Editorial

This ASN Report on the state of nuclear safety and radiation protection in France in 2010 is presented by a partly changed Commission. Jean-Jacques Dumont and Philippe Jamet, appointed by the President of the Republic and the President of the Senate respectively have, for a six-year term, replaced Marc Sanson and Jean-Rémi Gouze, whose mandates expired on 12th November 2010.

Paris, 1st March 2011

From the nuclear safety and radiation protection standpoint, 2010 was a relatively satisfactory year.

However, in the field of nuclear installations, ASN considers that EDF needs to improve its forward planning of a certain number of maintenance and component replacement operations. Belated decisions of this nature meant that EDF had to submit files to ASN to justify continued operation in degraded mode. These files were not felt to be acceptable by ASN from the safety standpoint. This type of management is neither efficient nor optimised, be it for ASN with regard to safety and the mobilisation of its resources, or for EDF. For example, the late replacement of the Bugey nuclear power plant reactor's 3 steam generators, after the discovery of significant corrosion of one of them, led to a 20 month reactor outage.

The publication of the second edition of the national radioactive materials and waste management plan (PNGMDR 2010-2012) was one of the significant events of 2010. The draft European directive on the management of waste and spent fuel, which has just been proposed by the European Commission, reiterates that the elaboration of such a plan is one of its fundamental requirements.

In the field of small-scale nuclear activities, the progress made in 2009 in radiotherapy patient safety has been confirmed by the increased numbers of medical radiation physicists (PSRPM) deployed under implementation of the Cancer II Plan and by the gradual implementation of quality management procedures designed to improve healthcare safety. However, ASN must continue to closely monitor a certain number of centres, especially when the shortage of PSRPM personnel is compensated for by calling in external contractors or through collaboration between centres.

Interventional radiology, in other words radiology which helps guide the physician's hand, particularly in cardiology, neurology and surgery, is a subject of some concern for ASN. High doses can be delivered to the patients and the radiation protection of the staff is not always what it should be, especially when these procedures are carried out in the operating theatre. Finally, it is worth noting that ASN's relations with a certain number of medical learned societies are on the whole constructive, a clear sign of the level of maturity now reached.

After its inspections, ASN sends a follow-up letter to the licensee or the party responsible for the activity monitored, presenting a summary of the main findings and a certain number of requests for remedial action. After the basic nuclear installations (BNI) sector in 2002 and then radiotherapy services in 2008, the scope of the follow-up letters published was extended in 2010 to take in all inspections carried out by ASN.

For the coming years, the ASN Commission has identified a number of national and international issues.

National issues

Regulating nuclear power generating reactors

The 13th June 2006 Nuclear Security and Transparency Act (TSN) requires a periodic safety review of nuclear facilities every ten years. EDF's 900 MWe reactors are now reaching thirty years of operation. In July 2009, on the basis of an assessment carried out on its behalf by the Institute for Radiation Protection and Nuclear Safety (IRSN), ASN issued a favourable opinion on the generic aspects of continued operation of the 900 MWe reactors beyond this period, subject to the results of the ten-yearly outage inspection carried out on each reactor. ASN issued a first favourable opinion for the Tricastin 1 reactor. The process will continue in 2011 and the following years for the other thirty-three 900 MWe reactors; ASN will make its position known, reactor by reactor.

EDF also stated that it wished to continue operating its reactors beyond forty years. For ASN, there are two aspects to both this issue and the periodic safety reviews: on the one hand, reactor conformity with the regulations applicable to them must be guaranteed and, on the other, the safety re-assessment must be conducted in the light of the safety objectives applicable to new reactors, such as the EPR. This approach is consistent with that adopted at a European level by WENRA (Western European Nuclear Regulators' Association). ASN is waiting for demonstration and justification data from EDF. ASN will be consulting its foreign counterparts on this major subject.

Regulating radioactive waste management

With regard to the back-end of the nuclear fuel cycle, ASN wants to see the national agency for radioactive waste management (ANDRA) play in full one of the roles entrusted to it by law: the design, siting and operation of radioactive waste repositories, in compliance with the stipulations of the PNGMDR. For the disposal of high-level waste and intermediate level, long-lived waste (HLW/IL-LLW), the Act states that ANDRA must submit the geological disposal facility authorisation application no later than the end of 2014 and that this submission must be preceded by a public debate. With the expert assistance of IRSN, ASN is continuing with the review of the files submitted by ANDRA concerning design options, operational and long-term safety, and reversibility. It is important that reversibility not compromise the safety of the repository, either during its operation or after its closure. ASN will consult its foreign counterparts on this new subject. ASN is also concerned by the absence of disposal capacity for low-level, long-lived waste (LLW-LL), and will closely monitor the development of this sector.

Regulatory framework

The regulations applicable to the design, operation and decommissioning of BNIs have been extensively overhauled, in particular by the TSN Act and its implementing decrees. Considerable progress has also been made on the drafting of technical regulations for nuclear facilities, through a broad process of consultation of the various stakeholders. This work should in 2011 lead to the publication of a government order and about fifteen ASN resolutions. The European directive on the nuclear safety of nuclear installations will thus be transposed into French law and the reference levels for reactors in operation defined by the WENRA association will be introduced into the national regulations.

Regulating the medical sector

In the field of small-scale nuclear activities, the aim is – together with the learned societies and professional organisations – to move forward on subjects of concern for ASN, as they represent radiation protection issues for workers and patients. In the medical field, this in particular entails continuing to improve radiotherapy treatment safety, to continue the efforts to train and recruit PSRPM to meet medical imaging requirements and to develop training and information in the fields of interventional radiology.

The rising doses received in medical imaging, particularly on account of the use of scanners, is a major concern for ASN. This is an issue that goes beyond national borders because the appliances used in medical imaging are built by international industrial firms. ASN will be initiating work on this subject with its foreign counterparts. For effective application of the examination justification principle, it will act with the Regional Health Agencies (ARS) to allow the development of magnetic resonance imaging (MRI) installations and, together with the French National Authority for Health (HAS) and the French Society of Radiology (SFR), will promote the development of decision-making tools for the prescribing physicians.

ASN is keeping an eye on the progress of research work which should lead to the development of individual radiation sensitivity tests. The most pertinent ongoing work is based on the detection of genes with abnormal activity under irradiation. This confirms the existence of the phenomenon of individual radiation sensitivity and its importance in radiotherapy.

ASN is being increasingly asked to help countries which already have reactors or which wish to embark on a nuclear programme.

Being independent creates an obligation of accountability, an obligation to inform and to communicate.

Regulating source security

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 malicious acts concerning these sources. ASN agreed to accept this role, provided that it was given the necessary means and was able to apply its rules of transparency in order to inform the public. These duties will be carried out incrementally according to the availability of its resources and, if necessary, with a redefinition of ASN's regulatory priorities.

International issues

International harmonisation of nuclear safety and radiation protection has always been one of ASN's core concerns. This is why the Commission took a public stance in 2010 on the level of safety of new reactors built around the world. It recalled that the safety objectives for new reactors have to take account of the lessons learned from the Three Mile Island accident in 1979, the Chernobyl disaster in 1986 and the attacks of 11th September 2001, in conformity with the objectives that the WENRA association has just adopted. It also specified that it did not want to see safety double-standards appear and that if reactor export projects failed to meet these safety objectives, ASN would not hesitate to declare that such reactors could not be built in France.

ASN is being increasingly asked to help countries which already have reactors or which wish to embark on a nuclear programme. ASN enjoys bilateral and multilateral collaborative relations with many foreign nuclear safety regulators. It is ready to answer any new requests but will have to establish priorities based on the pertinence of the requests and the manpower available.

Following the adoption of the European directive on nuclear safety of 25th June 2009, the construction of an European nuclear safety and radiation protection hub is progressing, with the draft directive on the management of waste and spent fuel. This directive will supplement the European regulatory framework for nuclear safety and radiation protection. ASN considers that this proposed directive is a very real step forward and will continue its active involvement in this project.

ASN hopes to see the safety objectives recently adopted by WENRA receive political approval at a European level. All European regulators will also be holding the first European conference on nuclear safety in June 2011, an event comparable to the nuclear safety conference held every year by the U.S. safety regulator.

In the field of radiation protection, the European Commission should in early 2011 be submitting a draft directive concerning a revision of the basic standards, in line with the recommendations from the International Commission on Radiological Protection (ICRP) and the International Atomic Energy Agency (IAEA). ASN informed the Government of its opinion of the draft issued by the Commission in 2010.

The role of the Heads of European Radiological protection Competent Authorities (HERCA) association is comparable to that of WENRA in the field of nuclear safety. It is working on a European Radiation Passbook for transboundary workers and has initiated action with regard to scanner manufacturers.

After ASN's four years of existence as an independent administrative authority, it is time to draw some initial conclusions.

Owing to the expanding role of the nuclear safety and radiation protection players and the rise in the number of matters handled, allied with a tighter budgetary situation, it is now time to take a fresh look at how the regulation of nuclear safety and radiation protection in France are financed, with respect to both the source and the management of this financing. A first step has been taken in this direction with the creation of a legal obligation on industry to finance IRSN's expertise. It would be desirable for this mechanism to be extended to all the financing of nuclear safety and radiation protection regulation in France. This change could also lead to the creation of a "regulation of nuclear safety and radiation protection" budget programme ensuring that the entire system is then transparent, as required by the TSN Act.

Independence does not however mean isolation. ASN reports on its actions, in particular through the presentation of this report to the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST), by taking part in the hearings organised by the commissions of the National Assembly and the Senate and by responding to queries from members of Parliament.

For ASN, independence and transparency go hand-in-hand. Being independent creates an obligation of accountability, an obligation to inform and to communicate. This is the spirit in which the Commission adopted a public stance in the debate on "safety double-standards" and it will continue to do so on key issues, legitimately and responsibly, to ensure that nuclear safety and radiation protection progress both in France and worldwide.

It is thanks to the competence and commitment of its personnel and with the support of the expertise of IRSN that ASN can aim to fulfil its duties with stringency and efficiency. ■

Last year, in its editorial for the ASN Annual Report on nuclear safety and radiation protection in 2009, the ASN Commission considered that the major topics for ASN in 2010 were the integrated vision of nuclear safety and radiation protection, international matters and the way in which it reported on its actions. These priorities reflect the main strategic areas defined in the 2010-2012 multi-year strategy plan.

The year 2010

Jean-Christophe NIEL, ASN director-general

Paris, 1st March 2011

In 2010, ASN continued to build an integrated vision of nuclear safety and radiation protection.

On all of the subjects it handles, ASN's aim is to develop a global vision promoting a coherent overall approach.

ASN therefore continued its work to create the new regulatory framework for BNIs, by incorporating nuclear safety, radiation protection and environmental protection issues into the texts, including working conditions and personnel safety at EDF nuclear power plants.

Having been alerted by the increase in the doses delivered to patients during medical examinations, it organised a seminar on medical imaging for all the stakeholders concerned, in order to review implementation of the justification principle and, more concretely, examine the conditions in which MRI could be used for certain examinations rather than the more irradiating scanner.

Other than reducing the risk at source, risk management is based on controlling urban development, emergency response plans and information. Therefore and on the basis of the Nuclear Security and Transparency Act (TSN), ASN continued its work to control urban development around basic nuclear installations (BNI). It contributed to the circular sent out on this subject to the *préfets*[1] and initiated consultation with local elected officials.

In the field of radioactive sources, ASN prepared for the integration of radiation protection and security, i.e., protection against malicious acts, a field for which it should be assuming operational responsibility in 2011, drafting legislative and regulatory texts and organising the operational aspects of this responsibility.

Finally, ASN set up its Scientific Committee, which is to provide guidelines for research work to be carried out or explored further by the licensees or research organisations, in the fields of nuclear safety and radiation protection.

In 2010, ASN continued its international commitment.

ASN is in charge of the world's second largest fleet of nuclear reactors and has extensive international commitments. This international involvement, representing about 5% of its activities, is both bilateral and multilateral.

In 2010, at the European level and within the framework of the Western European Nuclear Regulators' Association (WENRA), ASN made a major contribution to defining the safety objectives of the new reactors approved by this association and also worked on drafting a position statement on radioactive waste. After adoption of the Nuclear Safety Directive in July 2009, ASN took part in drafting a European directive on radioactive waste, which in particular includes the notion of the national radioactive waste and materials management plan developed in France. HERCA (Heads of the European Radiological protection Competent

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

Authorities), for which ASN is the Secretary, also produced joint position statements from radiation protection authorities. The foundations were thus laid out for a European Radiation Passbook, designed to make it easier to monitor workers exposed to ionising radiation in Europe.

At the 2009 tri-annual meeting of the parties to the Joint Convention on the Safety of Spent Fuel Management and the Safety of Radioactive Waste Management, the decision was taken that international thematic meetings would be organised between two plenary meetings of the parties. In 2010, ASN organised the first of these meetings on the topic of national radioactive waste management organisations.

