has asked the licensee to rapidly envisage the periodic safety review of these two facilities. These safety reviews will lead ASN to examine the conditions under which operation of these facilities can continue, considering the safety requirements currently applicable to BNIs, particularly those relative to containment. The complementary safety assessments must be carried out in 2012.

4 INTERNATIONAL ACTION

In 2010, as part of the exchanges within WENRA (Western European Nuclear Regulators' Association), ASN had transmitted questionnaires to the nuclear safety authorities concerned to gather information on the research reactors (type of reactor, date of commissioning, main operating problems, accidents studied in the safety analysis for the design of the facility, periodic safety review, production of radionuclides if applicable, etc.). After analysing the responses to these questionnaires, ASN organised a meeting in Paris on 2 March 2011. This meeting provided the opportunity firstly to present the specific way in which each nuclear authority regulates and monitors research reactors, and secondly to run through the main conclusions resulting from analysis of the questionnaires, particularly in view of the future meetings targeting some of these conclusions. With regard to this latter point, the future lines of work could thus focus on the following subjects:

– possible harmonisation of the safety documents required for these facilities;
– the licensing procedures for new facilities;
– the use of the "postulated initiating events" analysis method;
– the definition of the design-basis accidents and the beyond design-basis accidents;
– the external hazard risks to be considered in the safety analysis;
– plant aging;
– decommissioning.

The sharing of operating experience feedback from the research reactors could be organised in this context, notably by means of "cross" inspections.

These exchanges dedicated to research reactors have been presented on several occasions at the more general meetings of WENRA.

5 OUTLOOK

The research and other installations regulated by ASN differ widely, but are usually small in size. ASN will continue to concentrate on regulating the safety and radiation protection of these installations as a whole and on comparing practices per type of installation in order to choose the best ones and thus encourage operating experience feedback.

It is in this spirit that ASN as defined priorities for the submittal of the complementary safety assessments concerning the nuclear facilities other than the power reactors. A prior analysis was conducted to assess the risks in the light of the experience feedback from the Fukushima Daiichi accident and the "potential source term". In effect, given the diversity of the nuclear fleet, each facility must be studied individually.

In 2012, over and beyond the follow-ups that will be given to the complementary safety assessments received in 2011, ASN will examine those for:
– 9 other CEA facilities (PÉGASE, CABRI, RAPSODIE, MCMF, LECA, Cadarache storage yard, CHICADE, ORPHÉE, ATALANTE);
– support functions on the Cadarache and Marcoule sites;
– the inter-regional fuel warehouses;
– ITER;
– CIS bio international installation.

Moreover, ASN considers that the "major commitments" initiative implemented by the CEA over the last 4 years must be continued and regularly expanded to include new "major commitments". This system effectively allows targeted tracking of priority actions, which have a clearly set deadlines. Any extension to the deadline must therefore firstly be duly justified, and secondly be discussed with ASN. Even though the system can still be improved, and some deadlines have now been pushed back significantly with respect to the initial due dates, the results are globally positive. ASN will nevertheless remain particularly vigilant and could, if necessary, take decisions of a prescriptive nature.

In 2012 ASN will continue to pay particular attention to new projects such as the JHR, the GANIL extension, the ITER facility, and the restarting of the CABRI installation. It will also be attentive to meeting deadlines for transfer of nuclear materials stored in the MCMF, the EOLE and MINERVE reactors, and MASURCA, to the new MAGENTA facility.

ASN will examine the conclusions of the periodic safety review of the GANIL facility and of the CIS Bio International installation in order to decide on the acceptability of medium- to long-term continuation of their operation.

Moreover, in 2012, ASN will examine - via the examination of the ASTRID prototype project and work on fourth-generation "Generation IV" reactors (also see chapter 12) - the operating experience feedback from the fast neutron reactors (PHÉNIX, SUPERPHÉNIX and RAPSODIE, now shutdown), as well as the information requested from the CEA/EDF/AREVA consortium for comparison, in terms of safety, of the different systems. This will be part of the preparatory work to enable ASN to adopt a position at the end of 2012 on the interim report relative to the possibilities of transferring the long-lived waste, provided for by the "Waste act" of 28 June 2006.

Finally, in 2012 ASN will continue to promote international harmonisation on the safety of research reactors. It will also continue to be an active contributor to international reflection into the aging of installations and the safety of supply of radionuclides for medical use.

SAFE DECOMMISSIONING OF BASIC NUCLEAR INSTALLATIONS (BNIs)

1 **TECHNICAL AND LEGAL REQUIREMENTS APPLICABLE TO DECOMMISSIONING** 421

1|1 **Decommissioning strategies**

1|2 **Legal requirements**

1|3 **The financing of decommissioning and radioactive waste management**

1|3|1 Reminder of regulatory provisions

1|3|2 Review of the reports forwarded by the licensees

1|4 **Decommissioning risks**

1|5 **Complete clean-out**

2 **SITUATION OF NUCLEAR INSTALLATIONS UNDERGOING DECOMMISSIONING IN 2011** 426

2|1 **EDF nuclear power plants (NPPs)**

2|1|1 The Brennilis NPP

2|1|2 Natural Uranium Graphite Gas Reactors (UNGG)

2|1|3 CHOOZ A reactor (Ardennes NPP)

2|1|4 SUPERPHÉNIX reactor

2|2 **CEA installations**

2|2|1 Fontenay-aux-Roses centre

2|2|2 The Grenoble centre

2|2|3 The Cadarache centre installations undergoing decommissioning

2|2|4 The Saclay centre installations undergoing decommissioning

2|3 **AREVA installations**

2|3|1 UP2 400 spent fuel reprocessing plant and associated facilities

2|3|2 SICN plant in Veurey-Voroize

2|4 **Others installations**

2|4|1 The Strasbourg University reactor

2|4|2 The Electromagnetic radiation laboratory

3 **OUTLOOK** 437

APPENDIX 1 **LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2011** 437

APPENDIX 2 **LIST OF BASIC NUCLEAR INSTALLATIONS UNDERGOING DECOMMISSIONING AS AT 31.12.2011** 439

CHAPTER 15

RADIOACTIVE WASTE AND CONTAMINATED SITES AND SOIL

1 RADIOACTIVE WASTE 443

1|1 Radioactive waste management regulatory framework
1|1|1 Production of radioactive waste in basic nuclear installations
1|1|2 Production of radioactive waste by other facilities using radioactive materials
1|1|3 The national inventory of radioactive materials and waste
1|1|4 The national radioactive materials and waste management plan

1|2 The ASN role in the radioactive waste management system
1|2|1 Checks and inspections
1|2|2 Drafting of recommendations and prescriptions for sustainable waste management
1|2|3 Production of the legislative and regulatory framework
1|2|4 Evaluation of the nuclear financial costs
1|2|5 ASN's contribution to international works
1|2|6 Public information

1|3 Management of waste from nuclear licensees
1|3|1 CEA waste management
1|3|2 AREVA waste management
1|3|3 EDF waste management
1|3|4 Management of waste from small-scale nuclear activities

1|4 Long-term waste management
1|4|1 The very low level waste repository (CSTFA)
1|4|2 The surface repositories for low and intermediate level, short-lived waste
1|4|3 Management of long-lived high and intermediate level waste
1|4|4 Management of long-lived low level waste
1|4|5 Package acceptance in disposal facilities

2 MANAGEMENT OF SITES AND SOILS CONTAMINATED BY RADIOACTIVITY 462

2|1 Regulatory framework

2|2 Revision of the contaminated sites management methodology guide

2|3 The Radium Diagnosis operation

2|4 The main subjects examined by ASN
2|4|1 Coudraies district in Gif-sur-Yvette (Essonne)
2|4|2 Clos rose district in Gif-sur-Yvette (Essonne)
2|4|3 Making safe the Isotopchim site in Ganagobie (Alpes-de Haute-Provence *département*)
2|4|4 Rehabilitation of the site of the former Pierre et Marie Curie school at Nogent-sur-Marne (Val-de-Marne *département*)
2|4|5 Établissements Charvet in l'Ile Saint-Denis (Seine-Saint-Denis *département*)
2|4|6 Former Curie laboratories in Arcueil (Val-de-Marne *département*)
2|4|7 Orflam-Plast in Pargny-sur-Saulx (Marne *département*)
2|4|8 The Boucau site (Pyrénées-Atlantiques *département*)
2|4|9 Support for the State's regional services

2|5 International action concerning management of contaminated sites and soil

3 OUTLOOK 467

CHAPTER 16

The term "decommissioning" generally covers all the technical and administrative activities performed after shutdown of a nuclear installation in order to achieve a predetermined final status. These activities may in particular include equipment dismantling, clean-out of premises and soils, demolition of civil engineering structures, processing, packaging, removal and disposal of radioactive and other waste.

As many nuclear installations were built between the 1950s and the 1980s, a large number of them are being gradually shut down and then decommissioned, particularly over the past fifteen years. In 2011, about thirty nuclear installations of all types (electricity generating or research reactors, laboratories, fuel reprocessing plants, waste treatment facilities, etc.), were shut down or were undergoing decommissioning in France. Ensuring the safety and radiation protection of the decommissioning operations in these installations is a major concern for ASN.

The specific aspects of decommissioning activities (change in the nature of the risks, rapid changes in the installation status, duration of the operations, etc.) make it impossible to implement all the regulatory principles that were applied during the installation operating period. The regulations concerning the decommissioning of nuclear installations have progressively changed since the 1990s. They were clarified and supplemented in 2006 by the TSN Act now codified in books I to V of the Environment Code by Order 2012-6 of 5 January 2012. ASN continues to develop the regulatory framework and the applicable doctrine for this phase in the life of basic nuclear installations (BNIs). In 2008, it made public a report presenting its decommissioning strategy for BNIs, based primarily on the choice of the immediate decommissioning strategy and the need to achieve final status after decommissioning in which all hazardous material had been removed. This report was presented to the HCTISN (French High Committee for Transparency and Information on Nuclear Security) in 2009, and published in 2010.

UNDERSTAND

Decommissioning

Decommissioning covers all the technical and administrative activities carried out following the shutdown of a nuclear installation, in order to achieve a final predetermined status in which all the hazardous substances, and radioactive substances in particular, have been evacuated from the BNI. These activities can include equipment dismantling, clean-out of premises and soils, demolition of civil engineering structures, and waste management.

In the past, nuclear installations were gradually shut down, then decommissioned. Some installations were thus the subject of final shutdown decrees and transformed into storage BNIs for the waste left in place, pending a decommissioning decree.

Current regulations and the general policy of ASN recommending immediate decommissioning requires that a licensee having decided to shut down its installation must submit a final shutdown and decommissioning authorisation application. To improve the consistency of the operations, the submitted file must explicitly describe all the operations from final shutdown through to the final targeted status. These operations are then authorised by a final shutdown and decommissioning decree.

On completion of the decommissioning operations, the licensee provides proof that the targeted final status has been achieved, after clean-out if necessary. The installation is then delicensed, that is to say "removed from the list of BNIs" and is no longer subject to the BNI regulations. Delicensing may be subject to the institutional controls imposing restrictions on use.

1 TECHNICAL AND LEGAL REQUIREMENTS APPLICABLE TO DECOMMISSIONING

1|1 Decommissioning strategies

The IAEA has defined three strategies for decommissioning nuclear installations following their final shutdown:

– deferred decommissioning: the parts of the installation containing radioactive materials are maintained or placed in a safe state for several decades before actual decommissioning operations begin (the "conventional" parts of the installation can be decommissioned as soon as the installation is shut down);

– safe containment: the parts of the installation containing radioactive materials are placed in a reinforced containment structure for a period that is long enough to reach a radiological activity level sufficiently low to envisage release of the site (the "conventional" parts of the installation can be decommissioned as soon as the installation is shut down);

– immediate decommissioning: decommissioning is started as soon as the installation is shut down, without a waiting period, although the decommissioning operations can extend over a long period of time.

The decision to opt for one decommissioning strategy rather than another is influenced by many factors: national regulations, social and economic factors, financing of the operations, availability of waste disposal routes, decommissioning techniques and qualified personnel, exposure of the personnel and the public to ionising radiation as a result of the decommissioning operations, etc. Consequently, practices and regulations differ from one country to another.

In compliance with IAEA recommendations, French policy today aims to induce French BNI licensees to opt for immediate decommissioning strategies.

This strategy moreover avoids placing the technical and financial burden of decommissioning on future generations. At present, the leading French licensees have all made a commitment to immediate decommissioning of the installations currently concerned by the decommissioning process.

ASN also believes that management of the waste resulting from decommissioning operations is a crucial point that determines the correct running of the ongoing decommissioning programmes (availability of disposal routes, management of waste streams). In this respect, the waste management procedures are systematically assessed as part of the review of the overall decommissioning strategies adopted by each licensee.

Decommissioning operations can therefore only begin if appropriate disposal routes are available for all the waste liable to be created. The example of the decommissioning of EDF's first generation reactors is a good illustration of this problem (see point 2|1|2). The French management policy for very low-activity waste is clear and protective: it does not provide release thresholds for this waste, but, on the contrary, for it to follow a specific disposal route in order to confine it in a single place and ensure its traceability. This is why, with regard to the possible recycling of the waste resulting from decommissioning, ASN is attentive to the application of French waste doctrine, which states that material that has or may have been contaminated in the nuclear sector may not be reused outside this sector. Waste from decommissioning may not therefore be used outside the nuclear sector. However, ASN supports initiatives to recycle this waste in the nuclear sector, and the National Radioactive Material and Waste Management Plan (PNGMDR - see chapter 16) includes a recommendation to this effect.

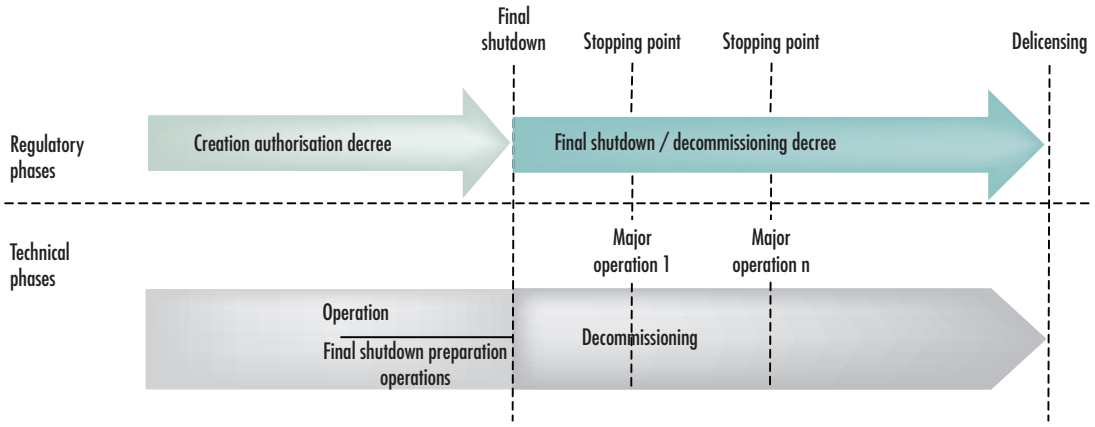
1|2 The legal framework of decommissioning

The technical provisions applicable to installations to be shut down and decommissioned must comply with general safety and radiation protection rules, notably regarding worker external and internal exposure to ionising radiation, the criticality risk, the production of radioactive waste, the discharge of effluents to the environment, and measures to reduce the risk of accidents and mitigate their consequences. Issues relating to safety and the protection of persons and the environment can be significant during active clean-out or decommissioning operations, and must never be neglected, including during passive surveillance phases.

Once the licensee has decided to proceed with final shutdown and decommissioning of its installation, it can no longer be covered by the regulations set by the creation authorisation decree nor the safety specifications associated with the operating phase. In accordance with the provisions of the TSN Act, final shutdown and decommissioning of a nuclear installation is authorised by a new decree, issued on the advice of ASN (see diagram 1). The final shutdown and decommissioning authorisation procedure for a nuclear installation is described in chapter 3.

In order to avoid fragmentation of the decommissioning projects and improve their overall consistency, the file submitted to support the final shutdown and decommissioning application

Diagram 1 : phases in the life of BNI



must explicitly describe all the planned work, from final shutdown to attainment of the target final status and, for each step, must explain the nature and scale of the risks presented by the installation as well as the envisaged means of managing these risks. The decommissioning phase may be preceded by a final shutdown preparation stage, provided for in the initial operating licence. This preparatory phase allows removal of all or part of the source term, as well as preparation for the decommissioning operations (readying of premises, preparation of worksites, training of staff, etc.). It is also during this preparatory phase that installation characterisation operations can be carried out: production of radiological maps, collection of pertinent data (operating history) with a view to decommissioning and so forth.

The TSN Act requires that the safety of an installation in the decommissioning phase be periodically reviewed. The frequency of these reviews is normally 10 years. ASN's objective is to check through these periodic reviews that the level of safety of the installation remains acceptable until it is delicensed, with the implementation of measures proportionate to the risks presented by the installation during decommissioning.

Following decommissioning, a nuclear installation can be delicensed. It is then deleted from the list of BNIs and is no longer attached to the BNI system. To support its delicensing application, the licensee must provide a file demonstrating that the envisaged final status has indeed been reached and describing the state of the site after decommissioning (analysis of the state of the soil and remaining buildings or equipment, etc.). Institutional controls may be implemented, depending on the final status reached. These may set a certain number of restrictions on the use of the site and buildings (use limited to industrial applications for example) or precautionary measures (radiological measurements to be taken in the event of excavation, etc.). ASN may make delicensing of a BNI dependent on the implementation of such controls.

An ASN guide created in 2003 specified the regulatory framework for BNI decommissioning operations, following major work designed to clarify and simplify the administrative procedure while at the same time giving greater importance to safety and radiation protection. A fully revised version of this guide, integrating the regulatory changes introduced by the TSN Act and decree 2007-1557 of 2 November 2007, and the work of the association WENRA, was issued in June 2010 (ASN Guide No.6, available on the web site *www.asn.fr*).

This guide is intended for nuclear licensees and its main objectives are:
– to explain the regulatory procedure laid down by the decree implementing the TSN Act;
– to clarify what ASN expects with regard to the content of certain items of the final shutdown and decommissioning authorisation application files, particularly the decommissioning plan;
– to explain the technical and regulatory aspects of the various phases of decommissioning (preparation for final shutdown, decommissioning, delicensing).

1|3 The financing of decommissioning and radioactive waste management

1|3|1 Reminder of regulatory provisions

Article 20 of Programme Act 2006-739 of 28 June 2006 on the sustainable management of radioactive materials and waste (now codified in books I to V of the Environment Code) creates a system for securing the nuclear costs involved in the decommissioning of nuclear installations and management of radioactive waste. This article is clarified by decree 2007-243 of 23 February 2007 and the order of 21 March 2007 concerning the securing of financing of nuclear costs.

The legal system created by these texts aims to secure the financing of nuclear costs, through implementation of the "polluter pays" principle. It is therefore up to the nuclear licensees to take charge of this financing, by setting up a dedicated portfolio of assets capable of meeting the expected costs. This is done under the direct control of the State, which analyses the situation of the licensees and can prescribe measures should it be seen to be insufficient or inadequate. Whatever the case, the nuclear licensees remain responsible for the satisfactory financing of their long-term expenses.

It stipulates that the licensees must make a conservative assessment of the cost of decommissioning their installations or, for radioactive waste disposal installations, their final closure, maintenance and surveillance costs. They must also evaluate the cost of managing their spent fuels and radioactive waste (I of article 20 of the act of 28 June 2006). They thus submit three-yearly reports and annual update memos.

These costs are divided into five categories (defined in paragraph I of article 2 of the decree of 23 February 2007):
– decommissioning costs, except for long-term management of radioactive waste packages;
– spent fuel management costs, except for long-term management of radioactive waste packages;
– cost of legacy waste recovery and packaging (RCD), except for long-term management of radioactive waste packages;
– cost of long-term management of radioactive waste packages;
– cost of surveillance following disposal facility closure.

These categories are detailed in the list contained in the order of 21 March 2007.

The costs involved must be assessed using a method based on an analysis of the options that could be reasonably envisaged for the operation, on a conservative choice of a reference strategy, on consideration of residual technical uncertainties and performance contingencies, and on consideration of operating experience feedback. These cost assessments, if necessary, comprise a breakdown into variable and fixed costs and, if possible, a method explaining the breakdown of the fixed costs over time. They also, insofar as is possible, comprise an annual schedule of costs, a presentation and justification of the scenarios adopted and methods used and, if necessary, an analysis of the operations carried out, the deviations from the forecasts and consideration of operating experience feedback. The licensees must also give a concise presentation of the assessment of these costs, the extent to which the work in progress is in line with

the forecast schedule, and the possible impact of work progress on the costs.

On 3 January 2008, an agreement was signed by ASN and the General Directorate for Energy and Climate (DGEC) whereby ASN carries out surveillance of these long-term costs. This agreement defines:

– on the one hand, the conditions in which ASN produces the opinions it is required to issue pursuant to article 12, paragraph 4 of the above-mentioned decree of 23 February 2007, on the consistency of the strategies for decommissioning and management of spent fuels and radioactive waste;
– on the other, the conditions in which the DGEC can call on ASN expertise pursuant to article 15, paragraph 2 of the same decree. It in particular stipulates that, as necessary, and under the same conditions as those governing analysis of the three-yearly reports, the DGEC may call on ASN after receiving the annual update memos.

1|3|2 Review of the reports submitted by the licensees

In 2007, all the nuclear installation licensees had submitted their first three-yearly reports pursuant to the provisions of article 20 of the Act of 28 June 2006. ASN had given the Government its opinion on the first three-yearly reports (opinion 2007-AV-037 of 20 November 2007).

In 2008 and 2009, ASN examined the new data forwarded by the licensees in their annual update memos. In 2010, ASN and the DGEC verified the methods used by the licensees to prepare the three-yearly reports and the update memos, and reminded them of the regulatory requirements, particularly with respect to article 2 of the decree. The licensees submitted their second three-yearly report in 2010. ASN gave its opinion to the DGEC (opinion 2011-AV-0107 of 3 February 2011, consultable on the web site), in which it recommends - as a general rule - better substantiation of assessment robustness and clarification of the uncertainties in the decommissioning and waste management operations that impact costs. Furthermore, as ASN had observed the need to check the tools used by the licensees to evaluate the decommissioning costs, it recommended implementing audits, and assisted the DGEC in defining the audit programme that should be conducted in the 2011-2013 period.

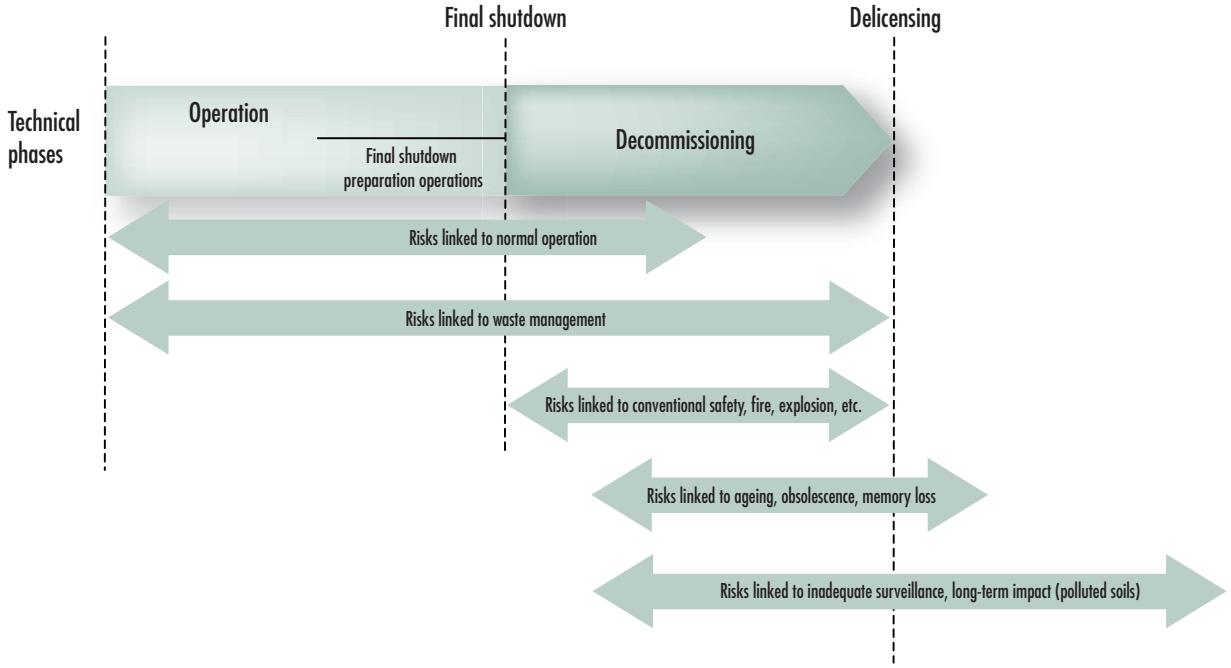
ASN also informed the DGEC of its opinion on decree 2010-1673 of 29 December 2010 amending decree 2007-243 of 23 February 2007 relative to securing of the financial costs of decommissioning. ASN reiterated the importance of maintaining the robustness of the composition of the assets dedicated to covering the decommissioning costs and the asset liquidity level in order to guarantee the effective availability of the funds.

In 2011 ASN started drafting a guide for the licensees, to specify what is required in application of the regulatory provisions relating to cost assessments.

1|4 The implications of decommissioning

Diagram 2 presents the main risks associated with the decommissioning of a nuclear installation and the periods during which these risks are highest.

Diagram 2: principal risks encountered during decommissioning



The risks involved in waste management and which concern safety or radiation protection (multiplication of the number of waste storage sites, storage of irradiating waste) are present throughout the phases in which large amounts of waste are produced and therefore in particular during the decommissioning phase.

The risks presented by the nuclear installation when in operation change as decommissioning progresses. Even if certain risks, such as criticality, quickly disappear, others, such as those related to radiation protection or general working safety (numerous contractors working together, falling loads, work at height, and so on) gradually become predominant. The same goes for the fire or explosion risks (technique of breaking down the structures by "hot points", that is to say those generating heat, sparks or flames).

Similarly, the risks associated with human and organisational factors (change in organisation with respect to the operating phase, frequent use of outside contractors) must be taken into account.

For complex nuclear installations such as NPP reactors, decommissioning work often lasts for more than a decade. This follows on from an operating period that often lasts several decades. Consequently, the risk of loss of the design and operational memory of the nuclear installations must be taken into consideration. The sometimes rapid changes in the physical condition of the installation and the risks it presents raise the question of ensuring that the means of surveillance used are adequate and appropriate at all times. It is often necessary to replace, either temporarily or lastingly, the centralised means of operating surveillance by other more appropriate means of surveillance. Following decommissioning, depending on the end-status achieved and the specific characteristics of each installation (operational history, incidents, etc.), there may be residual risks: soil pollution, areas for which clean-out is technically impossible under acceptable technical and economic conditions, etc. In this case, prior to delicensing of the installation, the licensee must present and justify the envisaged means of ensuring the surveillance of the installation or site. In such cases, institutional controls are imposed to restrict the use of the site.

1|5 Complete clean-out

Nuclear installation decommissioning operations lead to the gradual delicensing of the "nuclear waste zones" to "conventional waste zones". When the licensee is able to prove that there are no activation or contamination migration phenomena in all the structures making up a "nuclear waste zone", this zone can be delicensed on completion of any necessary simple clean-out operations (cleaning the walls of an area using appropriate products for example).

However, if activation or contamination migration phenomena occurred during the operating phase, complete clean-out – that is to say removal of the artificial radioactivity present in the structures themselves – may require operations involving actual physical removal of the parts of these structures considered to be nuclear waste (removing the skin of a concrete wall for instance).

Operations such as these mean that within the structure concerned, a new limit has to be defined between nuclear waste and conventional waste zones. To ensure consistency with the general waste zoning doctrine, the definition of this new waste zoning limit is based on the implementation of independent, successive lines of defence. The requirements of the ASN technical guide on complete clean-out operations, published in 2006 (guide SD3-DEM-02) have been implemented in a large number of installations of various types: research reactors, laboratories, fuel fabrication plants, etc.

At the end of 2008, ASN obtained national operating experience feedback on complete clean-out. The analysis has shown that, in spite of certain technical difficulties, the complete clean-out approach to civil engineering structures has proved its worth. Having listened attentively to the arguments of the various stakeholders, in June 2010 ASN published a new version of the 2006 guide (ASN guide no.14) which aims to specify the requirements in terms of modelling, delicensing of very large structures, use of innovative decontamination techniques, adoption of a suitable approach to the management of deviations and the approval of delicensing, while guaranteeing rigour in the chosen strategy.

2 SITUATION OF NUCLEAR INSTALLATIONS BEING DECOMMISSIONED IN 2011

2|1 EDF NPPs

In 1996, EDF's strategy was deferred decommissioning of its shutdown nuclear installations, namely the six gas-graphite reactors (Bugey 1, Saint Laurent A1 and A2, Chinon A1, A2 and A3), the heavy water reactor at Brennilis, the PWR at Chooz A and the fast neutron reactor at Creys-Malville. In April 2001, at the instigation of ASN, EDF decided to change its strategy and adopt a programme for the decommissioning of its first-generation plants, which is now scheduled for completion in 2036.

This new strategy was reviewed by the competent Advisory Committee of Experts in March 2004. On the basis of this review, ASN concluded that the decommissioning strategy for the first generation reactors adopted by EDF, as well as the programme and schedule, are acceptable in terms of safety and radiation protection, provided that a certain number of requests are taken into account and that there is compliance with the undertakings made by EDF with regard to the issues of decommissioning feasibility, safety, radiation protection and waste and effluent management. In July 2009, EDF forwarded a decommissioning strategy update file. In this file, EDF confirmed the position it had adopted in April 2001. The file includes a summary of the progress of the dismantling programme and identifies the forthcoming major milestones. Current thinking on the decommissioning strategy for the PWR reactors in operation is presented.

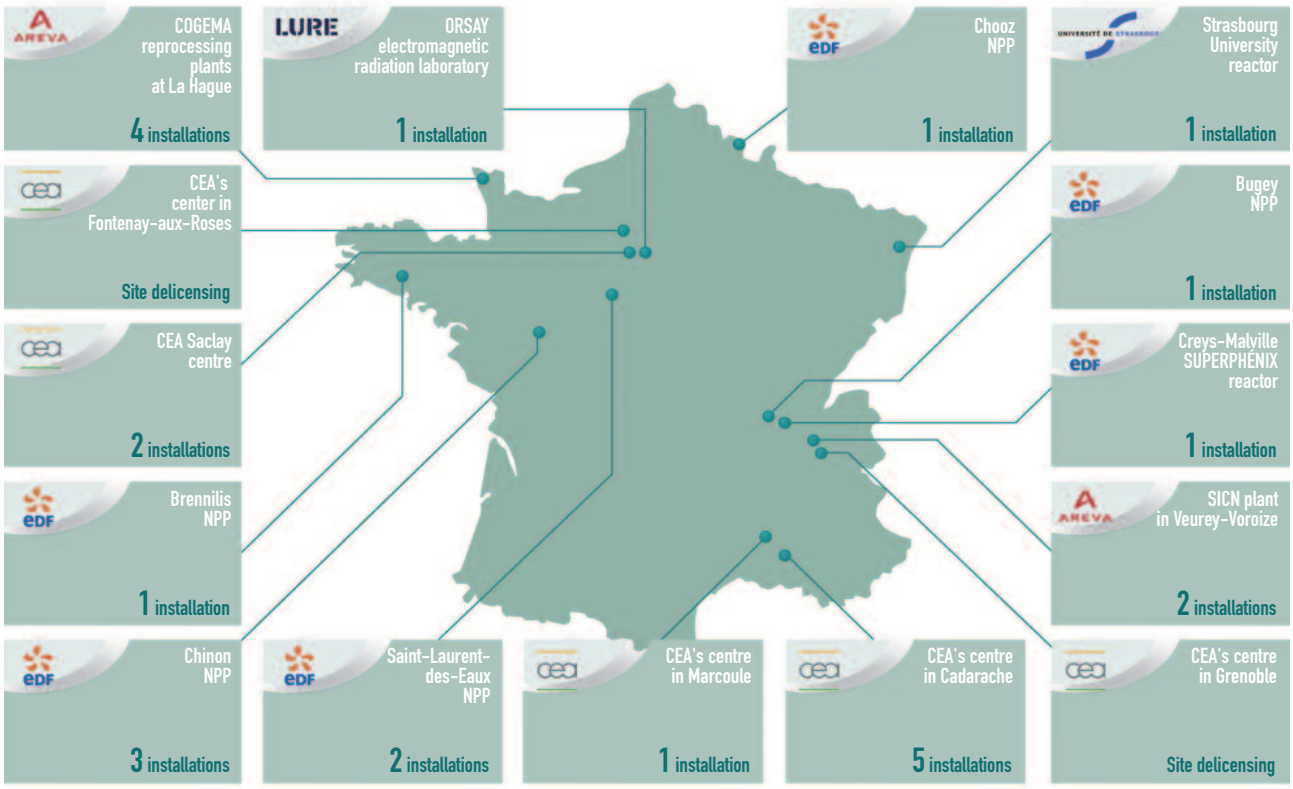
The conclusion after examining the file is that the principles of the strategy are basically satisfactory, but some additions are required, particularly with regard to alternative solutions for the management of graphite waste.

Internal authorisations

In a letter dated 9 February 2004, ASN authorised EDF to set up an internal authorisation system for the installations concerned by the decommissioning programme. This approach addresses a key requirement, namely to keep the safety specifications of an installation permanently up to date.

The system of internal authorisations is now governed by decree 2007-1557 of 2 November 2007 (see chapter 3) concerning BNIs and the regulation of the nuclear safety of the transport of radioactive substances. ASN decision 2008-DC-106 of 11 July 2008 specifies the ASN requirements for implementation of the provisions of the above decree relative to internal authorisations. Pursuant to article 3 of this decision, EDF submitted a file to ASN presenting an update of its internal authorisation system, concerning the decommissioning operations, with a view to having it approved by the ASN Commission. This file is being examined by the ASN.

Installations shut down or undergoing decommissioning in 2011



Experience feedback from the Fukushima nuclear accident

To take into account the experience feedback from the nuclear accident that occurred at the Fukushima Daiichi NPP in Japan, ASN took decision 2011-DC-0213 of 5 May 2011 instructing Electricité de France (EDF) to carry out a complementary safety assessment of some of its BNIs in the light of the Fukushima Daiichi accident

This decision applies equally well to the EDF reactors in operation, the reactors undergoing decommissioning mentioned below, and the fuel evacuation facility (APEC, situated on the EDF Creys-Malville site in the Isère *département*). ASN has asked that the reports for the EDF reactors under decommissioning and the APEC be submitted by 15 September 2012.