Finally, again in 2010, ASN began the "certification" of the ATMEA type reactor, for which its designers currently have no projects in France.

ASN continued to encourage pluralistic approaches enabling different views and viewpoints on nuclear activities to be compared.

In 2010, ASN reported on its actions through all the means enabled by the TSN Act.

ASN was therefore given a hearing by members of Parliament for the presentation of its Annual Report on Nuclear Safety and radiation protection in France in 2009. It was given a hearing on its radioactive waste management policy for the drafting of the national radioactive materials and waste management plan (PNGMDR), which it considers to be an essential tool for safe and long-term management of radioactive waste. The National Assembly's evaluation and monitoring commission questioned it on its role as an independent administrative authority.

Although previously covering only BNIs and radiotherapy activities, ASN has now extended publication on its website of its inspection follow-up letters concerning the entire scope of activities it regulates.

ASN continued to encourage pluralistic approaches enabling different views and viewpoints on nuclear activities to be compared. For the third periodic safety review of EDF's 900MWe reactors and the associated ten-yearly outage, ASN proposed a guide to the Local Information Committees (CLI) concerned, designed to help them, to look more closely into the subject should they so wish. ASN, together with the IRSN, opened up public access to the *www.mesure-radioactivite.fr* website which collates all environmental radioactivity measurements taken by the licensees, institutions, or any association that wishes to do so. ASN published its Tritium White Paper, which is the result of the work done by two pluralistic working groups, on the basis of which it prepared an action plan designed to obtain a clearer understanding and better management of this radionuclide and its effects. Together with the Ministry responsible for the environment, ASN continued to chair the pluralistic working group to draft the above-mentioned PNGMDR and will take on board the lessons from the report by the Limousin pluralistic experts group (GEP) on the monitoring and future of the former uranium mines in the Limousin area.

ASN now systematically conducts extensive consultation of the stakeholders on the general regulatory texts it produces. The drafts of the BNI order and the associated decisions defining and detailing the new BNI regime as resulting from the TSN Act were therefore placed on ASN's *www.asn.fr* website for consultation.

In 2010, ASN's day to day activities were interspersed with a number of major, structural actions, both planned and unplanned.

In 2010, ASN carried out 1,964 inspections, in all areas, including two in-depth inspections involving about ten inspectors on the MÉLOX and CEA Saclay sites.

1,107 incidents were rated, including three at level 2. Mention must also be made of the radioactive pollution by the Feursmetal company, following inadvertent cutting of a gamma radiography device cobalt 60 source, and by two companies, one in Saint-Maur-des-Fossés and the other in Bondoufle, involving tritium emanating from a device from CEA and incorrectly considered to be non-radioactive.

The ASN emergency response centre was activated for a real emergency, to deal with the risk of flooding at le Blayais nuclear power plant during storm Xynthia. Seven emergency exercises were carried out to test the robustness of the national emergency response organisation and to broaden the scope of the situations tested. In 2010, for example, the first exercise to manage a reactor accident of malicious origin was conducted on the Tricastin site.

The pertinence and quality of ASN's actions and its contribution in developing the high level of nuclear safety and radiation protection in our country are to a large extent built on its staff's competence, reactivity and ability to respond. In order to extract the maximum benefit from this situation, ASN in 2010 initiated an action plan for human resources management.

ASN continues to enjoy the invaluable support of IRSN. ASN noted with satisfaction that the assistance it receives from IRSN would now partly involve specifically assigned human resources. In this, it sees a first step towards creating an arrangement for financing nuclear safety and radiation protection that would better match the resources to the demands placed upon them. ■

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.

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. It also contributes to informing the public.

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 disciplines

Regulation

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. ASN also takes the individual resolutions required by the Public Health Code.

Monitoring

ASN 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.

Information

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 the event of an emergency, ASN assists the Government.

It in particular sends the competent Authorities its recommendations concerning the civil security measures to be taken.

Regulation of diverse activities and installations

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

A few key figures

• More than 450 staff, of whom nearly half are in the 11 regional divisions.

• 248 inspectors spread around the regional divisions and the departments.

• As at 01.01.2011: a total budget of about €146 million, of which €78 million are devoted to assessments.

• More than 820 inspections per year in the nuclear facilities and the transport of radioactive materials.

• More than 1,130 inspections per year in the medical, industrial and research sectors.

• More than 7,000 inspection follow-up letters published on the *www.asn.fr* website.

The help of experts

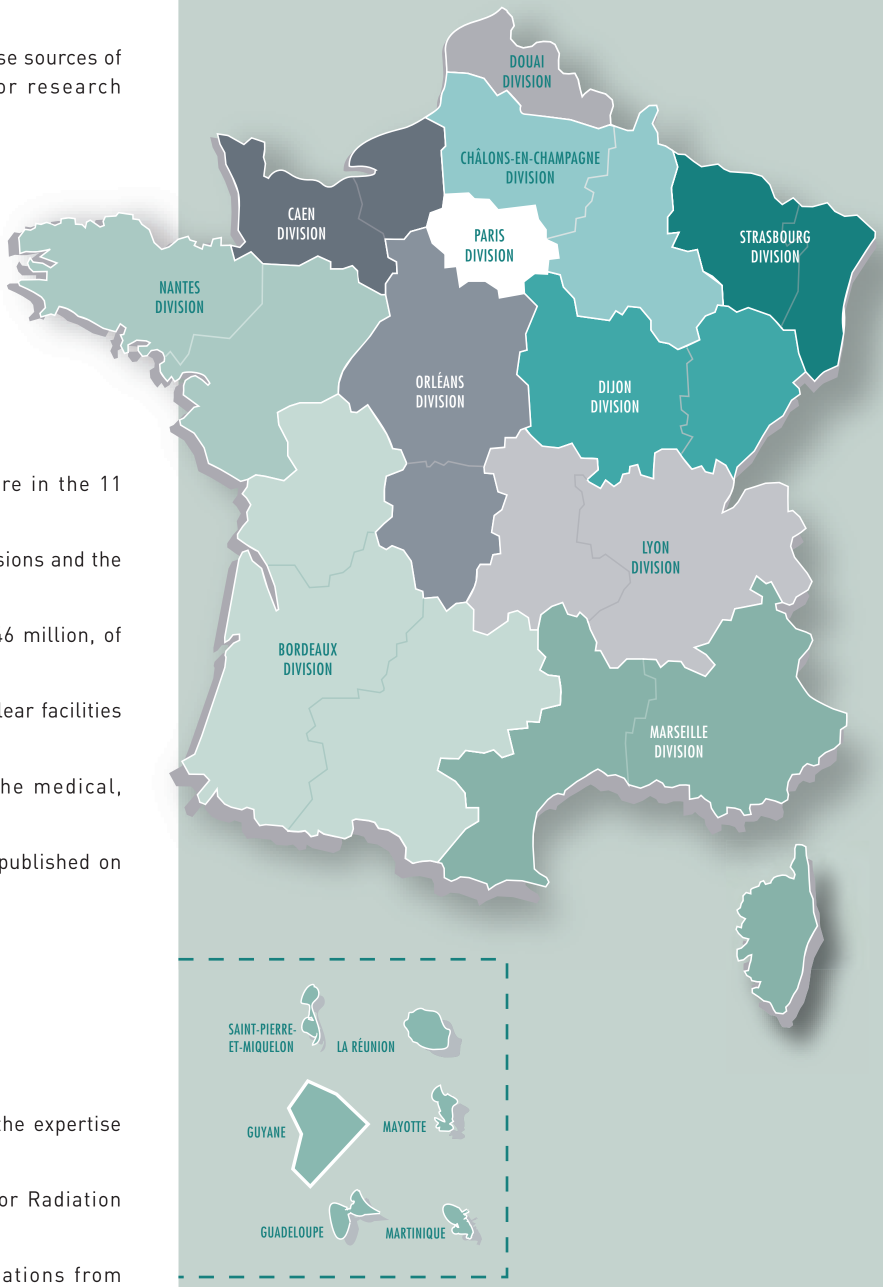
When taking certain resolutions, ASN calls on the expertise of technical support bodies.

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.

Regional 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 Commission

ANDRÉ-CLAUDE LACOSTE
Chairman

appointed on 8 November 2006 for a term of 6 years

MICHEL BOURGUIGNON
Commissioner

appointed on 8 November 2008 for a term of 6 years

JEAN-JACQUES DUMONT
Commissioner

appointed on 15 December 2010 for a term of 6 years

PHILIPPE JAMET
Commissioner

appointed on 15 December 2010 for a term of 6 years

MARIE-PIERRE COMETS
Commissioner

appointed on 8 November 2006 for a term of 6 years

Appointed by the President of the Republic

Appointed by the President of the Senate

Appointed by the President of the National Assembly

The Commission defines ASN general policy regarding nuclear safety and radiation protection

Impartiality

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

Independence

The Commissioners perform their duties on a full-time basis. Their mandate is for a six-year term which 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.

Competence

The Commission takes resolutions and publishes opinions in ASN's Official Bulletin.

It defines ASN external relations policy both nationally and internationally.

It defines ASN regulation and inspection 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 drafts the Reports on nuclear safety and radiation protection in France. Its Chairman reports on ASN's activities to the relevant commissions of the National Assembly and the 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.

The ASN organisation chart

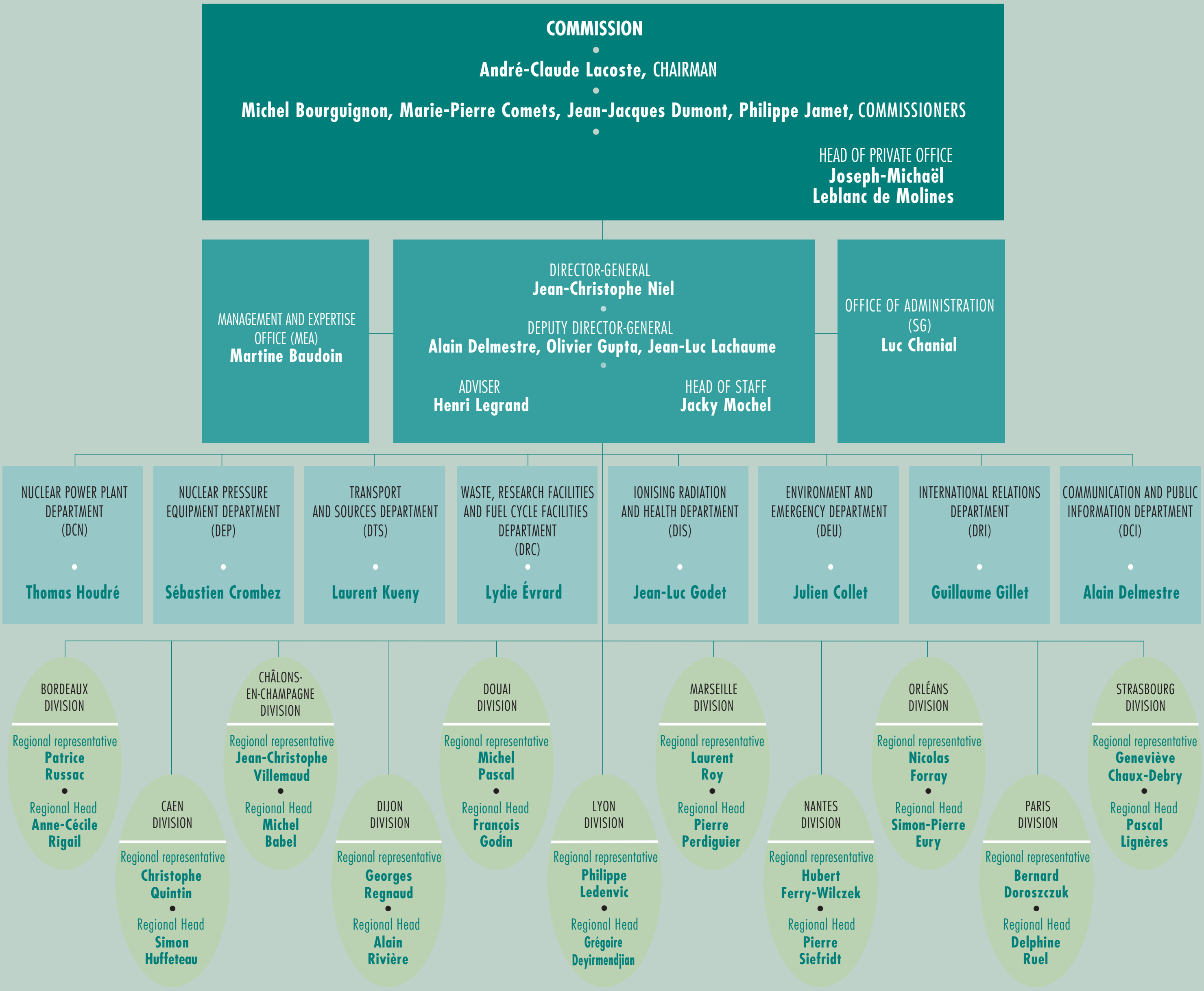
- *Commission of five commissioners*
- *General Directorate*
- *Eight departments*
- *Office of Administration*
- *Management and Expertise Office*
- *Eleven regional divisions*

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 represent the ASN chairman in the regions and contribute to ASN's public information role. The divisions carry out most of the direct inspections on BNIs, radioactive material transport operations and small-scale nuclear activities.

In emergency situations, the divisions assist the *préfet*[1] of the *département*[2], who is in charge of protecting the population, and monitor operations to safeguard the installation on the site, provided that it is accessible and does not constitute a hazard.

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



Organisation chart as at 1st March 2011

Highlights of 2010

classified according to main topics and to areas and activities regulated and inspected

ASN ACTIONS

ACTIVITIES REGULATED AND INSPECTED BY ASN

This introduction to the ASN Report on the state of nuclear safety and radiation protection in France in 2010 gives a summary of ASN actions and its assessment of the activities it regulates and inspects.

It proposes a thirty page round-up of the significant points developed within this report. This summary follows the same structural layout as the main report. It will therefore be easy to refer to the relevant chapters.

There is a difference in the form of this summary between the first chapters, which are more descriptive of the role and functions of ASN (1 to 8), and the other chapters which present its actions in the various sectors regulated and inspected (9 to 16). Each chapter begins with a summary of the function or activity concerned, continues by highlighting the significant aspects of the past year, and ends with the outlook for the coming one. For the chapters dealing with the regulated and inspected activities, the summaries also contain ASN's assessment of nuclear safety and radiation in the main fields considered.

1

Nuclear activities: ionising radiation and health and environmental risks

The common objective of nuclear safety and radiation protection is to protect individuals and property against the hazards and detrimental effects of whatsoever nature, arising from the operation of nuclear and radiological installations, the transport, utilisation and transformation of radioactive or fissile materials, and exposure to naturally occurring radioactive materials.

The effects of ionising radiation on living beings can be "deterministic" (health effects will necessarily appear when the radiation dose received exceeds a certain threshold) or "probabilistic" (for example, appearance of cancers with a probability of occurrence for an individual, but with no certainty). The application of measures to protect against ionising radiation, in particular compliance with the regulation dose limits for workers, virtually rules out the possibility of deterministic effects, but also aims to reduce the probability of radiation induced cancers. Patients require particular attention because the dose limitation principle does not apply to them.

The steps taken in the fields of nuclear safety and radiation protection to prevent accidents and mitigate detrimental effects have led to a reduction, although not the complete elimination, of risks. There is no such thing as zero risk. There are also a number of situations for which there are still uncertainties and unknown factors. These include:

• deterministic damage due to high doses is encountered during accidental exposure to high-level radioactive sources and as a complication and side-effect of radiotherapy and interventional radiology. This damage poses difficult therapeutic problems;

• the effects of chronic low doses of ionising radiation, for which the health effects are unknown. At this level, the risk of cancer is slight;

• individual radiation sensitivity is without doubt a major issue for radiobiology, because about 5% of individuals are hyper-sensitive to ionising radiation;

• no specific attention has so far been given to the effects on non-human species, based on the assumption that the protection of man implies protection of the environment. ICRP 103 proposes a methodology for specifically and gradually taking account of these effects.

Finally, as knowledge progresses, the regulations have to be adapted regularly. ASN is very closely monitoring ongoing scientific work.

Exposure to ionising radiation in France

The entire French population is potentially exposed to ionising radiation, but not everyone to the same extent (this depends in particular on where they live and the number of radiological examinations undergone), whether this radiation is of natural origin or the result of human activities.

The average exposure of an individual in France has been estimated by IRSN at 3.7 millisieverts (mSv) per year; the sources of this exposure are as follows:

– representing 1 mSv/year, naturally occurring radioactivity, excluding radon (in particular see the 2009 publication by ASN, the Ministry for Health and the IRSN on the radiological quality of the water distributed by public networks);

– representing 1.4 mSv/year, radon, which varies widely. This exposure is as yet inadequately documented: the creation of a radon exposure database, as required by the second national action plan for radon-related risks, is a key step towards obtaining a clearer understanding of these risks;

– representing 1.3 mSv/year, medical treatments, with a clear upwards trend (from 0.8 mSv per year in 2002 to 1.3 mSv per year in 2007) primarily due to the higher doses delivered during diagnostic examinations. At the end of 2010, ASN sent the Minister for Health proposals for action to control this rise;

– representing 0.03 mSv/year, the other artificial sources of exposure: past airborne nuclear tests, Chernobyl accident, releases from nuclear installations.

The automated monitoring networks managed by IRSN nationwide allow real-time monitoring of environmental radioactivity, signalling any abnormal variation.

Some workers are subject to particular levels of exposure. With regard to workers in nuclear activities, the annual dose remained below 1 mSv (effective annual dose limit for the public) for more than 95% of the workforce monitored. The number of monitored workers for whom the annual dose exceeded 20 mSv (regulation limit for nuclear workers) has fallen significantly. The same applies to the collective dose (fall of about 45% since 1996) whereas the population monitored has risen by about 40%. For workers in activity sectors entailing technological enhancement of naturally occurring radioactive materials, the doses received in 83% of cases are less than 1 mSv/year. In a number of known industrial sectors however, it is quite probable that this value will be occasionally exceeded.

Finally, aircrews are subject to particularly close monitoring owing to their exposure to cosmic radiation at high altitude. Of the recorded doses, 85% are between 1 mSv per year and 6 mSv per year, while 15% are below 1 mSv per year.

In addition to its regulation and inspection duties, ASN closely follows developments in research and available knowledge in the fields of health and ionising radiation and international radiation protection doctrine. ■

2 The principles and players in regulating nuclear safety, radiation protection and environmental protection

Nuclear activities must comply with the fundamental principles of the Environment Charter, the Environment Code and the two main legislative and regulatory texts which are the basis for the regulation of these activities: the 13th June 2006 Nuclear Security and Transparency Act (TSN Act) and the Public Health Code (CSP).

The principles involved are the prevention principle (anticipation of any environmental threat through rules and measures taking account of the "best available techniques at an economically acceptable cost), the "polluter-pays" principle (the polluter responsible for the environmental damage bears the cost of pollution prevention and remediation), the precautionary principle (the lack of certainty, in the light of current scientific and technical knowledge, must not delay the adoption of proportionate preventive measures), the participation principle (the populations must take part in determining public decisions), the justification principle (a nuclear activity can only be carried out if justified by the advantages it offers by comparison with its inherent exposure risks), the optimisation principle (exposure to ionising radiation must be kept as low as is reasonably achievable), the limitation principle (the regulations set limits for an individual's exposure to ionising radiation resulting from a nuclear activity except for medical or biomedical research purposes) and the principle of the nuclear licensee's responsibility for the safety of its installation.

The nuclear activity regulators

In France, responsibility for the regulation of nuclear safety and radiation protection lies essentially with three players: Parliament, the Government and ASN. The TSN Act and the CSP define the respective roles of the Government and ASN.

In addition to its role of passing laws dealing with nuclear safety, Parliament regularly monitors the regulation of nuclear safety

Presentation to OPECST of the ASN 2009 report on the state of nuclear safety and radiation protection in France – April 2010

and radiation protection, in particular through its special commissions, which conduct hearings, or the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST), which has issued a number of reports on this subject and to which ASN presents its annual report on nuclear safety and radiation protection in France.

On the advice of ASN, the Government defines the general regulations for nuclear safety and radiation protection. Also on the advice of ASN, it takes key individual decisions concerning BNIs (creation or decommissioning authorisation, closure in the event of unacceptable risk, etc.). It is responsible for civil protection in an emergency.

In the current Government organisation, the ministers responsible for nuclear safety are the Minister for Ecology, Sustainable Development, Transport and Housing and the Minister for the Economy, Finance and Industry, while the Minister for Labour, Employment and Health is responsible for radiation protection.

In the *départements*, the *préfets*, as representatives of the State, are the guarantors of public order and have a particular role to play in the event of an emergency, given that they are in charge of prevention measures for the population. The *préfet* also takes part in the various procedures concerning the nuclear installations in his département, overseeing local consultations and providing the Ministers or ASN with his recommendations as applicable.

Other territorial institutions intervene in areas of interest to ASN, in particular the regional health agencies (ARS).

ASN is an independent administrative authority (AAI) created by the TSN Act. It is responsible for regulating nuclear safety and radiation protection and contributes to informing the population on these subjects. It sends the Government proposals for regulatory texts and is consulted on the texts prepared by the Ministers. It clarifies the regulations by issuing regulatory decisions which are then sent to the competent ministers for approval. It issues certain individual authorisations. Nuclear activities are monitored and inspected by the ASN staff and by organisations duly authorised by ASN. ASN contributes to France's European and international actions. It alerts and informs the Authorities of third-party States in the event of a radiological emergency and in turn receives alerts and information from them. Finally, it provides its assistance for management of radiological emergencies.

ASN can call on the technical expertise provided by the Institute for radiation protection and nuclear safety (IRSN) and by the Advisory Committees that it has set up.

ASN has made a commitment to research, to identify areas of knowledge essential for medium and long-term expertise. In 2010, it therefore created a Scientific Committee.

ASN is run by a Commission of five full-time, non-revocable Commissioners, appointed for a non-renewable six-year mandate by the President of the Republic, the President of the Senate and the President of the National Assembly. It has head office departments and eleven regional divisions around the country.

ASN's total workforce on 31st December 2010 stood at 451. In 2010, the ASN budget reached 52.2 million euros, not including the services it receives from certain ministries for the operation of its head office departments or regional divisions. The IRSN also receives a government subsidy to cover the technical assistance it provides to ASN. In 2010, this amounted to 78.1 million euros (in 2011, this subsidy will be partially replaced by the revenue from a tax levied on the licensees of large nuclear facilities).

These resources as a whole allow ASN to perform most of its duties. However, these credits are at present split between four budget programmes, within which they are not always clearly identified. ASN therefore hopes to see a simpler system put into place, giving greater visibility and flexibility for financing the regulation of nuclear safety and radiation protection.

2010 was the first year of implementation of the multi-year strategic plan (PSP) for the period 2010-2012, adopted by ASN at the end of 2009.

Consultative bodies

The organisation of nuclear security and transparency also involves a number of consultative bodies, in particular the High Committee for Transparency and Information on Nuclear Security (HCTISN), an information, consultation and debating body for the risks related to nuclear activities and the impact of these activities on human health, the environment and nuclear security. There is also the French High Public Health Council (HCSP), a scientific and technical consultative body reporting to the Minister for Health and which takes part in defining multi-year public health objectives, evaluates the extent to which national public health targets are met and helps with their annual monitoring. ■

3 Regulations

The legal framework for radiation protection is based on international norms, standards and recommendations issued by various organisations, including the International Commission on Radiological Protection (ICRP), an NGO which publishes recommendations about protection against ionising radiation (the latest recommendations appear in the 2007 ICRP publication 103), the International Atomic Energy Agency (IAEA) which regularly publishes and revises nuclear safety and radiation protection standards, and the International Organisation for Standardisation (ISO) which publishes international technical standards.

At the European level, pursuant to the Euratom Treaty, various directives lay down basic rules for radiation protection and, since 2009, for safety. These directives are binding on all member States. In late 2010, the European Commission presented a draft directive on the management of radioactive waste and spent fuel.

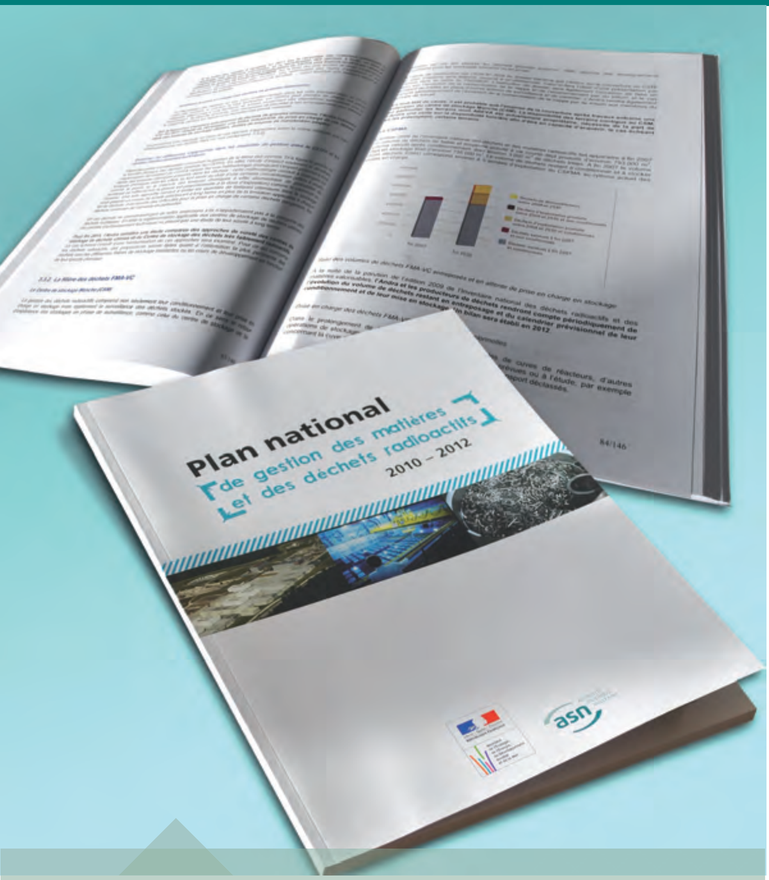
Concerning radiation protection, a process to merge and revise a number of directives led in March 2010 to the production of a draft directive, currently being examined. ASN plays an active role in the process to constitute a European regulatory framework.