The report presenting the methodology EDF will use for the reactor complementary safety assessments was examined by the Advisory Committee of Experts on 6 July 2011.

2|1|1 The Brennilis NPP

The Brennilis NPP is an industrial prototype of a heavy water-moderated, carbon dioxide-cooled NPP, operated from 1966 to 1985. Partial decommissioning operations were carried out from 1997 to mid-2007 (plugging of circuits, decommissioning of certain heavy water and carbon dioxides circuits and electro-mechanical components, demolition of non-nuclear buildings, etc.).

The decree 2006-147 of 9 February 2006 authorising EDF to proceed with the complete decommissioning of the installation was abrogated by the State Council on 6 June 2007 on the grounds that the impact study, in application of directive 85/337/CEE of 27 June, amended, should have been made available to the public before the Government delivered the authorisation. The operations that could be carried out, notably repackaging and removal of the legacy waste, were specified by ASN in decision 2007-DC-0067 of 2 October 2007 (amended), pending the signing of a new decree authorising its complete decommissioning.

A new complete decommissioning authorisation application file was submitted by EDF on 25 July 2008. In March 2010, the investigation commission delivered an unfavourable opinion for the project, on the grounds that no urgent need to decommission the reactor block had been demonstrated and that decommissioning was premature as long as ICEDA – the activated waste packaging and interim storage installation – was not operational. It nevertheless considered that EDF should be authorised, as of now, to complete the inventory of the initial radiological and chemical status of the site, to complete the effluent treatment station (STE) decommissioning operations, to clean out and fill in the effluent discharge channel leading to the river Ellez, to clean out the diffuse pollution areas, and lastly, start decommissioning of the heat exchangers following their radiological characterisation. After hearing EDF and the local information committee (CLI) of the Monts d'Arrée, the ASN commission gave the Government a favourable opinion (opinion 2011-AV-0122 of 5 July 2011) to the draft partial decommissioning decree, authorising performance of the operations described above, in accordance with the commission's opinion.

The partial decommissioning decree 2011-886 of 27 July 2011 was published in the *Official Gazette* of 28 July 2011. EDF engaged a new procedure for complete decommissioning by submitting an application file in December 2011.

Pursuant to article 37 of the Euratom Treaty, the European Commission was also consulted with respect to the filed authorisation application, and delivered a favourable opinion in May 2010.

Furthermore, through decisions 2011-DC-0239 and 2011-DC-0240 of 1 September 2011, and after receiving a favourable opinion from the CODERST (Departmental Council for the Environment and for Health and Technological Risks), ASN has regulated the conditions and limits of water intakes and effluent discharges.

2|1|2 Natural Uranium Graphite Gas Reactors (UNGG)

During the investigation of the file submitted by EDF in June 2009 concerning updating of the strategy for NPP decommissioning, ASN reaffirmed its strong support for an immediate decommissioning strategy. It nevertheless notes that where UNGGs are concerned, the question of the disposal route for graphite waste complicates implementation of this strategy.

ASN has confirmed that it is in favour of setting up a disposal centre for low-level long-lived waste, and graphite waste in particular, as quickly as possible. It has set 2012 as a first intermediate step to assess the situation regarding the creation of a graphite waste disposal centre, and will make a decision at that time. The progress of this project will then determine ASN's position - to be made known in 2014 at the latest - concerning the need for EDF to build an storage site for graphite waste in order to continue the decommissioning of the UNGGs.

Bugey 1 reactor

The final shutdown and work continued until the end of 2008, when the complete decommissioning decree for the installation was signed (decree 2008-1197 of 18 November 2008). At the end of 2009, EDF investigated the lower part of the Bugey 1 reactor compartment (taking radiological measurements, photos, dimensions, samples, etc.) to optimally prepare for its future decommissioning. The compartment was found to be in good condition with relatively low dust loading. The file concerning the integrity of the reactor internal structures will be examined by ASN.

The decommissioning preparation work, excluding the reactor vessel, started in November 2010 and continued in 2011. This work consisted in freeing up the premises necessary for the installation of the reactor vessel decommissioning "support" functions.

Chinon A1, A2 and A3 reactors

The old Chinon A1, Chinon A2 and Chinon A3 reactors were partially decommissioned and transformed into storage facilities for their own equipment. These operations were authorised by the decrees of 11 October 1982, 7 February 1991 and 27 August 1996, respectively as amended on 25 November 2005, respectively.





Views of the Saint-Laurent-des-Eaux NPP before and after the works

The work to characterise the rubble in the underground premises was completed in December 2010. The first observations showed that the majority of the underground rooms are empty or partially backfilled. The first analysis results confirm the presence of contamination in certain rooms.

The additional sampling operations on the Chinon A2 reactor were completed in March 2011.

The studies prior to the work to decontaminate the ground between the Chinon A2-A3 reactors are continuing.

The complete decommissioning of the Chinon A3 reactor vessel was authorised by decree 2010-511 of 18 May 2010. The main work carried out in 2011 was the preparation for decommissioning of the heat exchangers (the first step in the decommissioning of the installation).

Furthermore, in December 2010, under article 26 of decree 2007-1557 of 2 November 2007, EDF lodged a file with ASN applying for the modification of certain prescriptions of the ministerial order of 20 May 2003, amended by the order of 17 August 2005, authorising EDF to continue the water intakes and liquid and gaseous discharges for the operation of the Chinon site. This file aims at modifying the atmospheric discharge conditions to allow the decommissioning work on the Chinon A3 heat exchangers to be performed. This file, which is currently being examined, was made available for public consultation in July 2011.

Furthermore, pursuant to article 37 of the Euratom Treaty, on 20 December 2011 the European Commission gave a favourable opinion for the project to discharge radioactive effluents resulting from the first phase of decommissioning of the Chinon A3 reactor.

Saint-Laurent-des-Eaux A1 and A2 reactors

Complete decommissioning of the installation, whose final shutdown was declared in April 1994, was authorised by decree 2010-511 of 18 May 2010.

The work to renovate the instrumentation of the discharge stacks and reorganise the waste storage areas continued in 2011.

For Saint-Laurent A1 reactor, the pre-clean-out work on the pool and its structural reconstitution were carried out in 2011 with a view to using the pool for the decommissioning of the reactor compartments.

2|1|3 CHOOZ A reactor (Ardennes NPP)

This reactor was the first PWR built in France. It operated from 1967 to 1991.

For the partial decommissioning of the reactor, the decree of 19 March 1999 authorised the modification of the existing installation to convert it into a storage installation for its own equipment left on site and thus create a new BNI called CNA-D. Its complete decommissioning was authorised by decree 2007-1395 published in the *Official Gazette* on 27 September 2007.

By decision 2010-DC-0202 of 7 December 2010, ASN authorised the start of primary system decommissioning, apart from reactor vessel, subject to compliance with a number of technical requirements, and thus lifted the stopping point mentioned in paragraph III of article 2 of the Chooz A decommissioning decree.

Two steam generators were dismantled in 2011.



Removal of a steam generator at Chooz – October 2011

2|1|4 SUPERPHÉNIX reactor

The SUPERPHÉNIX fast neutron reactor, a sodium-cooled industrial prototype, is located at Creys-Malville. This installation is associated with another BNI, the fuel evacuation facility (APEC), consisting mainly of a storage pool for fuel removed from the Superphénix reactor vessel. The final shutdown authorisation for this reactor was given in decree 98-1305 of 30 December 1998. In early 2003, all the fuel assemblies were removed from the reactor and stored in the APEC. The four reactor coolant pumps were decommissioned in 2010, while the decommissioning of the intermediate heat exchangers, authorised by ASN on 3 August 2010, is in progress and should be completed in 2012.

ASN has authorised EDF to put the sodium treatment facility (TNA) into service, and to store the blocks of soda concrete produced by TNA through decision 2010-DC-0187 of 6 July 2010. The sodium treatment process is carried out by hydrolysis and leads to the production of soda. This soda is then used as the primary component of the concrete packages to be produced in the cement encapsulation facility and stored for a period on the site to allow decay prior to removal.

The treatment of sodium from the primary and secondary cooling systems in TNA is in progress and should end in 2016. More than a quarter of the total sodium has been treated to date.

Fuel evacuation facility (APEC)

This facility was commissioned on 25 July 2000 by the Ministers for Industry and the Environment. The spent fuel assemblies removed from the SUPERPHÉNIX reactor are treated and placed in the APEC pool.

The facility now includes within its bounds the storage area for the soda concrete packages produced by the sodium treatment plant.

EDF plans submitting the periodic safety review file at the end of 2012.

2|2 CEA installations

In December 2006, the Advisory Committees of Experts for plants and for waste issued their opinions on the overall decommissioning strategy for CEA's civil installations. This was considered to be on the whole satisfactory from the safety standpoint. The decommissioning schedules for the installations concerned are consistent with the strategy adopted. ASN considers that they should enable an acceptable level of safety to be maintained in these installations until they are delicensed. The documents outlining CEA's decommissioning strategy will be updated and reassessed every five years. Nevertheless, at the request of ASN, the CEA delivered an interim report on the updating of its decommissioning strategy, justifying the chosen deadlines and explaining the reasons, technical or otherwise, for the many delays with respect to the schedule. In response, ASN reiterated its position concerning the use of institutional controls, the priority given to immediate decommissioning, the clean-out levels to attain, and the schedule objectives for certain decommissioning operations.

2|2|1 Fontenay-aux-Roses centre

CEA's first research centre, dating from 1946 and located in Fontenay-aux-Roses (Hauts-de-Seine *département*) is continuing to move away from nuclear activities to concentrate on research into the life sciences. The decommissioning of the two installations present on the site, the Process installation (BNI 165) and the Support installation (BNI 166), was authorised by decrees 2006-772 and 2006-771 of 30 June 2006 published in the *Official Gazette* of 2 July 2006. Since January 2008, the laboratory clean-out and installation decommissioning programme has been built around a project called Aladin. This project uses the experience feedback from the Grenoble Passage project. These operations were initially planned to last about ten years, but the CEA has already informed ASN that, due to the strong presumptions of radioactive contamination underneath building 18, the decommissioning operations will be extended until 2012 for BNI 165, and 2025 for BNI 166. These dates are announced without allowing for any major contingencies that could arise during the works.

Before the administrative delicensing of the BNIs of the centre, ASN has asked the CEA to characterise the soils and propose a solution for their rehabilitation if necessary. The rehabilitation work sites are continuing, and the results of the hydrogeological study that started in 2009 should be submitted in 2013.

The Process installation (BNI 165)

This BNI, which comprises two buildings (buildings 18 and 52/2), accommodated nuclear fuel reprocessing research and development activities. These activities were stopped in 1985 for building 52/2 and in 1995 for building 18.

The decommissioning file for the PETRUS unit, initially omitted in the safety analysis report, submitted in support of the application for decree 2006-772, was submitted by the licensee in summer 2010 and was the subject in 2011 to decision 2011-DC-0245 of 11 October 2001 subjecting these operations to its authorisation, pursuant to article 4.2 of the abovementioned decree. The decommissioning work for this unit, which contains one of the largest shielded lines of building 18, should start in 2012.

The SUPPORT installation (BNI 166)

The purpose of this installation is initially to support the decommissioning operations to decommission the Process installation (BNI 165), before being decommissioned in turn.

This BNI is used for storage and removal of radioactive effluents from the site as well as the treatment of solid waste, storage in a decay pit of irradiated drums pending removal and storage of drums of low and very low level (VLL) waste pending shipment to a repository.

To improve the organisation of its activities and hence the safety of its installation, the CEA has installed a new waste drum characterisation line called SANDRA B. It submitted an application file in July 2010 and ASN authorised its entry into service in March 2011.

2|2|2 The Grenoble centre

The CEA Grenoble centre was inaugurated in January 1959 and the site's nuclear activities grew in line with the development of reactor technologies.

As from the 1980's, the nuclear activities were gradually transferred to other centres. Now the Grenoble centre conducts its research and development in the fields of renewable energies, health and microtechnology.

In 2002 the CEA centre in Grenoble launched a site delicensing process. This project, called "Passage", aims for nuclear activities to be completely over by 2012.

The site housed six nuclear installations which have been gradually phasing out their activities and moving to the decommissioning phase with the ultimate aim of delicensing. Delicensing of the SILOETTE reactor (BNI 21) was declared in 2007.

The CEA Grenoble centre has organised a large-scale event to highlight the progress of the "Passage" project, uniting all the contributing stakeholders. It was held on 1 July 2011 in the presence of the chairman of ASN, who underlined the quality of the work carried out and urged the CEA to continue its efforts in compliance with the regulations.

The departure of part of the CEA teams from the "Passage" project must not negatively impact the running of the operations. ASN thus asked the CEA Grenoble to remain vigilant and maintain the means enabling it to ensure maximum control over the safety of its facilities, in spite of the gradual reduction of the risks in terms of worker safety and radiation protection.

Radioactive effluent and solid waste treatment station and decay storage (STED) (BNIs 36 and 79)

The STED decommissioning operations were authorised for a period of eight years by decree 2008-980 of 18 September 2008, published in the *Official Gazette* on 21 September 2008.

The BNI 79 (STED) included in the bounds of BNI 36 is a decay storage facility for high-activity (HA) waste, which was completely emptied in 2010. There is currently no HA waste on the site.

The buildings have either already been destroyed or are undergoing dismantling in accordance with the abovementioned decree. The work to rehabilitate the ground is continuing, and part of the radiologically contaminated soils has been excavated.

Active material analysis laboratory (LAMA - BNI 61)

The active material analysis laboratory (LAMA) entered service in 1961. This laboratory conducted post-irradiation studies of uranium and plutonium based nuclear fuels, and structural materials from nuclear reactors. The scientific research activities ended in 2002.

Decommissioning of the LAMA was authorised by decree 2008-981 of 18 September 2008 and published in the *Official Gazette* of 21 September 2008. The year 2011 was marked by the delicensing of a portion of the premises of the installation by internal authorisation, with the approval of ASN. An inspection carried out at the end of summer 2011 validated the internal authorisation system in order proceed with delicensing of the waste zoning.

The CEA is continuing the clean-out of the very high level (VHL) cells and could use this procedure for the delicensing of the VHL cells by 2013.

MÉLUSINE reactor (BNI 19)

MÉLUSINE is an old pool reactor intended for fundamental research into structures and the production of radionuclides. Final shutdown was declared in 1994. The decree 2004-26 authorising CEA to modify the Mélusine reactor prior to its decommissioning and delicensing was published in the *Official Gazette* on 9 January 2004. The clean-out work has been completed and in mid-2009, CEA submitted a file applying for BNI delicensing. ASN consulted the Prefect of the Isère *département*, the parishes concerned and the local information committee (CLI), which gave a favourable opinion in summer 2010. Nevertheless, owing to the residual presence of three zones that did not comply with the chosen clean-out criteria, ASN asked the CEA to continue its cleaning out in order to achieve complete clean-out or to introduce institutional controls over the areas in question.

The CEA then proceeded with the clean-out of the three particular points in the first half of 2011. Thus, the ministerial order of 15 December 2011 approving ASN decision 2011-DC-250 for the delicensing of BNI 19 was published in the *Official Gazette* of 22 December 2011. Consequently, this installation is no longer subject to the BNI legal system.

SILOÉ reactor (BNI 20)

This former research reactor, currently undergoing decommissioning and clean-out, was primarily used for technological irradiation of structural materials and nuclear fuels. Since the decree of 26 January 2005, authorising final shutdown and decommissioning of the installations, operations have been continuing. All the internal structures have been dismantled, but the activity level of the pool block turned out to be higher than predicted in the initially envisaged decommissioning scenario. Despite a one year extension to the operations time initially prescribed in decree 2010-111 of 1 February 2010, the CEA reported further difficulties in treating the basemat (migration of low level contamination within the basemat). ASN has asked the CEA to present its strategy for completing the basemat clean-out work.

2|2|3 The Cadarache centre installations undergoing decommissioning

ASN considers that decommissioning of the Cadarache centre installations is proceeding satisfactorily on the whole. The example of the decommissioning of the HARMONIE reactor, delicensed on 10 June 2009, illustrates the feasibility of complete decommissioning.

Nevertheless, all the lessons must be drawn from the malfunctions associated with the ATPu incident (discovery of an underestimation of the quantity of fissile materials retained in the



ASN inspection of the delicensing of the SILOE reactor basemat – December 2011



View of the RAPSODIE reactor

glove-boxes) and declared by the CEA on 6 October 2009. The CEA thus indicated that ways of improving the quality of the information feedback chain had been identified. It pointed out that further to this incident, it has established a new procedure for immediate information feedback, up to CEA General Administrator level if justified by the nature of the incident.

RAPSODIE reactor and fuel assembly shearing laboratory (LDAC)

Final shutdown of RAPSODIE, an experimental fast neutron reactor which ceased operations in 1983, was declared in 1985. The work designed to partially decommission the reactor, which began in 1987, was interrupted in 1994 following a fatal accident during washing of a sodium tank. This accident, which emphasizes the risks involved in decommissioning operations, necessitated rehabilitation and partial clean-out work, which was completed at the end of 1997. Since then, clean-out and decommissioning work limited to certain equipment items has been resumed, along with waste removal. Renovation operations have also been carried out.

The LDAC, located within the same BNI as the RAPSODIE reactor, was designed for inspection and examination of spent fuel from the RAPSODIE reactor or other fast neutron reactors. This laboratory has been shut down since 1997. It has been cleaned-out, is under surveillance and awaiting decommissioning.

In 2007, ASN approved a revised version of the safety requirements for the operations involved in preparing final shutdown, enabling the licensee to carry out a number of reactor auxiliary equipment clean-out and dismantling operations. In 2008, CEA submitted a file applying for final shutdown and complete decommissioning. ASN informed CEA that its file was incomplete. The decommissioning strategy is currently being revised. A new file will be submitted on completion of this process. ASN reminded the CEA in 2011 that it wanted the decommissioning authorisation application file to be submitted without delay.

Enriched uranium processing facilities (ATUEs)

The ATUEs converted the uranium hexafluoride (UF_6) from the isotopic enrichment plants into sinterable oxide. They were also used for the chemical reprocessing of fuel element fabrication scraps to recover the enriched uranium they contain. The facility was also equipped with a low level organic liquid incinerator. Production in the facilities ended in July 1995 and the incinerator was shut down at the end of 1997.

The final shutdown and decommissioning decree for the facility was issued in February 2006, and prescribed work completion within 5 years. The year 2006 saw completion of the decommissioning phase for the process equipment.

The phases of structural dismantling and complete clean-out of the civil engineering continued from that time, but with several interruptions due to technical and economic difficulties. Owing to these difficulties, the licensee submitted a decree modification application file in June 2010 requesting a five-year extension of the time scale to complete these works.

Because of the significant extension in the duration of the planned decommissioning operations (10 years instead of the 5 years initially planned) and the increase in the quantity of very low level (VLL) waste to be produced, the modifications envisaged by the licensee were considered to be significant and therefore require a new authorisation.

The licensee was thus asked to submit a complete authorisation modification application file as rapidly as possible, so that it can be subject to the public consultations provided for in application of the "TSN" Act.

Pending transmission of this file and its examination prior to the modification of the final shutdown and decommissioning decree for the facility, the provisions of the initial decree of 2006 remain applicable and the clean-out and decommissioning operations continue in this framework



The enriched uranium processing facilities (ATUEs)

Plutonium technology facility (ATPu)

The ATPu produced plutonium-based fuel elements, initially intended for fast neutron or experimental reactors and then, as of the 1990s, for PWRs using MOX fuel. The activities of the LPC were associated with those of the ATPu: physical and chemical checks and metallurgical examination of plutonium-based products, processing of effluents and waste contaminated with alpha emitters. AREVA NC has been the industrial operator since 1994, initially in charge of operation and currently in charge of decommissioning. From a regulatory standpoint, CEA nonetheless remains the nuclear licensee for these installations.

Because it was impossible to demonstrate the seismic resistance of these facilities in accordance with the standards in effect[1], AREVA NC ended the commercial activities of the ATPu in August 2003. Since then, CEA has been involved in a final shutdown and decommissioning process for the two installations. The corresponding application files, sent to ASN in 2006, were the subject of a public inquiry at the beginning of the summer of 2008 and resulted in the *Official Gazette* publishing final shutdown and decommissioning decrees 2009-262 and 2009-263 on 6 March 2009.

A first phase consisted in recovering and packaging the manufacturing discards and the materials contained in the ATPu and the Chemical Purification Laboratory (LPC.) This phase, which is necessary to reduce the risks inherent in these materials prior to decommissioning of the installations, ended in the first half of 2008. The nuclear materials removed in this phase were repackaged and removed from the facilities, essentially being transferred to the AREVA NC La Hague site.

On 6 October 2009, CEA Cadarache informed ASN that the amounts of plutonium in the installation's glove boxes had been underestimated at about 8 kg during the installation operating period, whereas the quantities recovered to date stood at about 22kg and CEA estimated that the total quantity could even reach 39kg at the end of decommissioning. This significant incident, evidencing deficiencies in the procedures for fissile material accounting and tracking, was rated level 2 on the INES scale by ASN.

Further to this incident, two ASN decisions taken in October 2009 suspended the ongoing decommissioning operations in the facility and defined the conditions for work resumption.

During the years 2010 and 2011, ASN gradually authorised the CEA to resume the decommissioning activities on the basis of specific safety analysis files. Two ASN decisions taken in October 2010 define the technical requirements governing the decommissioning operations.

ASN is very attentive to the integration of experience feedback from the incident of 2009, particularly in the aspects relating to the estimation of fissile material quantities and criticality safety.

The association Les Amis de la Terre, the Collectif Antinucléaire 13, and some private individuals, appealed to the *Conseil d'État* (Council of State) in February 2011 to suspend the ATPu decommissioning activities.

With regard to the summary proceedings aiming at the immediate suspension of the activities, ASN was called upon to draw up the statement of case in defence of the State.

By order of 18 March 2011, the interim relief judge rejected the suspension request, having considered it unfounded.

As for the decree cancellation petition, it will undergo a second examination by the Council of State in the coming months.

Chemical purification laboratory (LPC)

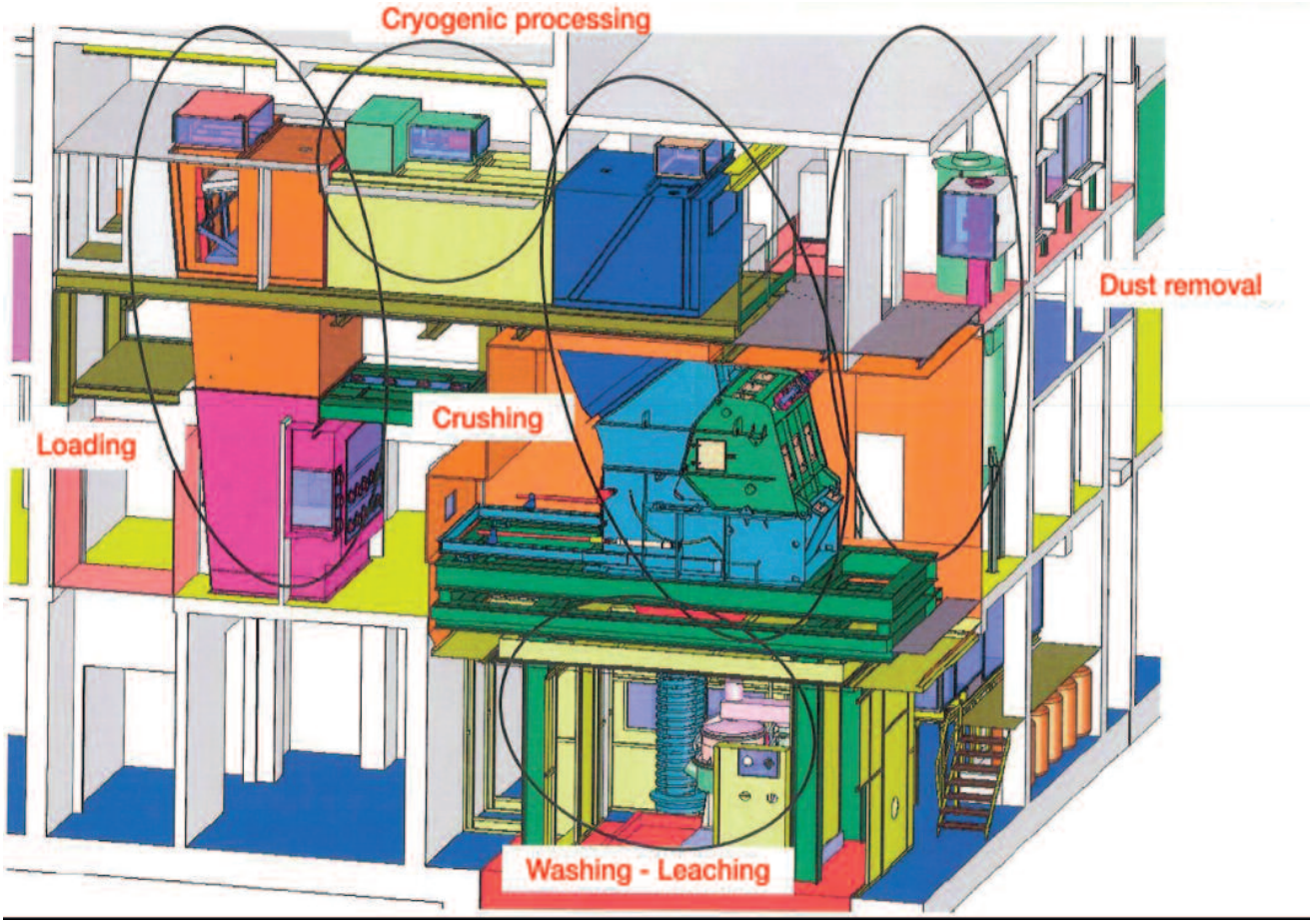
Operation of the LPC, which primarily served for the treatment of effluents and the analysis of the ATPu production, was stopped in 2003. The operations for final cessation of operations carried out as from 2003 consisted notably in removing the radioactive material present in the facilities by emptying and rinsing the effluent tanks and treatment equipment.

The final shutdown and decommissioning decree for the LPC, dated 6 March 2009, provides for six steps: The first step, of an estimated duration of seven years, is currently under way.

It consists in removing the first containment barrier within which the nuclear material was prepared.

1. The unsatisfactory resistance of the ATPu to the reference earthquake was confirmed by the complementary safety assessment (CSA) requested by ASN further to the Fukushima accident in March 2011 and submitted by the CEA in September 2011. This CSA confirmed the need to decommission and clean-out this facility as early as possible and plans for additional emergency management measures.

Schematic diagram of the LPC cryogenic processing unit



The decree of 6 March 2009 included two stopping points for this step, subject to the prior agreement of ASN, relative firstly to the decommissioning of the cryogenic processing unit, and secondly to the active tanks and associated equipment.

On 20 October 2011 ASN took two decisions, firstly to partially lift the stopping point concerning decommissioning of the active tanks, and secondly to totally lift the stopping point for decommissioning of the cryogenic processing unit. These decisions also include additional requirements, relating in particular to safety and the prevention of criticality risks in the tank decommissioning operations.

2|2|4 The Saclay centre installations undergoing decommissioning

The site decommissioning plan includes two BNIs that are definitively shut down, two ICPEs (Installations Classified on Environmental Protection Grounds), namely EL2 and et EL3, which were previously BNIs but which have not been completely dismantled due to the absence of a disposal route for HLW-LL waste, and three BNIs in operation but with sections having ceased their activity in which operations to prepare for final shutdown are currently being carried out (BNI 35, BNI 72 and BNI 50).

High activity laboratory (LHA) (BNI 49)

The high level activity laboratory (LHA) comprises several laboratories intended for research into or production of various radionuclides. On completion of the decommissioning and clean-out work authorised by decree 2008-979 of 18 September 2008, published in the *Official Gazette* on 21 September 2008, only two laboratories should remain under the ICPE system by 2018.

Dismantling work on the active effluent inter-cell tanks is continuing.

ASN has asked the licensee to improve monitoring of the outside contractors who are carrying out all the decommissioning work.

ULYSSE reactor (BNI 18)

Built in 1961 in the CEA Saclay centre, this reactor was used for teaching and experimental purposes. Operating authorisation was granted on 16 June 1967. The total energy delivered in operation is around 115 MWh, which is low. The end of reactor

operation was declared on 9 February 2007, and the final shutdown and decommissioning application was filed with the MSNR (Nuclear Safety and Radiation Protection Mission) in June 2009. ASN gave its opinion in 2010, considering that the file was admissible, but asked that some additional information be integrated before the public inquiry. The file is currently being reviewed.

CELIMENE cell (BNI 50)

The CELIMENE cell, adjoining the EL3 reactor, was commissioned in 1965 for review of the fuels from this reactor. This cell is now attached to the spent fuel testing laboratory (LECI). The last fuel rods were removed in 1995 and a number of partial clean-out operations conducted until 1998. Experimental clean-out methods using the ASPILASER technique were tested in this cell in 2009.

2|3 AREVA installations

2|3|1 The spent fuel reprocessing plant UP2 400 and the associated facilities

UP2 400 spent fuel reprocessing plant and associated facilities

HAO / Sud (High Activity Oxide / South) (BNI 80):

The situation of UP2 400 is described in chapter 13. The former UP2 400 reprocessing plant and the associated facilities (BNI 33, 38, 47 and 80), which have been shut down since 2004, are scheduled for decommissioning.

The final shutdown and decommissioning application file for BNI 80 (HAO) was submitted at the beginning of 2008. The final shutdown and decommissioning decree for this facility, dated 31 July 2009, was published in the *Official Gazette* on 4 August 2009. This decree provides for three steps. The first step, planned to continue until the end of 2015, is in progress. It aims at carrying out the majority of the decommissioning operations of the HAO / South facility, while the HAO / North facility, still in operation, is to be decommissioned in a second phase.

The abovementioned final shutdown and decommissioning decree of 31 July 2009 provides for four stopping points that are subject to prior ASN agreement.

The first of these stopping points concerns the recovery and packaging operations for the waste contained in the HAO silo and in the organised disposal of hulls (SOC). Between July and December 2010, the licensee sent ASN a set of files relative to the safety of these operations, which are subject to a technical examination.

A first draft decision on the partial lifting of this stopping point is currently being prepared.

BNI 33, 38 and ELAN IIB (BNI 47):

– AT1 pilot reprocessing plant
  The AT1 pilot plant reprocessed fuel from the RAPSODIE and PHÉNIX fast breeder reactors from 1969 to 1979. It is part of BNI 38 (STE2).
  Clean-out of this installation began in 1982 and ended in 2001, at which time ASN formally acknowledged completion of clean-out, civil engineering structures excluded, and entry into surveillance status. This installation is not however delicensed as its complete decommissioning will be part of the decommissioning application for the UP2 400 plant as a whole.
– Caesium-137 and strontium-90 source fabrication installation (ÉLAN IIB).
  The ÉLAN IIB (BNI 47) installation manufactured caesium-137 and strontium-90 sources until 1973. The initial decommissioning operations undertaken by the Technicatome firm ended in November 1991. A large number of renovation and maintenance operations took place during 2002 and 2003 (upgrading of the ventilation system, radiological mapping, etc.) with a view to resuming decommissioning operations. All the installation upgrade work and the work preparatory to decommissioning of the installation was carried out during 2004 and 2005.

In October 2008, AREVA NC submitted three final shutdown and decommissioning authorisation applications for BNIs 33 (UP2 400), 38 (STE2 and AT1 facility) and 47 (ELAN IIB). Further to the examination conducted by ASN, these files were judged inadmissible by the ministers in charge of nuclear safety[2]. AREVA thus made a number of additions to its files in November and December 2009.

In a letter dated 13 January 2010, the ministers in charge of nuclear safety, on the basis of ASN's proposal, judged these files admissible. The public inquiry was held from 27 September to 27 October 2010, and concluded with a favourable opinion from the inquiry commissioners.

On completion of the technical examination of the files submitted by the licensee, the Advisory Committee of Experts for plants (GPU) examined the possible conditions for authorising decommissioning of these facilities, at its meeting of 23 March 2011. The GPU indicates in its opinion sent on 20 April 2011 that the decommissioning measures defined by AREVA NC display nothing unacceptable from the point of view of safety, radiation protection or the management of waste and effluents. The opinion of the GPU nevertheless reveals the need for the operator to provide a large number of complementary studies, particularly with respect to the risks associated with earthquakes and the feasibility and safety of certain legacy waste recovery and packaging operations.

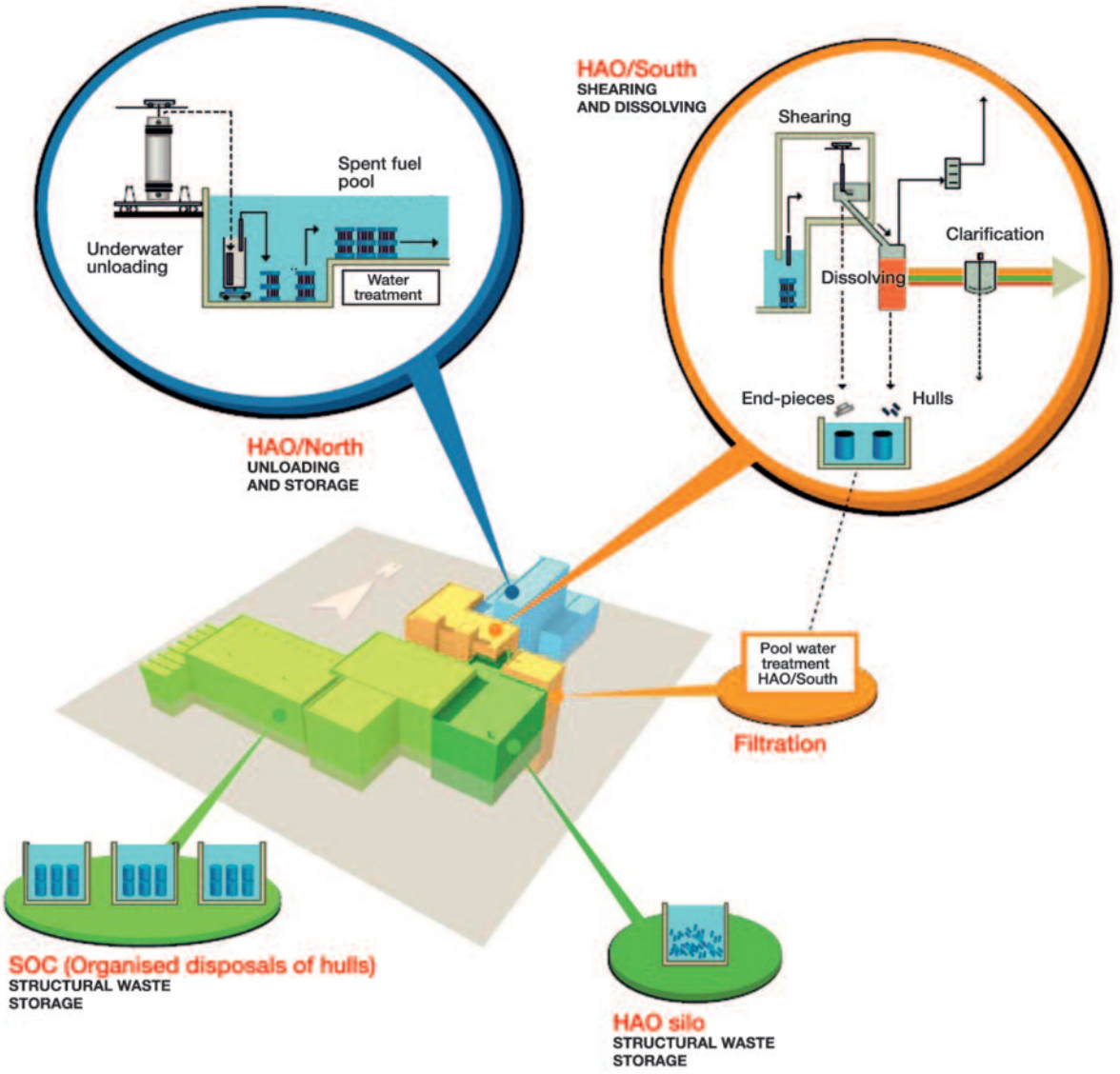
These decommissioning files are currently being examined.