Nationally, the legal framework for nuclear activities has been extensively overhauled in recent years. The legislative arsenal is now relatively complete and the publication of the implementing texts is well advanced, albeit not yet complete. The main requirements are contained in the Public Health Code (CSP) and the TSN Act, which should be incorporated into the Environment Code in 2011. Other texts are more specialised, such as the Labour Code, which deals with radiation protection of workers, or the 28th June 2006 Planning Act on the sustainable management of radioactive materials and waste (known as the "Waste" Act). Finally, various texts apply to certain nuclear activities but without being specific to them.

The activities regulated by ASN include a number of different categories presented below, along with the relevant regulations.

Basic nuclear installations (BNI): This concerns the 126 largest nuclear installations located on about 40 sites. These are nuclear power generating sector facilities (nuclear power plants, main "fuel cycle" installations), the large radioactive material stores and repositories, certain research facilities and the large accelerators and irradiators.

The BNI legal regime is defined by part IV of the TSN Act and its implementing decrees. This regime is said to be "integrated" because it aims to prevent or manage all risks and detrimental effects that a basic nuclear installation is liable to create for man and the environment, whether or not radioactive in nature. It in particular requires that the creation or decommissioning of a BNI be authorised by a decree issued on the advice of ASN, and that this decree authorises start-up of the installation and



Second edition of the National radioactive materials and waste management plan 2010-2012

stipulates requirements regarding its design and operation with respect to protection of the population and the environment.

Following the adoption of the TSN Act, ASN in 2008 began overhauling general technical regulations, jointly with the Ministry responsible for ecology. This should lead to the publication of a ministerial order and about twenty ASN regulatory decisions. In 2010, the draft order and ten draft decisions were discussed with all the stakeholders. ASN hopes to see most of these texts published during the course of 2011.

The transport of radioactive materials: The safe transport of radioactive materials is based on the "defence in depth" principle involving on the one hand the packaging and its content, which must withstand the foreseeable transport conditions, and on the other the means of transport and its reliability, plus the response measures deployed in the event of an incident or accident. Responsibility for implementing these lines of defence lies with the consignor.

The regulations concerning the transport of radioactive materials have a particularly international flavour. They are based on the IAEA recommendations integrated into the national agreements covering the various modes of dangerous goods transport. At a European level, the regulations are grouped into a single 24th September 2008 directive, transposed into French law by an order dated 29th May 2009.

Within this legal framework, ASN is responsible for approving package models for the most hazardous shipments. Working groups will be set up in 2011 for the forthcoming revision of the radioactive materials transport regulations (publication planned for 2012/2013).

Small-scale nuclear activities: This category covers the many fields that use ionising radiation, including medicine (radiology, radiotherapy, nuclear medicine), human biology, research, industry and certain veterinarian, forensic or foodstuff conservation applications.

The Public Health Code (CSP) created a system of authorisation or notification for the manufacture, possession, distribution (including import and export), and utilisation of radionuclides or products or devices containing them. The authorisations are issued by ASN and the notifications are filed with its regional divisions.

ASN is continuing to publish the decisions required by the CSP and the Labour Code updated at the end of 2007. This will continue in 2011. Moreover, in 2011, ASN should begin to take charge of regulating "source security".

Radioactive waste: In the same way as any other industrial activity, nuclear activities produce waste. Some is radioactive. The three fundamental principles underpinning rigorous management of radioactive waste are: the responsibility of the waste producer, the traceability of the waste and information of the public. If a management system based on these principles is to be fully effective, it must rule out any general radioactivity threshold ("release threshold") below which the disposal of waste from nuclear installations would be unregulated.

The technical management requirements to be implemented must be tailored to the risk presented by the radioactive waste. This risk can primarily be assessed on the basis of two parameters: the activity level, which contributes to the toxicity of the waste, and the half-life, defined by the time after which the activity is halved.

Finally, radioactive waste management must be determined prior to any creation of a new activity or any modification of an existing activity, in order to optimise the waste management solutions and ensure that there are channels for dealing with the various categories of waste liable to be produced, from the upstream phase (production of waste and packaging) to the downstream phase (storage, transport, disposal).

At the European level, pursuant to the Euratom Treaty, various directives lay down basic rules for radiation protection and, since 2009, for safety. These directives are binding on all member States.

Contaminated sites: The management of sites contaminated by residual radioactivity, either as the result of a past nuclear activity or an activity which produced a concentration of natural radionuclides, warrants specific radiation protection measures. Depending on the current and future uses of the site, decontamination objectives must be set and the removal of the waste produced during clean-out of the contaminated premises and soil must be managed, from the site up to storage or disposal.

In the event of long-term exposure of humans to ionising radiation, Article R. 1333-90 of the CSP gives the *préfet* the duty, after notifying ASN, of taking various protective measures (definition of a perimeter, deployment of a system for monitoring exposure, regulating access or use of the land and buildings, restrictions on marketing of foodstuffs produced in the zone, taking charge of the contaminated materials, etc.).

Activities involving technological enhancement of naturally occurring radioactive materials: Certain professional activities which cannot be defined as "nuclear activities" can lead to a significant increase in the exposure to ionising radiation for the workers and, to a lesser extent, for the neighbouring populations. This in particular concerns activities which use raw materials, construction materials or industrial residues containing naturally occurring radionuclides, not used for their radioactive, fissile or fertile properties. Examples are the phosphate mining and phosphated fertiliser production industries, the dye pigments industries, in particular those using titanium oxide and those utilising rare earth ores such as monazite. The radiation protection measures required in this field are based on a precise identification of the activities, an estimation of the impact of exposure for the persons concerned, the implementation of corrective measures to reduce this exposure, if necessary, and to monitor it.

Monitoring of human exposure to radon in premises open to the public focuses on the risk to the general population, but also to workers. This is a priority radiation protection measure in geographical areas where there is high potential for radon exhalation owing to the geological characteristics of the terrain. A strategy is required to reduce this exposure if the measurements taken exceed the regulatory action levels. Monitoring obligations have been created. ■

4 Regulation of nuclear activities and exposure to ionising radiation

In France, the licensee of a nuclear activity is responsible for the safety of its activities. It cannot delegate this responsibility and must ensure permanent monitoring of its installation.

ASN's regulation of nuclear activities consists in ensuring that any party responsible for a nuclear activity assumes its full responsibility and complies with the requirements of the regulations with regard to safety and radiation protection. ASN adapts the scope, methods and intensity of its regulation and inspections to the health and environmental safety stakes involved. Some inspections can be carried out by organisations and laboratories with the required level of expertise, validated by ASN approval. Regulation and inspection may take place with the support of the IRSN.

ASN checks compliance with the general rules and special requirements concerning nuclear safety radiation protection that apply to the licensees of basic nuclear installations (BNI), those responsible for construction and utilisation of pressure equipment (ESP) used in BNIs, those responsible for radioactive material transport activities, those responsible for activities entailing a risk of exposure of the public and workers to ionising radiation, those responsible for implementing measures to monitor exposure to ionising radiation, and the organisations and laboratories approved by itself.

Regulation and inspection have been broadened and today include organisational and human factors, taking account of individual and collective behaviour, management, organisation and procedures, relying on a variety of sources: significant events, inspections, relations with the stakeholders (personnel, licensees, contractors, occupational physicians, inspection services, approved organisations, etc.). They includes inspection of environmental protection measures and, in the nuclear power plants, the correct application of the Labour Code.

Inspection is one of ASN's primary means of monitoring. The inspections are generally carried out by two inspectors, if necessary with the assistance of an IRSN engineer specialising in the installation being inspected or the technical topic of the inspection.

The inspections can be unannounced or the licensee can be notified several weeks before the visit. They mainly take place on the site or during the course of the activities (construction site, transport operation). They can also concern the head offices or design offices of the larger nuclear licensees, the workshops or design offices of subcontractors, construction sites, plants or workshops manufacturing various safety-related components.

ASN has recourse to different types of inspections: routine inspections, in-depth inspections which take several days and require ten or so inspectors, inspections with sampling and measurements to run discharge checks independently of those carried out by the licensee, inspections in the aftermath of a significant event, construction site inspections which ensure a significant ASN presence on the sites during reactor outages or specific work, especially during the decommissioning phase.

With regard to enforcement and sanctions, ASN has a range of tools at its disposal, such as the inspector's comments to the

Tritium White Paper website,
http://livre-blanc-tritium.asn.fr/

licensee, the official letter from ASN to the licensee, formal notice from ASN to the licensee to rectify the administrative situation or meet certain specified conditions, within a specified period of time, administrative sanctions applied following formal notice. As necessary, ASN may suspend or revoke its authorisation. In parallel with ASN's administrative action, the inspector can draft reports which ASN sends to the public prosecutor's office with a view to initiating criminal proceedings.

With regard to monitoring environmental radioactivity, which is essentially carried out by the IRSN, which conducts nationwide monitoring, and by the BNI licensees in compliance with the terms of the discharge licenses, ASN approves specialist laboratories to check the quality of their measurements. The results of these measurements are centralised on the national environmental radioactivity monitoring network and are made available to the public on the *www.mesure-radioactivite.fr* website.

The main significant events of 2010

In 2010, ASN carried out 1,964 inspections on BNIs, radioactive material transport operations, activities involving ionising radiation, the organisations and laboratories it approved and the construction and utilisation of pressure equipment for BNIs.

With regard to enforcement and sanctions, ASN took administrative measures (formal notice, suspension, etc.) against six nuclear activity contractors and licensees. Further to the breaches found, it sent eighteen reports to the public prosecutor, including four for violation of conventional safety requirements in nuclear power plants.

With regard to protection of the environment, the two pluralistic think tanks set up by ASN in 2008, concerning sources and the health and environmental impact of tritium, submitted their conclusions and recommendations to ASN in April 2010. The work done recalled the low impact of tritium discharges in France, but also highlighted the need to carry out additional studies and research to confirm current 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. The entire Tritium White Paper, including the ASN plan of action, is available on the *http://livre-blanc-tritium.asn.fr* website.

Outlook

For 2011, ASN has scheduled 1,920 inspections of BNIs, radioactive material transport operations, activities involving ionising radiation, the organisations and laboratories it approved and the construction and utilisation of pressure equipment for BNIs.

ASN has initiated a review of the significant event notification procedures, which will take account of the small-scale nuclear facilities event experimental notification guide and the regulatory changes that have occurred in the BNI field. The notification criteria and procedures will be clarified and harmonised between the various sectors.

ASN will continue with implementation of its tritium action plan. This action plan will continue to be monitored by an oversight committee, which will meet for the first time in early 2011.

With regard to monitoring environmental radioactivity, ASN will be continuing the work begun with all the players on the national monitoring network. This will involve drawing conclusions from one year of operation of the national environmental radioactivity monitoring network website and defining changes to the monitoring strategy implemented around nuclear sites and in the rest of the country.

Finally, ASN is preparing to regulate and inspect a new field, that of radioactive source security (see chapter 10). ■

5

Emergency situations

Even if nuclear activities are designed to be carried out in such a way as to prevent accidents, the principle of defence in depth means that provision must be made to deal with an emergency situation concerning these activities, by both the licensee and the public authorities.

Management of these emergency situations is based on special response organisations and emergency plans. In situations such as these, ASN assists the *préfet* and the Government, checks the soundness of the decisions taken by the licensee and informs the public, international organisations and the countries likely to be concerned by the accident.

This regularly tested and evaluated arrangement is regularly revised, to take account of operating experience feedback from exercises and from the handling of real situations.

The main significant events of 2010

With regard to managing urban development around BNIs, the circular of 17th February 2010 from the Ministry for ecology asked the *préfets* to exercise greater vigilance concerning urban development in the vicinity of nuclear installations. This circular, which ASN helped draft in 2009, states that particular attention must be given to projects that are sensitive with regard to their size, their purpose or potential problems with regard to protection of the population in the immediate danger zone.

This circular gave ASN and the General Directorate for Risk Prevention (DGPR) the role of coordinating a pluralistic working group to define ways of controlling activities around nuclear installations.

In 2010, ASN coordinated work with the administrations, elected officials and licensees concerned, which led to the drafting of a guide presenting the general principles for controlling urban development: ensuring that nothing impedes the implementation of the emergency plans, controlling population growth inside the danger zone, giving preference to land use development outside the danger zone and ensuring controlled development meeting the needs of the resident population.

ASN aims to see these principles applied at the local level and, following a wide-ranging consultation, incorporated into urban planning documents so that the neighbouring populations are better informed and protected against the risks generated by nuclear installations.

Consuming stable iodine tablets is one way that the populations can protect themselves in the event of a radiological emergency. In 2009, jointly with the other administrations and EDF, ASN oversaw the fourth iodine tablets distribution campaign to the populations living around NPPs. This comprised three phases: collection from the pharmacy, mailing of tablets direct to the home, provision of a permanent stock in the pharmacies.

Nationwide, following the first distribution phase, nearly 50% of those concerned collected boxes of tablets from their pharmacy. In early 2010, boxes were mailed directly to persons who had not collected theirs. Following this second phase, the overall coverage of the population around the NPPs is about 93%.

Complete operating experience feedback will be collated in 2011 from all the stakeholders concerned, along with a more precise review with the *préfectures*[3]. A survey was conducted to find out why boxes were not collected and will help optimise the procedures for stable iodine distribution to the populations.

The Steering committee for managing the post-accident phase of a nuclear accident or radiological emergency situation (CODIRPA) set up a new organisation in 2009 and created two commissions, one dedicated to the transition phase, the other to long-term studies. CODIRPA commission 1 produced an operational guide in 2010 covering management plans for making the transition from the emergency phase, giving the local public authorities information of use for preparing their local plan for the end of emergency phase transition. The first draft of this guide is being 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 communal safeguard plan. Commission 2 is also preparing guidelines for management of the long-term phase, in particular taking account of international work (CORE, COREX) carried out in Belorussia after the Chernobyl accident.

In 2010, ASN prepared the international seminar scheduled for May 2011, the aim of which is to share CODIRPA's work with the local stakeholders (préfectures, communes, CLI, etc.), national experts and foreign experts engaged in comparable work, plus foreign radiation protection authorities and the French and foreign organisations concerned.

In 2010, ASN's emergency response centre was activated once owing to the meteorological situation threatening the le Blayais NPP (storm Xynthia).

In 2010, ASN continued its meetings with its foreign counterparts responsible for managing emergency situations. ASN met the British, Irish, Swiss and German authorities during the course of crisis management discussion meetings. ASN also welcomed a delegation from the USA who, on 9th September 2010, came to observe a nuclear emergency exercise on the Penly site. In November 2010, ASN was invited by its Spanish counterpart (CSN) to observe a dirty bomb attack post-accident management exercise.

Seven national exercises were held in 2010 and tested the provisions of the end of emergency phase transition guide drafted by the CODIRPA.

3. Office of the *préfet*
4. Smallest administrative subdivision administered by a mayor and a municipal council

ASN command centre during the emergency exercise in the Cattenom NPP on 8th April 2010

Outlook

In 2011, ASN will be involved in meeting national emergency exercise objectives. They concern the performance of an exercise to test the security/safety interface, to test the response procedures defined by the CODIRPA, the actual evacuation of the populations, the inclusion of extensive communication to the population, a scenario involving a "minor" accident, the gravity of which does not necessarily require immediate implementation of the off-site emergency plan (PPI) and the performance of an exercise concerning a major fire. A nuclear or radiological emergency of seismic origin will also be simulated.

Seven national exercises were held in 2010 and tested the provisions of the end of emergency phase transition guide drafted by the CODIRPA.

ASN will continue its work to reinforce its doctrine on controlling urban development around basic nuclear installations. Via the *préfet*, ASN has the duty to inform local councils of the risk generated by nuclear installations. This information role must be carried out coherently and systematically for all installations which have a PPI. In the longer term, a methodology will need to be defined for establishing public protection restrictions to control urban development and thus limit the consequences of an accident occurring in an installation.

In the post-accident domain, the international seminar scheduled for May 2011 will give an overview of all the work currently in progress. The expected publication of the end of emergency phase transition guide and the management guidelines for the transitional and long-term phases will be accompanied by a debate on the future programme of work in the post-accident field and the resulting changes to CODIRPA's current organisation. ■

6 Public information and transparency

"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 1 of the TSN Act). ASN is fully aware of its role in implementing these transparency provisions of the TSN Act.

ASN strengthens its own transparency-related actions through active communication with the general public, the media, the institutional public and the professionals.

It monitors application of the TSN Act by the stakeholders and supports action in favour of transparency by the local information committees (CLI) and the French High Committee for Transparency and Information on Nuclear Security (HCTISN).

In its regulation of nuclear licensees, ASN is developing compliance with the transparency obligations contained in the TSN Act. To anyone who so requests, the licensees are now required to transmit the information in their possession on the risks linked to their activity and the safety or radiation protection measures they have taken to prevent or minimise these risks.

Every year, ASN presents its Report on the state of nuclear safety and radiation protection in France to Parliament. Discussions with its institutional, parliamentary and local authority audiences enable it to be more effective in its duties and exercise the independence granted to it by the TSN Act.

The main significant events of 2010

In 2010, ASN reinforced its public information activities. Since 2002, ASN has been publishing follow-up letters to all the inspections carried out in basic nuclear installations (BNI) and, since 2008, ASN has been publishing follow-up letters to radiotherapy inspections. Since April 2010, ASN has also included small-scale nuclear facility inspection follow-up letters on its *www.asn.fr* website.

In 2010, new sections were added to the site, for example those devoted to the ASN's Scientific Committee, to ASN strategy and doctrine. Several dossiers, including "sites polluted with radium and other radioactive substances" and the Tritium White Paper, were also placed on-line. In addition to updating all the regional pages, the 2009 reviews taken from ASN's annual report were included for each division. Furthermore, in order to take part in the debate on nuclear safety, a public consultation was launched in May 2010 on "the overhaul of the BNI general regulations". This will continue into 2011.

Since 2010, the "Advisory Committees (GPE)" section of its website presents summaries of the IRSN reports presented to the GPE and the opinions that IRSN sent to the Authorities. Since March 2010, ASN has been present on social networks such as Facebook, Twitter and Dailymotion. In 2010, more than 300,000 browsers logged onto the *www.asn.fr* site and nearly two million pages were consulted.

The *Contrôle* magazine in 2010 looked at the regulation and inspection of nuclear reactor pressure equipment; the monitoring of environmental radioactivity and the construction of a European nuclear safety and radiation protection hub.

In April 2010, ASN launched the magazine *Transparence* aimed at ASN personnel, but also distributed to an outside audience (institutional players, public authorities, stakeholders, schools, etc.).

The fourth stable iodine tablets distribution campaign around the EDF nuclear power plants took place between June 2009 and the first quarter of 2010. It concerned about 500,000 people within a 10 kilometre radius around 19 French NPPs and involved a particular effort to inform the populations: personal letter addressed to each home concerned, national and local press coverage, pedagogical information documents (folders, posters, special website *www.distribution-iode.com*). Nationwide, 88% of those questioned said that they had heard about this campaign, 49.2% of those concerned collected their boxes and more than 338,000 boxes were delivered. A survey carried out in November 2010 showed that the public had contrasting perceptions of the nuclear risk. The radiation protection culture of the population therefore needs to be further developed in the field with the support of the local players (préfectures, CLI, communes, health professionals, schools).

Throughout 2010, through more than thirty national and regional press briefings, about twenty press releases, a hundred or so information memos and numerous interviews, ASN answered media questions on nuclear regulation in France. The media in particular queried ASN on topical and strategic issues: day to day safety of nuclear installations, the EPR reactor construction site at Flamanville, the level 2 incident in the ATPu (plutonium technology facility), the evaluation of EPR instrumentation & control, the extended operating life of NPPs, the safety level of the new reactors being built around the world.

In 2010, ASN also held joint press conferences on various subjects: launch of the national environmental radiation monitoring network (RNM) with the IRSN, the national radioactive materials and waste management plan, with the Ministry responsible for ecology (MEEDDM), the Tritium White Paper, the report from the Limousin Advisory Committee (GEP) on the management of the former uranium mining sites in France, with the MEEDDM.

In 2010, in Marseille (February 2010) and Avignon (December 2010) ASN organised regional discussion days on how the seismic risk is taken into consideration in the nuclear installations in the South of France.

With regard to the CLI, implementation of the TSN Act's provisions was almost complete in 2010, with the creation of new CLIs for sites on which they did not yet exist. At the end of 2010, there were thirty-six CLIs as stipulated by the TSN Act.

The CLIs are financed by the regional authorities and by ASN. In 2010 ASN devoted about 600,000 euros to the CLIs and their federation. It also submitted a proposal to the Government for implementation of the system, specified by the TSN Act, replacing the budget allocated to the CLIs based on their association status, by a levy on the BNI tax, but this system has not yet been put into place.

The HCTISN held four plenary meetings in 2010 and activated several working groups. It in particular drafted a report on the "transparency of the management of nuclear materials and waste produced at the different stages of the fuel cycle", which was submitted to the Minister for Ecology and the OPECST in July 2010. The High Committee continued its work on the topic "Transparency and confidentiality" and on the creation of a web portal for information about nuclear matters. On several occasions, it raised questions relating to waste (presentation of the PNGMDR, LLW-LL waste repository siting process, situation of former uranium mines, etc.). It was also able to discuss aspects of the "cancer" plan concerning radiation protection, considerations regarding environmental monitoring policy, and so on. During its plenary sessions, the High Committee also looked at various topical issues, inviting the main parties concerned to make presentations.

The matters presented and discussed during the HCTISN meetings can be consulted on its website, *www.hctisn.fr.*

Outlook

In 2011, ASN will continue to strengthen transparency and information on subjects within its scope, jointly with the other players and stakeholders. It will aim to develop the organisation of national and international debates on general subjects

ASN aims to ensure greater public involvement in its decision-making process and explain its decisions. It will therefore encourage greater public consultation via its website.

relating to nuclear safety and radiation protection, but also on society's approach to risk in general. ASN aims to ensure greater public involvement in its decision-making process and explain its decisions. It will therefore encourage greater public consultation via its website. The development of exchanges with institutional partners and stakeholders will also be a key area of progress for information of the public.

In 2011, ASN will also continue to work to develop application of the TSN Act's provisions on the transparency of nuclear activity licensees and procedures. It will contribute to the reform of the public consultation procedures regarding nuclear activities, as required by the Act constituting the national environment undertaking ("Grenelle 2" Act): this in particular involves a reform of public inquiries and, as proposed by ASN, the creation of a systematic public consultation procedure for projects liable to lead to a significant rise in water intake from or discharges into the environment by a BNI, but which do not require a public inquiry.

ASN will continue to monitor correct application of the new requirements concerning access to the information in the possession of the licensees and the safety reports. In this respect, it will examine the conditions for implementation of the recommendations that the HCTISN should be publishing in early 2011 regarding how to reconcile transparency and confidentiality as protected by law.

Following the consultations started in 2010, ASN will submit a proposal to the Government for extending to the field of transport the right of access to information in the possession of those responsible for nuclear activities.

22nd CLI conference, 8th December 2010 in Paris

Finally, ASN will continue its support for CLI activities. Together with the ANCCLI and jointly with the licensees, it will establish rules of good practice to make it easier for the CLIs to carry out their duties. It will renew its proposals to the Government aimed at giving the CLIs the means and resources they need. ■

7 International relations

The fleet of nuclear installations regulated by ASN is one of the largest and most diverse in the world. This extensive experience has led ASN to engage widely in international relations with its foreign counterparts with a view to strengthening safety and radiation protection worldwide and achieve the goal of becoming recognised as an "international benchmark".

The main significant events of 2010

Europe is the focus of ASN's international actions and it aims to help build a Europe with a leading role in nuclear safety, the safe management of waste and spent fuel and radiation protection. After the adoption of the European nuclear security directive in June 2009, the construction of a European nuclear safety and radiation protection hub is progressing, as indicated by the Commission's submission of a draft directive on the management of waste and spent fuel. This directive will complete the European nuclear safety and radiation protection regulations.

ASN makes an active contribution to the work of WENRA (Western European Nuclear Regulators' Association), an informal club created in 1999 at the initiative of the ASN Chairman and it today brings together the heads of all the safety regulatory authorities in the expanded European Union, plus Switzerland. The safety regulators from ten European countries without nuclear power generating reactors attend as observers and have been joined since 2010 by those from Armenia, Russia and Ukraine. The WENRA association has just adopted safety objectives for the new nuclear power generating reactors in Europe. ASN hopes to see these objectives initially endorsed by the European institutions, and then promoted by the EU on the international stage. Moreover, the European regulators will in 2011 be organising the first European conference on nuclear safety.