COMURHEX plant of Pierrelatte (BNI 105)

Since 1961, the activity of the COMURHEX Pierrelatte plant on the Tricastin nuclear platform has been the chemical conversion

2. It is the MSNR (Nuclear Safety and Radiation Protection Mission) within the Ministry of Ecology, Sustainable Development, Transport and Housing, that delivers the decisions, based on the ASN proposal.

The HAO facility (AREVA)



of uranium (fluorination of uranium tetrafluoride, UF_4, into uranium hexafluoride, UF_6). This step precedes the enrichment of UF_6 carried out by EURODIF.

The COMURHEX Pierrelatte plant comprises several facilities with different administrative statuses: there are ICPEs ensuring the fluorination of natural uranium, and BNI 105 which fluorinates reprocessed uranium. This BNI definitively stopped operation at the end of 2008.

A project for the creation of a new BNI to take over from BNI 105 is being studied.

In May 2011, at the request of ASN, the BNI 105 licensee submitted a final shutdown and decommissioning application file. ASN judged this file inadmissible, mainly due to the inadequacy of the impact study.

Moreover, the coexistence on the same site of a BNI and various ICPEs displaying associated risks and possessing a number of common equipment items, considerably complicates administrative tracking and regulation of the facilities, currently ensured by the DREAL (Regional Directorate for the Environment, Planning and Housing) for the ICPEs, and ASN for the BNI. In addition, this situation is not in conformity with the provisions of the TSN act, which in such cases provides for all the facilities to be included within the perimeter of the BNI, and for ASN to regulate all the facilities, including the ICPEs.

Consequently, to bring the administrative situation of BNI 105 into conformity with the applicable requirements, ASN decided in October 2011 to propose a draft decree to the ministers responsible for nuclear safety, modifying the perimeter of BNI 105 in order to include all the site's facilities in it.

2|3|2 SICN plant in Veurey-Voroize

Two nuclear installations, BNIs 65 and 90, located on the site of the SICN company (AREVA group) in Veurey-Voroize, constitute this former nuclear fuel fabrication plant. Fuel fabrication ceased

definitively at the beginning of the years 2000. Final shutdown operations took place between 2000 and the end of 2005. The decrees authorising the decommissioning operations were signed on 15 February 2006 and published in the *Official Gazette* on 22 February 2006, thereby allow the operations to start.

The civil engineering structural clean-out operations continued in 2010. On completion of these operations it was possible to delicense a large number of areas from the waste zoning viewpoint. Nonetheless, the licensee had to deal with a number of problems with implementing its complete clean-out methodology, because some of the older design buildings were incompatible with easy and optimum use of this methodology. The strategy has therefore changed and entails the dismantling of certain buildings on the site, contrary to what had been initially planned in the project.

The review of the file describing the management strategy for the site floors and soils, polluted by the former activities, has resulted in steps being taken to determine the nature of the institutional controls that will be put in place during administrative delicensing of the BNIs.

The inspections carried out by the ASN in 2010 revealed a lack of rigour in the monitoring of the decommissioning worksites.

During the inspections carried out in 2011, ASN had samples taken from the soils and ground water in order to assess the level of radiological and chemical contamination of the areas outside the site. These analyses are in progress.

During one of these inspections, pipes that still contained contaminated effluents were discovered, necessitating additional work to eliminate these structures. At the request of ASN, the licensee notified a significant event further to this discovery.

As the decommissioning work has not been completed, ASN considers that delicensing of the facilities cannot be envisaged in their present state. Delicensing could be envisaged in 2012 after completing the works, subject to confirmation by appropriate radiological measurements that the clean-out objectives have been achieved.

2|4 Others installations

2|4|1 The Strasbourg University reactor

Very similar in design and characteristics to the CEA ULYSSE reactor at Saclay, the Strasbourg University reactor (RUS - BNI 44) at Louis Pasteur University was mainly used for experimental irradiations and the production of short-lived radioisotopes.

The decree authorising Louis Pasteur University in Strasbourg to proceed with final shutdown and decommissioning was published in the *Official Gazette* of 22 February 2006. Decommissioning work began in the second half of 2006 and ended in mid-2009. In 2010, ASN continued its review of the file for the installation to be removed from the list of BNIs. Pursuant to the TSN Act, ASN consulted the Government services, the 21 municipalities situated within less than five kilometres of the installation, and the CLI which was instituted in July 2010 by the *Conseil Général* of the Bas-Rhin *département*. An institutional control to maintain a record that a BNI was operated on the land, should be signed before delicensing of the facility is declared.

2|4|2 The Electromagnetic radiation laboratory

The electromagnetic radiation laboratory (LURE), located at the heart of the Orsay campus (Essonne *département*), is an installation producing synchroton radiation (high-power X-rays) for a wide variety of research applications. It comprises six particle accelerators.

In January 2007, following a final shutdown preparation phase that lasted from 2004 to 2008, the LURE licensee, the CNRS (French National Centre for Scientific Research) submitted an application for authorisation to decommission its installation, with the exception of the CLIO and PHIL accelerators, which are to be kept in operation. Review of this application resulted in MAD-DEM (final shutdown and decommissioning) decree 2009-405 dated 14 April 2009.

The decommissioning operations were completed in 2010, though two particular areas present residual activity linked to the presence of the electron converters and have not been completely cleaned out, to maintain the stability of the building. The licensee submitted its decommissioning file in spring 2011. ASN performed a delicensing inspection of the waste zoning which revealed the presence of radiological activity in a pipe. ASN asked the licensee to completely remove this piping. The work was carried out during the 4th quarter of 2011.

At the same time, institutional controls to restrict access to specific areas have been engaged with the Essonne *département* prefecture.

3 OUTLOOK

The main actions ASN will carry out in 2012 will be firstly the continuing development of the regulatory framework for decommissioning, and secondly closer monitoring of certain installations. ASN will thus endeavour to finalise the guide to the clean-out of polluted soils on sites undergoing decommissioning, and, after publication of the BNI order, to finalise the revision of the guide relating to complete clean-out methodologies.

In 2012, ASN will continue its inspections of installations undergoing decommissioning. It will focus in particular on:
– examining the complete decommissioning authorisation application for the Brennilis NPP;
– continue examining the decommissioning applications and finalise its opinion concerning the draft final shutdown and decommissioning (MAD DEM) decrees for the nuclear facilities of the UP2 400 plant at La Hague;
– reviewing the preparatory operations for final shutdown of the installations that will soon be shut down and decommissioned (PHÉNIX, COMURHEX, EURODIF).

The announcement of the pushing back of several decommissioning deadlines has led ASN to ask the CEA for an interim report on the updating of its decommissioning strategy (see point 2|2). ASN will endeavour to examine the information communicated by the CEA as part of this update.

APPENDIX 1: LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2011

Installation Location	BNI	Type of installation	Commissioned	Final shutdown	Last regulatory acts	Current status
NEREIDE FAR* CENTRE	(former BNI 10)	Reactor (500 kWth)	1960	1981	1987: Removed from BNI list	Decommissioned
TRITON FAR* CENTRE	(former BNI 10)	Reactor (6.5 MWth)	1959	1982	1987: Removed from BNI list and classified as ICPE	Decommissioned
ZOÉ FAR* CENTRE	(former BNI 11)	Reactor (250 kWth)	1948	1975	1978: Removed from BNI list and classified as ICPE	Confined (museum)
MINERVE FAR* CENTRE	(former BNI 12)	Reactor (0.1 kWth)	1959	1976	1977: Removed from BNI list	Dismantled at FAR* and re-assembled at Cadarache centre
EL 2 SACLAY CENTRE	(former BNI 13)	Reactor (2.8 MWth)	1952	1965	Removed from BNI list	Partielly decommissioned, remaining parts confined
EL 3 SACLAY CENTRE	(former BNI 14)	Reactor (18 MWth)	1957	1979	1988: Removed from BNI list and classified as ICPE	Partielly decommissioned, remaining parts confined
PEGGY CADARACHE CENTRE	(former BNI 23)	Reactor (1 kWth)	1961	1975	1976: Removed from BNI list	Decommissioned
CÉSAR CADARACHE CENTRE	(former BNI 26)	Reactor (10 kWth)	1964	1974	1978: Removed from BNI list	Decommissioned
MARIUS CADARACHE CENTRE	(former BNI 27)	Reactor (0.4 kWth)	1960 in Marcoule, 1964 in Cadarache	1983	1987: Removed from BNI list	Decommissioned
LE BOUCHET	(former BNI 30)	Ore processing	1953	1970	Removed from BNI list	Decommissioned
GUEUGNON	(former BNI 31)	Ore processing	1965	1980	Removed from BNI list	Decommissioned
STED FAR* CENTRE	BNI 34	Processing of liquids and solid waste	Before 1964	2006	2006: Removed from BNI list	Integrated into BNI 166

APPENDIX 1: LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2011

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Last regulatory acts	Current status
HARMONIE CADARACHE	(former BNI 41)	Reactor (1 kWth)	1965	1996	2009: Removed from BNI list	Destruction of ancillaries building
ALS	(former BNI 43)	Accelerator	1958	1996	2006: Removed from BNI list	Cleaned-out – institutional controls***
SATURNE	(former BNI 48)	Accelerator	1966	1997	2005: Removed from BNI list	Cleaned-out – institutional controls***
ATTILA** FAR*	(former BNI 57)	Reprocessing pilot	1968	1975	2006: Removed from BNI list	Integrated into BNIs 165 and 166
LCPu FAR* CENTRE	(former BNI 57)	Plutonium chemistry laboratory	1966	1995	2006: Removed from BNI list	Integrated into BNIs 165 and 166
BAT 19 FAR* CENTRE	(former BNI 58)	Plutonium metallurgy	1968	1984	1984: Removed from BNI list	Decommissioned
RM2 FAR* CENTRE	(former BNI 59)	Radio-metallurgy	1968	1982	2006: Removed from BNI list	Integrated into BNIs 165 and 166
LCAC GRENOBLE CENTRE	(former BNI 60)	Fuels analysis	1975	1984	1997: Removed from BNI list	Decommissioned
STEDs FAR* CENTRE	(former BNI 73)	Radioactive waste decay storage	1989		2006: Removed from BNI list	Integrated into BNI 166
ARAC SACLAY CENTRE	(former BNI 81)	Fabrication of fuel assemblies	1981	1995	1999: Removed from BNI list	Cleaned-out
IRCA	(former BNI 121)	Irradiator	1983	1996	2006: Removed from BNI list	Cleaned-out, institutional controls***
FBFC PIERRELATTE	(former BNI 131)	Fuel fabrication	1990	1998	2003: Removed from BNI list	Cleaned-out, institutional controls***
SNCS OSMANVILLE	(former BNI 152)	Ioniser	1983	1995	2002: Removed from BNI list	Cleaned-out, institutional controls***
MAGASIN D'URANIUM MIRAMAS	(former BNI 134)	Uranium bearing materials warehouse	1964	2004	2007: Removed from BNI list	Cleaned-out, institutional controls***
SILOETTE GRENOBLE CENTRE	(former BNI 21)	Reactor (100 kWth)	1964	2002	2007: Removed from BNI list	Cleaned-out, institutional controls***
MÉLUSINE GRENOBLE CENTRE	(former BNI 19)	Reactor (8 MWth)	1958	1988	2011: Removed from BNI list	Cleaned-out

(*) FAR: Fontenay-aux-Roses – (**) Attila: reprocessing pilot located in a unit of BNI 57 – (***) Private law documents have been signed by the State and the licensee for the cleaned out parcels, to conserve a record of the former nuclear activity.

APPENDIX 2: LIST OF BASIC NUCLEAR INSTALLATIONS UNDERGOING DECOMMISSIONING AS AT 31.12.2011

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Last regulatory acts	Current status
CHOOZ AD (FORMERLY-CHOOZ A)	163 (former BNI 1, 2, 3)	Reactor (1,040 MWth)	1967	1991	2007 : Final shutdown and decommissioning decree	Decommissioning in progress
CHINON A1D (FORMERLY-CHINON A1)	133 (former BNI 5)	Reactor (300 MWth)	1963	1973	1982: Chinon A1 confinement decree and creation of the Chinon A1D storage BNI	Partially decommissioned, changed into a BNI for storing waste left in place (museum)
CHINON A2D (FORMERLY-CHINON A2)	153 (former BNI 6)	Reactor (865 MWth)	1965	1985	1991: Partial decommissioning decree for Chinon A2 and creation of the Chinon A2D storage BNI	Partially decommissioned, changed into a BNI for storing waste left in place
CHINON A3D (FORMERLY-CHINON A3)	161 (former BNI 7)	Reactor (1,360 MWth)	1966	1990	2010 : Decommissioning decree	Decommissioning in progress
SILOÉ GRENOBLE	20	Reactor (35 MWth)	1963	1997	2010: Modification of final shutdown and decommissioning decree	Decommissioning in progress
RAPSODIE CADARACHE	25	Reactor (40 MWth)	1967	1983		Preparation for final shutdown
EL 4D (FORMERLY-EL4 BRENNILIS)	162 (former BNI 28)	Reactor (250 MWth)	1966	1985	1996: Decree for decommissioning and creation of the EL 4D storage BNI 2006: final shutdown and decommissioning decree 2007: decision of the Conseil d'État / State Council cancelling the decree of 2006 2011: Partial decommissioning decree	Partially decommissioned, changed into a BNI for storing waste left in place. Decommissioning in progress again.
SPENT FUEL REPROCESSING PLANT (UP2) (LA HAGUE)	33	Transformation of radioactive materials	1964	2004	2003: Boundary change	Preparation for final shutdown
STED AND HIGH LEVEL WASTE STORAGE UNIT (GRENOBLE)	36 and 79	Waste treatment and storage facility	1964/1972	2008	2008 : Final shutdown and decommissioning decree	Decommissioning in progress
EFFLUENT AND SOLID WASTE TREATMENT STATION (STE2) AND FORMER PILOT REPROCESSING PLANT FOR SPENT FUEL FROM FAST NEUTRON REACTORS (AT1) (LA HAGUE)	38	Effluent and waste treatment facility	1969	1979		Preparation for final shutdown

APPENDIX 2: LIST OF BASIC NUCLEAR INSTALLATIONS UNDERGOING DECOMMISSIONING AS AT 31.12.2011

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Last regulatory acts	Current status
STRASBOURG UNIVERSITY REACTOR	44	Reactor (100 kWth)	1967	1997	2006 : Final shutdown and decommissioning decree	Decommissioning in progress
BUGEY 1	45	Reactor (1,920 MWth)	1972	1994	2008 : Final shutdown and decommissioning decree	Decommissioning in progress
ST-LAURENT A1	46	Reactor (1,662 MWth)	1969	1990	2010 : Decommissioning decree	Decommissioning in progress
ST-LAURENT A2	46	Reactor (1,801 MWth)	1971	1992	2010 : Decommissioning decree	Decommissioning in progres
ÉLAN II B LA HAGUE	47	Fabrication of Cs 137 sources	1970	1973		Preparation for final shutdown
HIGH ACTIVITY LABORATORY (LHA) SACLAY	49	Laboratory	1960	1996	2008 : Final shutdown and decommissioning decree	Decommissioning in progress
ATUE CADARACHE	52	Uranium Processing	1963	1997	2006 : Final shutdown and decommissioning decree	Decommissioning in progress
LAMA GRENOBLE	61	Laboratory	1968	2002	2008 : Final shutdown and decommissioning decree	Decommissioning in progress
SICN VEUREY-VOROIZE	65 and 90	Fuel fabrication plant	1963	2000	2006 : Final shutdown and decommissioning decree	Decommissioning in progress
HAO (HIGH LEVEL OXIDE) FACILITY (LA HAGUE)	80	Transformation of radioactive materials	1974	2004		Decommissioning in progress
ATPu CADARACHE	32	Fuel fabrication plant	1962	2003	2009 : Final shutdown and decommissioning decree	Decommissioning in progress
LPC CADARACHE	54	Laboratory	1966	2003	2009 : Final shutdown and decommissioning decree	Decommissioning in progress
SUPERPHÉNIX CREYS-MALVILLE	91	Reactor (3,000 MWth)	1985	1997	2009 : Final shutdown and decommissioning decree	Decommissioning in progress
COMURHEX PIERRELATTE	105	Uranium chemical Transformation plant	1979	2009		Preparation for final shutdown
LURE	106	Particle accelerators	From 1956 to 1987	2008	2009 : Final shutdown and decommissioning decree	Decommissioning in progress
FAR* CENTRE PROCESS	165	Grouping of former process installations	2006		2006 : Final shutdown and decommissioning decree	Decommissioning in progress
FAR* CENTRE SUPPORT	166	Waste packaging and processing	2006		2006 : Final shutdown and decommissioning decree	Decommissioning in progress

(*) Fontenay-aux-Roses : création des INB 165 et 166, en substitution aux INB 34,57,59 et 73 et mise en œuvre des opérations de mise à l'arrêt et de démantèlement des INB 165 et 166 suite au regroupement de bâtiments dans le cadre du projet de dénucléarisation du site de Fontenay aux Roses.

RADIOACTIVE WASTE AND CONTAMINATED SITES AND SOIL

1 RADIOACTIVE WASTE 443

1|1 Radioactive waste management regulatory framework
1|1|1 Production of radioactive waste in basic nuclear installations
1|1|2 Production of radioactive waste by other facilities using radioactive materials
1|1|3 The national inventory of radioactive materials and waste
1|1|4 The national radioactive materials and waste management plan

1|2 The ASN role in the radioactive waste management system
1|2|1 Checks and inspections
1|2|2 Drafting of recommendations and prescriptions for sustainable waste management
1|2|3 Production of the legislative and regulatory framework
1|2|4 Evaluation of the nuclear financial costs
1|2|5 ASN's contribution to international works
1|2|6 Public information

1|3 Management of waste from nuclear licensees
1|3|1 CEA waste management
1|3|2 AREVA waste management
1|3|3 EDF waste management
1|3|4 Management of waste from small-scale nuclear activities

1|4 Long-term waste management
1|4|1 The very low level waste repository (CSTFA)
1|4|2 The surface repositories for low and intermediate level, short-lived waste
1|4|3 Management of long-lived high and intermediate level waste
1|4|4 Management of long-lived low level waste
1|4|5 Package acceptance in disposal facilities

2 MANAGEMENT OF SITES AND SOILS CONTAMINATED BY RADIOACTIVITY 462

2|1 Regulatory framework

2|2 Revision of the contaminated sites management methodology guide

2|3 The Radium Diagnosis operation

2|4 The main subjects examined by ASN
2|4|1 Coudraies district in Gif-sur-Yvette (Essonne)
2|4|2 Clos rose district in Gif-sur-Yvette (Essonne)
2|4|3 Making safe the Isotopchim site in Ganagobie (Alpes-de Haute-Provence *département*)
2|4|4 Rehabilitation of the site of the former Pierre et Marie Curie school at Nogent-sur-Marne (Val-de-Marne *département*)
2|4|5 Établissements Charvet in l'Ile Saint-Denis (Seine-Saint-Denis *département*)
2|4|6 Former Curie laboratories in Arcueil (Val-de-Marne *département*)
2|4|7 Orflam-Plast in Pargny-sur-Saulx (Marne *département*)
2|4|8 The Boucau site (Pyrénées-Atlantiques *département*)
2|4|9 Support for the State's regional services

2|5 International action concerning management of contaminated sites and soil

3 OUTLOOK 467

CHAPTER 16

This chapter presents the role and actions of ASN concerning the management of waste generated by activities using radioactive substances and the management of sites polluted by radioactive contamination. It in particular describes the steps taken to define and determine the main radioactive waste management orientations and the controls carried out by ASN with respect to nuclear safety and radiation protection in facilities involved in the management of radioactive waste. It also presents the steps taken by ASN concerning sites polluted by radioactive contamination and how they are managed.

Radioactive waste means radioactive materials for which no subsequent use is planned or envisaged. It may stem from nuclear activities or may be produced by non-nuclear activities in which the radioactivity naturally contained in the materials, not used for their radioactive or fissile properties, may have been concentrated by the processes employed.

Clean-out of contaminated sites consists in rehabilitating sites on which a nuclear or non-nuclear activities has created pollution from radioactive substances.

1 RADIOACTIVE WASTE

Like any human activity, nuclear activities produce waste. Pursuant to the provisions of the Environment Code and more specifically of Act 2006-739 of 28th June 2006, the producers of waste are responsible for it until disposed of in a duly authorised facility. Waste producers must also constantly endeavour to minimise the volume and activity level of their waste, at the front-end through design and operating provisions and at the back-end through appropriate waste management.

Radioactive waste varies considerably by activity level, half-life, volume or even nature (scrap metal, rubble, oils, etc.). Each type of waste requires treatment and a long-term management solution that is appropriate, in order to overcome the risk involved, notably the radiological risk. The latter can be assessed on the basis of two main parameters: the activity level, which contributes to the toxicity of the waste, and the radioactive half-life, which depends on the radioactive decay periods of the radionuclides it contains. Therefore, on the one hand we have very low, low, intermediate or high level waste and, on the other hand, waste known as very short-lived, resulting mainly from medical activities (radioactivity halved in less than 100 days), short-lived (radioactivity halved in less than 30 years) and long-lived, containing a large quantity of long half-life radionuclides (radioactivity halved in more than 30 years).

All the operations associated with managing a category of waste, from production, through sorting, packaging, interim storage to final disposal, are what make up the disposal route. Each disposal route must be adapted to the nature of the waste handled. The operations within each route are interlinked and all the routes are interdependent. Each party in the route is responsible for the safety of the facilities it operates and the activities it performs.

1|1 Radioactive waste management regulatory framework

Radioactive waste management falls within the general framework defined in book V, part IV, chapter I of the Environment Code and its implementing decrees. The particular requirements concerning radioactive waste were introduced by Act 91-1381 of 30th December 1991 on research into high-level, long-lived waste, known as the "Bataille Act", and by the 28th June 2006 Act giving a legislative framework to management of all radioactive materials and waste (these Acts are codified in book V, part IV, chapter II of the Environment Code). This latter sets the new calendar for research into high and intermediate level, long-lived waste and a clear legal framework for ring-fencing the funds needed for decommissioning and for the management of radioactive waste. It in particular requires the production of a national radioactive materials and waste management plan, which aims to produce a periodic review of radioactive materials management policy. It also reinforces the duties of the French national radioactive waste management agency (ANDRA). Finally, it bans the final disposal on French soil of foreign waste, by providing for the adoption of rules specifying the conditions for the return of waste resulting from reprocessing in France of spent fuel or waste from abroad.

1|1|1 Production of radioactive waste in basic nuclear installations

In France, radioactive waste management is such that there are no predetermined release thresholds below which a very low level waste from a nuclear facility can be considered as manageable by a conventional waste disposal route. In concrete terms, this doctrine leads to the definition of "waste zoning" which, in basic nuclear installations (BNIs), separates zones producing contaminated, activated or potentially activated waste, from zones producing conventional waste. Waste that is contaminated, activated or potentially activated must be managed in dedicated radioactive waste routes and it can only be reused in a nuclear facility. Waste from conventional waste zones, once confirmed as free of radioactivity, is sent to routes dedicated to conventional waste. Waste zoning and changes to this zoning are subject to approval by ASN. The order of 31st December 1999 on the general regulations applicable to

BNIs stipulates the creation of this zoning. This order also asks the licensees to carry out a study on the management of their waste, specifying their objectives with respect to reducing the production and harmfulness of the waste produced in their facilities and optimising its management, taking account of the reprocessing routes, as disposal is reserved solely for ultimate waste. Summaries of these studies are submitted to ASN for approval.

During the course of 2010, ASN posted a draft decision on its website for consultation, concerning the study of waste management and the review of the waste produced in the BNIs. This text also details the content of the waste studies requested and the general principles for establishing and modifying zoning. In 2011, ASN revised the text so that its publication could coincide with the order defining the general regulations applicable to BNIs.

The 9th August 2011 incident involving the unloading of a lorry load of rubble from the Bugey power plant, which comprised slight traces of radioactivity, into a quarry backfilled with inert materials, was because of incorrect definition of waste zoning. This incident, which had no consequences on the environment, the general public or workers, was rated level 0 on the INES scale. ASN sent the licensee formal notice to comply with the requirements of Article 21 of the above-mentioned order of 31st December 1999 on waste zoning.

1|1|2 Production of radioactive waste in nuclear facilities using radioactive substances

The provisions mentioned in decree 2002-460 of 4th April 2002 concerning the general protection of persons against ionising radiation have been incorporated into the Public Health Code. Article R. 1333-12 of this Code states that the management of effluents and waste contaminated by radioactive substances originating from all nuclear activities related to medicine, human biology, or biomedical research and entailing a risk of exposure to ionising radiation must be examined and approved by the public authorities. ASN decision 2008-DC-0095 of 29th January 2008, approved by the Ministers responsible for the Environment and Health, lays out the technical rules to be met for the disposal of effluents and waste contaminated or potentially contaminated by radionuclides owing to a nuclear activity.

1|1|3 The national inventory of radioactive materials and waste

Article L.542-12 of the Environment Code tasks ANDRA with *"establishing, updating every three years and publishing the inventory of radioactive materials and waste present in France, along with their location on the national territory"*.

The national inventory was published in June 2009 and presents information concerning the quantities and locations of radioactive materials and waste as at the end of 2007, plus the forecasts for the end of 2020, the end of 2030 and following the operating lifetime of the existing facilities or those for which construction has been authorised. ASN takes part in the steering committee of the national inventory of radioactive waste and recoverable materials. This inventory constitutes input data for the national radioactive materials and waste management plan.

1|1|4 The national radioactive materials and waste management plan

Article L.542-1-2 of the Environment Code requires the production of the national radioactive materials and waste management plan (PNGMDR), revised every three years, the purpose of which is to review the existing management procedures for radioactive materials and waste, to identify the foreseeable needs for storage and disposal facilities, to clarify the necessary capacity of these facilities and the storage durations and, for radioactive waste for which there is as yet no final management solution, to determine the objectives to be met. The main provisions of the plan and the studies required by the PNGMDR are set by a decree implementing Article L.542-1-2 of the Environment Code.

This plan is drafted by a pluralistic working group co-chaired by the General Directorate for Energy and Climate (DGEC) and ASN, for example including environmental protection associations, representatives of elected officials, the regulatory authorities, alongside the radioactive waste producers and managers.

The Parliamentary Office for the evaluation of scientific and technological choices (OPECST) published a report in early 2011 on the evaluation of the PNGMDR 2010-2012. This report praises the creation and the actions of the PNGMDR working group and the dialogue initiated with the associations. It presents a number of recommendations concerning the organisation of the PNGMDR working group as well as the content and format of the plan that the DGEC and ASN have already adopted or which will be adopted in the drafting of the next plan.

The studies stipulated by the PNGMDR 2010-2012 for example concern the management of legacy situations (disposal and storage of legacy waste, mines), long-term management of radioactive substances (depleted uranium, reprocessed uranium, thorium) and radioactive waste. These studies in particular concern sealed sources, tritiated waste, the optimisation of disposal facilities for existing routes and continued research into planned routes.

In addition to the studies requested and to ensure overall management consistency, two working groups, under the supervision of the DGEC, were set up. These working groups, in which ASN is a participant, aim to define the management methods for waste currently with no disposal route and to optimise the breakdown of the flow of radioactive waste between the existing or planned routes.

1|2 The role of ASN in the radioactive waste management system

The public authorities, ASN in particular, are keen to ensure that this management of radioactive waste takes place in safe



Meeting of the PNGMDR working group at the French National Assembly – June 2011

conditions at each step (from production in the BNIs up to disposal) and that there is a management route for all the waste. ASN thus considers that the development of management routes appropriate to each waste category is of vital importance and that any delay in the search for waste disposal solutions will only increase the volume and size of the storage areas in the facilities, with all the attendant risks. Within the context of the PNGMDR, ASN is particularly vigilant in ensuring that the system consisting of all these routes is optimised as part of an overall, consistent approach to the management of radioactive waste. This approach must take account of safety, radiation protection, traceability and waste volume minimisation issues. Finally, ASN considers that this management must be transparent to the public. The PNGMDR is thus produced by a pluralistic working group. Furthermore, the publication of the PNGMDR and its summary on the ASN website, as well as the publication in early 2011 of number 190 of *Contrôle* magazine devoted to radioactive waste, help inform the public about the main issues associated with radioactive waste management.

In order to fulfil its duties, ASN can call on the services of the Institute for Radiation Protection and Nuclear Safety (IRSN).

1|2|1 Checks and inspections

With regard to radioactive waste management, the checks and inspections which lie at the heart of ASN's duties consist, on the one hand, in checking correct application of the regulations regarding waste management on the production sites and the safety of facilities dedicated to radioactive waste management (waste reprocessing, storage and disposal facilities). On the other hand, the checks carried out by ASN must ensure correct implementation of the defined conditions for manufacture of the waste packages intended for the waste disposal facilities. These measures are described in this chapter as well as in chapters 8 and 13.

1|2|2 Drafting of recommendations and prescriptions for sustainable waste management

Together with the DGEC, ASN is responsible for drafting the PNGMDR, with the assistance of a specifically created pluralistic working group. This PNGMDR drafting work is followed by an examination of the dossiers submitted pursuant to the decree stipulating the PNGMDR requirements with regard to improvements to the radioactive waste management arrangements. On 25th August 2009, ASN presented the Minister for the Environment with its opinion on the studies requested under the decree of 16th April 2008 setting out the requirements concerning the PNGMDR (opinion 2009-AV-0075 of 25th August 2009). The ASN opinion served as the basis for the preparation of the second edition of the PNGMDR (2010-2012 version) which was transmitted to the Government in early 2010.

ASN also gave the Government its recommendations concerning the disposal projects for long-lived radioactive waste. ASN is also focusing on verifying that the conditions in which these projects are developed will guarantee the operational and long-term safety of the future facilities.

1|2|3 Production of the legislative and regulatory framework

ASN was a key player in the drafting of the 28th June 2006 Act on the sustainable management of radioactive materials and waste. Following the passage of the "TSN" Act on transparency and security in the nuclear field, ASN also engaged in a process to overhaul the regulations applicable to BNIs. ASN thus pays particularly close attention to reinforcing the oversight of radioactive waste management. The order defining the general regulations applicable to BNIs thus makes provision for special measures to be implemented in the ASN decisions on the topics of waste management in BNIs, storage of radioactive waste, waste packaging and radioactive waste disposal facilities.

1|2|4 Evaluation of the nuclear financial costs

The regulatory framework designed to secure the financing of nuclear facility decommissioning costs or, for radioactive waste disposal facilities, the final shutdown, maintenance and surveillance costs, in addition to the cost of managing spent fuel and radioactive waste, is described in chapter 15 point 1|3|2. In 2011, ASN sent the DGEC its opinion on the three-yearly reports submitted by the nuclear operators to describe the evaluation of the nuclear costs and ways and means chosen to create the assets needed to cover these costs (see chapter 15 point 1|3|2).

ASN also sent the DGEC its opinion on decree 2010-1673 of 29th December 2010 amending decree 2007-243 of 23rd February 2007 concerning the ring-fencing of the financial costs of decommissioning (see chapter 15 point 1|3|2).

1|2|5 ASN's contribution to international works

One of the WENRA[1] missions is to develop a joint approach to nuclear safety and regulation. WENRA implemented a procedure designed to draft reference safety levels for harmonising nuclear safety practices in Europe. Working groups were set up in 2002 in order to draft these reference levels. One of them, the WGWD (Working Group on Waste and Decommissioning), was more specifically tasked with defining reference levels concerning the safety of interim storage of radioactive waste and spent fuel and of nuclear installation decommissioning operations. In 2010, this group extended its work to include definition of the reference levels applicable to radioactive waste disposal facilities. The coordination of the work involved in drafting this report was entrusted to the ASN representative within the WGWD. In 2010, the WGWD finalised the reference levels for the storage of radioactive waste and spent fuels. The report was published in 2011. In 2010, the WGWD continued its work to draft reference levels concerning the safety of decommissioning operations.

The transposition of the reference levels by the WENRA members will require updating of the national regulations. The work to update the French regulations currently in progress, already partly incorporates these reference levels. An additional ASN decision on interim storage will be drafted as part of this transposition process. The WENRA member countries are required to produce national action plans for the implementation of this transposition. ASN will thus draft an action plan to meet the WENRA requirements.

On the strength of its experience with drafting the PNGMDR, but also the creation of a regulatory authority and the preparation of a dedicated legislative framework, France was a driving force behind the project to draft a European directive on radioactive waste management, in particular through its

TO BE NOTED IN 2011

Council directive 2011/70/EURATOM establishing a community framework for the responsible and safe management of spent fuel and radioactive waste

On 19th July 2011, the Council of the European Union adopted directive 70/2011/Euratom establishing a community framework for the responsible and safe management of spent fuel and radioactive waste.