In the field of radiation protection, the work by the HERCA (Heads of the European Radiological protection Competent Authorities) association led in 2010 to the creation of a European Radiation Passbook and to the joint declaration on the justification for the use of full-body X-ray scanners in airports. The Commission should in 2011 adopt a draft directive revising the basic standards for the health protection of the population and workers against ionising radiation, in line with the recommendations of the ICRP and IAEA.

Outside Europe, there are numerous multilateral cooperation agreements, in particular within IAEA and the NEA. Within IAEA, ASN actively participates 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 within Europe. The ASN Chairman has been Chairman of the CSS since 2005. ASN also takes part in the IRRS (Integrated Regulatory Review Services) audit missions.

The United States Nuclear Regulatory Commission (NRC) and ASN took the initiative of launching an international project, the Multinational Design Evaluation Program (MDEP) for the joint evaluation of the design of new reactors. This programme, which has been expanded to include numerous partners worldwide and whose secretariat has been entrusted to the OECD's Nuclear Energy Agency (NEA), shares information about the safety assessment of the EPR and AP1000 reactors. The initiative eventually aims to harmonise the safety objectives, codes and standards associated with analysing the safety of a new reactor.

ASN has signed bilateral cooperation agreements with many countries. The usually annual meetings of the "steering committee" identify subjects for cooperation and the joint action to be taken. ASN also promotes staff exchanges with its foreign counterparts, contributing to improved mutual understanding and development. This may concern isolated actions, such as cross-inspections and short-term missions, in order to examine a precise technical topic, or the secondment of an inspector to a foreign regulator for an extended period of time (one to three years). It is also worth noting the appointment of representatives of foreign safety regulators to the ASN advisory committees. ASN adopted this practice, which enables experts from other countries not only to be members of these committees, but also sometimes to stand as chair or vice-chair.

ASN is often contacted by countries seeking its assistance. ASN first analyses the nuclear safety situation of the countries issuing the request. If, following this analysis, ASN concludes that safety cannot be guaranteed, it expresses its reservations as to the suitability of the envisaged cooperation. In those cases in which ASN decides to initiate cooperation, the aim is to enable the countries concerned to acquire the independence and safety and transparency culture essential to setting up an effective and credible national system for the regulation of nuclear safety and radiation protection. ASN is also examining ways of pooling nuclear safety assistance with its counterparts within the Regulatory Cooperation Forum, a structure hosted by IAEA.

Visit by E. Leeds, Director of the NRC's Office of New Reactors, to the AREVA components manufacturing plant in Chalon/Saint-Marcel – June 2010

Finally, France is a contracting party to four international agreements aimed at preventing accidents linked to the use of nuclear energy and mitigating their consequences. IAEA is the depository of these agreements and acts as secretary. 2010 was devoted to preparing the ASN report for the fifth review meeting of the Convention on Nuclear Safety, to be held in Vienna in April 2011.

Outlook

In 2011, in the field of international relations, ASN will focus on continuing its active contribution to improving nuclear safety and radiation protection worldwide, within the context of the bilateral relations already established, as well as for those countries expressing a serious interest in the adoption of nuclear energy. This goal will be pursued while maintaining a strong and permanent ASN presence in European and international bodies. ASN's aim is to have the new reactor safety objectives defined by WENRA endorsed by the European institutions and then adopted internationally. The European regulators will also be organising the first European conference on nuclear safety in June 2011. ■

8 Regional round-up of nuclear safety and radiation protection

This chapter presents the state of nuclear safety and radiation protection as seen locally by the ASN regional divisions.

Summary sheets present the basic nuclear installations and small-scale nuclear facilities (medical, industrial and research) and the local actions particularly representative of ASN's work in the regions.

This presentation follows the same principle as that adopted in the various ASN information media, *www.asn.fr* or the quarterly *Contrôle* magazine, and aims to allow easier access to local information (for more information, please consult the ASN website - *www.asn.fr*). ■

9 Medical uses of ionising radiation

Whether for diagnosis or therapy, medicine uses various sources of ionising radiation, produced either by electric generators or by radionuclides.

In France, there are several thousand conventional or dental radiology appliances, about a thousand computed tomography facilities, more than 200 nuclear medicine departments using unsealed sources for in vivo or in vitro diagnosis and internal radiotherapy, and 180 external radiotherapy centres treating some 200,000 patients every year.

The technologies involved are continuing to evolve (multi-detector scanner) as are their conditions of use, such as tele-radiology, which enables radiology examinations to be carried out and interpreted remotely.

The medical benefits and usefulness of these techniques have been proven. However, the exposure of health professionals, patients and the population to the associated radiation has to be justified and controlled and the currently expanding applications require close attention. This is why about 180,000 people working in the field of medical uses of ionising radiation were subject to dosimetric monitoring of their exposure. Medical radiology alone accounts for 65% of the medical personnel exposed.

The main significant events of 2010

The number of significant radiation protection events (ESR) notified to ASN in the medical field in 2010 stands at 419, up by more than 50% since 2008. Of the 372 notifications analysed, it would seem that 66% of the ESR concern radiotherapy, 18% nuclear medicine, 13% diagnostic and dental radiology and 3% interventional radiology.

Of these events, 29 concern persons working in medical facilities, 5 of which were rated 1 on the INES scale. Although few in number, they are rising and either reflect practices involving particularly high exposure (long-duration interventional radiology procedures, preparation of radiopharmaceuticals), or professionals who are regularly exposed owing to their expertise or competence ("seniors" or radio-pharmacists). 282 events concern patients exposed for diagnostic or therapeutic purposes. It should be noted that the ESR notification approach in the field of radiotherapy has become significant and now accounts for nearly 66% of all notifications. In this field, the number of notifications received by ASN is unchanged in relation to 2009. The number of centres which have never issued a notification is also falling, 20% of centres as against 29% at the end of 2009.

The trends observed during the course of the experimental period confirm that the majority of the events notified are linked to organisational and human shortcomings (96%). ASN observes that the causes often focus on the operators and that the underlying causes linked to the organisation, the working environment or the institutional context are insufficiently examined when analysing the events, thus limiting the ability to enhance system reliability by identifying and implementing lines of defence.

Since 2007, radiotherapy health care safety has been a priority area for ASN regulation, entailing the annual inspection of each centre. ASN is also playing an active role in the work of the national committee for radiotherapy monitoring, run by the national cancer institute (INCa). The result in 2010 was the identification of additional measures to be incorporated into the radiotherapy roadmap arising from the conclusions of the international conference on the radiation protection of patients, held by ASN in Versailles in December 2009. The conclusions of this conference were closely reviewed jointly with all the stakeholders concerned, in order to identify the measures required to complete the national radiotherapy plan overseen by INCa. This subject will be examined by the national plan supervisory committee in 2011.

The ASN inspections carried out in 2009 confirm the positive trend begun in 2008 with regard to the increased human resources deployed in the medical radiation physics field.

> *Since 2007, radiotherapy health care safety has been a priority area for ASN regulation, entailing the annual inspection of each centre.*

However, as in the previous year, ASN observed that the medical radiation physics situation at the end of 2009 remained precarious in several centres, in particular those which directly employed too few medical radiation physicists (PSRPM) (about a dozen centres at the end of 2009). The steps taken in the centres to make up for PSRPM absences of less than and more than 48 hours, need to be more clearly defined. The inspections also confirm a positive trend with regard to the gradual implementation of radiotherapy safety and quality management. The results of these inspections show real commitment to the national radiotherapy plan on the part of the healthcare professionals. However, ASN identifies highly disparate degrees of progress in this approach depending on the centre, along with widely varying levels of commitment by the management. More specifically with regard to managing the preparation and performance of treatment, the situation is considered to be on the whole satisfactory. However, concerning risk management, few preliminary risk analyses are conducted, mainly owing to the fact that they will not be mandatory for quite some time and owing to a lack of time and/or specific expertise in this field. Finally, the notification and analysis of malfunctions have become widely applied. On the other hand, progress is needed in the analysis of causes and in the medium and long-term monitoring of measures to improve the healthcare safety and quality management system, as well as in the internal circulation of information concerning the malfunctions and the improvements made.

ASN inspection of the nuclear medicine department in the Nord de Saint-Denis radiology centre – December 2010

In the medical imaging field, both in France and the other Western countries, the significant rise in the doses delivered to patients (+50% between 2002 and 2007) is due to several factors, including:

– the increase in the number of examinations carried out, owing to their diagnostic performance,

– the rise in the number of scanners in use, which deliver higher doses than conventional appliances,

– the rise in the number of new examinations which deliver high doses (whole-body scanner, virtual colonoscopy, CT heart scanner, etc.).

This situation led ASN to organise a seminar in September 2010 with all the professionals and organisations concerned, the conclusions of which are available on the ASN website. ASN identified two main actions as a result of this seminar:

– encourage access to MRI through the regional planning of heavy equipment investments and through more effective pricing incentives in favour of MRI;

– continue efforts to train and recruit radiation physicists: this effort was started in 2008 in order to address urgent needs in the radiotherapy field and will need to be continued for at least five consecutive years to ensure adequate levels of medical imaging personnel.

Outlook

Until 2012, ASN will at the least be maintaining its inspections in all radiotherapy centres: it will be particularly vigilant concerning compliance with the requirement for the presence of a radiation physicist during treatment, as of the end of the interim period, for which transitional criteria were published in July 2009 by the Minister responsible for health, and the gradual development of quality assurance, regarding which the first requirements will be mandatory at the beginning of 2010. In this context, ASN will pay particular attention to those centres where, owing to a lack of manpower, the medical radiation physics requirements will need to be covered by external contracting or by resorting to collaboration between centres. ASN will be attentive to strengthening the medical radiation physics staffing levels.

In the coming years, particular attention will be needed on the rise in ionising radiation doses delivered to the patients. ASN will therefore be closely monitoring the creation of nationwide programmes by the Minister responsible for health, in particular concerning the growth in the numbers of non-irradiating imaging appliances, the development of decision-making tools for correct implementation of the justification principle and the continued reinforcement of human resources in medical radiation physics, which are the means of guaranteeing true implementation of the principle of optimisation of the doses delivered to patients. ■

10 Non-medical uses of ionising radiation

Industry, research and numerous other sectors use sources of ionising radiation in a wide variety of applications ranging from industrial irradiation, to non-destructive testing, to the detection of lead in paint. The radiation sources are either sealed or unsealed radionuclide sources or electric generators of ionising radiation.

Faced with this diversity, the safety of workers, the public and the environment in particular requires source management, from manufacture to end-of-life.

The main significant events of 2010

With regard to the activity regulations, the steps taken to revise the authorisation and licensing regimes initiated in 2008, with a view to simplification and graduation of the risks, led ASN in 2010 to issue new definitions of the requirements of the contents of the authorisation application files. Similarly, work to introduce a notification regime led to the publication of several approved decisions defining the scope and the procedures for implementation of the new regime.

Finally, in 2010, ASN continued with its general actions to boost awareness of and promote compliance with the regulations.

On the subject of justification, ASN initiated exchanges with its European counterparts on the issues associated with implementing this principle. The aim in particular is to minimise the disparities with the other members states, while preserving the way in which France applies the justification principle. For existing activities, justification is reassessed if current knowledge and technology so warrants. This is in particular the case for ionization smoke detectors, devices for which ASN in 2010 submitted a draft order to the Government and two draft decisions proposing gradual replacement by alternative technologies.

Old objects containing radioactive sources, such as lightning conductors and surge arresters, are still present around the country. ASN considers that these radioactive objects, even if not generally a risk as long as they are not handled, should be gradually collected in an organised manner by specialised companies. To raise the awareness of the professionals and ensure that these objects are recovered in good conditions, ASN in 2010 contacted all the professionals concerned to remind them of the regulations, while at the same time beginning inspections of companies involved in the collection of these objects.

A significant event occurred in May 2010 in the Feursmetal (Loire) plant, rated level 2 on the INES scale. Six people, along with the foundry premises and tools, were contaminated during an attempt to recover a radioactive source jammed inside a gamma radiography device guide tube.

The legislative and regulatory texts for implementing the monitoring of radioactive source protection against malicious acts are nearing completion. Although the additional means requested for this new role were not included in the Budget Act, the ASN Commission in September 2010 confirmed its approval of ASN's involvement in this role, as part of its duty to protect the general public interest.

ASN assessment

On the subject of industrial radiography, ASN feels that, depending on the company, the situation regarding consideration of the risk of worker exposure to ionising radiation varies widely and that improvements are still necessary. Even if the regulations are on the whole followed, progress must still be made in the preparation for interventions and the coordination between clients and contractors. Regional approaches for establishing charters of industrial radiography good practices are under way and should be continued.

With regard to research activities, action taken in recent years has produced significant results, particularly concerning the involvement of persons with competence for radiation protection, ASN has observed an overall awareness of radiation protection issues. However, the lack of commitment by certain parties and a legacy from past activities that is problematical for installation conformity with radiation protection requirements, along with the disposal of very old "forgotten" radioactive sources, remain hurdles that are sometimes hard to overcome.