This directive defines a binding legislative framework and in particular requires that each member State set up a regulatory authority with competence for the safe management of waste and spent fuel, given the financial and human resources necessary for the performance of its duties. It sets safety requirements and requires the creation of a system of authorisations for waste and spent fuel management facilities. It also requires those holding these authorisations to devote adequate financial and human resources to waste management.

Moreover, this directive requires the definition of a national programme to implement the waste and spent fuel management policy. This programme, which is based on a national inventory, must concern all waste, from production up to disposal. It must be periodically revised and the Commission notified.

The directive also defines the requirements concerning transparency with regard to the public and requires periodic self-evaluation of the regulatory arrangements, supplemented by a peer review. It also requires that there be a system of sanctions.

Finally, it formally stipulates the ultimate responsibility of each member State for the management of its radioactive waste and specifies the possibilities regarding the export of this waste for disposal.

ASN considers the adoption of this directive to be a key event and one that helps strengthen nuclear safety within the European Union, while making the member States more accountable for the management of their radioactive waste and spent fuels.

Each member State must now transpose this directive within a period of two years. With regard to France, most of the provisions of this directive are already an integral part of national legislation, for example through the requirements of the 28th June 2006 Act on the sustainable management of radioactive materials and waste, and those of the 13th June 2006 Act on transparency and security in the nuclear field, recently integrated into the Environment Code.

Implementation schedule:
– Publication in the Official Gazette of the European Union: 2nd August 2011;
– Transposition in the 27 member States: no later than 23rd August 2013;
– First notification by the member States to the European Commission of their national radioactive waste and spent fuel management programme: no later than 23rd August 2015.

1. WENRA: Western European Nuclear Regulators' Association. that brings together the heads of nuclear safety authorities in countries of Western Europe

TO BE NOTED IN 2011

ASN publication

Issue no.190 of Contrôle *magazine, published in February 2011, is devoted to "Radioactive waste management: progress and outlook". It was presented to the press on 10th February 2011. This issue gives the viewpoint of the various stakeholders, licensees, administrations, environmental protection associations, consultative committees and foreign experts on the subject of radioactive waste management. It explains the issues and the complexity of radioactive waste management and looks at the various aspects of the waste problem: scientific, technical, but also as related to society.*



***Contrôle* magazine 190 is also available in English**

involvement in the preparatory work done by ENSREG[2] (European Nuclear Safety Regulators' Group). After the July 2011 adoption of the European directive on radioactive waste management, new provisions will need to be transposed into French law.

Finally, at an international level, ASN is a participant in the International Atomic Energy Agency's (IAEA) Waste Safety Standards Committee (WASSC), whose role is to draft and then approve the international standards defined by IAEA, for example concerning the management of radioactive waste.

1|2|6 Public information

ASN has a general public information duty. In 2011, the main form of communication about radioactive waste management was the publication of an issue of *Contrôle* magazine on "Radioactive waste management: progress and outlook" (see box). ASN and ANDRA also co-organised the radioactive waste workshop at the *Assises des déchets* conference on 15th September 2011. ASN recalled the fundamental principles contained in the PNGMDR and the management doctrine for very low level (VLL) waste based on BNI zoning.

1|3 Management of waste from nuclear licensees

Before final disposal, certain categories of radioactive waste undergo processing to reduce their volume or harmfulness and, whenever possible, to recover reusable materials. This processing can produce secondary waste. After processing, the waste is packaged and then, depending on its nature, placed in an interim storage facility or sent to a disposal facility. ASN asks the licensees to define a management strategy for all the radioactive waste produced in their facilities. The following sections clarify the waste management procedures adopted by the main producers of waste.

1|3|1 CEA waste management

a) CEA's waste management strategy

CEA has processing, packaging and storage facilities for the waste it produces. Each CEA nuclear site has processing and packaging installations for the waste and radioactive effluents it produces. The solid wastes for which there are operational routes (reprocessing, elimination by incineration or melting, disposal in approved surface repositories) are removed accordingly (installations of the CEA, Centraco, ANDRA repositories, etc.). Long-lived intermediate and high level waste is stored by CEA in dedicated storage facilities with a lifespan limited to a few decades, pending creation of a long-term disposal route.

Very low level waste, a significant volume of which is generated by CEA, particularly owing to decommissioning of its former installations, is stored on-site before being taken away to the Morvilliers VLL waste repository. Liquid waste is treated, solidified and packaged. Depending on their activity level, the resulting packages are either disposed of in ANDRA's Aube waste repository, or stored by CEA pending final disposal.

CEA is also in possession of legacy solid and liquid waste for which there could be certain processing problems, owing to its physical-chemical nature or the fact that there is currently no disposal route. Nuclear fuel without further use from the CEA civil facilities is placed in interim storage, either dry (pit) such as in the CASCAD facility, or in a pool, pending definition of a final management route (reprocessing or storage).

2. ENSREG, set up in March 2007, is a grouping of the heads of the European Union's safety regulators and the European Commission. Based on guidelines defined by the Council of Ministers, it applied itself to a review of safety, waste and spent fuel management and transparency in the nuclear sector, at a European level. This work in particular led to the adoption of a nuclear safety directive on 25th June 2009.

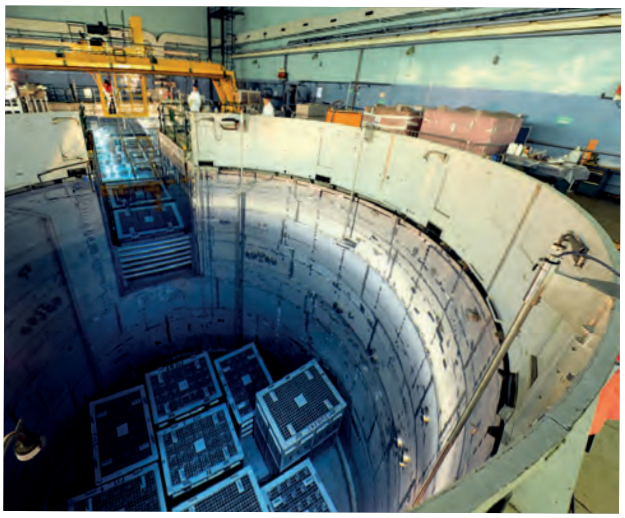
In the light of changes to the CEA's waste management strategy, both in terms of organisation and plans for new facilities or upgrades to existing facilities, ASN asked CEA in late 2008 to present its management strategy for solid waste, liquid effluents, sources and spent fuel from CEA civil uses in the coming decades, as well as the means necessary to implement this strategy (facilities, transport containers, etc.). In March 2010, CEA submitted the corresponding file. Jointly with the ASND, ASN stated that this file should be examined by the Advisory Committee. This latter will for example analyse the pertinence and consistency of CEA's management strategy for existing and future waste, effluents and spent fuel, in the light of safety and radiation protection issues, as well as its calendar for recovery of legacy waste and effluents, given the available and planned resources. ASN will issue a position statement on this subject in the first half of 2012, together with the ASND.

In April 2011, ASN carried out an inspection at CEA head offices in order to examine the processes CEA had defined in order to produce its management strategy for waste, spent fuels and sources and to ensure implementation and coordination by the nuclear sites. The inspectors for example noted that a process dedicated to clean-out, decommissioning, management and transport of radioactive materials and waste was in the process of being implemented by the CEA's services. They did however observe that the waste management strategy control and monitoring tools were not all available. With regards to nationwide coordination, they appreciated the fact that the division in charge of clean-out projects and waste management held periodic follow-up meetings with the heads of the facilities whose projects it is monitoring.

b) Issues associated with CEA waste management

The two main issues for CEA with regard to radioactive waste management are:

– bringing new waste reprocessing and storage facilities online within a time frame compatible with its commitments to shut down old installations in which safety no longer complies with modern requirements;
– running projects for removal of certain legacy waste from storage.



Spent fuels from the CEA research reactors have been stored in this pool since 1980. They are currently being removed and reprocessed.

As in previous years, ASN observes that CEA is experiencing persistent difficulties with managing these two issues. For 2011, ASN noted, however, that there had been occasional progress with some projects, in line with the licensee's commitments and especially concerning the licensee's "major commitments" on nuclear safety and radiation protection. ASN for example noted that the project for removal from storage of the drums containing plutonium in the PEGASE facility (BNI 22) is currently being run satisfactorily by the Cadarache centre, with a scheduled completion date of late 2013. ASN also observes that in recent years, CEA has strengthened the organisation of the project to recover waste from BNI 56 in Cadarache but nonetheless notes significant delays in the performance of the operations, owing to the many unexpected technical uncertainties the licensee has to deal with.

ASN also points outs the technical difficulties and project management problems encountered by CEA in running the new facility projects and the delays in upgrading of the existing facilities dedicated to radioactive waste management.

New facility projects

STELLA project

Basic nuclear installation (BNI) 35, notified by CEA in a letter of 27th May 1964, is located on the CEA Saclay site. Its purpose is the reprocessing of radioactive liquid effluents. Decree 2004-25 of 8th January 2004 authorises CEA to create an extension in BNI 35, called STELLA, for reprocessing low-level aqueous effluents from the Saclay centre, using an evaporation concentration process with the concentrates then blocked in a cement matrix, to produce packages that can be placed in an ANDRA surface repository. STELLA commissioning is seriously behind schedule owing to technical problems with qualification of the waste packages. Given the problems with producing satisfactory packages without cracks, CEA decided in 2010 to opt for commissioning of the STELLA facility in stages. In its decision 2010-DC-0198 of 9th November 2010, ASN authorised this staged commissioning to enable CEA to run tests on the evaporation process and concentrate the effluents present in the facility. In its decision 2011-DC-041 of 22nd September 2011, ASN authorised commissioning of the cementation and chemical pretreatment processes. ASN did however ask CEA to provide the necessary justifications concerning management of the effluents containing complexing substances and to continue its work to qualify the reference packages known as "12H".

DIADEM project

In November 2007, CEA sent ASN a file of safety options concerning a new project, DIADEM, to be located in Marcoule for storage of irradiating waste, plus decommissioning of the PHÉNIX facility. This storage would be for a period of 50 years, pending the arrival of an appropriate disposal route. ASN issued its position on this report on 1st July 2008, indicating that it had no objection to continuation of the process leading to creation of the installation, subject to the provision of a certain amount of additional information. In 2009, CEA informed ASN that the files applying for the DIADEM creation authorisation would be late. CEA should be submitting the creation authorisation application file in 2012. Commissioning of the installation will now take place by mid-2016 at the earliest.

AGATE project

ASN also observes delays in commissioning of the AGATE facility, the creation of which was authorised by decree 2009-332 of 25th March 2009. The AGATE installation will provide evaporation treatment of radioactive liquid effluents mainly from the CEA/Cadarache nuclear installations, comprising primarily beta and gamma radionuclides. The file on commissioning of the AGATE installation was examined by the Advisory Committee in the spring of 2010. After this examination, ASN observed that the safety measures adopted by CEA were satisfactory. It nonetheless asked CEA to present and justify the strategy adopted for processing of the concentrates produced by the AGATE facility, taking account of any problems with handling of these concentrates by the Marcoule effluents treatment station. At its session of 16th November 2011, the CSLUD[3] noted the technical feasibility of bituminisation of the AGATE concentrates in the Marcoule STEL. However, it reminded CEA of the need to continue research on development of packaging of these same concentrates by cementation in the STEL, once it has been renovated and the waste treatment processes modified. Commissioning of the AGATE facility was repeatedly postponed and is now planned for the second half of 2012.

In the light of the important issues linked to the commissioning of these facilities, ASN regularly reminds CEA of its undertakings to provide operational waste management routes.

CEDRA facility

Decree 2004-1043 of 4th October 2004 authorised CEA to create the CEDRA (packaging and storage of radioactive waste) basic nuclear installation 164 on the Cadarache site. The purpose of the facility is to treat low and intermediate level, long-lived waste and store packages of low and intermediate level waste. This storage would be for a period of 50 years, pending the arrival of an appropriate disposal route.

In April 2006, ASN authorised start-up of the storage facility for low-level waste (two storage buildings) and intermediate level waste (one storage building).

The inspections performed by ASN on the CEDRA facility mainly concern the package acceptance conditions (acceptance file, transfer of responsibility on the site, radioactivity measurement, handling in the storage buildings) and the conditions for this transfer to the ANDRA repositories as applicable.

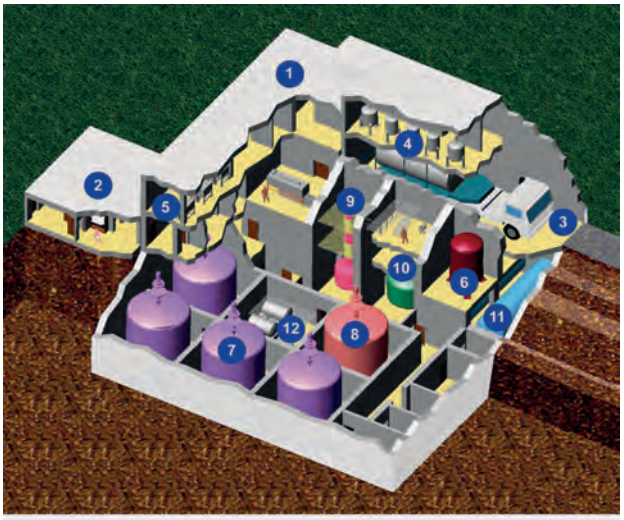
ASN drew CEA's attention to the need to make plans to build and commission extensions to the CEDRA facility, so that the capacity needed to store the amount of waste to be managed is available on time. CEA stated that the currently available data indicate that the maximum storage capacity for low and intermediate level waste will be reached in 2019 and 2018 respectively.

Retrieval of legacy waste

On the Saclay site

BNI 72

The decree of 14th June 1971 authorises CEA to modify the facilities in the Saclay nuclear research centre by building a zone for management of radioactive solid waste (BNI 72). BNI 72 provides waste storage and packaging as well as waste recovery from small producers (sources, scintillating liquids, ion exchanger resins) and storage of radioactive sources. At the beginning of 2009, at the request of ASN, the competent Advisory Committee examined the periodic safety review file for the solid waste management zone. At that time, CEA made a number of commitments, in particular to shut down the installation's waste treatment units within a period of 10 years and, within the same time-frame, to remove the fuel stored in the pool and the fuel stored in the blocks.



1. Process Building
2. Cloakrooms building
3. Truck hall
4. Reagents area
5. Radiological and chemical analyses laboratory
6. Transfer tank
7. Upstream liquid storage tanks
8. Assembly tank
9. Evaporator
10. Concentrates tanks
11. Distillates tanks
12. Industrial effluents tanks

Cross-section of the AGATE project in Cadarache

At the request of ASN, CEA transmitted the BNI 72 decommissioning plan in 2011. CEA should be forwarding its authorisation application file for final shutdown in 2017, as requested by ASN following the facility's periodic safety review in 2009. At its request, CEA also sent ASN the calendar of removal from storage of waste, fuels, sources and materials with no further use inside the facility. These projects will require considerable technical and human resources.

By means of periodic meetings, ASN checks the licensee's progress with regard to its undertakings. It notes that there are delays in meeting the deadlines set for some of the undertakings.

BNI 35

The progress of the operations to recover legacy effluent stored in BNI 35, pending initial processing and then clean-out of the facility's old buildings, are among CEA's priorities concerning this facility. The first operations were performed to recover the organic radioactive effluent stored in tank HA4

3. Safety commission for laboratories and plants, reporting to the ASND

and a part of the effluent was removed to the ATALANTE treatment facility. The end of the clear-out operations is scheduled for 2013. The decree of 8th January 2004 states that tank HA4 and the other radioactive effluents contained in the MA 500 tanks of building 393 must be removed from storage before 8th January 2014.

On the Cadarache site

The radioactive waste storage area
The radioactive waste storage area (BNI 56) in Cadarache was the subject of notification SJC 68/036 of 8th January 1968 to the Ministry responsible for scientific research and atomic and space questions, under the title "Final disposal area for solid waste" concerning the solid waste disposal area and the trenches disposal area. The main purpose of this facility is storage of legacy radioactive solid waste (ILW-LL) from operation or decommissioning of CEA facilities and which cannot be sent to the Aube surface repository. The waste is stored there in pits, in trenches, in warehouses and, for the VLL waste, in a dedicated area.

A part of the Cadarache interim storage facility consists of five trenches which, between 1969 and 1974, were filled with a variety of low and intermediate level solid waste, then covered with earth. The facility was at the time an experimental waste disposal facility. An ASN inspection on 17th March 2011 brought to light shortcomings in CEA's surveillance of the contractors responsible for waste recovery. CEA then took the initiative of suspending the work to recover the waste from this trench T2 in order to integrate ASN's observations. The T2 recovery work restarted on 23rd May 2011.

Recovery of waste from the other trenches will require major modifications to the facility. In 2011, ASN informed the CEA that the examination of these modifications should be included in the final shutdown and decommissioning application file (MAD-DEM) expected no later than the second quarter of 2013.

In its old pits, BNI 56 also stores intermediate level waste in conditions which no longer meet current safety standards. In April 2009, ASN also approved the recovery operations from pits F5 and F6, provided that certain reservations are taken into account. In order to address the problems encountered when recovering waste from pits, CEA intends to make major modifications to the facility. ASN informed CEA that these modifications will be reviewed as part of the MAD-DEM file.

BNI 22
The PEGASE reactor in BNI 22 entered service in 1964 and was then operated for about ten years. By decree of 17th September 1980, CEA was authorised to reuse the PEGASE facilities to store spent fuel elements.

Pegase is now an installation mainly storing spent fuel elements under water or dry and radioactive substances and equipment. Removal of the fuels from storage began in January 2006. By the end of 2013, CEA is required to remove all the drums of plutonium-bearing by-products stored in the PEGASE premises, along with fuel elements.

In the decree of 4th September 1989, CEA was authorised to modify the PEGASE facility to create a dry storage facility for CASCAD spent fuel. On the basis of the facility's periodic safety review file, and on the advice of IRSN, ASN in June 2010 approved the continued operation of the CASCAD facility, provided that a number of measures were taken. By means of periodic meetings, ASN also ensures that steps identified following the periodic safety review are implemented and that the associated deadlines are met.

Renovation or shutdown of old facilities

BNI 37
The effluent and waste treatment station (BNI 37), notified by CEA in a letter of 27th May 1964, processes and packages liquid and solid radioactive waste from the Cadarache centre.

In 2008, ASN examined the safety options file for the reinforcements programmed by CEA to ensure the continued operation of part of the solid waste treatment stations (STDS) in BNI 37. In 2011, CEA informed ASN that further analysis of the seismic risk at the location of the facility meant that it was modifying its strategy. Given the central role of the STDS in BNI 37 for management of CEA radioactive waste, technical discussions were held in 2011 between ASN and the licensee in order to clarify the strategy chosen by CEA for this facility. These discussions in particular concerned the programme to reinforce the facility, the technical conditions envisaged by the licensee and the administrative conditions for their implementation. ASN observes that CEA's strategy with regard to this facility has been changing over the past two years. ASN reminded CEA that the facility review file must be transmitted no later than the first quarter of 2012 so that it can be examined by the Advisory Committee. ASN also informed CEA that proposals to reinforce the facility will be the subject of particularly close scrutiny during this examination.

In its decision 2011-DC-0208 of 27th January 2011, ASN stated that the effluent treatment station (STE) in BNI 37 should no longer receive radioactive effluents as of 1st January 2012. ASN also stated that use of the STE's treatment units must cease no later than two years after the facility stops receiving radioactive effluents.

The waste treatment stations on the CEA sites at Fontenay-aux-Roses (BNI 73) and Grenoble (BNI 79) provide interim storage capacity for fuel elements or high level waste in pits and/or blocks. CEA has initiated a programme to recover this waste as part of the delicensing of the Grenoble and Fontenay-aux-Roses sites (see chapter 15).

1|3|2 AREVA waste management

a) AREVA waste management strategy

The spent fuel reprocessing plant at La Hague produces most of AREVA's radioactive waste. The fuel cycle installations are described in chapter 13. The waste present on the La Hague site comprise on the one hand that resulting from reprocessing of the spent fuel from the nuclear power plants and, on the other, the waste linked to operation of the facilities of the La Hague plant itself. Most of this waste remains the property of the licensees of nuclear power plants (French, such as EDF, or foreign) which have their spent fuel processed.

b) The issues and implications

The main issues relating to the management of waste from the licensee AREVA concern:

– the safety of the storage facilities for the legacy waste present on the La Hague site. ASN also noted recurring delays in recovery of legacy waste from La Hague and the lack of an integrated view within the establishment for ranking of the legacy waste recovery projects in the light of the safety issues surrounding storage (see Chapter 13),
– the definition of solutions for waste packaging, in particular the legacy waste.

It should be recalled that the 28th June 2006 Act on the sustainable management of radioactive materials and waste requires that ILW-LL waste produced before 2015 be packaged no later than the end of 2030. ASN therefore reminded AREVA of the need to define and finalise solutions for packaging this waste within a time-frame enabling the 2030 deadline to be met. These solutions will have to be approved by ASN beforehand. Moreover, on the basis of the recommendations from the Advisory Committee issued during examination of the decommissioning conditions for BNIs 33, 38 and 47, ASN reminded AREVA of the need to continue the qualification studies for the packaging processes for the waste resulting from reprocessing of gas-cooled reactor fuels (UNGG) in order to meet the decommissioning schedules for the facilities concerned.

In September 2008, subsequent to the meeting of the Advisory Committee to deal with the BNI 118 safety review, ASN issued a decision banning bituminisation of the STE2 sludges and asked AREVA to continue to look for an alternative process for sludge bituminisation. These sludges, representing 3,400 tons of salts, were produced between 1966 and the late 1990s and are the result of reprocessing of radioactive effluents from the UP2-400 plant units or the CEA research centres. AREVA presented ASN with a project for an alternative package (known as C5) consisting of pellets of compacted waste, placed in a container filled with an inert material. After obtaining the opinions of IRSN and ANDRA, ASN asked AREVA, in decision 2011-DC-0206 of 4th January 2011, to continue with its studies and demonstrations regarding the properties of the package, in order to be able to rule on the acceptability of this package for subsequent disposal.

Moreover, in its decision 2010-DC-0176 of 23rd February 2010, ASN asked AREVA by February 2012 to present the progress of its work to define an alternative waste package, known as S5, for packaging alpha technological waste, produced primarily by the La Hague and MELOX plants. ASN considers that the S5 package does not offer sufficient guarantees for long-term storage and for disposal in deep geological formations.

c) The ECRIN facility operated by COMURHEX Malvési

The waste produced by the facility is stored on the Malvési site in former settling tanks named B1 and B2. This waste chiefly contains natural radionuclides. However, some traces of artificial radionuclides, as a result of reprocessing of spent fuels, carried out in the facility until 1983, have been detected in these ponds. The storage facilities consequently fall under the BNI regime.

In compliance with the ASN Commission's decision of 22nd December 2009, the COMURHEX company submitted a license application for the creation of a BNI at the end of 2010. ASN and its technical support organisation are currently examining this file.

On 31st December 2011, COMURHEX submitted a study to the ministers for energy, nuclear safety and radiation protection, proposing safe long-term management routes for the waste currently being stored in the B1 and B2 settling ponds in its Malvési establishment, along with the management procedures for new waste produced by operations in the Malvési facilities. This study is being examined by ASN.

1|3|3 EDF waste management

a) EDF waste management strategy

The waste produced by EDF nuclear power plants is activated waste (from reactor cores) and waste resulting from plant operation and maintenance. To this can be added the legacy waste and waste resulting from ongoing decommissioning operations. EDF is also the owner of long-lived high level and intermediate level waste from its share of the spent fuels reprocessed in the AREVA plant at La Hague.

Activated waste

This waste comprises control rod assemblies and poison rod assemblies used for reactor operations. This is long-lived intermediate level waste produced in small quantities. It is at present stored in pools in the power plants, pending storage in the future centralised ICEDA facility located on the Bugey site, the creation of which was authorised by decree 2010-402 of 23rd April 2010. The function of this installation will be to process and store activated waste from the BNIs currently being operated by EDF, from the decommissioning of the first generation reactors and from decommissioning of the Creys-Malville plant. In 2011, ASN continued its civil engineering inspections to ensure that a number of important civil engineering operations were being carried out correctly. More than one year after the construction work began, concreting of the floors of the main buildings has been completed. The building roof slabs and the various beams are currently being poured. ASN considers that monitoring of the construction work is satisfactory.

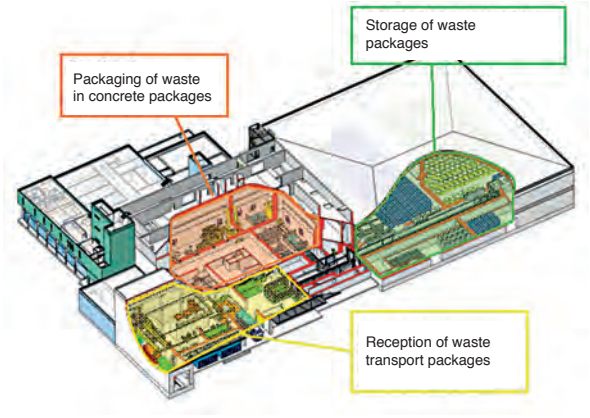
It must however be remembered that in its judgement of 6th January 2012, the administrative court of Lyon cancelled the building permit for the facility. This cancellation is liable to delay the anticipated facility commissioning schedule, planned by EDF for early 2014.

Operating and maintenance waste

Some of the waste is reprocessed by the Centraco facility in Marcoule in order to reduce the volume of ultimate waste. The other types of operating and maintenance waste are disposed of in the Aube repository and in the Morvilliers VLL repository for the particularly low level waste. It contains beta and gamma emitters but few or no alpha emitters. Some of the waste is reprocessed by the Centraco facility in Marcoule in order to reduce the volume of ultimate waste. The other types of operating and maintenance waste are disposed of in the Aube repository and in the Morvilliers



Basins B1 and B2 of the plant for conversion of natural uranium into UF_4 on the COMURHEX Malvési site



View of the ICEDA project

VLL repository for the particularly low level waste. It contains beta and gamma emitters but few or no alpha emitters.

b) The issues and implications

The main issues related to the EDF waste management strategy concern:

– *the management of legacy waste*. This primarily concerns structural waste (graphite sleeves) from the gas-cooled reactor fuels. This is low level, long-lived waste (LLW-LL) which is eventually to be disposed of in the corresponding ANDRA repository currently being planned. This waste is primarily stored in semi-buried silos at Saint-Laurent-des-Eaux. Graphite waste is also present in the form of stacks in the gas-cooled reactors currently being decommissioned.

In the light of the postponed opening of the repository which was to take the graphite waste, ASN asked EDF to look at a possible intermediate graphite storage programme to accompany the gas-cooled reactor decommissioning programme (see chapter 15). ASN is waiting for the 2012 deadline on developments regarding the creation of a repository for graphite waste in order to specify its expectations on this point.

The graphite sleeves containing gas-cooled reactor fuel elements and technological waste were stored in the silos at Saint-Laurent (BNI 74) from 1971 to 1994. These silos consist of two semi-buried reinforced concrete bunkers, made leaktight by a steel liner. In 2003, following the review of the facility's baseline safety requirements, and bearing in mind EDF's undertaking to empty the silos by 2010, ASN authorised continued operation of the silos. Given the delay in the search for a site for the graphite waste repository and in response to ASN's request for definition of an alternative strategy to guarantee the safe management of this waste, EDF in July 2007 presented a solution which was to place a containment barrier around the silos. In July 2008, ASN approved the principle of a geotechnical containment around the silos, subject to the provision of a certain amount of additional data, which was subsequently made available by EDF in 2009. The geotechnical containment installation work was carried out in 2010. Following transmission by the licensee in January 2010, ASN referred the facility's periodic safety review file, modified accordingly, to IRSN. ASN in particular wants the IRSN to analyse the data concerning the effectiveness of the geotechnical containment and associated equipment. ASN will issue a position statement on this file in early 2012.

– *changes linked to the fuel cycle*. EDF fuel use policy (see chapter 12) has consequences for the fuel cycle installations (see chapter 13) and for the quantity and nature of the waste produced. This subject was examined by the Advisory Committees for reactors, for plants and for waste at the end of 2001 and early 2002. ASN asked that the "cycle consistency" file be updated. The revised file was sent by EDF to ASN at the end of 2008. This file was examined on 30th June 2010 by the Advisory Committees for laboratories and plants and for waste. Following this examination. In its letter of 5th May 2011, ASN asked EDF to implement a more rigorous policy for managing its storage capacity for substances before their disposal or their treatment or reprocessing. More specifically with regard to waste, EDF must for example ensure that the available packaging containers can meet the disposal needs.

The CENTRACO low-level waste processing and packaging centre, located in Codolet near the Marcoule site (Gard *département*[4]), is operated by SOCODEI, a subsidiary of EDF. This facility was authorised by an amended decree dated 27th August 1996 and entered service in 1999. The purpose of the CENTRACO facility is to process low or very low level waste by melting of metal waste or incineration of incinerable waste such as the clothing worn by staff intervening in nuclear facilities (gloves, suits), oils, solvents, resins, etc. The melting process consists in treating primarily ferrous metal waste (valves, pumps, pipes, tools, etc.) generated by maintenance and by decommissioning of nuclear facilities.

Owing to the many deviations observed in 2008, the ASN Chairman asked the licensee to draw up a safety improvement plan for its facility. ASN also reinforced its checks to ensure that this plan was effectively implemented. Nine inspections were carried out in 2009, five in 2010 and eight in 2011.

4. Administrative region headed by a *préfet*



CENTRACO plant in Marcoule: drums and ingots before they leave for ANDRA's surface repository in Soulaines

On 12th September 2011, an explosion in the melting furnace killed one employee and injured four others, including one seriously. From its national emergency centre, which was rapidly activated following the CENTRACO accident, ASN analysed the developing situation and informed the public, with the help of the information supplied by IRSN and that supplied by the licensee and the fire brigade's specialised services.

ASN went to the site as soon as the accident happened and ordered a reactive inspection on Tuesday 13th September, in order to clarify the circumstances of the accident. This inspection lasted several days, ending on Thursday 22nd September 2011.

A judicial inquiry was opened at the same time as ASN was carrying out its investigations. During the course of this judicial inquiry and then the subsequent criminal investigation for unintentional injury and manslaughter, ASN was requisitioned to provide technical assistance to the court. During this mission, the ASN inspectors thus had access to all the documents and premises placed under seal, for the purposes of their investigations. A copy of the ASN interim technical report was transmitted to the courts at the end of 2011. This information, which is *sub judice*, could not follow ASN's usual public communication procedures.

Following the technical checks conducted by the inspectors after the accident, ASN specified that the activity contained in the furnace at the time of the accident was about 30 mega becquerels (MBq) and not 63 kilo becquerels (kBq) as had been stated by the licensee on the day of the accident. Based on the results of an analysis of a sample of metal taken from the furnace, the specific activity of the melted waste was 7.7 Bq/g and the mass of waste in the furnace about 4 tonnes. According to the results of the sample analysis, the main radionuclides present were cobalt-60 and manganese-54. Although this remains a low value, ASN did however ask the licensee for explanations regarding this under-evaluation.

On the occasion of an inspection carried out on 4th October 2011, the inspectors focused on determining the exact reasons for this erroneous value being transmitted. It appeared that this under-estimation was the result of a human error in the initial evaluation of this activity level, with the licensee's procedures subsequently being unable to either identify or correct this under-estimation before it was communicated. The licensee told the inspectors that it had identified this error the day following the accident and had mentioned it at the meeting of the local information committee (CLI) on 14th September. ASN finds it regrettable that at the session of the High Committee for Transparency and Information on Nuclear Security (HCTISN) held on 15th September 2011, the SOCODEI representative did not mention this rectified information.

ASN asked the licensee to review its operational emergency management procedures to ensure that the data transmitted, in particular the figures, be systematically checked beforehand. This appears in the inspection follow-up letter appended to this correspondence.

This accident did not lead to any dispersal of radioactivity into the environment. The premises housing the furnace were partially damaged by the accident. However, the fusion unit building containing the furnace area was not damaged. The furnace area, which was placed under seal by the public prosecutor's office for the purposes of the judicial inquiry, is not accessible.

Without prejudice to any measures that may be taken under the judicial procedure, ASN in a decision dated 27th September 2011, stipulated that it would need to issue prior approval before any restart of the melting and incineration furnaces, which were shut down shortly after the accident. As at 31st December 2011, no restart authorisation had been given.

During the course of 2012, ASN intends to examine the facility's periodic safety review file forwarded by the licensee in February 2011. This examination will be an opportunity to review the conformity of the facility, evaluate its status with respect to the best practices and examine the steps taken by the licensee to guarantee operating safety.

1|3|4 Management of waste from small-scale nuclear activities[5]

a) Management of waste from non-BNI nuclear activities

Issues and implications

The use of unsealed sources in nuclear medicine, biomedical or industrial research creates solid and liquid waste: small laboratory items used to prepare sources, medical equipment used for administration, leftovers of meals eaten by patients who had received diagnostic or therapeutic doses, etc. Radioactive liquid effluents also come from source preparation as well as from patients who naturally eliminate the radioactivity administered to them.

The diversity of waste from small-scale nuclear activities, the large number of establishments which produce it and the radiation protection issues involved have all led the public authorities to tighten the management of the waste generated by these activities.

5. Small-scale nuclear activities correspond to all installations using ionising radiation but not covered by the BNI regime. Small-scale nuclear activities concern many fields such as medicine (radiology, radiotherapy, nuclear medicine), human biology, research and industry.

Implementation of ASN decision 2008-DC-0095

ASN decision 2008-DC-0095 of 29th January 2008 lays out the technical rules to be met by the disposal of effluents and waste contaminated or potentially contaminated by radionuclides owing to a nuclear activity[6]. This decision incorporates the main provisions of the circular from the Minister responsible for Health (DGS/DHOS no.2001/323 of 9th July 2001) which only applied to medical activities.

Following consultation of the stakeholders, ASN will in early 2012 publish the guide for application of this decision, which specifies the good practices for management of effluents and waste produced by BNI nuclear activities.

On the occasion of the consultation about the ASN draft guide, the professionals pointed out that some of the requirements were not suited to their particular situation, or that there were problems with practical implementation of certain requirements, such as that concerning installation of a permanent detection system in establishments with a nuclear medicine unit. ASN notes that these problems are for example linked to the diversity of situations encountered in the various industrial, university and medical domains to which the decision applies.

ASN will make good use of the information sent to it by the stakeholders during the consultation, as well as experience feedback from its inspections, in order to propose any necessary changes to the text.

b) Management of waste containing enhanced natural radioactivity

Some professional activities using raw materials which naturally contain radionuclides but which are not used for their radioactive properties, may lead to an increase in the specific activity of the radionuclides present. This is known as enhanced natural radioactivity. Most of these activities are (or were) regulated under the regime of installations classified on environmental protection grounds (ICPE).

Waste containing enhanced natural radioactivity can be accepted in various types of facilities, depending on its specific activity:

– in a waste disposal centre authorised by order of the *préfet*[7], if it can be proven that the waste activity level is negligible from a radiation protection viewpoint. The circular from the Directorate for the Prevention of Pollution and Risks (DPPR) of 25th July 2006 stipulates the conditions for acceptance of waste containing enhanced natural or concentrated radioactivity in disposal facilities;
– in ANDRA's very low level waste disposal facility;
– in a storage facility. Some of this waste is waiting for a disposal route, in particular the commissioning of a disposal centre for long-lived, low level waste.

In 2004 and 2008, ASN tasked the Robin des Bois association with carrying out two surveys, which more accurately identified the potential sources of occupational and general public exposure to ionising radiation from enhanced natural radioactivity. Under the terms of the PNGMDR, ASN in July 2009, forwarded its report on the management solutions for waste with enhanced natural radioactivity to the Ministers for Environment and Health. The conclusions of this report do not call into question the existing management solutions. However, ASN also made recommendations for improvement of management routes for disposal of this type of waste. Most of these recommendations are focused on ICPEs. On these subjects, ASN works together with the Ministry for the Environment. The PNGMDR 2010-2012 also incorporates the main recommendations made by ASN and defines late 2011 as the deadline for production of a review of implementation of the circular of 25th July 2006, and late 2012 as the deadline for provision by ANDRA of storage solutions for some of the waste containing enhanced natural radioactivity.



Guide no.18: Disposal of effluents and waste contaminated by radionuclides, produced in facilities licensed under the Public Health Code.

6. The nuclear activities concerned by the decision are those mentioned in article R.1333-12 of the Public Health Code, that is all authorised or notified nuclear activities (including nuclear activities intended for medicine, human biology or biomedical research) with the exception of those carried out in the following facilities:
– basic nuclear installations mentioned in III of article 28 of Act 2006-686 of 13th June 2006 concerning transparency and security in the nuclear field (BNI);
– nuclear installations and activities mentioned in III of article 2 of Act 2006-686 of 13th June 2006 concerning transparency and security in the nuclear field (BNI), that is defence-related nuclear activities and installations;
– installations classified on environmental protection grounds subject to authorisation pursuant to articles L. 511-1 to L. 517-2 of the Environment Code (ICPE);
– installations subject to authorisation pursuant to article L153-3 of the new Mining Code

7. In a *département*, representative of the State appointed by the President

c) Management of mining residues and mining waste rock

Uranium mines were worked in France between 1948 and 2001, producing 76,000 tons of uranium. Exploration, mining and processing work was carried out on about 210 sites in France spread over 25 départements. Ore processing however was carried out in 8 plants. The former uranium mines are now almost all under the responsibility of AREVA NC.

The Mining Code applies to mining activities, both during operation of the mine and until the end of the validity of the mine title. The Environment Code applies to residue disposal areas. Finally, the Public Health Code and the Labour Code guarantee radiation protection of the public and workers.

The uranium mine workings produced two categories of products:
– mining waste rock, comprising the soil and rock excavated to access the minerals of interest;
– static or dynamic processing residues, which are the products remaining after extraction of the uranium from the ore. Such residues correspond to process waste, as defined by the Environment Code.

In France, treatment residues represent 50 million tonnes spread over 17 disposal sites. These disposal sites can cover surface areas varying from one to several tens of hectares, and enclosing from a few thousand to several million tonnes of residues. The radioactivity measurements carried out on the disposal sites give values of the same order as the measurements taken in the environment of the site.

Regulatory context

The uranium mines and their annexes are covered by the Mining Code. The mining regulator focuses primarily on operation and on conventional mining risks, without taking specific account of radiation protection issues. It also deals with the site closure conditions. Operation of the French mines is based on a system of concessions, most of which will expire on a common date in 2018, set by the Mining Code.

The mining residue disposal sites are covered by the regime of installations classified on environmental protection grounds. Decree 2006-1454 of 24th November 2006 created a specific section 1735[8] for these sites.

The Ministry for the Environment and ASN issued a circular on 22nd July 2009 defining a plan of action comprising the following working topics: monitor the former mining sites, improve understanding of the environmental and health impact of the former uranium mines and their surveillance, manage the waste rock (better identify its uses and reduce impacts if necessary), reinforce information and consultation. In a letter of 12th June 2009, the Chairman of AREVA NC undertook to implement an action plan to help apply these measures, alongside measures taken under the aegis of the State's services.



Aerial view of the Bellezane mining site, La Crouzille mining division, in 1984



Redeveloped Bellezane open-cast mines 105 and 68, former La Crouzille mining division, in 2001

Issues and current measures

The long-term behaviour of the mining residue disposal sites

Redevelopment of the uranium processing residues disposal sites consisted in placing a solid cover over the residues to provide a protective barrier to limit the risks of intrusion, erosion, dispersion of the products on the site and the risks of external and internal (radon) exposure of the surrounding populations.

Article 4 of Act 2006-739 of 28th June 2006 required that by the end of 2008, an inventory be produced of the long-term impact of uranium mining residue disposal sites, with the implementation if necessary of an enhanced radiological monitoring plan for these sites. On 25th August 2009 (see ASN opinion 2009-AV-0075) ASN sent the Minister for the Environment its opinion of the studies submitted by AREVA. ASN considers that the studies concerning the residue disposal sites need to be continued and added to in the coming years.

The PNGMDR 2010-2012 is based on the opinion submitted by ASN and specifies the additional studies to be performed

8. Radioactive substances (depot, storage or disposal) in the form of solid residues of uranium, thorium or radium ore, as well as their reprocessing products containing no uranium with isotope 235 enrichment, the quantity of which is greater than 1 tonne.

by AREVA over the next few years concerning management of the residues disposal sites and the management of mining waste rock. The requests in particular concern the additional information to be provided by AREVA concerning the characterisation of mining residues, the long-term strength of the embankments surrounding the mining residue disposal sites and the long-term radiological impact of the residue stocks and waste dumps. AREVA will also have to study the feasibility and pertinence of reinforcing the quality of the covering on the mining residue disposal sites, evaluate current and future practices for mining site water treatment and the associated discharges, for example with regard to the chemical and radiological risks. Finally, AREVA will need to inventory the mining waste rock present in the public domain and evaluate its dosimetric impact.

ASN regularly follows up the requests made in accordance with the PNGMDR and periodically conducts joint reviews with AREVA NC to check the progress of the work and identify any difficulties.

At its request, ASN and the MEEDTL met with the Bois Noirs association in January 2011, which wanted to present the concerns of the residents living near the Bois Noirs-Limouzat mining site (*commune*[9] of Saint-Priest-la-Prugne) with regard to AREVA's plans to dry out the layer of water covering the mining residues. ASN asked representatives of the association to take part in the plenary sessions of the PNGMDR working group when it deals with management of former mining sites.

Reuse of waste rock in the public domain

Most of the waste rock remains on the site where it was produced (mine in-fill, redevelopment work or waste dumps). Nonetheless, mining waste rock may have been used as backfill, in earthworks or for road beds on locations near the mining sites. Although since 1984 the transfer of waste rock to the public domain has been traced and sometimes carried out in compliance with orders from the préfet to the quarry operators, the picture is incomplete with regard to transfers prior to 1984. ASN and the Ministry for the Environment asked AREVA to inventory the mining waste rock reused in the public domain, in order to verify that these uses are compatible and to reduce the impacts if necessary.

AREVA carried out helicopter-borne measurement campaigns around former French mining sites between November 2009 and the end of 2010. The areas overflown are the *départements* of Creuse, Corrèze, Saône-et-Loire, Allier, Puy-de-Dôme, Lozère, Loire, Nièvre, Morbihan and Vendée. The data then underwent statistical processing to identify the geographical areas that require verification on the ground. No situation requiring emergency intervention has so far been identified. The reconnaissance and ground verification phase began in 2011 and will continue until early 2013. The inventory of waste rock will only be known after completion of all of the ground reconnaissance operations. ASN is remaining particularly vigilant to monitoring of these various phases and to any situation which could require additional measures.

In 2011, AREVA completed its inventory of mining waste rock in the Creuse and Corrèze *départements*.

AREVA sent ASN a proposed methodology for evaluating usage compatibility and the management methods for the waste rock that could be removed. This file is currently being examined by ASN, which will issue a position statement on the acceptability of the methodology proposed by AREVA early in 2012.

ASN considers the public must be involved in the management of waste rock in the public domain, and indeed management of redeveloped former mining sites. The steps taken pursuant to the MEDDTL and ASN circular of 22nd July 2009, the PNGMDR and the GEP Limousin, make provision for involving the stakeholders in the deliberations and the measures to be taken.

The Ministry for the Environment, the Ministry for Industry and the Ministry for Solidarity, Health and the Family decided as early as 2005 to set up and finance a pluralistic expert group (GEP) to provide third-party assessment of the redevelopment of the former mining sites in the Limousin. On 15th September 2010, the GEP Limousin submitted its final report and its recommendations to the Minister for the Environment and the ASN Chairman, concerning the short, medium and long term management of former uranium mining sites in France. The GEP noted the considerable progress made in recent years on the subject of mining sites, both in the Limousin and nationally. The Group is of the opinion that this progress should be continued and be broadened in order to develop a clear perspective on the sustainable management of these sites over the next decade. The ASN Chairman and the Minister for the Environment have made a commitment to the GEP to examine the ways and means for implementation of these recommendations and to ensure follow-up as part of the remit of the PNGMDR working group. The Ministry for the Environment and ASN asked the GEP Chair in May 2011 to present its conclusions and recommendations to the local and national consultative bodies and, by the end of 2012, to evaluate the implementation of these recommendations.

ASN and the MEDDTL drafted an action plan designed to implement the main GEP recommendations. The main areas of work were presented to the GEP at its December 2011 session. They will be applied operationally.

ASN is a member of the steering committee for the national inventory of uranium mining sites, MIMAUSA (History and impact of uranium mines: summary and archives; *www.irsn.fr*), under the aegis of the Ministry for the Environment. This inventory will be supplemented by an inventory of mining waste rock by 2014, as well as by a review of the situation of the former mining sites as identified by the AREVA surveys and IRSN's verifications and measurements in the field. The local authorities were kept informed of the results of the actions taken on the former mining sites in Brittany and the Limousin.

9. Smallest administrative subdivision administered by a mayor and a municipal council

From 14th to 16th September 2010, experts from the European Commission, in accordance with article 35 of the Euratom Treaty[10], carried out an independent assessment of the regulatory systems and the organisation put into place in France to check and monitor the radioactive releases from the former uranium mining sites in the Limousin *région* as well as the radioactivity levels in the environment around these former mining sites. Based on what they saw in the Limousin and in the light of the answers provided both by the authorities and by the licensee AREVA, the Commission's experts considered that the requirements of article 35 are met with regard for the French former uranium mining sites. The experts noted the high level of expertise in France on this subject and in particular underlined the quality and diversity of the tools used to inform the public. The Commission also hopes that the French authorities and the licensee will be able to share their experience with the other member States of the European Union by developing appropriate ties with these countries.

d) Management by ANDRA of waste from small-scale nuclear activities

Article L.542-12 of the Environment Code entrusts ANDRA with a public service storage mission for waste produced by small-scale nuclear activities (e.g.: research laboratories, hospitals, etc.). Until now, ANDRA has not operated any storage facilities, but has had agreements with other nuclear licensees for access to storage capacity on their facilities. On behalf of ANDRA, CEA thus stores radium lightning rods and used sealed sources for which there is currently no disposal route.

In order to obtain its own storage capacity, ANDRA submitted an application in 2011 for modification of the facilities of the Aube very low level repository (covered by the regime applicable to installations classified on environmental protection grounds) in order to create two new buildings designed to take waste from small-scale nuclear activities. This includes a building for grouping of waste packages so that they can be sent to other facilities in France for treatment and packaging, and a storage building for waste for which there are as yet no dedicated disposal facilities. ASN was approached by the Champagne-Ardenne Regional Directorate for the Environment, Planning and Housing (DREAL). ASN notified the DREAL of its opinion at the end of 2011.

ASN considers that the approach adopted by ANDRA will be such as to meet the duties entrusted to it under Article L.542-12 of the Environment Code. It should however be pointed out that, if authorised, these facilities will not be able to receive tritiated waste, owing to its characteristics. ASN considers that management solutions must be sought for this type of waste. The PNGMDR 2010-2012 thus requires that ANDRA submit a study concerning ways and means of having decay storage facilities accept tritiated waste that cannot be disposed of directly. At the end of 2011, ANDRA submitted the study required by the PNGMDR. This study is currently being examined by ASN.

1|4 Long-term management of radioactive waste

1|4|1 The very low level waste disposal facility (CSTFA)

The CSTFA, located in the Aube *département* on the *communes* of Morvilliers and La Chaise, covers an area of 45 hectares. This ICPE, licensed by order of the *préfet* dated 26th June 2003, offers a disposal capacity of 650,000 m³ and has been in service since August 2003. Waste treatment operations, such as the compacting or packaging (solidification) of certain very low level (VLL) waste, are carried out prior to disposal.

In 2005 and 2009, ANDRA submitted applications for modifications to the operating conditions regarding the architecture of the centre's vaults, in order to optimize the use of the available volume. These modifications are subject to the supplementary orders of the *préfet* of 21st July 2006 and 26th March 2010.

1|4|2 Surface repositories for low and intermediate level, short lived waste

Most low and intermediate level waste with a short half-life (less than 30 years) is sent for final disposal in the surface waste repositories operated by ANDRA. The principle underlying these repositories is to protect the waste from hazards, notably water circulation, during what is known as the surveillance phase (by convention 300 years) until such time as its activity level has decayed sufficiently to become negligible. There are two such repositories in France.

a) The Manche repository

The Manche radioactive waste repository (CSM) covers an area of about 15 hectares at the tip of the La Hague peninsular and has a total capacity of 527,225 m³ of waste packages. It was commissioned in 1969 and was the first radioactive waste repository to be operated in France. Operations at the CSM came to an end in July 1994 and the centre entered the surveillance phase in January 2003 (decree 2003-30 of 10th January 2003).

Isolated problems with the repository covering were identified a few years ago and required limited consolidation work. After consolidation of the "east embankment" in the summer of 2010, ANDRA proceeded to consolidate the "north embankment" in the summer of 2011. This work required authorisation by ASN and is the first step in putting a more long-lasting cover into place. In addition, ASN asked that more work be done to understand the long-term behaviour of the repository. An interim review of the modifications made to the repository cover will be presented within four years, as requested by ASN, on the basis of the opinion issued by the Advisory Committee for waste in 2009.

ASN also had this Advisory Committee examine the final safety report, the general monitoring rules, the regulation monitoring plan and the on-site emergency plan. In response to requests

10. Article 35 of the Euratom Treaty states that "each Member State shall establish facilities necessary to carry out continuous monitoring of the levels of radioactivity in air, water and soil and to ensure compliance with the basic safety standards.
The European Commission has the right of access to such facilities in order that it may verify their operation and efficiency."

from ASN, ANDRA in 2011 submitted a new version of its on-site emergency plan, the regulation monitoring plan and the general monitoring rules, which were the subject of an agreement with ASN. These modifications led ASN to undertake work to revise the prescriptions of the order governing discharges and releases.

Finally, in accordance with the recommendations of the commission assessing the situation of the Manche repository (known as the "Turpin Commission"), ANDRA in March 2008 drafted an interim version of the "Concise History" intended to preserve essential information about the CSM repository for future generations. In 2012, a reassessment will be made of the exhaustiveness and completeness of this information.

b) The low and intermediate level short-lived waste repository in the Aube

In 1992, the low and intermediate level waste repository of the Aube (CSA) took over from the Manche repository, taking full advantage of the operating experience feedback gained from it. This installation was authorised by the decree of 4 September 1989[11] and commissioned in January 1992. It is located in Soulaines-Dhuys (Aube) and has a disposal capacity of 1 million m^3 of waste, distributed among 400 disposal structures. The operations performed in the facility comprise packaging of the waste, either by injecting mortar into 5 or 10 m^3 metal containers, or by compacting 200 litre drums.

Waste containment is achieved by three consecutive barriers: the package, the covering and the ground in which the repository is engineered. The repository's activities therefore generate a very small quantity of radioactive effluents. These are regulated by the order of 21st August 2006 authorising ANDRA to discharge liquid and gaseous effluents and to intake water for the Aube repository.

In 2010, a health investigation was carried out around the repository by the Health Monitoring Institute (InVS) at the request of the "Citoyens du Coin" interest group and local elected officials. The results of this survey brought to light no link between the repository and any health effects. They were sent to the Soulaines CLI in late October 2010.

In 2010, operations in the repository were marked by the appearance of unusual cracks on the basemats of certain structures of the tranche under construction (tranche 8). According to the licensee, these anomalies are attributable to a change in the cement used for the basemat concrete. In the summer of 2011, following ASN approval, ANDRA initiated a modification concerning adaptation of the layer, the shape, the slope of the structures and injection of resin into the cracks in order to reinforce the tightness of the basemats.

In 2011, ANDRA submitted a request for modification of the facilities to allow X-ray imaging inspections, tritium degassing checks and destructive tests (core sampling of low level packages) on the site, in addition to the non-destructive checks already carried out (visual, radiological, dimensional, gamma spectrometry checks). This modification request is currently being investigated by ASN.

ASN is favourable to the idea of ANDRA acquiring its own high-performance inspection resources to ensure the quality of the packages received in its facilities.

At the end of 2010, ANDRA submitted a request to ASN for authorisation to implement a system of internal authorisations, as specified in article 27 of decree 2007-1557 of 2nd November 2007. The file thus submitted describes the type of operations concerned, the planned internal monitoring system and the ASN information procedures. This application is being examined by ASN, which will reach a decision on this subject in early 2012.

1|4|3 Management of long-lived high and intermediate level waste

The 28th June 2006 Act states that research on the management of long lived, high or intermediate level radioactive waste (HLW/ILW-LL) should be continued in three directions: separation and transmutation of long-lived radioactive elements, reversible disposal in deep geological layers and interim storage. ASN considers that studies in these three directions are on the whole proceeding satisfactorily.

a) Separation/transmutation

Separation/transmutation processes aim to isolate and then transform long-lived radionuclides in radioactive waste into short-lived radionuclides or stable elements. The transmutation of the minor actinides contained in the waste is liable to have an impact on the size of the disposal facility, by reducing both the heating power of the packages placed in it[12] and the repository inventory.

The 28th June 2006 Act on the sustainable management of radioactive materials and waste, as well as the PNGMDR, require that CEA coordinate research into the separation-transmutation of long-lived radioactive elements, together with other research organisations and with ANDRA, concerning the potential impact of the use of this technology on the disposal of waste. By the end of 2012, CEA is required to submit a "report assessing the prospects of the various industrial separation-transmutation technologies", in particular comprising a part dealing with the benefits of separation-transmutation for geological disposal. At the end of 2010, CEA submitted an interim report which, for the various scenarios studied, presented the potential benefits in terms of reducing the harmfulness of the radioactive waste, the impact on the footprint of the future geological disposal facility and the impacts on the cycle installations (fuel fabrication, reactor operation, reprocessing) and on transport operations. This file is currently being examined by the ASN.

b) Storage

The 28th June 2006 Act states that storage studies must be carried out so that *"no later than 2015, new storage facilities can be created or existing facilities modified, to meet the needs, particularly in terms of capacity and duration"*. The need to extend or create interim storage facilities must be surveyed to ensure provision of adequate storage capacities for waste before its final

11. The decree of 4th September 1989 authorising the Commissariat à l'énergie atomique (CEA/ANDRA) to create a radioactive waste disposal facility at Soulaines-Dhuys and La Ville aux Bois (Aube *département*)

12. The greater the heat given off by the packages, the further apart they must be spaced in the repository and the larger the disposal footprint.

disposal. The 28th June 2006 Act gives ANDRA responsibility for continuing interim storage studies. On 31st December 2009, ANDRA submitted a file presenting storage options complementing disposal. ASN asked the Advisory Committee for waste to examine this file together with the "2009 dossier" submitted by ANDRA for the high level and intermediate level, long-lived waste disposal project. At this stage, ASN has no particular comments concerning the analysis of storage requirements prior to disposal, as presented by ANDRA. In its opinion 2011-AV 0118 of 28th July 2011 submitted to the Minister for the Environment and the Minister for Higher Education and Research, ASN does however recommend that the studies be continued by ANDRA together with the producers of the waste concerned, so that sufficient storage capacity prior to disposal of intermediate and high level, long-lived waste is available in good time.



Aerial view of the LLW/ILW-SL (low and intermediate level, short-lived waste) disposal vaults in the Aube LLW/ILW repository

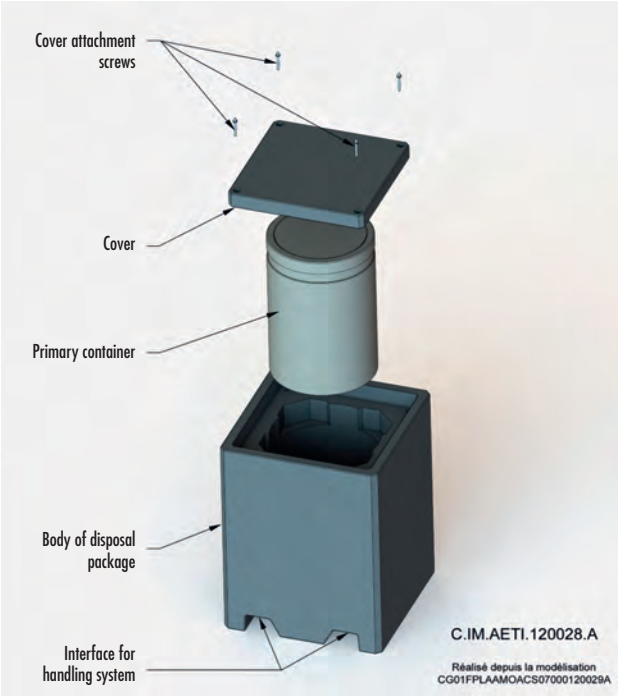
c) Disposal in deep geological formations / CIGEO (industrial geological repository centre) Project

The research work for the deep geological formation waste disposal project is being carried out in the underground laboratory in Meuse/Haute-Marne. The decree of 3rd August 1999 authorised ANDRA to create and operate this underground laboratory within the commune of Bure. In order to continue the studies needed to acquire additional data, particularly with a view to producing the creation authorisation application file for a deep repository, ANDRA presented the Ministers with a request for renewal of the authorisation to operate the laboratory for the period 2012-2030. ASN sent the Director General for the prevention of risks its opinion (no.2011-AV 0118 of 10th May 2011) on the memorandum and draft specifications for the laboratory, presented in the authorisation renewal application file. The memorandum and specifications summarise the research programme already carried out since 2004 and present that envisaged until about 2030, along with the disposal facility project milestones. In its opinion submitted on 10th May 2011, ASN recalled the benefits of continuing the research and experimentation in the Meuse/Haute-Marne underground laboratory, considering this to be essential to the acquisition of the knowledge needed to demonstrate the safety of placing high and intermediate level, long-lived radioactive waste in the same geological formation and to demonstrate the feasibility of its construction, its operation and its closure, in compliance with safety requirements. ASN also issued a certain number of recommendations for the continuation of this research and experimentation work. ASN also issued a favourable opinion (no.2011-AV0123 of 7th July 2011) on the draft decree authorising the national agency for radioactive waste management (ANDRA) to continue to operate an underground laboratory within the *commune* of Bure (Meuse), to study deep geological formations in which the disposal of radioactive waste could take place.

In accordance with the PNGDMR decree of 16th April 2008, ANDRA at the end of 2009 proposed a zone of interest to the Minister for the Environment and the Minister for Higher Education and Research, which was suitable for siting a disposal facility and in which it would conduct detailed geological investigations. On 5th January 2010, ASN gave the Government a favourable opinion on the choice of this 30 km² zone of interest for detailed reconnaissance work (ZIRA), with a view to siting of the underground installations of the future disposal facility and potential zones for siting of the surface installations (ZIIS). ASN also recalled the importance of choosing a site for disposal of high and intermediate level long lived waste, for commissioning of the disposal facility in 2025.

At the end of 2009 and pursuant to the PNGDMR decree of 16th April 2008, ANDRA also forwarded a file presenting an update of safety and reversibility options for disposal in the repository, of the inventory model for the waste packages used for design of the repository and the main design principles for the surface facilities envisaged. The file was examined on 30 November 2010 by the Advisory Committees for waste and for laboratories and plants, on the basis of the report presented by IRSN. ASN more particularly requested an examination of the pertinence of the inventory model for sizing of the repository, the design, safety and reversibility options, as well as the pertinence of the experimentation programme planned for the Meuse/Haute-Marne laboratory, in terms of it enabling ANDRA to provide the data necessary to demonstrate the safety and feasibility of the repository, in good time. ASN also stated that it wanted to see storage concepts studied in addition to those for disposal. ASN considers that the design changes following examination of the "2005 file"[13], primarily concerning aspects relating to the architecture of the facility, are not such as to modify the conclusions with regard to the feasibility of disposal. ASN notified the Ministers for the Environment, Energy and Research of its opinion (opinion no.2011-AV 0129 of 26th July 2011). ASN in particular considers that, since its examination of the 2005 file, ANDRA has developed elements concerning the design, safety and reversibility aspects ensuring management of the risks during operation of the disposal facility. ASN considers that these elements must nonetheless be clarified in the creation authorisation application file for a deep geological layer disposal facility. ANDRA will also need to make a more detailed analysis of some of the risks linked to operation of the facility. With regard to the safety of the repository after its

13. Le dossier 2005 est le dossier présenté par l'ANDRA en 2005 relatif à l'évaluation de la faisabilité d'un stockage en formation géologique profonde dans la formation argileuse étudiée au moyen du laboratoire souterrain de Bure.



Package disposal concept in CIGEO

closure, ASN recommends that ANDRA complete the justifications concerning the feasibility and the performance of the structure seals.

The CIGEO project underwent a project review, headed by Mr Laurent Stricker at the request of the General Directorate for Energy and Climate, in May 2011. This project review in particular concerned the industrial programme input data, to allow the initial facility design studies to be performed, the requirements placed upon the lead contractor, particularly with regard to safety and reversibility, the flexibility of the project so as to leave room for optimisation, as well as the project management organisation adopted by ANDRA.

ANDRA informed ASN that the conclusions of this project review are not liable to call into question the contents of the 2009 file examined. ASN also notes that, following the project review, ANDRA continued to make changes to its organisation, in order to improve project management. These changes are also in response to the comments made by ASN during its 2010 inspection at ANDRA head offices concerning the processes used in the running of the CIGEO project.

ASN, together with its technical support organisation IRSN, defined milestones for the examination of the interim files to be submitted by ANDRA before submission of the repository creation authorisation application, which should take place in early 2015. The purpose of these examinations will in particular be to study the progress made with integration of the recommendations made by ASN on the occasion of its review of the files submitted by ANDRA.

By means of inspections in the Bure underground laboratory, ASN continues to ensure that the experiments carried out as part of the research required by the 28th June 2006 Act are performed in accordance with processes guaranteeing the quality of the results obtained.

In February 2007, ASN published the safety guide for final disposal of radioactive waste in deep geological formations, replacing Basic Safety Rule III.2.f., following the favourable opinion given by the Advisory Committee for waste. In 2008, ASN set up a working group to look more closely at radiation protection values and the safety demonstration as applicable to lengthy time-scales. It conclusions were presented to the Advisory Committee for waste in March 2010. ASN observed, in particular, that the approach described in the safety guide is consistent with the doctrine applied internationally where these subjects are concerned.

1|4|4 Management of long-lived low level waste

Long-lived, low level waste (LLW-LL) comprises two main categories: graphite waste resulting from the decommissioning of the gas cooled reactor (UNGG) nuclear power plants, and radium-bearing waste, from the radium industry and its offshoots. ASN considers that the existing stores for this type of waste do not meet current safety requirements.

In June 2008, ANDRA was asked by the Government to begin a campaign to search for a potential site for a LLW-LL radioactive waste repository in areas with suitable geology. ASN sent the Government a favourable opinion concerning ANDRA's approach to analysing the geological context of the *communes* proposing to host a repository (opinion no.2009-AV-0068 of 15th January 2009). ASN stated that there was nothing, from a geological standpoint, to rule out continued investigation into the siting of a LLW-LL waste repository on one of the sites classified by ANDRA as geologically "very interesting" and that the capacity of the sites to host a disposal facility should be confirmed on the basis of the results of detailed investigations.

In 2010, following the failure of the process to search for LLW-LL waste disposal sites, the HCTISN decided to set up the "GT FAVL" working group, tasked with reviewing the available information and the consultation process linked to the creation of the LLW-LL disposal facility. For its part, ASN observed that the deadlines set by the law (commissioning of the repository initially scheduled for late 2013) were too tight and that the "commune" was not the appropriate level for candidatures, in the light of the implications of the project. At its May 2011 interview with the HCTISN working group in charge of experience feedback from the siting process, ASN recommended that the Government and the State be more closely involved in the decision-making process. ASN also recalled that it considered that for safe management of LLW-LL waste, it was important that a solution be defined for this waste in the short term.

The PNGMDR 2010-2012 thus sets new orientations for the LLW-LL waste disposal project. ANDRA must continue its search for a site for the centre, increasing dialogue with the various stakeholders and considering the various possible disposal scenarios, in particular by more closely examining the possibility of separate management of radium-bearing and graphite wastes. By 2012, ANDRA is required to propose a model waste inventory to be considered for the design and sizing of the disposal facility.

1|4|5 Package acceptance in the disposal facilities

In May 1995, in basic safety rule III.2.e, ASN defined requirements concerning approval of the low-level radioactive waste packages in surface repositories. In order to control the quality of the packages it receives on its sites, ANDRA issues package approvals on the basis of a technical file submitted by the waste producer. ANDRA also verities the quality of the packages by means of checks on the packages received in its facilities and through audits and monitoring missions at the waste package producers. These evaluations can if necessary lead to suspension or withdrawal of approval. A summary of the quality of the packages received by the CSFMA is sent to ASN by ANDRA every year.

In 2007, ANDRA for example detected a quality defect on the packages resulting from pyrolysis mineralisation of organic effluents. Production was then suspended. The appraisal carried out by AREVA showed that a modification to the process was the reason for the anomalies detected. ASN reminded the licensee of the need to carry out impact assessments on the effect of the modifications on the quality of the waste packages. An arrangement such as this is now incorporated into the draft decision on radioactive waste packaging currently being finalised.

For intermediate to high level waste packages, ANDRA has not yet defined specifications. Pursuant to the decree of 12th May 1981, AREVA NC must therefore request ASN's approval of the packaging methods for the various types of waste. In 2011, on the basis of IRSN and ANDRA opinions, ASN approved packaging on the La Hague site:

– of solutions of fission products from the R7 and T7 units resulting from the reprocessing of spent fuels from UNGG type gas-cooled reactors, using the cold-crucible technique (CSD-U);
– of intermediate level effluents by vitrification (CSD-B);
– of technological waste and structural elements, sheared into small sections and compacted into cakes (CSD-C) containing dissolver bottom residues. ASN decision 2011-DC-0248 of 25th October 2011 sets out the requirements applicable to the production of this type of CSD-C packages.

By means of its inspections, ASN checks that ANDRA takes adequate steps to ensure the quality of the packages accepted in its disposal facilities. During an inspection in early 2011 at ANDRA head offices, the ASN inspectors reminded ANDRA of the need to tighten up monitoring of the waste producers, in order to ensure the conformity of the packages received in its facilities. In 2011, ASN also carried out an inspection on the quality assurance of the packages from the R7 unit at La Hague. The inspectors carried out spot checks on various package quality and production monitoring indicators. Control of the CSD-B package specifications was considered to be satisfactory.



Type A radioactive waste package

As part of the revision of the general regulations applicable to BNIs, ASN has begun to draft a decision clarifying the requirements regarding waste packaging and the conditions for issue of approval and for monitoring of the producers by ANDRA. This text was opened to consultation on the ASN website in 2010. It will be finalised after the publication of the order defining the technical provisions applicable to BNIs.

ASN exercises particular vigilance in ensuring that the packages produced are in conformity with the conditions of the authorisations and approvals issued. It thus considers that the role of ANDRA in the approvals issue process and in monitoring of the waste package producers is vital to guaranteeing the package quality necessary to comply with the safety demonstration of the waste repositories. ASN therefore considers that ANDRA must acquire the appropriate means to enable it to carry out destructive checks on waste packages, or have them carried out.

2 MANAGEMENT OF SITES AND SOILS CONTAMINATED BY RADIOACTIVITY

A site contaminated by radioactive materials is any site, either abandoned or in operation, on which natural or artificial radioactive materials have been or are employed or stored in conditions such that the site constitutes a hazard for health and the environment. For several decades now, the public authorities have devoted continuous efforts to the management of contaminated sites and soils

Contamination by radioactive substances can be the result of industrial, medical or research activities involving radioactive substances. It can concern the places where these activities are carried out, but also their immediate or more remote vicinity. The activities concerned are generally either "nuclear activities" as defined by the Public Health code, or activities concerned by enhanced natural radioactivity, as covered by the order of 25th May 2005. However, most of the sites contaminated by radioactive substances and today requiring management in fact concern past industrial activities, dating back to a time when radioactive hazards were not perceived in the same way as at present. The main industrial sectors from which the radioactive contamination today identified originated are: radium extraction for medical and parapharmaceutical needs, from the early 20th century up to the end of the 1930s; the manufacture and application of luminescent radioactive paint for night vision and the industries working ores such as monazite or zircons. A site contaminated by radioactive substances is managed on a case by case basis, requiring a precise diagnosis of the site and the contamination. Several complementary contaminated site inventories are available to the public: the ANDRA national inventory which comprises the sites identified as contaminated by radioactive substances (the June 2009 edition is available on the *www.andra.fr.* website) as well as the databases available on the web portal of the Ministry for the Environment (*www.sites-pollues.ecologie.gouv.fr*) dedicated to contaminated sites and soils.