The inspections carried out in 2010 in veterinary surgeries showed that the administrative picture was still far from satisfactory. Technical radiation protection checks, workstation and risk analyses all still need to be improved. However, ASN has seen considerable progress in recent years. At present, the vast majority of structures employ a person with competence for radiation protection and the workers receive dosimetric monitoring; a large number of administrative regularisation files were submitted in 2010.

Outlook

With regard to regulation of the applications of ionising radiation in the non-medical sector, ASN is aiming to ensure that the licensees take full account of the risks linked to the use of ionising radiation. ASN will therefore be continuing its oversight of radioactive source suppliers, both for examination of authorisation files and inspections within the entities. On the user side, it will focus on the use of sources of ionising radiation on worksites and on searching for establishments in breach of the regulations.

As a result of incidents involving gamma radiography sources, ASN has launched specific measures targeting high-level sources. It will continue with these measures, enhancing the aspects relating to safety, in anticipation of its new roles. ■

11

Transport of radioactive materials

About 900,000 packages of radioactive materials circulate in France every year, or a small percentage of the total dangerous goods traffic. Most (two-thirds) comprise packages for medical or industrial uses (lead analysers, gamma radiography devices, etc.). These packages are extremely diverse.

Their radioactivity varies by more than twelve orders of magnitude, that is from a few thousand becquerels (pharmaceutical packages) to millions of billions of becquerels (spent fuel) and their mass from a few kilograms to about a hundred tons.

Road transport accounts for about 90% of radioactive material shipments, rail 3% and sea 4%. Air transport is widely used for small, urgent packages to be transported long distances, for example short-lived radiopharmaceuticals. All of these transport operations can be international.

The sectors using these packages are also extremely diverse. There is obviously the nuclear sector, but also the medical, conventional industrial and research sectors. These last three sectors account for more than 85% of the traffic involving radioactive material packages. The nuclear power generating cycle generates transport operations for a variety of radioactive materials. The most important represent about 300 annual shipments of new fuel, 250 of spent fuel, about thirty of MOX fuels and about sixty of plutonium oxide powder.

The main parties involved in the transport operation are the consignor and the transporter. The consignor is responsible for package safety and, when it hands the package over to the transporter, it accepts its liability via the shipment declaration.

ASN is responsible for the regulations concerning the safe transport of radioactive and fissile materials for civil uses and for monitoring their application. This safety must not be confused with security, or physical protection, which is the prevention of loss, theft or misappropriation of nuclear materials (usable for making weapons), for which ASN is not responsible.

> *ASN is thus closely involved in the various international exchanges associated with the drafting and implementation of these regulations.*

In 2010, ASN issued 75 certificates for package models, defining their conditions of manufacture, utilisation and maintenance.

In 2010, ASN carried out 92 inspections at the various parties involved in radioactive material transport operations, consistently with the other regulators responsible for inspecting means of transport, conventional safety inspections in the transport sector or the protection of nuclear materials. The consignors and transporters receive constant attention, but the inspections also concern activities related to transport, such as the manufacture and maintenance of the containers. For example, in 2010, the inspections primarily concerned the following situations: handling of radioactive packages in airports, BNI field inspections, design, testing, manufacture and maintenance of containers, manufacture and testing of packages not subject to approval by the competent authority.

The observations or findings following the inspections show that the most frequent anomalies concern quality assurance and documentation, the responsibilities of the various parties, or compliance with procedures and instructions stipulated in the approval certificates, the safety files or, more generally, the regulatory texts.

The inspections in 2009 and 2010 show progress, especially in the drafting of the radiation protection programmes, which have been mandatory since 2001, but also reveal that this progress is as yet insufficient. ASN considers that the situation is unsatisfactory, in particular for packages which do not require approval by the competent authority. This situation is all the more unsatisfactory as these packages are the cause of a large share of the incidents that occurred in 2010.

In 2010, 53 events were rated level 0 and nine level 1. These events occurred during handling of packages or during the actual transport operation. They could also involve nonconformity with the regulations stipulated in the orders specific to each mode and in the package model approval certificates.

The medical, conventional industry and research sectors are the origin of about 46% of the transport events, even though they account for the vast majority of transport operations. This is no doubt due to a lack of notification from the professionals in the small-scale nuclear sector. It is therefore striking to note that most of the anomalies notified to ASN in the medical, conventional industry and research sectors are events which cannot be concealed, such as damage, theft or loss of packages, or road accidents. ASN considers this situation to be unsatisfactory, because a poor design or incorrect use of these packages can lead to the workers or public receiving doses that are higher than the regulation limits, in particular if their contents leak. The transport event notification obligation and procedures were recalled at the various information seminars. ASN supplements its regulation and inspection work by a more pedagogical approach: four information seminars for the various radioactive material transport stakeholders were thus organised to present the key points and changes to the regulations, to recall the importance of notifying events that may have affected package safety.

Article 19 of the TSN Act states that the transparency requirements introduced by that same Act apply to the transport of radioactive substances once the quantities transported are higher than thresholds defined by decree. A first decree drafted by ASN was submitted to the various stakeholders in 2010.

The managers of the largest infrastructures were required by decree 2007-700 of 3rd May 2007 to submit a hazard assessment of their installation to the *préfet* of the *département* no later than May 2010. In 2010, ASN distributed a draft guide for the performance of radioactive material hazard assessments in transport infrastructures to provide the infrastructure managers with the methodology and data they need to determine the specific risks associated with radioactive materials and to be included in their hazard assessments.

By its very nature, transport is international. The regulations are therefore also essentially international. ASN is thus closely involved in the various international exchanges associated with the drafting and implementation of these regulations; multilateral exchanges with IAEA, or under the aegis of the European Commission, or bilateral exchanges with its counterparts. ASN was thus in close contact with its German counterparts on the occasion of the return of vitrified waste from the La Hague plant to the Gorleben site in Germany, in December 2010.

Outlook

In 2011, ASN will be continuing its regulation of packages not subject to approval, particularly in the medical, conventional industry and research sectors. ASN will pursue its efforts to harmonise and reinforce the nuclear industry's emergency plans to deal with a transport accident. ASN will also seek to improve the regulations for the transport of dangerous goods inside nuclear sites. ■

ASN inspectors, together with the IRSN, taking radioactivity measurements at Cadarache before the spent fuel shipment leaves for the Greifswald centre in Germany – December 2010

12

Nuclear power plants (NPP)

The design of the fifty-eight pressurised water reactors in the French nuclear power plants is on the whole the same. These plants are operated by a single licensee, EDF.

EDF has considerable engineering capacity and an organisation enabling it to take advantage of the benefits of this standardisation, and also to manage its drawbacks: given that the EDF NPPs provide nearly 80% of France's electricity, it is important to be able to prevent any serious and generic anomalies. ASN is particularly attentive to the measures adopted by EDF in this respect. Since 2007, EDF has also begun to build an EPR type reactor on the Flamanville site, for which ASN is in charge of regulating the design and construction, and at the end of 2010 it submitted a creation authorisation application for an EPR type reactor on the Penly site *(Seine-Maritime département).* Finally, in 2010 and with the support of the IRSN and its advisory committees, ASN began to review the safety options for the planned 1,000 megawatt reactor being developed by the company ATMEA. This review should be completed by end 2011.

The main significant events of 2010

The periodic safety review associated with the third ten-yearly outages of the 900 MWe reactors

The periodic safety reviews are one of the cornerstones of safety in France, by requiring not only that the licensee maintain the safety level of its installation, but also improve it. The safety review process comprises:

– a "conformity check", which requires an in-depth examination of the condition of the installation, to check that it is compliant with all the applicable safety requirements;

– an "in-depth review" of the installation to improve its safety level, especially by comparing the requirements applicable to the installation with those in force for more recent installations and taking account of national and international operating experience feedback.

Following these two steps, the licensee sends ASN a report, on the basis of which ASN then adopts a stance on whether or not to allow continued operation by the installation.

The third ten-yearly outages for the 900 megawatt reactors began in 2009 on Tricastin 1 and Fessenheim 1 and will end in about 2020 with those at Chinon. The periodic safety review associated with these ten-yearly outages concerned the following topics in particular: on-site flooding and explosions, fire, earthquake, resistance to extreme climatic conditions, protection of water intakes against oil slicks and situations liable to lead to simultaneous loss of the heatsink and electrical power supplies.

After adopting a stance in 2009 on the generic aspects of continued operation of the 900 megawatt reactors, ASN in 2010 began to determine its position, reactor by reactor, based on the results of the inspections carried out during the conformity check on each reactor during the third ten-yearly outage and the assessment of the safety review report for each one. In 2010, ASN thus considered that the Tricastin 1 reactor could be operated for a further ten years.

Inspection and maintenance operations conducted by EDF on the steam generators. In recent years, the inspections carried out on the steam generators, during maintenance and refuelling outages or as a result of unexpected events, revealed a certain amount of damage. Some, which was extensive and unanticipated, required that EDF take wide-ranging maintenance measures on many of its French NPPs, which could not fail to

Ten-yearly inspection of the Tricastin NPP – May 2009

Reactor building, EPR construction site at Flamanville – December 2010

have an impact on the level of availability of its reactors. With regard to the damage observed on a steam generator at Bugey 3, the justification files produced by EDF were not felt by ASN and its technical support organisations to be sufficient to allow reactor restart before replacement of the steam generators concerned. This was then carried out between July and December 2010.

This operating experience feedback led ASN to ask EDF to carry out a complete review of steam generator design and monitoring, which should in particular ensure that the replacement operations are planned far enough in advance to prevent these items from suffering excessive damage. The first results were presented to ASN and its technical support organisation at the end of 2010 and in particular concern an overhaul of the maintenance programmes for this equipment, taking account of recent French and international operating experience feedback. EDF will also be continuing its steam generator replacement programme by carrying out these operations on the 1300 MWe reactors: manufacture of the equipment concerned will begin in 2011.

Regulation of construction of the EPR reactor in Flamanville

Construction work on the Flamanville 3 EPR reactor began in September 2007, following the Government's authorisation, based on a favourable opinion issued by ASN. In this opinion, ASN considered that the proposed design was able to meet the ambitious safety objectives it had set for new reactors.

The next regulatory step is "commissioning" authorisation by ASN. In preparation for this step, ASN in 2007 initiated a review of certain topics requiring lengthy examination and checks on the detailed design of the more important systems, including the control and instrumentation system, so that it could rule on their ability to comply with safety requirements. In accordance with the request submitted by ASN in 2009, consistent with the stance adopted by its Finnish and British counterparts, EDF reviewed the design of the I&C system for the EPR reactor. ASN considered in 2010 that these new proposals were a step in the right direction.

At the same time, ASN is in charge of oversight of reactor construction (detailed design studies, factory manufacturing, construction site), through documentary examinations and inspections, in a manner proportionate to safety, radiation protection and environmental protection issues. In 2010, with the support of IRSN, ASN thus carried out 9 inspections in the engineering centres, 37 on the construction site, including 13 relative to conventional safety. ASN also carried out, or had approved inspection organisations carry out, nearly 900 checks on this equipment at the AREVA NP, its suppliers and subcontractors.

With regard to civil engineering activities on the site, and whenever anomalies were detected, ASN checked that EDF's handling of the problem was satisfactory from the safety standpoint.

Concerning the manufacture of nuclear pressure equipment, ASN assesses, or has approved inspection organisations assess, their conformity with the requirements of the regulations applicable to this equipment. This assessment involves documentary examinations and inspections at the manufacturers, as well as at their suppliers and subcontractors. In 2011, these actions will be supplemented by monitoring operations carried out on the Flamanville 3 site.

ASN is making efforts to impart an international dimension to the regulation described above, in particular by maintaining close relations with the safety regulators of countries in which construction of an EPR type reactor is either in progress (Finland) or planned. Therefore since 2009, ASN has reinforced its cooperation with the British (HSE) and US (NRC) regulators, including the secondment of British and American inspectors to ASN and French inspectors to the HSE and NRC. Jointly with IRSN, ASN also organised a specific seminar for the Indian safety regulator on EPR authorisation and regulation procedures. ASN is in addition an active participant in the new reactors Multinational Design Evaluation Program (MDEP). Four meetings devoted to the EPR reactor have been held within the framework of this programme. This cooperation in 2010 took the form of a joint inspection with STUK, in the presence of HSE, of the anomalies encountered on the reactor coolant piping intended for the Finnish EPR. These cooperative actions are guarantees of the robustness of the safety reviews conducted.

ASN assessment

ASN considers that 2010 was on the whole satisfactory from the safety and radiation protection standpoint in the nuclear power plants.

With regard to day to day operations, ASN considers that the efforts made by EDF in recent years to improve operational stringency have borne fruit on certain sites but need to be continued on others.

ASN considers that EDF's preparation for managing emergency situations is satisfactory.