In 2011, ASN continued its work with a view to formally writing up the basic principles of its doctrine in the area of management of sites polluted by radioactive substances. It considers that the exposure of individuals to ionising radiation as a result of operations to manage sites polluted by radioactive substances must be kept as low as reasonably achievable in the light of current technology and of economic and social factors. This is why the prime objective is to remove as much radioactive contamination as possible. ASN also believes that the solution involving the contamination being maintained in-situ should not be considered the reference solution for management of sites contaminated by radioactive substances and that this option can only be an interim solution or reserved for cases in which complete clean-out cannot be contemplated owing, in particular, to the volume of waste to be excavated.

ASN also considers that the management of contaminated sites requires public involvement when choosing the solution adopted, in order to create a climate of trust and minimise conflicts.

2|1 Regulatory framework

Article 14 of Planning Act 2006-739 of 28th June 2006 on the sustainable management of radioactive materials and waste states that ANDRA has particular responsibility for the collection, transport and handling of radioactive waste and the rehabilitation of sites polluted by radioactive materials, on request, and at the expense of the parties responsible, or further to public requisition when the parties responsible for this waste or these sites have defaulted. ANDRA thus has a state subsidy which contributes to financing the missions of public interest entrusted to it. The French National Funding Commission for Radioactive Matters (CNAR), was set up within ANDRA in 2007. The commission is chaired by the executive director of ANDRA and includes representatives from the supervising ministries (Ministries in charge of Environment, Energy and Health), ASN, IRSN, the Association of Mayors of France, environmental defence associations and qualified key figures. The commission met twice in 2011, for example to decide on the allocation of public funds for management of contaminated sites considered to be high-priority, such as Orflam-Plast, Gif-sur-Yvette, Isotopchim, for monitoring the Radium Diagnosis operation and, occasionally, to take charge of certain waste. Since 2010, a scaled-down CNAR has been in place for day to day management of the Radium Diagnosis operation (see following paragraph).

The circular of 17th November 2008 from the Ministry for the Environment, intended for the préfets, describes the applicable administrative procedure for managing sites polluted by radioactive substances covered by the ICPE regime or the Public Health Code, whether the party responsible is solvent or defaulting. In any case, the préfet relies on the opinion of its services, the ASN and the ARS, to validate the rehabilitation project before it is implemented and the objectives for clean-out and for protection of the general public and the workers, pending removal of the contamination or after rehabilitation of the site. He may also recommend public protection or other restrictions.

2|2 Revision of the contaminated sites management methodology guide

The methodology guide for the management of sites potentially contaminated by radioactive substances, produced by ASN, the MEDDTL and IRSN, to update the methodology guide for management of industrial sites potentially contaminated by radioactive substances, which was issued in October 2000, was published on the websites of these entities in late 2011. This new guide describes how to deal with the various situations liable to be encountered when rehabilitating sites (potentially) contaminated by radioactive substances. It is consistent with the methodology chosen for chemical pollution (circulars from the Ministry of the Environment to the Préfets, dated 8th February 2007). A draft version of this guide was opened for consultation from November 2010 to February 2011. ASN, the MEDDTL and IRSN then analysed more than 450 comments sent in by the licensees, administrations, technical experts and other players. The draft guide was also presented to the "SFRP 2011" National Radiation Protection Conference in Tours from 20th to 23rd June 2011, where it received a favourable reception, as well as at the 14th ICEM (International conference on environmental remediation and radioactive waste

management) held in Reims from 20th to 25th September 2011. This draft was also presented in Canada (ICRER 2011) and the United States in April 2011 (12th Superfund).

In addition to drafting this guide, ASN continued its work on clarifying the kinds of restrictions that could be recommended by ASN in the event of management of a site contaminated by radioactive substances and covered by neither the ICPE nor the BNI regimes, in particular in the case of small-scale nuclear activities.

2|3 The Radium Diagnosis operation

In October 2010, the State decided to carry out diagnoses in order to detect and if necessary treat any radium pollution resulting from past activities. This operation concerns 84 sites in the Ile-de-France region and 50 sites in the provinces that have accommodated activities associated with radium, and necessitating diagnosis. Discovered by Pierre and Marie Curie in 1898, radium has been used in certain medical (the first cancer treatments) and craftwork activities (clock-making until the 1950s, due to its property of radioluminescence; manufacture of lightning arresters and cosmetic products).

These medical or craftwork activities, which are not linked to the nuclear industry, can have left traces of radium on certain sites. The diagnosis of the sites having accommodated an activity that used radium is a continuation of the many actions engaged by the State in recent years, such as the rehabilitation of sites on which research and radium extraction activities were carried out at the beginning of the 20th century, or the recovery of radioactive objects from private households, etc.

This operation is free of charge for the occupants of the premises concerned: the diagnosis consists in taking systematic measurements to detect the presence of any traces of radium or to confirm the absence of radium. These measurements are taken by a team of IRSN specialists, accompanied by an ASN coordinator, who first of all makes contact with the occupant in order to describe the operation. On completion of this diagnosis, the occupants are informed verbally of the results, with subsequent written confirmation by post. If traces of contamination are detected, rehabilitation operations are performed by ANDRA free of charge, with the agreement of the property owners. Ultimately, each person concerned is given a certificate guaranteeing the results of the operation.

At the end of 2011, twelve sites in the Ile-de-France region had been or are still being investigated, representing 146 diagnoses (one diagnosis per apartment or house or commercial property).

The sites which underwent diagnosis are residential buildings with common areas, apartments and/or commercial premises, one abandoned industrial site undergoing demolition and private houses.

Five sites were also declared free of contamination. These were sites on which buildings were constructed subsequent to the date of handling of the radium. Checks revealed that no parts of the old building or its annexes, and thus no radium contamination, were still present on the premises.

Of the 146 diagnoses performed by IRSN, 130 premises are free of contamination and 16 diagnoses detected traces of radium: three apartments, five houses, three commercial premises, one abandoned industrial site, one cellar and the common areas of a residential building.

The rehabilitation operations are nearly completed in one apartment and the abandoned industrial site. They will shortly be starting in three private houses, one apartment and a commercial property. The other sites are being studied prior to the rehabilitation work. This should make all these sites compatible with unrestricted use.

Experience feedback, more than one year after the operation started, shows that it is relatively well accepted by the occupants and environmental protection associations. The vast majority of the premises diagnosed are clear of radiological contamination. The pollution levels recorded are low and confirm that there is no health risk; the maximum dosimetry received is less than 2.4 mSv/year (added value), which is approximately the same order of magnitude as the dose received per year by the French population from naturally occurring sources of radioactivity.

In relation to the initial calendar, the end of the first phase in the Ile-de-France region was delayed for two reasons. On the one hand, the number of diagnoses to be performed proved to be higher than expected. An old address for a site which used to house an activity employing radium may now correspond to the location of several private homes. Similarly, a residential building may involve a large number of diagnoses if it comprises numerous apartments and cellars.

In addition, there were delays owing to the pollution clean-up operations, some of which are technically more complex than initially anticipated and which lead to the clean-out objectives having to be adapted. There are no high levels of contamination, but it does appear to be more diffuse than expected and thus entails work over larger areas, taking more time.

The Radium Diagnosis operation will be continued in the Ile-de-France *région* in 2012.



Radium Diagnosis operation poster

2|4 The main subjects examined by ASN

2|4|1 Coudraies district in Gif-sur-Yvette (Essonne)

Review of the files on the properties in the Coudraies district in Gif-sur-Yvette, which began in 2002, enabled the Essonne *préfet* to propose allocation of technical and financial aid for clean-out of contaminated sites, for the simpler cases. The aim in this district is to clean out land that can be cleaned and to demolish the two houses that cannot be subject to this type of work. Requirements for the Coudraies district were incorporated in May 2007 into the local development plan for Gif-sur-Yvette. Radiological monitoring was continued in 2011.

Following on from the steps taken by the State to manage the contaminated sites in the district, a house bought up by the State was demolished in September 2010. A technical meeting was held in the Gif-sur-Yvette Town Hall on 26th May 2011 in the presence of the mayor, ANDRA and ASN, at which various redevelopment scenarios were presented, along with their cost. A public meeting, in September 2011, was an opportunity for ANDRA to present local residents with the future scenario which could be chosen for the fate of this property.

In early 2012, ASN will notify its opinion on the file presented by ANDRA for rehabilitation of this site.

ANDRA purchased a second property in June 2010. In 2011, however, the rehabilitation of this plot had not yet been started.

2|4|2 Clos rose district in Gif-sur-Yvette (Essonne)

Following a request from a local resident and after analysing the history of the district, ASN began work to clarify the situation regarding a few plots of land in the Clos rose district of Gif-sur-Yvette, near the Federal Mogul industrial site, on which there was radiological contamination. The results were presented to the inhabitants in the last quarter of 2010 and at the CNAR of 7th December 2010. Of 11 plots investigated, two houses have radon activity concentrations above 400 Bq/m^3. Additional investigations were carried out in 2011 to identify the radon transfer pathways in these houses and to take the steps necessary to reduce these radon activity concentrations.

2|4|3 Making safe the Isotopchim site in Ganagobie (Alpes-de-Haute-Provence *département*)

From 1987 to the end of 2000, the Isotopchim Company in Ganagobie (Alpes-de-Haute-Provence *département*), was involved in carbon-14 and tritium labelling of molecules intended for medical and industrial applications. In 2000, the company went into bankruptcy, leaving the environment significantly contaminated, with considerable chemical and radioactive waste remaining on the site. Since December 2002, ANDRA has been working to clean up the site. Priority refrigerated waste was packaged and removed to CEA's Marcoule centre from March to June 2008. Continuation of clean-out and rehabilitation work is now being examined by the CNAR. Steps were taken to improve security in July 2009. In 2010, the premises were emptied of their contents and all bulky waste (furniture, papers, etc.) was removed as VLL waste.

Three types of waste still need to be removed in accordance with the provisions validated by the CNAR on 20th September 2011: sludges contaminated with carbon 14 will be removed to the CSFMA towards the end of 2012, solid chemical waste will be inventoried, in order to define the disposal methods. Finally, additional analyses were initiated with a view to defining the disposal routes for the remaining liquid radioactive chemical products. ASN is paying close attention to ensuring that ANDRA immediately initiates the measures to allow removal of the liquid waste for which there is no disposal route, as soon as its interim storage facility is operational. ASN considers that it is essential for this removal to take place as rapidly as possible. The continued clean-out and final redevelopment work on the site is in effect dependent on this complete removal of waste. The CNAR of 20th September 2011 also requested a study for future decommissioning of this facility.

2|4|4 Rehabilitation of the site of the former Pierre et Marie Curie school at Nogent-sur-Marne (Val-de-Marne *département*)

The Pierre et Marie Curie school was built on a former radium extraction site. The land is currently unused. This matter was referred to the CNAR of 8th December 2009, which adopted a rehabilitation project involving partial excavation of the contaminated land and the construction of public sports facilities on top. At the request of ASN, the CNAR nonetheless felt it necessary to ensure that the redevelopment of the site should not hinder subsequent operations in areas where residual contamination may persist and recommended that the municipality evaluate the possibility of more extensive extraction of contaminated material to attain more far-reaching clean-out objectives.

ASN was required to validate the various phases of the work and defined check-points after each phase. The first phase, which began on 19th October 2010, consisted primarily in removing the bulky items from the former school premises. It ended in early 2011. ASN inspected the site on 4th March 2011.

A local information and monitoring committee (CLIS), of which ASN is a member, was set up by the Val-de-Marne *Préfet* and met for the first time on 6th May 2011. The second phase, which consisted in soil clean-out work, began following this CLIS meeting. ASN will be required to check that the clean-out objectives have been met.

2|4|5 Établissements Charvet in l'Ile Saint-Denis (Seine-Saint-Denis *département*)

From 1910 to 1928, this site housed a plant extracting radium from uranium ore and a laboratory for Marie Curie. The Charvet company (butchery waste transit operations) is the current owner of the site, which is today closed and to which access is prohibited. The Charvet company is eligible for financing under France's recovery plan, and is part of the project to

develop an eco-district on the Ile-Saint-Denis island. The rehabilitation project consists of partial excavation of the contaminated soil, allowing development of a park or equivalent use, and taking account of the possibility of subsequent intervention on a part of the site where the contaminated soil and rubble is to be stored. The clean-out work will take place in two phases, the first under the responsibility of the Charvet SA company, the second after handover to the public establishment for land management of the Ile-de-France region (EPFIF).

The first phase, completed at the end of 2012, consisted in sorting of the contaminated waste from the conventional waste and removal from site. The waste sorting and packaging facility was inspected by ASN on 30th June 2010. The volume of rubble generated is far greater than anticipated and the waste also contains small amounts of asbestos. Removal of the rubble has so far not been completed, as funding has not yet been found for the extra costs generated by the greater than expected volume of waste. Discussions are in progress between the State and the Charvet company for financing of this operation.

During validation of the rehabilitation scenario, the CNAR in September 2009, also decided that it was necessary to take further the hydro-geological surveys of the site to decide on the risk of pollution of groundwater and to stipulate appropriate management methods and procedures.

A CLIS is currently being set up. ASN will sit on it as a member representing the public administrations. The CLIS will meet once the land has been transferred from the Charvet company to the EPFIF.

2|4|6 Former Curie laboratories in Arcueil (Val de Marne *département*)

By order of the *préfet* on 20th August 2004, University Paris VI, the owner of the Curie Foundation's former radioactive materials handling site (*Institut du radium*) in Arcueil was asked to carry out safeguard, surveillance and decontamination work. Since 2006, this has been the responsibility of the State. In September 2008, ASN therefore validated the waste sorting objectives, designed to ensure their removal via appropriate disposal routes. After an unauthorised entry to the site in June 2010, site security was reinforced. Because the budget allocated to the work had been exceeded, the local education authority, which was the client for the work on this site, decided to suspend the work and terminated the contracts during the summer of 2010, while security was provided round the clock. Following a public call for bids, all the contracts should be placed by the end of the first half of 2012. A contractors' camp was also installed on the site in mid-December 2011. A hydrogeological survey was started in late 2011 and should be completed by the end of January 2012.

2|4|7 Orflam-Plast in Pargny-sur-Saulx (Marne *département*)

Since 1934, the Pargny-sur-Saulx site has in turn accommodated lighter flint production by extraction of the thorium contained in imported monazite ore and the production of pure thorium nitrate. After the liquidation of the Orflam-Plast company, the Orflam site was transferred to State ownership on 24th November 2008.

Since early 2008, rehabilitation of the site has been managed by the CNAR. Since the end of October 2008, stores of contaminated legacy waste from the Orflam-Plast plant have been discovered and work has been done to make them safe. ASN asked IRSN to analyse the sediments, water and aquatic fauna. The results of these analyses enabled a resumption of fishing to be authorised in the lake at the end of August 2009. Spectrometry mapping was carried out by a helicopter on 29th and 30th June 2009 over a 60 km² area. The investigations confirmed the presence of contaminated waste in the areas already identified. However, no new area showing signs of thorium activity significantly higher than the local background level was found. At the end of 2009, the CNAR ruled on the rehabilitation scenarios for the contaminated areas both off and on the site. A local information and monitoring commission (CLIS) was set up at the end of 2009. The "pond" site was completely cleaned up in 2010, and fishing was once again authorised in July 2010. The rehabilitation work on the "peupleraie" site, with a multi-layer cover put into place, was carried out in 2011. Work on the plant site should resume in 2012. ASN and the DREAL are working in close collaboration on this matter. Specific restrictions for the plant, "peupleraie" and pond sites will be implemented and are currently being drawn up by the DREAL and ASN.



Evacuation of waste from the Orflam-Plast plant

2|4|8 The Boucau site (Pyrénées-Atlantiques *département*)

The Boucau site in the Pyrénées-Atlantiques département is a former industrial site which used to carry out ore crushing activities. Crushing of monazite, an ore naturally rich in radionuclides, which took place primarily between 1973 and 1980, led to radioactive contamination of a part of the site. The activity continued until 1993, albeit with smaller quantities of monazite. The licensee of this site is currently the Agriva company, which has submitted a file indicating its intention to cease operations. Decontamination and radioactivity containment steps have been taken by the Agriva company, in accordance with the criteria set by order of the préfet in 2000. The Regional council, which is the owner of the Port of Bayonne, wishes to acquire the corresponding land. With regard to the cessation of operations file, ASN sent the DREAL its opinion of 3rd October 2011 concerning clean-out of this site and the conditions in which the current uses of the site could be modified. ASN in particular recalled that clean-out of land contaminated by radioactive substances must be taken as far as possible in order to reduce any potential impacts. It also observed that information on the radiological status of the site and on the anticipated possible reuse was not precise enough to be able to rule on the acceptability of these future uses of the site. Given the information of which it was made aware, ASN recommended implementing restrictions on the use of and access to the most heavily contaminated part of the land.

2|4|9 Support for the State's regional services

Pursuant to the circular of 17th November 2008, ASN may be asked by the DREAL for an opinion on the rehabilitation objectives of a site. In 2011, in addition to the sites previously mentioned, ASN responded to the inter-departmental regional directorate for environment and energy in the Ile-de-France region (DRIEE) concerning the plans for rehabilitation of CEA's sites (rehabilitation of part of the former plant site at Le Bouchet and clean-out of the sludge pits of the Orme des Merisiers landfill storage site.

Together with the DREALs, ASN also takes part in monitoring the phosphogypsum disposal sites.

2|5 International action concerning management of contaminated sites and soil

From 21st to 25th March 2011 ASN took part in the annual seminar of the Environmental Protection Agency (EPA) on the subject of sites contaminated by radioactivity and covered by federal "Superfund" financing. ASN has been regularly invited to these conferences since 2004, offering it an opportunity to share experience about contaminated sites, decommissioning of facilities and emergency situations with its American and other counterparts. ASN presented its draft methodology guide for management of contaminated sites and soils and the Radium Diagnosis operation.



Visit to the Savannah site in the United States – March 2011

3 OUTLOOK

Generally speaking, ASN considers that the French radioactive waste management system, built around a specific body of legislative and regulatory texts, a national radioactive materials and waste management plan and an agency dedicated to the management of radioactive waste, is capable of regulating and implementing a structured and coherent national waste management policy.

In 2011, ASN continued with its actions aimed at ensuring that radioactive waste is managed safely, from the moment it is first produced. ASN thus regulates its management within the nuclear installations and periodically assesses the strategies put in place for this purpose by the licensees. ASN in particular remains attentive to ensuring that the licensees recover the legacy waste stored on their sites. ASN notes that the licensees are late in doing this or are experiencing technical difficulties, leading to postponement of the dates for removal from storage of legacy waste on the La Hague and CEA sites. In addition, in 2012, ASN will continue to follow attentively the retrieval from storage of wastes presenting the greatest safety challenges.

With regard to the long-term management of radioactive waste, ASN is encouraged by the way ANDRA operates its disposal facilities. ASN considers that there must eventually be safe disposal routes for all waste. To this end, it is of the opinion that France should be provided with a facility to allow disposal of low level long-lived waste. ASN will therefore attentively follow the process of searching for a site and the development of disposal facility design.

With regard to high and intermediate level, long-lived waste, ASN considers that key steps in the development of the disposal project will be reached in the next few years. In its opinion issued on the file submitted by ANDRA in 2009, ASN determined the main areas for work that needed to be taken further before the creation authorisation application, which should be submitted at the end of 2014. ASN in particular recommended that ANDRA further analyse certain risks linked to operation of the facility, clarify the technical measures to be taken to manage these risks and use demonstrators to complete its understanding of the damage resulting from the excavation of major structures and to qualify the techniques for sealing the drifts and the connections between the surface and the underground facility. ASN remains vigilant in ensuring that ANDRA provides the expected elements.

Together with the stakeholders, 2012 will be more particularly devoted to drafting the new edition of the PNGMDR for the period 2013-2015. This work will be an opportunity to present the progress made in the management of radioactive waste, as linked to the provisions of the previous plan and to define new objectives for continuous improvement of radioactive materials and waste management. ASN will thus ensure that the OPECST recommendations are taken into account and that this work is in line with the requirements of the European directive on radioactive waste recently adopted[14]. ASN will also continue its involvement in work being done on these topics internationally, in particular within ENSREG and the WENRA club of nuclear regulator associations.

ASN has focused more closely on contaminated sites and soils since 2009 and this will continue in 2012, together with the administrations concerned and the other stakeholders. After consultation, ASN issued several opinions in 2011 on polluted site rehabilitation projects and was particularly closely involved in operational oversight of the Radium Diagnosis operation. At the end of 2011, ASN, the Ministry for the Environment and IRSN, published the revised methodology guide for management of sites and soils contaminated by radioactive substances. This publication will be the opportunity in 2012 for ASN to fix its doctrine concerning polluted site and soil rehabilitation principles. ASN restates its position that the solution involving maintaining the contamination in-situ must not be the reference solution for management of sites polluted by radioactive materials and that this option can only be an interim solution or reserved for situations in which the complete clean-out option cannot be contemplated, in particular owing to the volume of waste to be excavated. Finally, in 2012, ASN will continue to oversee the diagnosis operations on sites liable to have housed activities utilising radium in the Ile-de-France region.

14. Council directive 2011/70/EURATOM of 19th July 2011 establishing a community framework for the responsible and safe management of spent fuel and radioactive waste.

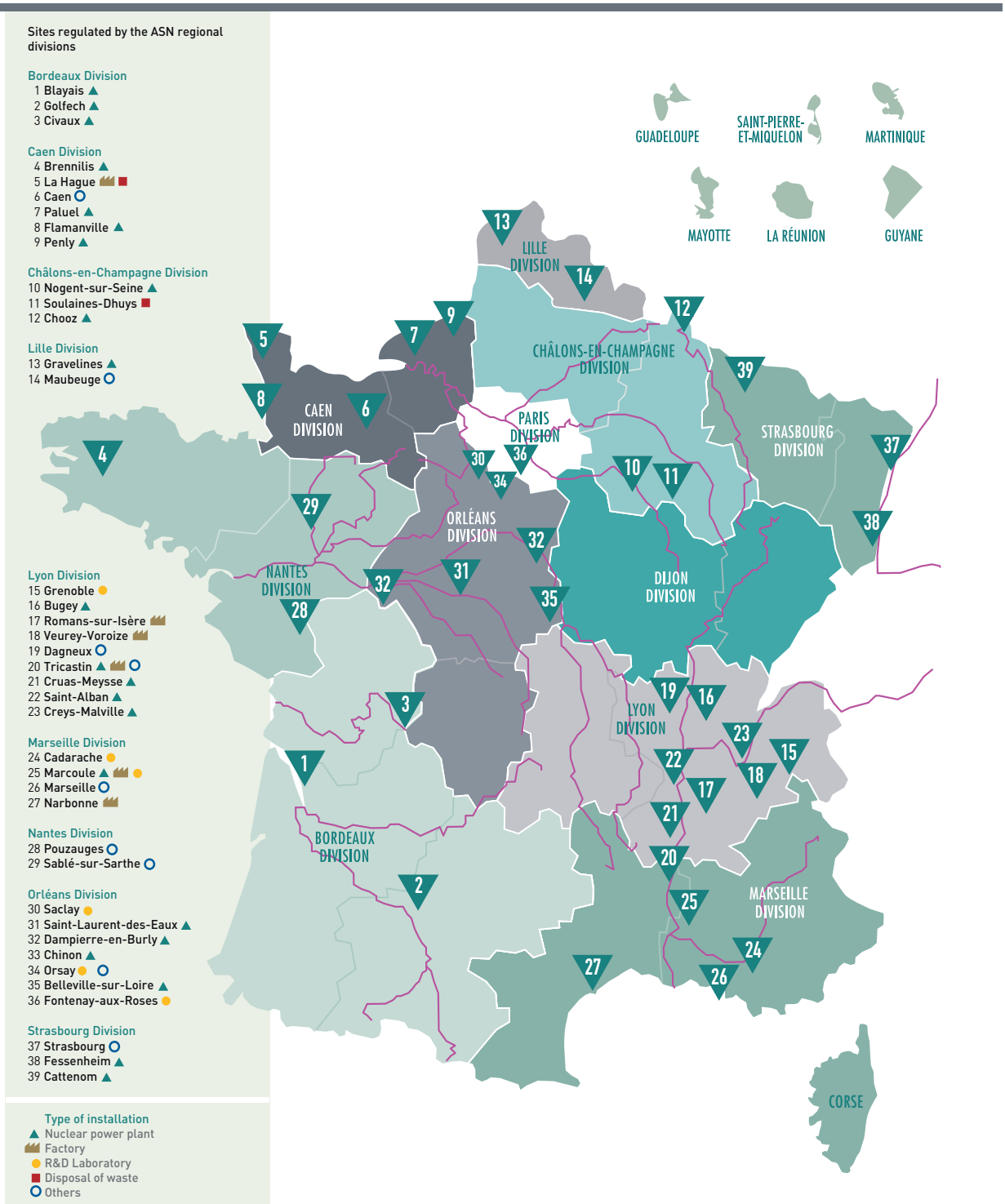
APPENDIX

A LIST OF BASIC NUCLEAR INSTALLATIONS AS AT 31.12.2011 471

B ACRONYMS AND ABBREVIATIONS 483

To regulate all civil nuclear activities and installations in France, ASN has sand up a regional organisation relying on 11 divisions based in Bordeaux, Caen, Châlons-en-Champagne, Dijon, Lille, Lyon, Marseille, Nantes, Orléans, Paris and Strasbourg.

The Paris division is also responsible for activities in Martinique, Guadeloupe, French Guyana, Réunion, Mayotte and Saint-Pierre and Miquelon. The Caen and Orleans divisions are responsible for BNI regulation in the Brittany and Ile-de-France regions respectively. This organisation enables ASN to carry out its duties nation wide and in the overseas *départements*[1] and territories.



1. Administrative region headed by a *Préfet*.

LIST OF BASIC NUCLEAR INSTALLATIONS AS AT 31.12.2011

A basic nuclear installation (BNI) is one that, by its very nature or owing to the quantity or activity of the radioactive materials it contains, is subject to specific regulation arrangements as defined by the TSN Act of 13 June 2006 (now codified in books I and V of the environment code by order 2012-6 of 5 January 2012). These installations must be authorised by decree issued following a public inquiry and an ASN opinion. Their design, construction, operation and decommissioning are all regulated.

The following are considered to be BNIs:
1. Nuclear reactors;
2. Large installations for the preparation, enrichment, fabrication, treatment or storage of nuclear fuels or the treatment, storage or disposal of radioactive waste;
3. Large installations containing radioactive or fissile materials;
4. Large particle accelerators.

Except for nuclear reactors, which are all BNIs, decree 2007-830 of 11 May 2007 concerning the list of basic nuclear installations sets thresholds for each category determining the point at which they become subject to the BNI system.

For technical or legal reasons, the concept of a basic nuclear installation can cover a number of different physical situations: for example in a nuclear power plant, each reactor may be considered as a separate BNI, or a given BNI might in fact consist of two reactors. Similarly, a fuel cycle plant or a CEA centre can comprise several BNIs. These different configurations do not alter the regulation conditions in any way:

The following are subject to the BNI system:
– installations under construction, provided that they are the subject of a creation authorisation decree;
– installations in operation;
– installations shut down or undergoing decommissioning, until they are delicensed by ASN.

As at 31 December 2011, there were 125 basic nuclear installations (legal entities).

NNP name	Name and location of the installation	Licensee	Type of installation	BNI
LOCATION OF INSTALLATIONS REGULATED BY THE BORDEAUX DIVISION				
BLAYAIS 1	BLAYAIS NUCLEAR POWER PLANT (reactors 1 and 2) 33820 Saint-Ciers-sur-Gironde	EDF	Reactors	86
BLAYAIS 1	BLAYAIS NUCLEAR POWER PLANT (reactors 3 and 4) 33820 Saint-Ciers-sur-Gironde	EDF	Reactors	110
GOLFECH 2	GOLFECH NUCLEAR POWER PLANT (reactor 1) 82400 Golfech	EDF	Reactor	135
GOLFECH 2	GOLFECH NUCLEAR POWER PLANT (reactor 2) 82400 Golfech	EDF	Reactor	142
CIVAUX 3	CIVAUX NUCLEAR POWER PLANT (reactor 1) BP 1 - 86320 Civaux	EDF	Reactor	158
CIVAUX 3	CIVAUX NUCLEAR POWER PLANT (reactor 2) BP 1 - 86320 Civaux	EDF	Reactor	159

LOCATION OF INSTALLATIONS REGULATED BY THE CAEN DIVISION

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
BRENNILIS [4]	MONTS D'ARRÉE EL4D Brennilis 29218 Huelgoat	EDF	Disposal or storage of radioactive materials	162
LA HAGUE [5]	SPENT FUEL REPROCESSING PLANT (UP2) (La Hague) 50107 Cherbourg	AREVA NC	Transformation of radioactive materials	33
LA HAGUE [5]	EFFLUENT AND SOLID WASTE TREATMENT STATION (STE2) AND SPENT NUCLEAR FUELS REPROCESSING FACILITY (AT1) (La Hague) 50107 Cherbourg	AREVA NC	Transformation of radioactive materials	38
LA HAGUE [5]	ELAN IIB FACILITY (La Hague) 50107 Cherbourg	AREVA NC	Transformation of radioactive materials	47
LA HAGUE [5]	MANCHE WASTE REPOSITORY (CSM) 50448 Beaumont-Hague	ANDRA	Disposal of radioactive waste	66
LA HAGUE [5]	HAO (HIGH LEVEL OXIDE) FACILITY (La Hague) 50107 Cherbourg	AREVA NC	Transformation of radioactive materials	80
LA HAGUE [5]	REPROCESSING PLANT FOR SPENT FUEL ELEMENTS FROM LIGHT WATER REACTORS "UP3 A" (La Hague) 50107 Cherbourg	AREVA NC	Transformation of radioactive materials	116
LA HAGUE [5]	REPROCESSING PLANT FOR SPENT FUEL ELEMENTS FROM LIGHT WATER REACTORS "UP2 800" - (La Hague) 50107 Cherbourg	AREVA NC	Transformation of radioactive materials	117
LA HAGUE [5]	LIQUID EFFLUENT AND SOLID WASTE TREATMENT STATION "STE3" - (La Hague) 50107 Cherbourg	AREVA NC	Transformation of radioactive materials	118
CAEN [6]	LARGE NATIONAL HEAVY ION ACCELERATOR (GANIL) 14021 Caen Cedex	G.I.E. GANIL	Particle accelerator	113
PALUEL [7]	PALUEL NUCLEAR POWER PLANT (reactor 1) 76450 Cany-Barville	EDF	Reactor	103
PALUEL [7]	PALUEL NUCLEAR POWER PLANT (reactor 2) 76450 Cany-Barville	EDF	Reactor	104
PALUEL [7]	PALUEL NUCLEAR POWER PLANT (reactor 3) 76450 Cany-Barville	EDF	Reactor	114
PALUEL [7]	PALUEL NUCLEAR POWER PLANT (reactor 4) 76450 Cany-Barville	EDF	Reactor	115
FLAMANVILLE [8]	FLAMANVILLE NUCLEAR POWER PLANT (reactor 1) 50830 Flamanville	EDF	Reactor	108
FLAMANVILLE [8]	FLAMANVILLE NUCLEAR POWER PLANT (reactor 2) 50830 Flamanville	EDF	Reactor	109

LIST OF BASIC NUCLEAR INSTALLATIONS (continuation)

LOCATION OF INSTALLATIONS REGULATED BY THE CAEN DIVISION (continuation)

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
FLAMANVILLE [8]	FLAMANVILLE NUCLEAR POWER PLANT (reactor 3 - EPR) 50830 Flamanville	EDF	Reactor	167
PENLY [9]	PENLY NUCLEAR POWER PLANT (reactor 1) 76370 Neuville-lès-Dieppe	EDF	Reactor	136
PENLY [9]	PENLY NUCLEAR POWER PLANT (reactor 2) 76370 Neuville-lès-Dieppe	EDF	Reactor	140

LOCATION OF INSTALLATIONS REGULATED BY THE CHÂLONS-EN-CHAMPAGNE DIVISION

NOGENT-SUR-SEINE [10]	NOGENT-SUR-SEINE NUCLEAR POWER PLANT (reactor 1) 10400 Nogent-sur-Seine	EDF	Reactor	129
NOGENT-SUR-SEINE [10]	NOGENT-SUR-SEINE NUCLEAR POWER PLANT (reactor 2) 10400 Nogent-sur-Seine	EDF	Reactor	130
SOULAINES-DHUYS [11]	AUBE WASTE REPOSITORY (CSA) Soulaines-Dhuys 10200 Bar-sur-Aube	ANDRA	Radioactive waste surface repository	149
CHOOZ [12]	CHOOZ B NUCLEAR POWER PLANT (reactor 1) 08600 Givet	EDF	Reactor	139
CHOOZ [12]	CHOOZ B NUCLEAR POWER PLANT (reactor 2) 08600 Givet	EDF	Reactor	144
CHOOZ [12]	ARDENNES NUCLEAR POWER PLANT - CNA-D 08600 Givet	EDF	Disposal or storage of radioactive materials	163

LOCATION OF INSTALLATIONS REGULATED BY THE LILLE DIVISION

GRAVELINES [13]	GRAVELINES NUCLEAR POWER PLANT (reactors 1 and 2) 59820 Gravelines	EDF	Reactors	96
GRAVELINES [13]	GRAVELINES NUCLEAR POWER PLANT (reactors 3 and 4) 59820 Gravelines	EDF	Reactors	97
GRAVELINES [13]	GRAVELINES NUCLEAR POWER PLANT (reactors 5 and 6) 59820 Gravelines	EDF	Reactors	122
MAUBEUGE [14]	NUCLEAR MAINTENANCE FACILITY (SOMANU) 59600 Maubeuge	SOMANU	Nuclear maintenance	143

LOCATION OF INSTALLATIONS REGULATED BY THE LYON DIVISION

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
GRENOBLE [15]	SILOÉ 38041 Grenoble Cedex	CEA	Reactor	20
GRENOBLE [15]	EFFLUENT AND SOLID WASTE TREATMENT STATION 38041 Grenoble Cedex	CEA	Transformation of radioactive materials	36
GRENOBLE [15]	ACTIVE MATERIAL ANALYSIS LABORATORY (LAMA) 38041 Grenoble Cedex	CEA	Utilisation of radioactive materials	61
GRENOBLE [15]	HIGH FLUX REACTOR (RHF) 38041 Grenoble Cedex	Institut Max von Laue Paul Langevin	Reactor	67
GRENOBLE [15]	DECAY INTERIM STORAGE FACILITY 38041 Grenoble Cedex	CEA	Radioactive materials storage	79
BUGEY [16]	BUGEY NUCLEAR POWER PLANT (reactor 1) BP 60120 - 01155 Lagnieu Cedex	EDF	Reactor	45
BUGEY [16]	BUGEY NUCLEAR POWER PLANT (reactors 2 and 3) BP 60120 - 01155 Lagnieu Cedex	EDF	Reactors	78
BUGEY [16]	BUGEY NUCLEAR POWER PLANT (reactors 4 and 5) BP 60120 - 01155 Lagnieu Cedex	EDF	Reactors	89
BUGEY [16]	BUGEY INTER-REGIONAL WAREHOUSE BP 60120 - 01155 Lagnieu Cedex	EDF	Storage of new fuel	102
BUGEY [16]	ACTIVATED WASTE PACKAGING AND STORAGE INSTALLATION (ICEDA) 01120 Saint-Vulbas	EDF	Packaging and storage of radioactive materials	173
ROMANS-SUR-ISÈRE [17]	FUEL ELEMENTS FABRICATION PLANT 26104 Romans-sur-Isère	FBFC	Fabrication of radioactive materials	63
ROMANS-SUR-ISÈRE [17]	NUCLEAR FUELS FABRICATION UNIT 26104 Romans-sur-Isère	FBFC	Fabrication of radioactive materials	98
VEUREY-VOROIZE [18]	NUCLEAR FUELS FABRICATION PLANT 38113 Veurey-Voroize	SICN	Fabrication of radioactive materials	65
VEUREY-VOROIZE [18]	PELLET FABRICATION FACILITY 38113 Veurey-Voroize	SICN	Fabrication of radioactive materials	90
DAGNEUX [19]	DAGNEUX IONISATION PLANT Z.I. Les Chartinières - 01120 Dagneux	IONISOS	Utilisation of radioactive materials	68

LIST OF BASIC NUCLEAR INSTALLATIONS (continuation)

LOCATION OF INSTALLATIONS REGULATED BY THE LYON DIVISION (continuation)

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
TRICASTIN [20]	TRICASTIN NUCLEAR POWER PLANT (reactors 1 and 2) 26130 Saint-Paul-Trois-Châteaux	EDF	Reactors	87
TRICASTIN [20]	TRICASTIN NUCLEAR POWER PLANT (reactors 3 and 4) 26130 Saint-Paul-Trois-Châteaux	EDF	Reactors	88
TRICASTIN [20]	GEORGES BESSE PLANT FOR URANIUM ISOTOPE SEPARATION BY GASEOUS DIFFUSION (EURODIF) 26702 Pierrelatte Cedex	EURODIF PRODUCTION	Transformation of radioactive materials	93
TRICASTIN [20]	URANIUM HEXAFLUORIDE PREPARATION PLANT (COMURHEX) 26130 Saint-Paul-Trois-Châteaux	COMURHEX	Transformation of radioactive materials	105
TRICASTIN [20]	URANIUM CLEAN-UP AND RECOVERY FACILITY (TRICASTIN) 26130 Saint-Paul-Trois-Châteaux	SOCATRI	Factory	138
TRICASTIN [20]	INSTALLATION TU 5 BP 16 - 26701 Pierrelatte	AREVA NC	Transformation of radioactive materials	155
TRICASTIN [20]	TRICASTIN OPERATIONAL HOT UNIT (BCOT) BP 127 - 84504 Bollène Cedex	EDF	Nuclear maintenance	157
TRICASTIN [20]	GEORGES BESSE 2 PLANT FOR CENTRIFUGAL SEPARATION OF URANIUM ISOTOPES 26702 Pierrelatte Cedex	SET	Transformation of radioactive materials	168
CRUAS-MEYSSE [21]	CRUAS-MEYSSE NUCLEAR POWER PLANT (reactors 1 and 2) 07350 Cruas	EDF	Reactors	111
CRUAS-MEYSSE [21]	CRUAS-MEYSSE NUCLEAR POWER PLANT (reactors 3 and 4) 07350 Cruas	EDF	Reactors	112
SAINT-ALBAN [22]	SAINT-ALBAN-SAINT-MAURICE NUCLEAR POWER PLANT (reactor 1) 38550 Le Péage-de-Roussillon	EDF	Reactor	119
SAINT-ALBAN [22]	SAINT-ALBAN-SAINT-MAURICE NUCLEAR POWER PLANT (reactor 2) 38550 Le Péage-de-Roussillon	EDF	Reactor	120
CREYS-MALVILLE [23]	SUPERPHÉNIX REACTOR 38510 Morestel	EDF	Fast-neutron reactor	91
CREYS-MALVILLE [23]	FUEL EVACUATION FACILITY (Creys-Malville) 38510 Morestel	EDF	Storage of radioactive materials	141

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
LOCATION OF INSTALLATIONS REGULATED BY THE MARSEILLE DIVISION				
CADARACHE (24)	TEMPORARY DISPOSAL FACILITY (PÉGASE) AND SPENT NUCLEAR FUEL DRY STORAGE INSTALLATION (CASCAD) (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Storage of radioactive materials	22
CADARACHE (24)	CABRI (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Reactor	24
CADARACHE (24)	RAPSODIE/LDAC (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Reactor	25
CADARACHE (24)	PLUTONIUM TECHNOLOGY FACILITY (ATPu) - (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Fabrication or transformation of radioactive materials	32
CADARACHE (24)	EFFLUENT AND SOLID WASTE TREATMENT STATION (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Transformation of radioactive materials	37
CADARACHE (24)	MASURCA (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Reactor	39
CADARACHE (24)	ÉOLE (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Reactor	42
CADARACHE (24)	ENRICHED URANIUM PROCESSING FACILITY (ATUE) (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Fabrication of radioactive materials	52
CADARACHE (24)	ENRICHED URANIUM AND PLUTONIUM WAREHOUSE (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Storage of radioactive materials	53
CADARACHE (24)	CHEMICAL PURIFICATION LABORATORY (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Transformation of radioactive materials	54
CADARACHE (24)	ACTIVE FUEL EXAMINATION LABORATORY (LECA) AND SPENT FUEL REPROCESSING, CLEAN-OUT AND REPACKAGING STATION (STAR) (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Utilisation of radioactive materials	55
CADARACHE (24)	RADIOACTIVE WASTE INTERIM STORAGE AREA (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Storage of radioactive materials	56
CADARACHE (24)	PHÉBUS (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Reactor	92
CADARACHE (24)	MINERVE (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Reactor	95
CADARACHE (24)	LABORATORY FOR THE EXPERIMENTAL DESIGN AND FABRICATION OF ADVANCED NUCLEAR FUELS (LEFCA) (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Fabrication of radioactive materials	123
CADARACHE (24)	CHICADE (Cadarache) BP 1 - 13108 Saint-Paul-lez-Durance Cedex	CEA	R&D Laboratory	156

LIST OF BASIC NUCLEAR INSTALLATIONS (continuation)

LOCATION OF INSTALLATIONS REGULATED BY THE MARSEILLE DIVISION (continuation)

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
CADARACHE [24]	CEDRA (Cadarache) 13115 Saint-Paul-lez-Durance Cedex	CEA	Packaging and interim storage of radioactive materials	164
CADARACHE [24]	MAGENTA 13115 Saint-Paul-lez Durance Cedex	CEA	Reception and shipment of nuclear materials	169
CADARACHE [24]	EFFLUENT ADVANCED MANAGEMENT AND PROCESSING FACILITY "AGATE" (Cadarache) 13115 Saint-Paul-lez Durance Cedex	CEA	Packaging and interim storage of radioactive materials	171
CADARACHE [24]	JULES HOROWITZ REACTOR (RJH) (Cadarache) 13115 Saint-Paul-lez Durance Cedex	CEA	Reactor	172
MARCOULE [25]	PHENIX NUCLEAR POWER PLANT (Marcoule) 30205 Bagnols-sur-Cèze	CEA	Reactor	71
MARCOULE [25]	ATALANTE CEN VALRHO Chusclan - 30205 Bagnols-sur-Cèze	CEA	R&D laboratory and study of actinides production	148
MARCOULE [25]	NUCLEAR FUELS FABRICATION PLANT (MELOX) BP 2 - 30200 Chusclan	MÉLOX SA	Fabrication of radioactive materials	151
MARCOULE [25]	CENTRACO Codolet - 30200 Bagnols-sur-Cèze	SOCODEI	Radioactive waste and effluent processing	160
MARCOULE [25]	GAMMATEC 30200 Chuslan	ISOTRON FRANCE S.A.S	Ionisation treatment of materials, products and equipment, for industrial purposes and for research and development	170
MARSEILLE [26]	GAMMASTER IONISATION PLANT M.I.N. 712 13323 Marseille Cedex 14	ISOTRON FRANCE	Ionisation installation	147
NARBONNE [27]	Ponds B1 and B2 Malvési, 11100 Narbonne	COMURHEX	Packaging and interim storage of radioactive materials	

LOCATION OF INSTALLATIONS REGULATED BY THE NANTES DIVISION

POUZAUGES [28]	POUZAUGES IONISATION PLANT Z.I. de Monlifant - 85700 Pouzauges	IONISOS	Ionisation installation	146
SABLÉ-SUR-SARTHE [29]	SABLÉ-SUR-SARTHE IONISATION PLANT Z.I. de l'Aubrée 72300 Sablé-sur-Sarthe	IONISOS	Ionisation installation	154

LOCATION OF INSTALLATIONS REGULATED BY THE ORLEANS DIVISION

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
SACLAY [30]	ULYSSE (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Reactor	18
SACLAY [30]	ARTIFICIAL RADIONUCLIDES PRODUCTION FACILITY (Saclay) 91191 Gif-sur-Yvette Cedex	CIS-bio international	Fabrication or transformation of radioactive materials	29
SACLAY [30]	LIQUID EFFLUENT MANAGEMENT ZONE (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Transformation of radioactive materials	35
SACLAY [30]	OSIRIS-ISIS (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Reactors	40
SACLAY [30]	HIGH ACTIVITY LABORATORY (Saclay) 91191 Gif-sur-Yvettee Cedex	CEA	Utilisation of radioactive materials	49
SACLAY [30]	SPENT FUEL TEST LABORATORY (LECI) (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Utilisation of radioactive materials	50
SACLAY [30]	SOLID RADIOACTIVE WASTE MANAGEMENT ZONE (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Disposal or storage of radioactive materials	72
SACLAY [30]	POSÉIDON – CAPRI IRRADIATION FACILITIES (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Utilisation of radioactive materials	77
SACLAY [30]	ORPHÉE (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Reactor	101
SAINT-LAURENT-DES-EAUX [31]	SAINT-LAURENT-DES-EAUX NUCLEAR POWER PLANT (reactors A1 and A2) 41220 La Ferté-Saint-Cyr	EDF	Reactors	46
SAINT-LAURENT-DES-EAUX [31]	INTERIM STORAGE OF IRRADIATED GRAPHITE SLEEVES (Saint-Laurent-des-Eaux) 41220 La Ferté-Saint-Cyr	EDF	Disposal or storage of radioactive materials	74
SAINT-LAURENT-DES-EAUX [31]	SAINT-LAURENT-DES-EAUX NUCLEAR POWER PLANT (reactors B1 and B2) 41220 La Ferté-Saint-Cyr	EDF	Reactors	100
DAMPIERRE-EN-BURLY [32]	DAMPIERRE-EN-BURLY NUCLEAR POWER PLANT (reactors 1 and 2) 45570 Ouzouer-sur-Loire	EDF	Reactors	84
DAMPIERRE-EN-BURLY [32]	DAMPIERRE-EN-BURLY NUCLEAR POWER PLANT (reactors 3 and 4) 45570 Ouzouer-sur-Loire	EDF	Reactors	85
CHINON [33]	IRRADIATED MATERIALS FACILITY (Chinon) 37420 Avoine	EDF	Utilisation of radioactive materials	94
CHINON [33]	CHINON INTER-REGIONAL WAREHOUSE 37420 Avoine	EDF	Storage of new fuel	99

LIST OF BASIC NUCLEAR INSTALLATIONS (continuation)

LOCATION OF INSTALLATIONS REGULATED BY THE ORLEANS DIVISION (continuation)

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
CHINON [33]	CHINON NUCLEAR POWER PLANT (reactors B1 and B2) 37420 Avoine	EDF	Reactors	107
CHINON [33]	CHINON NUCLEAR POWER PLANT (reactors B3 and B4) 37420 Avoine	EDF	Reactors	132
CHINON [33]	CHINON A1D 37420 Avoine	EDF	Disposal or storage of radioactive materials	133
CHINON [33]	CHINON A2D 37420 Avoine	EDF	Disposal or storage of radioactive materials	153
CHINON [33]	CHINON A3D 37420 Avoine	EDF	Disposal or storage of radioactive materials	161
ORSAY [34]	LABORATORY FOR THE USE OF ELECTROMAGNETIC RADIATION (LURE) 91405 Orsay Cedex	CNRS	Particle accelerator	106
BELLEVILLE-SUR-LOIRE [35]	BELLEVILLE-SUR-LOIRE NUCLEAR POWER PLANT (reactor 1) 18240 Léré	EDF	Reactor	127
BELLEVILLE-SUR-LOIRE [35]	BELLEVILLE-SUR-LOIRE NUCLEAR POWER PLANT (reactor 2) 18240 Léré	EDF	Reactor	128
FONTENAY-AUX-ROSES [36]	PROCESS 92265 Fontenay-aux-Roses Cedex	CEA	Decommissioning research installation	165
FONTENAY-AUX-ROSES [36]	SUPPORT 92265 Fontenay-aux-Roses Cedex	CEA	Installation for treatment of effluents and storage of decommissioning waste	166

LOCATION OF INSTALLATIONS REGULATED BY THE STRASBOURG DIVISION

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
STRASBOURG [37]	STRASBOURG UNIVERSITY REACTOR 67037 Strasbourg Cedex	Université Louis Pasteur	Reactor	44
FESSENHEIM [38]	FESSENHEIM NUCLEAR POWER PLANT (reactors 1 and 2) 68740 Fessenheim	EDF	Reactors	75
CATTENOM [39]	CATTENOM NUCLEAR POWER PLANT (reactor 1) 57570 Cattenom	EDF	Reactor	124
CATTENOM [39]	CATTENOM NUCLEAR POWER PLANT (reactor 2) 57570 Cattenom	EDF	Reactor	125
CATTENOM [39]	CATTENOM NUCLEAR POWER PLANT (reactor 3) 57570 Cattenom	EDF	Reactor	126
CATTENOM [39]	CATTENOM NUCLEAR POWER PLANT (reactor 4) 57570 Cattenom	EDF	Reactor	137

The declared BNIs are those which existed prior to publication of decree n° 63-1228 of 11 December 1963 concerning nuclear installations and for which said decree did not require authorisation but simply notification to the Minister in charge of Atomic Energy.

The missing BNI numbers correspond to installations that figured in previous issues of the list, but which no longer constitute BNIs further to their delicensing (see chapter 15) or their licensing as new basic nuclear installations.

ACC	hulls and end-pieces compaction facility (AREVA NC – La Hague)
ACN	Aarhus Convention and Nuclear (ANCCLI initiative)
ACO	Orsay collider ring (LURE – CNRS – Orsay)
ACR	resins conditioning facility (AREVA NC – La Hague)
ACRO	Association for the Control of Radioactivity in the West
AD2	technological waste packaging facility (AREVA NC – La Hague)
ADEME	French Environment and Energy Management Agency
ADF	Assembly of *départements* of France
ADN	French acronym for DeoxyriboNucleic Acid (DNA)
ADNR	Agreement on the transport of dangerous substances on the Rhine
ADR	European Agreement concerning the International Carriage of Dangerous Goods by Road
ADS	Accelerator Driven System (nuclear reactor driven by a particle accelerator)
AEN	NEA Nuclear Energy Agency (OECD)
AERB	Atomic Energy Regulatory Board (Indian regulatory body)
AFCEN	French Association for NSSS Equipment Construction Rules
AFCN	Federal Agency for Nuclear Control (Belgium)
AFPPE	French Association of Electroradiology Paramedical Staff
AFSSA	French Agency for Food Safety (incorporated into the National Agency responsible for food, environment and occupational health safety in 2010)
AFSSAPS	French Health Product Safety Agency
AFSSET	French Agency for Environmental and Occupational Health Safety (created in September 2005, incorporated into the National Agency responsible for food, environment and occupational health safety in 2010)
AFTMN	French Association fo Nuclear Medicine Technologists
AGATE	effluent advanced management and processing facility (CEA – Cadarache)
AIEA	IAEA International Atomic Energy Agency
ALARA	As Low As Reasonably Achievable (radiation protection principle also called "optimisation principle")
ALLEGRO	experimental low-power, non-electricity generating, gas-cooled fast reactor (GFR) project
ALQA	Lorraine Air Quality Association
ALS	Saclay linear accelerator (CEA)
AMDE	French equivalent of FMEA (Failure Modes and Effects Analysis)
AMI	irradiated material facility (EDF – Chinon)
ANCCLI	National Association of Local Information Commissions and Committees (since 2009)
ANCLI	National Association of Local Information Committees (until 2009)
ANDRA	French National Agency for Radioactive Waste Management
ANR	French Reasearch Agency
ANRE	Agency for Natural Resources and Energy (Japan)
ANSES	National Agency responsible for Health and Safety of Food, the Environment and Work (since July 2010)
ANSN	NNSA National Nuclear Security Administration (China)
ANSTO	Australian Nuclear Science and Technology Organisation
AP 1000	Pressurised Water Reactor designed by Westinghouse
AP 913	maintenance doctrine (EDF)
APE	state-based approach (principle governing incident or accident situation operating strategies)
APEC	fuel evacuation facility (EDF – Creys-Malville – Isère *département*)
AP-HP	Public Health Service – Paris Hospitals
ARCCAD	renovated conditioning facility, Cadarache (CEA)
AREVA	industrial group active in the nuclear fuel cycle and construction of nuclear installations
AREVA NC	fuel cycle licensee (AREVA group)
AREVA NP	designer and builder of nuclear power plants (AREVA group)
ARH	Regional Hospitalisation Agency (integrated in the ARS in 2010)

ARN	RNA RiboNucleic Acid
ARS	Regional Health Agency (since 2010)
ASF	systematic training approach
ASG	steam generator auxiliary feedwater system (PWR)
ASN	*Autorité de Sûreté Nucléaire* (French nuclear regulatory body)
ASND	Defence Nuclear Safety Authority (structure responsible for regulating nuclear safety and radiation protection with regard to defence-related nuclear activities and installations. It is placed under the authority of DSND)
ASQA	air quality monitoring association
ASR	simple refuelling outage (PWR)
ASSET	Assessment of Safety Significant Events Team (IAEA expertise)
ASTRID	prototype sodium-cooled fast reactor (SFR) projet (CEA)
AT1	former pilot reprocessing plant for spent fuel from fast neutron reactors (CEA – La Hague)
ATALANTE	Alpha facility and laboratory for transuranian elements analysis and reprocessing studies (CEA – Marcoule)
ATENA	former project for a contaminated sodium waste treatment installation (CEA)
ATEX	EXplosive ATmospheres (ATEX regulations)
ATMEA	joint venture between AREVA and MHI responsible for the development, commercialisation, certification and sale of ATMEA 1, a new 1,100 MWe reactor
ATPu	plutonium technology facility (AREVA NC – Cadarache)
ATSR	French Association for Technical and Scientific Radiation Protection
ATUE	enriched uranium processing facility (CEA – Cadarache)
AZF	former name of the company operating the fertiliser plant destroyed in the 21 September 2001 accident in Toulouse
BAC	waste auxiliary buildings
BAG	glovebox
BAM	German Federal Institute for Materials Research and Testing
BAN	nuclear auxiliary buildings
BASIAS	French former industrial sites and departments activity database
BASOL	French database of polluted sites and soils requiring action by the public authorities
BCI	spent fuel building
BCOT	Tricastin operational hot unit (nuclear maintenance installation – EDF – Bollène)
BEA	French Aircraft Accident Investigation Bureau
BEAD-air	French Defence Air Accident Investigation Bureau
BEA-mer	French Marine Accident Investigation bureau
BEA-TT	French Land transport accident investigation bureau
BECQUEREL	unit of radioactivity / name of a nuclear exercise held in 1996 in Saclay
BEIR	Committee on the Biological Effects of Ionizing Radiations (United States Academy of Science Committee)
BERD	EBRD European Bank for Reconstruction and Development
Bel V	Technical Safety Organisation and subsidiary of FANC (since 2008)
BK	BK fuel building
BMU	German Federal Ministry of the Environment, Nature Conservation and Nuclear Safety
BNFL	British Nuclear Fuels Limited
BNI	Basic Nuclear Installation
BO	Official Bulletin
Bq	Becquerel
BRGM	French Geological and Mining Research Office
BSF	drum storage building (EDF – Chooz)
BSS	Basic Safety Standards
BTE	effluent treatment building
BWR	Boiling Water Reactor
CABRI	research reactor (CEA – Cadarache)
CADA	Committee of Access to Administrative Documents
CANR	CNRA Committee on Nuclear Regulatory Activities
CAPRA	increased consumption of plutonium in fast neutron reactors (plutonium burnup research programme – CEA)
CARES	underwater storage facility (CEA – Cadarache)
CASCAD	Cadarache bunker research reactor spent fuel storage facility (CEA)

CCAP	French Central Committee for Pressure Vessels
CCINB	BNI Consultative Committee (until 2010)
CCSN	CNSC Canadian Nuclear Safety Commission
CDE	definitive cessation of operational activity (notion qualifying a phase in the life of a BNI, used before the 2006 reform)
CE	European Community – "CE mark" - mandatory and regulatory conformity mark for some products in the European Union to ensure that the product conforms with the "essential requirements" defined by a European directive
CEA	French Atomic Energy Commission (now the Atomic Energy and Alternative Energy Commission)
CEDAI	Internal Authorisations Assessment Committee
CEDRA	radioactive waste packaging and interim storage unit (CEA – Cadarache)
CEE	European Economic Community
CEE-NU	UNECE United Nations Economic Commission for Europe
CEI	International Electrotechnical Commission
CEIDRE	Construction and Operation Expert Appraisal and Inspection Centre (EDF)
CELIMENE	former unit used to examine EL3 reactor fuel (CEA – Saclay)
CENAL	National Alarm Centre (division of the Swiss Federal Office for the protection of the population: the Confederation's technical organ for extraordinary events such as increases in radioactivity or various other technological accidents)
CENTRACO	low-level waste processing and packaging centre (CEA – Marcoule)
CEPN	Nuclear Protection Evaluation Centre
CERCA	Company for the Design and Fabrication of Atomic Fuel
CERN	European Organization for Nuclear Research
CESE	EESC European Economic and Social Committee
CETIM	French Mechanical Engineering Industries Technical Centre
CFCa	Cadarache fabrication complex (COGEMA – MOX facility)
CFU	Colony Forming Unit (the CFU per litre is the unit used to measure the concentration of legionella bacteria)
CGEDD	French Departmental Council for the Environment and Sustainable Development (Ministry of Ecology, Sustainable Development, Transport and Housing)
CGIET	General Council for Industry, Energy and Technologies (Ministry of the Economy, Finance and Industry)
CH	Hospital Centre
CHICADE	Chemistry, waste characterization (CEA Cadarache)
CHRU	Regional university hospital
CHSCT	Committee for Health, Safety and Working Conditions
CHU	University hospital
CIA	incident or accident response procedure (PWR)
CIC	French Inter-ministerial Crisis Committee
CICNR	Inter-ministerial Committee for Nuclear or Radiological Emergencies
CIDEN	Nuclear Environmental and Decommissioning Engineering Centre (EDF)
CIPN	Nuclear Equipment Engineering Department (EDF)
CIPR	International Commission on Radiological Protection (ICRP)
CIRC	International Agency for Research on Cancer (part of the WHO - Lyon)
CIRCE	transfer packaging containing radioactive organic waste (CEA – Fontenay-aux Roses)
CIREA	Interministerial Commission for Artificial Radioelements
CIRIL	Interdisciplinary ion laser research centre (CNRS & CEA – Caen)
CIS bio	Company specialising in international biomedical technologies, especially radiopharmaceuticals
CISSCT	Inter-firm Health, Safety and Working Conditions Committee (for EDF power plants)
CITMD	French Interministerial Commission for the Carriage of Hazardous Goods
CL	Lethal Concentration (CL X% = Concentration for a case fatality rate of X%)
ClF_3	chlorine trifluoride

CLI Local Information Committee

CLIGEET Tricastin major energy facility local information committee (name of the CLI on the Tricastin site since 2008)

CLIO free electron laser (LURE – CNRS – Orsay)

CLIS – Local Committee for Information and Follow-up – name of the CLI for underground laboratories

– Local Committee for Information and Monitoring (name of the CLI at the Fessenheim plant since 2009)

CMIR mobile radiological intervention unit

CMS maximum design flood level (flood protection)

CNA Ardennes first French PWR – Chooz A reactor – EDF

CNA-D Equipment storage facility during decommissioning of the Chooz A reactor (EDF – Chooz)

CNAM French National Health Insurance Fund

CNAR French National Funding Commission for Radioactive Matters

CNDP French National Public Debates Commission

CNE National Review Board (concerning progress made in research into and studies on the management of radioactive materials and waste)

CNE2 Second National Review Board (commission set up after the "Waste" Act of 28 June 2006)

CNEN National Centre for Nuclear Equipment – EDF

CNEPE National Electricity Generating Equipment Centre – EDF

CNPE Nuclear Power Generation Site – EDF

CNRA Committee on Nuclear Regulatory Activities (NEA)

CNRS French National Centre for Scientific Research

Co Cobalt

COD Departmental Operations Centre

CODERST Departmental Council for the Environment and for Health and Technological Risks (since 2006)

Codex collection of food health safety and consumer protection standards produced by a Alimentarius commission set up by the FAO and the WHO

CODIRPA Steering committee for managing the post-accident phase of a nuclear accident or radiological emergency situation

CODIS-CTA Departmental Fire and Emergency Operational Centre – Alert Processing Centre

COFRAC French Accreditation Committee

COFREND French Non-Destructive Testing Confederation

COGEMA *Compagnie générale des matières nucléaires* (AREVA group, now known as AREVA-NC)

COGEMA nuclear materials packaging and logistics transport compagy (COGEMA subsidiary)

COGIC French Government Emergency Management Operational Centre

COLEN standing committee on nuclear pressure equipment

COLTI operational committee for the prevention of illegal labour

COMURHEX Société pour la conversion de l'uranium en métal et en hexafluorure (Company for the conversion of uranium into metal and hexafluoride) (AREVA group)

CONCERT Concertation on European Regulatory Tasks (grouping of the nuclear regulatory bodies from eastern and western European countries)

COPAT Plant Unit Shutdown Steering Committee (EDF)

CORE COperation for REhabilitation of living conditions in the contaminated Belarus territories

COREX Follow-up to the CORE programme; analysis of experience feedback from actions taken in Belarus by the French teams

CoRWM Committee on Radioactive Waste Management (high-level group of British experts on radioactive waste management)

COSRAC Committee for the Monitoring of Research on the Cycle Back-End

COWAM Community Waste Management ("concerted action" by the European Union's 5th framework R&D programme concerning local decision-making with regard to nuclear waste)

CO_2 carbon dioxyde

CP0 first series of 900 MWe PWRs (EDF)

CP1 1st subdivision of the CPY series

CP2 2nd subdivision of the CPY series

CPA	special authorisation conditions – radiation sources
CPE	special utilisation conditions – radiation sources
CPP	main primary (cooling) system (PWR)
CPY	second series of 900 MWe PWRs (EDF)
CRAM	Regional Health Insurance Fund
CRIIRAD	Committee for Independent Research and Information on Radioactivity
CRPPH	Committee on Radiation Protection and Public Health (NEA)
CSA	- Aube waste repository (ANDRA) (former name of the CSFMA), - Complementary Safety Assessment
CSD-B	standard bituminised waste package
CSD-C	standard compacted waste package
CSD-V	standard vitrified waste package
CSFMA	low and intermediate level waste disposal facility (ANDRA)
CSG	irradiated graphite disposal centre
CSIC	High Council for Classified Installations (replaced by the CSPRT in 2010)
CSIN	Committee on the Safety of Nuclear Installations (NEA)
CSLUD	Laboratories and Plants Safety Commission (reporting to the DSND, having competence for defence-related nuclear laboratories and plants)
CSM	Manche waste repository (ANDRA)
CSN	– Consejo de Seguridad Nuclear (Spanish regulatory body) – Nuclear Safety Convention
CSP	– main secondary cooling system (PWR) – French Public Health Code
CSPRT	High Council for the Prevention of Technological Risks (since 2010)
CSS	Commission on Safety Standards (IAEA)
CST	Scientific and Technical Committee (Euratom)
CSTB	Building Industry Scientific and Technical Centre
CSTFA	VLL waste repository (ANDRA – Morvilliers – Aube *département*)
CT	Labour Code
CTC	Technical Emergency Centre
CTCAE	Common Terminology Criteria for Adverse Events (criteria used to rate the side-effects of cancer treatments)
D/E EB	unit of the AREVA NC plant at La Hague
D/E EDS	solid waste storage/storage removal (AREVA NC – La Hague)
DAC	authorisation decree (BNI procedure)
DAPE	operation extension approval dossier for BNIs
DCI	Communication and Public Information Department (ASN)
DCN	– Nuclear Power Plants Department (ASN) – Nuclear Fuels Division (EDF)
DDAC	Community law adaptations bill
DDASS	Departmental Health and Social Action Directorate (until 2010)
DDTEFP	Departmental Labour, Employment and Professional Training Directorate (until 2010)
DEM	decommissioning
DEP	Nuclear Pressure Equipment Department (ASN)
DEU	Environment and Emergency Department (ASN)
DFD	Franco-German Steering Committee for Nuclear Safety Issues
DfT	Department for Transport (United Kingdom)
DFK	Franco-German Committee for Nuclear Plant Safety Issues
DGAC	General Directorate for Civil Aviation – Ministry of Ecology, Sustainable Development, Transport and Housing
DGCCRF	General Directorate for Competition Policy, Consumer Affairs and Fraud Control – Ministry of the Economy, Finance and Industry
DGDDI	General Directorate of Customs and Excise (Ministry of the Budget, Public Accounts and Administrative Reform)
DGEC	General Directorate for Energy and Climate (Ministry of Ecology, Sustainable Development, Transport and Housing)
DGITM	General Directorate for Infrastructure, Transport and the Sea (Ministry of Ecology, Sustainable Development, Transport and Housing)

DGOS General Directorate for Health Care (Ministry of Labour, Employment and Health) (since 2010)

DGPR General Directorate for Risk Prevention (Ministry of Ecology, Sustainable Development, Transport and Housing)

DGS General Directorate for Health – Ministry of Labour, Employment and Health

DGSCGC General Directorate for Civil Protection and Crisis management (Ministry of the Interior)

DGSNR General Directorate for Nuclear Safety and Radiation Protection (ASN central structure until the November 2006 reform)

DGT General Directorate for Labour (Ministry of Labour, Employment and Health)

DG/TREN Directorate-General for Energy and Transport (European Commission)

DHOS Directorate for Hospitalisation and Health Care Organisation – Ministry of Health, and Sport (until 2010)

DHUP Directorate of Housing, Planning and Landscape (Ministry of Ecology, Sustainable Development, Transport and Housing)

DIADEM irradiating or alpha waste from decommissioning

DIN Nuclear Engineering Division – EDF

DIRECCTE Regional Directorate for Businesses Competition Policy Consumer Affairs Labour and Employment

DIS Ionising Radiation and Health Department (ASN)

DIT Industrial Activities and Transport Department (ASN – until end of 2010)

DNA DeoxyriboNucleic Acid

DOE Department of Energy (United States)

DOR review orientation file

DOS safety options file (for BNIs)

DOT Department of Transportation (USA)

DPI Production and Engineering Directorate (EDF)

DPAEP Directorate for Personnel Management and Adaptation of the Professional Environment (Ministry of Economy, Finance and Industry)

DPN Nuclear Operation Division (EDF)

DQPRM Medical and Radiological Physics qualifying diploma

DRASS Regional Health and Social Action Directorate (until 2010)

DRC Nuclear Waste, Research Facilities, and Cycle Department (ASN – since beginning of 2011)

DRD Research Facilities and Waste Department (ASN – until end of 2010)

DREAL Regional Directorate for the Environment, Planning and Housing

DRI International Relations Department (ASN)

DRIEE Inter-Departemental Regional Directorate for Environement and Energy (Ile-de-France region)

DRIRE Regional Directorate for Industry, Research and the Environment (until 2010)

DRL Diagnostic Reference Level

DRTEFP Regional Labour, Employment and Professional Training Directorate (until 2010)

DRYPAC sludge drying process

DSC Directorate for Civil Security (Ministry of the Interior, Overseas France, Local Authorities and Immigration)

DSND Delegate for Nuclear Safety and Radiation Protection for National Defence Installations and Activities (see ASND)

DTS Transport and Sources Department (ASN – since beginning of 2011)

DTI Total Indicative Dose

DTPA diethylene-triamine-penta-acetate (substance used in nuclear medicine)

DUP declaration of public interest procedure

EAN European ALARA Network (the aim of which is to promote implementation of the ALARA principle)

EACA European Association of Competent Authorities on the transport of radioactive material

EAS reactor building containment spray system (PWR)

EBR relative biological efficiency (RBE)

ECS complementary safety assessment

ECURIE European Community Urgent Radiological Information Exchange system

EDE containment annulus ventilation system (PWR)

EDF *Électricité De France*

EDS solid waste interim storage area

EEVSE	glass storage building (AREVA NC – La Hague)
EEVLH	glass storage building extension on the La Hague site (AREVA NC – La Hague)
EFOMP	European Federation of Organisations in Medical Physics
EGRA	Expert Group on Regulatory Authorisation (sub-group of the NEA's CRPPH)
EGRPM	Expert Group on the Radiological Aspects of the Fukushima Accident
EIL	interlaboratory tests
EIS	safety-related equipment
ELAN II B	former sealed source fabrication installation (CEA – La Hague)
EL3	heavy water reactor No. 3 (former experimental reactor – CEA – Saclay)
EL4	heavy water reactor No. 4 (former Monts d'Arrée nuclear power plant – EDF – Brennilis)
EL4-D	equipment interim storage installation for decommissioning of the Monts d'Arrée nuclear power plant
ENEF	European Nuclear Energy Forum
ENS	European Nuclear Society
ENSI	Eidgenössisches Nuklearsicherheitsinspektorat (Swiss regulatory body since 1st January 2009)
ENSREG	European Nuclear Safety Regulators Group (high-level group set up by the European Commission to deal with nuclear safety and waste management – former HLG)
EOLE	research reactor (CEA – Cadarache)
E.ON	Electricity and gas production and distribution company (Germany, various European contries and United States)
EP	public inquiry
EPA	Environmental Protection Agency (United States)
EPAL	Emergency Preparedness and Action Levels (population protection measures harmonisation group – HERCA)
EPEES	security protection and evaluation exercises
EPFIF	public establishment for land management of the Ile-de-France region
EPR	Evolutionary Pressurized Water Reactor (new type of nuclear reactor developed by AREVA NP)
EPRD	revenue and spending forecast (public establishment "budget")
EPRUS	health emergency preparedness and response organisation
EPS	probabilistic safety study
ERNET	Emergency Response NETwork (IAEA)
ERP	establishment open to the public
ERPAN	European Radiation Protection Authorities Network
ERR	European Radiation Research society
ESE	significant environmental event
ESP	pressure vessel
ESPN	nuclear pressure vessel
ESR	significant radiation protection event
ESRF	European Synchrotron Radiation Facility (Grenoble)
ESS	significant safety event
EST	significant transport event
ESWS	Essential Service Water System
ETARE	establishments listed for emergency response purposes
ETPT	Full-Time Equivalent (FTE)
EURANOS	EURopean Approach to Nuclear and radiological emergency management and rehabilitation Strategies
Euratom	EURopean ATOMic energy community treaty
EUROCLI	European Association of Local Information and European dialogue forums
EURODIF	European gaseous diffusion enrichment plant
EUROFAB	Fabrication in Europe (experimental programme to produce MOX fuel from military plutonium under the terms of the American-Russian agreement to reduce plutonium stocks)
EUTERP	European Training and Education on Radiation Protection Platform
EVEREST	French acronym for "evolving towards entry without standard suit" (entry into a controlled area in working overalls – initiative implemented by EDF)
FA-MA	low activity - medium activity wastes
FANR	Federal Authority for Nuclear regulation (UAE)
FAO	Food and Agriculture Organization of the united nations

FAVL	low activity and long life radioactive waste
FBFC	Franco-Belgian Fuel Fabrication Company (Pierrelatte and Romans-sur-Isère)
FDG	fluorodeoxyglucose (substance used in nuclear medicine)
FISA	Fission Safety (biennial conferences on nuclear reactor safety organised by the European Union)
FLS	local safety organisation
FMA	low and medium activity wastes (LMW)
FMA-VC	Low or medium activity and short-lived waste
FOD	Field Operations Directorate (HSE Directorate)
FOH	organisational and human factors
FOSSEA	CEA project for recovering waste stored in old pits
FP	Fission Products
FRAMATOME	French NSSS builder (now known as AREVA NP)
FRAMATOME-ANP	Framatome – Advanced Nuclear Power (company set up by AREVA and SIEMENS to develop the new EPR reactor type – now known as AREVA NP)
FRAREG	Framatome Regulators (Association of regulatory bodies in countries operating power plants of French design)
GALICE	nuclear fuel management method (EDF)
GAMMATEC	ionisation installation (ISOTRON France company in Marcoule)
GANIL	Large National Heavy Ion Accelerator (Caen)
GB I	Georges Besse Plant I – EURODIF
GB II	Georges Besse Plant II
GBq	GigaBecquerel (thousand million Becquerels)
GEN IV	International "Forum" of ten countries and the European Union to develop future nuclear reactors, known as 4th generation (GEN IV)
GEP	pluralistic expert group
GESI	French group of Electronic Fire Safety industries
GFR	Gas-cooled Fast Reactor (see RNR-G)
GIAG	severe accident action guide
GIE	economic interest grouping
GIF	Generation IV International Forum of ten countries and the European Union to develop future nuclear reactors, known as 4th generation (see. GEN IV)
GIMELEC	French industry association for electrical equipment, automation and related services
GPE	Advisory Committee of experts (reporting to ASN)
GPD	Advisory Committee for waste (reporting to ASN)
GPESPN	Advisory Committee for nuclear pressure equipment (reporting to ASN)
GPMED	Advisory Committee for medical exposure (reporting to ASN)
GPMDR	"Radioactive Materials and Waste" Advisory Committee (ANCCLI)
GPPA	"Territories – Post-nuclear-accident management" Advisory Committee (ANCCLI)
GPR	Advisory Committee for nuclear reactors (reporting to ASN)
GPRAD	Advisory Committee for radiation protection (non-medical) (reporting to ASN)
GPT	Advisory Committee for transport (reporting to ASN)
GPU	Advisory Committee for nuclear laboratories and plants (reporting to ASN)
GQA	Atomic Questions Group (AQG) (European Council)
GRNC	Nord Cotentin Radioecology Group (pluralistic experts group set up by ASN and the ministries concerned, to examine the issue of the radiological impact of nuclear activities in the Nord Cotentin region)
GRS	*Gesellschaft für Anlagen und Reaktorsicherheit* (technical support organisation for the German regulatory body)
GSS	Moisture Separator-Reheater System (PWR)
GV	steam generator
GWj	gigawatt day (energy unit)
GWj/t	gigawatt day per ton (volume energy unit)
Gy	gray (unit of absorbed dose)
G8	Group of the 8 leading industrial nations (Germany, Canada, United States, France, Italy, Japan, United Kingdom and Russia)
HA	high activity
HAO	oxide high activity facility (AREVA NC – La Hague)
HARMONIE	former fast neutron source reactor (CEA – Cadarache)

HAS	French National Authority for Health – since 2005
HA-LL	high-activity long-lived waste
HCSP	French High Public Health Council
HCTISN	French High Committee for Transparency and Information on Nuclear Security (created by the 13 June 2006 Act)
HERCA	Head of European Radiation Control Authorities
HFD	Defence High Official
HFDS	Defence and Security High Official
HFR	High Flux Reactor (Joint Research Centre of the European Union – Petten – Netherlands)
HPST	law 2009-879 of 21 July 2009, reforming the hospital and relative to patients, health and the territories
HSE	Health and Safety Executive (UK organisation responsible for the prevention of technological risks)
HSE/ND	Health and Safety Executive/Nuclear Directorate (UK regulatory body within the HSE)
HSK	Hauptabteilung für die Sicherheit der Kernanlagen - Swiss Federal Nuclear Safety Inspectorate (Swiss regulatory body)
HT	tritium gas
HTO	tritiated water
HTR	High Temperature Reactor (thermal neutron high temperature reactor)
Hydrotéléray	network for continuous measurement of radioactivity in major rivers (IRSN)
ICAO	International Civil Aviation Organisation
ICCRB	International Consultative Committee of Regulatory Bodies (group comprising representatives from the Regulatory authorities of Canada, Finland, France, Germany, Italy, Spain, Switzerland, United Kingdom and United States for the purpose of advising the Ukrainian regulatory body with respect to the Chernobyl site)
ICEDA	activated waste packaging and interim storage installation (EDF interim storage project)
ICL	Loire Cancerology Institute
ICPE	installation classified on environmental protection grounds (owing to its potential impact on the public and the environment, installation subject to the regulations defined in part I of book V of the French Environment Code)
ICRU	International Commission on Radiation Units and measurements
ICSI	Institut for an Industrial Safety Culture
ICSN	Nuclear Safety Cooperation Instrument (NSCI) (European Union)
IDSP	weighted scanner dose index
IDT	Uncoupling and transit installation
IFSN	Swiss Federal Nuclear Safety Inspectorate (since 1 January 2009)
IGAS	General Inspectorate of Social Affairs
ILE	ITER Legal Entity (international body to be created to operate ITER)
ILL	Laue-Langevin Institute – Grenoble
IMDG	International Maritime Dangerous Goods code
IN	Nuclear Inspection (EDF)
INB	Basic Nuclear Installation (BNI)
INBS	Secret Basic Nuclear Installation
INCa	French National Cancer Institute
INERIS	French National Institute for the Study of Industrial Environments and Risks
INES	International Nuclear Event Scale
INEX	International Nuclear Emergency eXercise (conducted by the NEA in particular)
INF	international code for the safe carriage of packaged Irradiated Nuclear Fuel, plutonium and high-level radioactive wastes on board ships
INPO	Institute of Nuclear Power Operations (United States)
INRA	– International Nuclear Regulators' Association (grouping the German, Canadian, Spanish, US, French, Japanese, UK and Swedish nuclear regulators) – French National Institute for Agricultural Research
INSAG	International Nuclear Safety Advisory Group (IAEA)
INSERM	French National Health and Medical Research Institute
INSTN	French National Institute for Nuclear Science and Technology – CEA
InVS	French Health Monitoring Institute
IONISOS	company operating irradiation installations

IPA	Instrument for Pre-Accession Assistance (European Union)
IPN	French Nuclear Physics Institute – Orsay
IRE	National Radioelements Institute, Fleurus – Belgium
IRCA	Cadarache irradiator (CEA)
IRM	MRI magnetic resonance imaging
IRPA	International Radiation Protection Association
IRRS	Integrated Regulatory Review Service (regulatory body organisation audit performed by the IAEA)
IRSN	French Institute for Radiation Protection and Nuclear Safety – since 2002
ISIS	research reactor (CEA – Saclay)
IS Ouest	West France welding institute
ISO	International Standard Organisation
ISOE	Information System on Occupational Exposure (OECD)
ISOTRON	company operating ionisation installations
IT	conventional safety inspection/conventional safety inspectorate
ITER	International Thermonuclear Experimental Reactor (nuclear fusion reactor to be installed at Cadarache)
JAA	Joint Aviation Authorities (Association of the national civil aviation authorities of the European countries, attached to the European Civil Aviation Conference. It sets guidelines for civil aviation certification, operations, maintenance and licensing)
JAIF	Japan Atomic Industrial Forum
JAR	Joint Aviation Requirements (rules drafted by the JAA)
JAR-OPS	Joint Aviation Requirements-Operations (rules drafted by the JAA concerning aircraft operations)
JEPP	equivalent full power day
JFR	French radiology days (annual conference organised by SFR)
JHR	Jules Horowitz reactor (irradiation reactor: CEA – Cadarache)
JNES	Japan Nuclear Energy Safety Organization (technical support organisation for the Japanese regulatory body)
JO	*Journal Officiel* – French official journal
KEY	experimental sealing of drifts by pouring an "anchoring key" (ANDRA – Bure)
KEPCO	Kansai Electric Power Company (Japanese electricity production utility)
KINS	Korea Institute of Nuclear Safety (technical support organisation for the South Korean regulatory body)
KKU	*Kernkraftwerk Unterweser* (nuclear power plant in Germany)
kW	kiloWatt
LAMA	active materials analysis laboratory (CEA – Grenoble)
LCC	central product quality control laboratory (AREVA NC – La Hague)
LCIE	electrical certification and testing entity for Bureau Veritas
LCPu	plutonium chemistry laboratory (CEA – Fontenay-aux-Roses)
LDAC	fuel assembly shearing laboratory (CEA – Cadarache)
LECA	active fuel examination laboratory (CEA – Cadarache)
LECI	spent fuel testing laboratory (CEA – Saclay)
LEFCA	laboratory for research and experimental fabrication of advanced nuclear fuels (CEA – Cadarache)
LEP	Large Electron Positron Collider (CERN – Geneva)
LFR	Lead-cooled Fast Reactor
LHA	high activity laboratory (CEA – Saclay)
LHC	Large Hadron Collider (CERN – Geneva)
LI	indicative limit (set by the Codex Alimentarius for the presence of radionuclides in foodstuffs)
LOLF	French constitutional by law on budget acts
LPC	Chemical Purification Laboratory (AREVA NC – Cadarache)
LUDD	Laboratories, Plants, Waste and Decommissioning
LURE	Electromagnetic Radiation Laboratory (CNRS – Orsay)
M5	name of a zirconium and niobium based alloy
MAD	final shutdown
MAD/DEM	final shutdown and decommissioning (BNI procedure)

MAGENTA	cellular nuclear materials storage facility project (CEA – Cadarache)
MAPu	medium level plutonium (MAPu facility: AREVA NC – La Hague)
MARN	Nuclear Risk Management Support Team – Ministry of the Interior/DDSC
MAS alpha	special intermediate level alpha effluent
MASURCA	Cadarache fast-breeder mockup (research reactor – CEA – Cadarache)
MAU	medium level uranium activity (MAU facility: AREVA NC – La Hague)
MA-LL	medium-activity long-lived waste
MBq	megabecquerel (million of becquerels)
MCMF	central fissile material warehouse (CEA – Cadarache)
MDB	river authority
MDEP	Multinational Design Evaluation Program (multinational initiative in which secretaryship is ensured by the NEA, and which aims at pooling the knowledge of the safety authorities who will be responsible for the regulatory evaluatio of new reactors)
MDG	large components cutting unit (EDF – Creys-Malville – Isère *département*)
MDS	organic solvent mineralisation facility (AREVA NC – La Hague)
MDSB	solvents mineralisation facility (AREVA NC – La Hague)
M€	million of euros
MEA	management and appraisal mission (ASN)
MEAH	national mission for hospital appraisal and audit
MEDDTL	Ministry of Ecology, Sustainable development, Transport and Housing (since November 2010)
MELOX	MOX fuel fabrication plant (Marcoule)
MELUSINE	research reactor (CEA – Grenoble)
MERM	medical radiation technologist, radiation therapy technician
METI	Ministry of Economy, Trade and Industry (Japan)
MeV	mega electron volt
MEXT	Ministry of Education, Cculture, Sports, Science and Technology (Japan)
MHI	Mitsubishi Heavy Industries, Ltd (Japanese company working in the nuclear power plant sector, among others)
MIMAUSA	History and impact of uranium mines: summary and archives – Programme for an inventory of uranium mining sites
MINEFI	Ministry of Economy, Finance and Industry (since November 2010)
MINERVE	research reactor (CEA – Cadarache)
MIR	inter-regional fuel stores (EDF – Bugey and Chinon)
MMS	mobile emergency equipment
MoO_3	Molybdenum trioxide
MOST	Ministry of Science and Technology (South Korean nuclear regulatory body)
MOX	mixed oxide fuel (mix of uranium and plutonium oxides)
MPL	Maximum Permissible Levels (for radioactive contamination of foodstuffs or livestock feed)
MSNR	nuclear safety and radiation protection mission (MEDDTL/DGPR)
MSR	Molten Salt Reactor
mSv	millisievert (a thousandth of Sievert)
MTI	temporary modifications of nuclear facilities
MTMD	hazardous materials transport mission
MWe	Megawatt electric (electric power unit)
N4	1,450 MWe nuclear power plant built by EDF
NATURA 2000	group of natural sites protected in application of the European directives for the protection of birds and "natural habitats"
NCACG	National Competent Authority Coordination Group (IAEA)
NEA	Nuclear Energy Agency (OECD)
NECSA	Nuclear Energy Corporation of South Africa (South-African public entity carrying out R&D in the nuclear power field)
NERSA	société "centrale nucléaire européenne à neutrons rapides SA" (former operator of SUPERPHÉNIX)
NF	– *Naeglaria Fowleri* (species of amoeba) – French standard
nGy	nanogray (thousand millionth of a gray)
NII	Nuclear Installations Inspectorate (HSE – United Kingdom)

NISA Nuclear and Industrial Safety Agency (METI – Japon)

NMA Maximum Permissible Level (MPL) (for radioactive contamination of foodstuffs or livestock feed)

NNEMA National Nuclear Emergency Management Administration (China)

NNR National Nuclear Regulator (South African regulatory body since 1999)

NNSA National Nuclear Safety Administration (Chinese regulatory body)

NORM Naturally Occurring Radioactive Materials

NOx nitrogen oxides

NPH spent fuel element unloading and interim storage facility (plant UP2 800 – AREVA NC – La Hague)

NRBC Nuclear Radiological Biological Chemical

NRC Nuclear Regulatory Commission (American regulatory body)

NRD French acronym for Diagnostic Reference Level (DRL)

NRPA Norwegian Radiation Protection Authority

NRR Nuclear Reactor Regulation (NRC office in charge of reactor safety)

NRU National Research Universal reactor (Chalk River – Canada)

NSC Nuclear Safety Commission (Japanese regulatory body)

NSSG Nuclear Safety and Security Group (G8)

nSv nanosievert (thousand millionth of a sievert)

NSWG Nuclear Safety Working Group (G7)

NUSSC Nuclear Safety Standards Committee (IAEA)

NuPEER Nuclear Pressure Equipment Expertise & Regulation (nuclear pressure vessel symposium)

OA approved organisation for supervision

OACI French acronym for the International Civil Aviation Organisation (ICAO)

OBT Organically Bound Tritium

OCDE OECD Organisation for Economic Cooperation and Development

OEEI EDF project to "Obtain Instalations in Exemplary Condition "

OFSP Federal Public Health Office (Swiss radiation protection inspection agency)

OIT ILO International Labour Organisation

OMS WHO Word Health Organisation (United Nations)

ONR Office for Nuclear Regulation

ONU United Nations Organiation (UNO)

OPECST Parliamentary Office for the Evaluation of Scientific and Technological Choices

OPERA permanent environmental radioactivity observatories

OPPBTP Occupational Risk Prevention Organisation for the Building and Civil Engineering Industries

OPS see JAR-OPS

ORCADE Project set up by AREVA NC for the decommissioning of the La Hague installations

ORL French acronym for "Ear, Nose and Throat"

ORPHEE research reactor (CEA – Saclay)

ORSEC general plan organising the emergency services at departmental, defense zone, or maritime prefecture level, should a disaster be declared by the State

OSART Operational SAfety Review Team (IAEA)

OSIRIS research reactor (CEA – Saclay)

OSPAR Convention for the Protection of the Marine Environment of the North-East Atlantic (signed in 1992 and combining and updating the Oslo 1972 and Paris 1974 conventions)

OSRDE Safety Radiation Protection Availability Environment Observatory (EDF)

P4 first series of 1,300 MWe nuclear reactors (EDF)

P'4 second series of 1,300 MWe nuclear reactors (EDF)

PACA *Provence-Alpes-Côte d'Azur* (region)

PAHO Pan American Health Organization

PAI fire-fighting action plan

PAP annual performance plan (within the framework of the LOLF – document appended to the budget bill and for a given programme, presenting in particular the objectives and the expected results of the various programme actions)

PAREX post-accident experience feedback

PASEPRI action plan for monitoring patient exposure to ionising radiation

PBMR	Pebble Bed Modular Reactor (4th generation reactor project – South Africa)
PC	Command post
PCC	Command and Control Post (evaluation of consequences and measures)
PCD	strategic management command post
PCL	local command post (installation operation)
PCM	resources command post (logistics)
PCR	Person Competent in Radiation protection
PCRD	research and development framework programme
PCS	communal disaster contingency plan
PDD	development plan (ANDRA)
PEGASE	spent fuel and radioactive susbtances interim storage installation (CEA – Cadarache)
PET	Positron Emission Tomography
PETSCAN	Positron Emission Tomography camera coupled with a CT scanner
PF	fission products
PHARE	Poland and Hungary Assistance for Reconstruction of Economy (programme of Community aid to contries of Central and Easter Europe)
PHÉBUS	research reactor (CEA – Cadarache)
PHÉNIX	fast neutron reactor (CEA – Marcoule)
PHIL	linear electron accelerator (CNRS – Orsay)
PIRATE	response plans that are integrated in an overall heightened security, prevention, protection and counter-terrorism approach
PIRATOME	defense plan designed to counter the malicious use or threatened malicious use of radioactive or nuclear materials against people, the environment or property
PLU	local urban planning scheme
PMSI	Medicalised Programme for Information Systems
PNGMDR	French National Radioactive Material and Waste Management Plan (instituted by the 28 June 2006 Programme Act on the sustainable management of radioactive materials and waste)
PNSE	French National Health Environment Plan (to reduce the effects of environmental damage on the health of the population)
POES	equipment maintenance and monitoring programmes
POPM	organisational plan in medical radiation physics
POSÉIDON	irradiation facility (CEA – Saclay)
PPI	off-site emergency plan (specific emergency plan drawn up by the State addressing risks associated with the existence and operation of specific installations or structures)
PRECIS	Programme for recovery of spent fuel elements stored in a fuel assembly block
PRER	Radiation Protection, Environment and Risks Centre
PRI	integrated radiological protection
PRISME	EURODIF project for intensive rinsing followed by venting
PROCEDE	decommissioning research installation (CEA – Fontenay-aux-Roses)
PROSPER	Peer Review of Operational Safety Performance Experience (organised by IAEA)
PSP	multi-year strategic plan
PSRPM	medical radiation physicist
PSS	specialised emergency plan
PSS-TMR	specialised emergency plan for the transport of radioactive materials
PTB	low operating range (PWR)
PTD	technical documentation series
PTR	reactor cavity and spent fuel pit cooling and treatment system (PWR)
PUI	on-site emergency plan (crisis management plan drawn up by a BNI licensee)
PuO_2	plutonium oxide
PU-TMR	emergency plan for the transport of radioactive materials
PV	report, minutes of a meeting/statement of offence
R7	vitrification facility (AREVA NC – La Hague)
RADWASS	Radioactive Waste Safety Standards (IAEA)
RAMG	Regulatory Assistance Management Group (group set up by the European Commission to advise it on technical assistance requests from the nuclear regulators of Eastern European states)
RANET	Response Assistance NETwork (response network to requests for assistance in the case of a radiological emergency – IAEA)
RAPSODIE	former fast neutron experimental reactor (CEA – Cadarache)

RASSC	Radiation Safety Standards Committee (IAEA)
RaSSIA	Radiation Safety and Security Infrastructure Appraisal (IAEA)
RCC	design and construction rules
RCC-E	design and construction rules for electrical equipment
RCC-G	design and construction rules for civil engineering
RCC-M	design and construction rules for mechanical equipment
RCD	waste recovery and packaging
RCV	chemical and volume control system (PWR)
REB	French acronym for Boiling Water Reactor (BWR)
REC II	Reception, Shipment and Monitoring unit for uranium hexafluoride containers (Georges Besse II plant)
REDT	study and technological development reactor
REP	French acronym for Pressurised Water Reactor (PWR)
RESERVOIR	aqueous radiaoctive effluent storage installation (CEA – Saclay)
REX	operating experience feedback
RFS	basic safety rule
RGE	general operating rules
RGSE	general surveillance and maintenance rules
RHF	high flux reactor (Institut Laue-Langevin – Grenoble)
RIA	Radio Immunology Assay
RIC	Regulatory Information Conference (annual public conference held by the United States regulatory body)
RID	Regulations concerning the International Carriage of Dangerous Goods by Rail
RIFE	Radioactivity in Food and the Environment (British report on radioactivity in the food chain and the environment)
RIS	safety injection system (PWR)
RIV	internal vectorised radiotherapy
RIVM	Dutch National Institute for Public Health and the Environment
RJH	Jules Horowitz reactor (irradiation reactor: CEA – Cadarache)
RM2	former radiometallurgy laboratory No. 2 (CEA – Fontenay-aux-Roses)
RNR	fast neutron reactor
RNR-G	gas-cooled fast neutron reactor
RNR-Na	sodium-cooled fast neutron reactror
ROI	industrial tool renewal
ROTONDE (la)	solid waste management installation project (CEA – Cadarache)
RPE	Radiation Protection Expert
RPO	Radiation Protection Officer
RPII	Radiological Protection Institute of Ireland
RPS	preliminary safety report (BNI procedure)
RRA	residual heat removal system (PWR)
RRI	component cooling system (PWR)
RSE-M	rules for in-service monitoring of mechanical equipment
RSN	regulation concerning the safety of ships
RTE	French Transmission System Operator
RTN	Rostekhnadzor (Russion nuclear safety authority, attached to the Federal Service of Industrial, Environmental and Nuclear Regulation)
RTSG	Radioactive Transport Study Group (IAEA working group)
RTGV	steam generator tube rupture
RTR	Research and Test Reactors (fuel assemblies known as “aluminides” used in research reactors)
RTV	main steam rupture
RUS	Louis Pasteur University reactor (Strasbourg)
RWMC	Radioactive Waste Management Committee (NEA)
RX	X-ray
R & D	R&D research and development
SCR	Radiation Protection Department
SAPPRE	Reflex Phase Population Alert System
SAMU	French Emergency Medical Service
SARnet	European Severe Accident Research network
SATURNE	former particle accelerator (CEA – Saclay)
SCHAPI	Central Hydrometeorology and Flood Prediction Support Department (MEDDTL/DGPR)
SCWR	SuperCritical Water Reactor
SDIS	Departmental Fire and Emergency Service

SEC	Essential Service Water System (ESWS) (PWR)
SEI	irreversible effects threshold
SEIVA	Valduc information exchange structure (Association created around the CEA centre at Valduc)
SEL	lethal effects threshold
SEPTEN	Design Department for Thermal and Nuclear Projects (EDF/DIN)
SET	*Société d'Enrichissement du Tricastin*
SEVESO	– "Seveso II" directive: name given to Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances (with reference to the site of a 1976 accident in a chemical plant) – "Seveso " installation: installation subject to the "Seveso II" directive
SFBMN	French Society for Biophysics and Nuclear Medicine
SFEN	French Nuclear Energy Society
SFMN	French Nuclear Medicine and Molecular Imaging Society
SFPM	French Society of Medical Physics
SFR	French Society of Radiology
SFRO	French Society for Radiation Oncology
SFRP	French Radiation Protection Society
SG	Office of Administration (ASN)
SGDN	French General Secretariat for National Defence (until 2009)
SGDSN	General Secretariat for Defence and National Security (since 2010)
SHFJ	*Service hospitalier Frédéric Joliot* (CEA hospital service located in Orsay hospital – Essonne)
SI-ASN	ASN Information system
SICN	*Société Industrielle de Combustible Nucléaire* (Industrial Nuclear Fuel Company)
SIEVERT	– equivalent dose and effective dose unit (Sv) – Computerized system for assessing the exposure to cosmic radiation during air transportation
SIGIS	source inventory management information system
SILOE	research reactor (CEA – Grenoble)
SILOETTE	research reactor (CEA – Grenoble)
SIRCOM	Communication Department (Ministry of Economy, Finance and Industry)
SIRLaF	International society of radiation biology in French language
SISE-Habitat	Environment – Habitat health information system
SISERI	Ionizing radiation exposure monitoring information system
SISE-Eau	Environment – Water health information system
SITA FD	"ultimate" waste and polluted earth processing and disposal company (SITA group)
SITOP	*Site Optimisation* (SITOP project about organisation change at AREVA NC La Hague)
SKI	Statens KärnkraftInsspektion (Swedish regulatory body until 1 July 2008)
SMHV	maximum historically likely earthquake
SMP	Sellafield MOx Plant (MOx fuel production plant operated by the company BNFL in Sellafield)
SMQ	quality management system
SMS	French acronym for Safe Shutdown Earthquake (SSE)
SNCS	*Société Normande de Conserve et de Stérilisation* (Normandy preserves and sterilisation company situated in Osmanville – Calvados)
SNM	military nuclear system (either a weapon system designed or adapted to deploy a nuclear weapon, or a military vessel propelled by nuclear power)
SNR	*Société Nouvelle du Radium* (former radium mining company which left polluted sites after it closed)
SNRCU	State Nuclear Regulatory Committee of Ukraine (Ukrainian regulatory body)
SOC	Organised disposal of hulls (AREVA NC – La Hague)
SOCATRI	*Société auxiliaire du Tricastin* (company operating an AREVA owned clean-up and uranium recovery installation at Bollène – Vaucluse *département*)
SOCODEI	*Société pour le Conditionnement des Déchets et Effluents Industriels* (Company for industrial effluent and waste treatment – EDF group)
SOH	socio-organizational and human (analysis)
SOLEIL	LURE Optimized Source of Intermediary Energy Light (synchrotron located in Saint Aubin, Essonne *département*)

SOMANU Société de Maintenance Nucléaire (Nuclear Maintenance Company - AREVA group - Maubeuge)

SOx sulphur oxides

SPECT Single Photon Emission Computed Tomography

SPF fission products repository SPF facilities (AREVA NC – La Hague)

SPIN in-pile separation and incineration (Actinides Incineration Research Programme – CEA)

SPIRAL radioactive accelerated ion beam production source (GANIL – Caen)

SPPPI Permanent Secretariat for the Prevention of Industrial Pollution and Hazards (multipartite local discussion structures for industrial pollution and hazards)

SPRA French Army Radiological Protection Service

SPF fission products storage (SPF units – AREVA NC – La Hague)

SPS Super Proton Synchrotron (super synchrotron à protons – CERN – Geneva)

SSI *StatensSträlskyddsInstitut* (Swedish nuclear safety and radiation protection authority since 1 July 2008)

SSM *Sträl säkerhets myndigheten* (Swedusg nuclear safety and radiation protection authority since 1 July 2008)

STA Science and Technology Agency (Japan)

STAR treatment, clean-out and reconditioning station (CEA – Cadarache)

STD waste treatment station

STE – technical operating specifications

– effluent treatment station

STED effluent and waste treatment station

STEDS radioactive effluent and solid waste treatment station

STEG Tunisian Company of Electricity and Gas

STEL liquid effluent treatment station

STELLA active liquid effluent treatment station project (CEA – Saclay)

STUK *Säteilyturvakeskus* (Radiation and Nuclear Safety Authority - Finnish regulatory body)

SÚJB *Státní Uřad pro Jadernou Bezpečnost* (State Office for Nuclear Safety - Czech regulatory body)

SUPERPHÉNIX Fast Breeder Reactor under decommissioning (Creys-Malville – Isère *département*)

SUPPORT Facility effluent treatment and waste storage facility under dismantling (CEA – Fontenay-aux-Roses)

Sv sievert (equivalent dose unit and effective dose unit)

T7 vitrification facility (AREVA NC – La Hague)

TACIS Technical Assistance to the Commonwealth of Independent States (European Union aid programme for the former URSS countries)

TAR cooling tower

TBq terabecquerel (one trillion becquerels)

TDM TomoDensitoMeter (computed tomography scanner)

TE Transfer and Sampling unit (AREVA NC – Tricastin)

TELEHYDRO network for continuous monitoring of waste water radioactivity in major cities (IRSN)

TELERAY ambient radioactivity measurement network

TEMP French acronym for Single Photon Emission Computed Tomography (SPECT)

TEMP-TDM French acronym for Single Photon Emission Computed Tomography (SPECT) coupled with a CT scanner

TENORM Technologically Enhanced Naturally Occurring Radioactive Materials (raw materials whose radionuclide content has been increased by an industrial process but which are not used for their fissile, fusible or fertile properties)

TEP French acronym for Positron Emission Tomography (PET)

TEP-TDM Positron Emission Tomography associated with a computed tomography scanner

TEPCO Tokyo Electric Power Company (Japanese electric utility)

TEPSCAN PET camera coupled with a computed tomography scanner

TFA French acronym for Very Low Activity (VLA waste)

TGAP General Tax on Polluting Activities

THA French acronym for Very High Activity (VHA waste)

TMD Transport of Dangerous Goods

TMP Treatment of plutonium-bearing materials

TMR Transport of Radioactive Materials

TN International	International subsidiary of AREVA NC specialising in the packaging, transport and interim storage of nuclear materials
TNA	sodium treatment installation (Na) (EDF – Creys-Malville – Isère *département*)
TRANSAS	TRANsport Safety Appraisal Service (mission organised by the IAEA to evalute the organisation relative to the transport of radioactive materials and application of the international regulations in this area)
TRANSSC	TRANsport Safety Standards Committee (IAEA committee on radioactive materials transport safety standards)
TSN	TSN Act: Act of 13 June 2006 on transparency and security in the nuclear field
TSR	Transport of radioactive substances
TU5	fuel cycle installation (AREVA NC – Pierrelatte)
TVO	*Teollisuuden Voima Oy* (Finnish electricity utility)
UAlx	mixture of uranium and aluminium
UCD	Alpha Waste Conditionning Central Unit (AREVA NC – La Hague)
UE	EU European Union
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
UFC	French acronym for Colony Forming Unit (CFU) (the CFU per litre is the unit used to measure the concentration of legionella bacteria)
ÚJD	Úrad Jadrového Dozoru (Nuclear Regulatory Authority of the Slovak Republic)
UKEA	United Kingdom Environment Agency (England and Wales)
ULYSSE	"teaching" reactor (CEA – Saclay)
UMo	uranium-molybdenum alloy
UMoSnAl	uranium-molybdenum-tinaluminium alloy
UNGG	Uranium Natural Graphite Gas (old-generation nuclear reactor process)
UNIE	Operation Engineering Unit (EDF)
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UOX	uranium oxide based fuel
UP2-400	1st spent fuel reprocessing plant (AREVA NC – La Hague)
UP2-800	spent fuel reprocessing plant (AREVA NC – La Hague)
UP3	spent fuel reprocessing plant (AREVA NC – La Hague)
URE	enriched reprocessing uranium (fuel assemblies)
USIE	Unified System for Information Exchange in Incidents and Emergencies – (IAEA tool proposed to member countries for the notification of nuclear events occurring on their territory)
USNRC	see NRC
UTE	Technical Union for Electricity and communication (French electro-technical standardisation body)
UTM	Monazite treatment unit
UTO	central technical department (EDF)
UO2	uranium dioxyde
$UO_2(NO3)_2$	uranyl nitrate
U_3O_8	triuranium octoxide
VATESI	*Valstybiné ATominés Energetikos Saugos Inspekcija* (Lithuanian regulatory body)
VC	French acronym for short life
VD	ten-yearly outage
VD1	1st ten-yearly outage
VD2	2nd ten-yearly outage
VD3	3rd ten-yearly outage
VD4	4th ten-yearly outage
VDS	Surveillance inspection visit
VHTR	Very High Temperature Reactor
VP	partial inspection outage
VVP	main steam system
W	fuel cycle plant (AREVA NC – Pierrelatte)
WANO	World Association of Nuclear Operators
WASSC	Waste Safety Standards Committee (IAEA)
WATRP	Waste management Assessment and Technical Review Programme (AIEA appraisal)
WENRA	Western European Nuclear Regulators' Association (extended in 2003 to all "nuclear" States that are members of the European Union or currently negociating membership)
WGIP	Working Group on Inspection Practices (NEA)

WGWD	Working Group on Waste and Decommissioning (WENRA)
WNA	World Nuclear Association
WNTI	World Nuclear Transport Institute
WPAQ	Working Party on Atomic Questions (Council of the European Union)
WPNEM	Working Party on Nuclear Emergency Matters
ZEP	population clearing zone
ZGDS	solid waste management zone (CEA – Saclay)
ZGEL	liquid radioactive waste management zone (CEA – Saclay)
ZIIS	surface installation zone (for waste disposal in deep geological formations)
ZIRA	zone of interest for in-depth studies (for waste disposal in deep geological formations)
ZPP	population protection zone
ZS	products and foodstuffs surveillance zone (following a nuclear accident)
ZSR	tightened surveillance zone



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