With regard to maintenance, ASN feels that EDF failed in the past to anticipate certain problems, which means that it is today faced with delicate, large-scale corrective maintenance work on the steam generators to ensure their safety. This lack of anticipation in the equipment maintenance and replacement programmes, including the steam generators, has also in recent years led to extensive inspection and appraisal programmes. ASN does however note that EDF has learned the lessons from this and now for example has a programme for replacement of this equipment on the 1300 MWe reactors. With regard to implementation of maintenance policy on the sites, ASN considers that EDF must ensure that it has adequate human and material resources. Progress is also expected with regard to the quality of preparation of maintenance work, the management of spare parts and the quality of the actual maintenance work.

The equipment maintenance and replacement programmes, the safety review approach and the correction of conformity anomalies identified help maintain NPP equipment in a condition that is on the whole satisfactory. However, ASN does feel that EDF needs to reinforce how it maintains equipment qualification for accident conditions, whether during preventive maintenance or equipment replacement.

Most maintenance activities on the sites are entrusted to contractors, selected on the basis of a qualification and evaluation system. ASN considers that application of this system is satisfactory but that EDF needs to evaluate its contracting policy, as ASN has observed a deterioration in field monitoring of the activities carried out by the contractors and considers that this needs to be rapidly improved and strengthened. Finally, as in previous years, ASN observes that the material resources are frequently inadequate or inappropriate.

With regard to radiation protection, EDF proved itself capable of reacting to the findings of 2009, by once again focusing on and committing to the ALARA approach. Dosimetry results from the NPPs showed improvement after two years of deterioration. ASN also observes that the action plan put into place by EDF to improve the radiation protection of workers during industrial radiography inspections is continuing to bear fruit.

In the environmental protection field, ASN considers that in 2010, after the regression observed in 2009 with regard to non-radioactive releases, EDF has once again focused on this issue, although the sites cannot yet be said to have returned to a satisfactory situation.

On the 19 sites:

Five sites stand out in this general assessment: Bugey, Penly and Tricastin with regard to nuclear safety; Civaux and Golfech with regard to radiation protection.

Four sites are under-performing: Saint-Alban, in all aspects; Chinon with regard to radiation protection and nuclear safety, in particular operating stringency; Chooz and Nogent-sur-Seine, with regard to the environment.

Outlook

Concerning the NPPs in operation, ASN's regulatory work in 2011 will focus on the following main aspects.

Regulation of the NPPs in operation will remain a priority. ASN considers that maintaining the condition of the reactors will demand a sustained maintenance effort on the part of EDF. The significant extension of the duration of the outages of certain reactors since 2009 reflects the scale and scope of the maintenance operations required when equipment deterioration has not been anticipated sufficiently well in advance. With regard to environmental protection, ASN expects EDF to consolidate and continue the efforts it started in 2010 to obtain satisfactory environmental performance. ASN will strengthen its inspections, including on subcontracted maintenance activities and the management of equipment qualification for accident conditions. Finally, with the support of the IRSN and the Advisory Committee for nuclear reactors, ASN will define guidelines for the conditions in which operation of the reactors currently in service could be extended beyond forty years.

The development of technical regulations consistent with the best European practices will be continued so that in 2011, a coherent set of regulatory (ministerial orders, ASN decisions) and related texts (ASN guides) can be proposed to the Government, based on the benchmark levels adopted in Europe by the WENRA association.

With regard to new reactor projects, ASN's regulatory work in 2011 will focus on the following main aspects.

Monitoring of the construction of the Flamanville 3 EPR reactor, by means of sampling proportionate to the safety issues, will continue. At the peak of the civil engineering and systems erection activity, ASN intends to focus its oversight on conventional accident risk prevention and EDF monitoring of the quality of the work done. In addition, oversight of the manufacture of the main pressure equipment will continue through monitoring of the operations carried out on the Flamanville site. At the same time, ASN will continue to review certain aspects preparatory to the commissioning application, in particular the accident study methods and the installation operating principles. It will seek (whenever possible) to cooperate with its foreign counterparts, in order to define a harmonised stance. ASN will also begin to review the creation authorisation application for an EPR reactor at Penly. For the longer term, with the support of the IRSN and the Advisory Committee for nuclear reactors, ASN will examine the extent to which fast sodium reactor technology operating experience feedback is taken into account, for example for selection by CEA, EDF and AREVA of the future technology to be adopted for the fourth generation. Finally, ASN - with the support of IRSN and its Advisory Committees - will in 2011 issue a position statement on the safety options for the 1000 megawatt reactor project being developed by the ATMEA company. ■

13

Nuclear fuel cycle installations

The fuel cycle runs from fabrication to the reprocessing of nuclear fuel after it has been used in nuclear reactors.

The main plants in the cycle – COMURHEX, AREVA NC Pierrelatte, EURODIF, GEORGES BESSE II, FBFC, MÉLOX, AREVA NC La Hague – are part of the AREVA group. These plants include facilities which have BNI status.

The main significant events of 2010

There were no major events in the fuel cycle in 2010.

With regard to the uranium enrichment activities, ASN is pleased to note AREVA's decision to cease operations at Eurodif at the end of 2012 and to immediately begin preparing the final shutdown and decommissioning application. ASN observes that at the same time, the operations to commission the GEORGES BESSE II plant, designed to replace EURODIF, are progressing satisfactorily.

With regard to fuel fabrication activities, 2010 was marked by the 9th February event in the MELOX facility, which was rated level 1 on the INES scale. During a glove box maintenance operation, a mechanical flywheel was turned by a motor operating intermittently, leading to rupture of the containment through tearing of the glove being used by an operator, with internal contamination of said operator's forearm. This event led the licensee to review the human factors analysis incorporated into the work authorisation procedure.

In the front-end cycle, the event of most significance on the La Hague site was the 17th June start-up of the cold crucible vitrification process in unit B of installation R7. This innovative process reflects the licensee's desire to protect the environment and optimise its industrial tool.

The licensee also completed the safety review of UP3 and began that of UP2 800. These operations make a major contribution to improving installation safety.

Finally, the ASN decision of 14th December is noteworthy. It will be applicable as of 1st January 2011 and authorises the La Hague licensee to implement a system of internal authorisations. In order to enhance the level of licensee awareness and responsibility, this system makes provision for two levels of internal authorisation, depending on the importance of the operations and the associated radiation protection and safety issues. Before being authorised, the envisaged operation or modification is evaluated, according to the defined level, either by a safety specialist independent of the operating unit making the application, or by an internal

ASN inspection of the EURODIF plant – March 2010

authorisations evaluation commission (CDAI) for the more important or large-scale operations.

ASN Assessment and Outlook

Cross-disciplinary aspects

In 2010, the licensees of the fuel cycle installations made progress in the way they take account of operating experience feedback. On the whole, they showed themselves to be more rigorous in complying with notification criteria and in report transmission times. Several incidents however demonstrated that there were still weaknesses in the organisation of safety and radiation protection in the AREVA group's facilities, even though the number had on the whole fallen. ASN will remain vigilant with regard to the measures taken by the licensees to prevent numbers rising again. In September 2010, ASN also began the overall review of safety and radiation protection management within the AREVA group.

In 2011, ASN will be continuing the steps started in 2010 to improve management of ongoing and future authorisation applications and the planned periodic safety reviews.

Tricastin site

Although ASN approves of the changes on the Tricastin site, involving the shutdown of older installations and their replacement by safer plants, it is concerned by the recent postponement of certain projects it feels to be essential, such as that concerning the site's effluent and waste treatment plants. In 2011, pollution prevention will remain a key issue on this site. ASN will check the progress of the remedial measures taken by the various installations.

Finally, ASN will ensure that the preparations for shutdown of the EURODIF plants take place in the conditions defined by the TSN Act, in particular with regard to information of the public and minimisation of the waste produced by the future decommissioning.

Romans-sur-Isère site

On the Romans-sur-Isère site, ASN will in 2011 remain attentive to confirmation of the progress already made with regard to safety. It is in particular expecting improved management of waste storage. It will also be attentive to the steps taken following the safety reassessment of the CERCA company's facilities.

MÉLOX plant

With regard to the MÉLOX plant in Marcoule, ASN will remain vigilant concerning the organisation and the resources deployed, in order to increase the industrial tool's production capacity and assist it in dealing with the new materials utilised, in compliance with the expected safety and radiation protection requirements. Management of dosimetry and the ability to prevent organisational and human factor risks will therefore be regulation and inspection priorities.

The periodic safety review of the MÉLOX plan is scheduled for 2011. It will be a key step in the life of the facility, in that it will assess its conformity with the regulations and with its safety requirements, while establishing the programme of work for the safety improvements for the next ten years. This review will be an opportunity to look at fundamental questions about the choice of the computerised production management system, which today manages both criticality risk prevention and nuclear materials accounting.

La Hague site

For the La Hague plants, ASN considers the situation to be satisfactory, in particular with regard to personnel exposure. However, ASN considers that further efforts are needed, especially during the periodic safety reviews, in the drafting of the general operating rules and the definition of elements important for safety. In this respect, ASN asked IRSN to more particularly examine the UP3 plant conformity reviews and the effects of ageing on structures and equipment.

With regard to the recovery of legacy waste, ASN will be attentive to ensuring that U-turns in industrial strategy do not significantly delay the recovery and removal of the waste from silo 130 and the sludges from STE2 and HAO. ASN has already issued the corresponding instructions for silo 130 and will keep a closer watch on the programme as a whole in 2011. ■

14

Nuclear research facilities and other nuclear facilities

Nuclear research facilities and facilities not directly related to the nuclear power generating industry, includes all the basic nuclear installations of the civil part of the French Alternative Energies and Atomic Energy Commission, the basic nuclear installations of other research organisations and some other basic nuclear installations which are not power reactors and are not involved in the nuclear fuel cycle.

The main significant events of 2010

There were no significant events in 2010 in the research facilities field.

Periodic safety review

A large number of the facilities currently operated by CEA entered service in the early 1960s. The design of these facilities is old and their equipment is ageing. They have also been modified over the years, sometimes with no overall safety review. All the facilities for which no periodic safety review has been scheduled, will need to perform one no later than 2017, and thereafter every ten years.

In 2010, on the basis of the opinion of the Advisory Committee for reactors, ASN examined the periodic safety review file for the ORPHÉE installation.

Although a number of requests were made, especially concerning the methodologies adopted for certain highly hypothetical accidents or for fire prevention, ASN observed that the level of safety in this installation was satisfactory and it issued no objection to its continued operation.

ASN also completed its examination of the periodic safety review for the OSIRIS installation. In 2010, CEA submitted its periodic safety review files for the ÉOLE and MINERVE installations, which will be examined in 2011, and will be submitted to the Advisory Committee for reactors for its opinion.

Consideration of the seismic risk

The seismic risk is the subject of constant attention on the part of ASN. This risk is in particular reassessed during the periodic safety reviews of each installation in order to take account of scientific progress in characterising the hazard and changes to design rules.

On 4th February 2010 in Marseille and then on 7th December 2010 in Avignon, ASN organised two information days covering incorporation of the seismic risk in the design and operation of nuclear installations in South-Eastern France.

The installations

The main subjects of concern for ASN with regard to CEA installations in 2010 are:

– the end-of-life tests on the PHÉNIX reactor;

– the periodic safety review of the ORPHÉE and OSIRIS installations;

– the end of the renovation work on the CABRI installation and the continuation of construction work on the RJH reactor (reactor to be used for experimentation and the production of artificial radionuclides);

– commissioning of the MAGENTA installation.

The main subjects concerning installations other than those operated by CEA:

– signing of a new agreement regarding the safety of the CERN installations;

– initial examination of the ITER facility creation authorisation application;

– the periodic safety review of the CIS bio international facility. It would seem necessary for the radioactive iodine inventory in this facility be reduced in order to minimise the potential consequences of a severe accident.

Seismic reinforcement by strips of carbon fibre fabric (TFC) in Cadarache

ASN assessment

Even if certain areas still need improvement, ASN notes that CEA has made considerable progress since 1999 with regard to the management of safety and radiation protection. It in particular takes note of the ongoing improvements concerning skills management and the management of safety and radiation protection in contracted services.

However, ASN firmly hopes that the "major commitments" approach will be continued and rigorously applied. In 2007, CEA acquired a tool enabling it, at the highest level, to control the decisions concerning upgrading the older installations and the new projects. These "major commitments", which are officially checked by CEA every six months, ensure greater transparency and visibility for ASN with respect to the processes liable to delay complex projects with high nuclear safety and radiation protection stakes. This enables priority to be focused on areas with the highest risk. ASN has however observed that budget constraints have led CEA to request the postponement of certain operations, a move which runs contrary to the very principle of the major commitments.

ASN considers that by ring-fencing a limited number of projects with high stakes, the approach aims precisely to avoid postponements for reasons other than justified technical problems. It is important that CEA devote the budgetary and human resources necessary for correct performance of these "major commitments".

ASN noted that some postponements concerning removal from storage or final shutdown and decommissioning of installations no longer comply with current standards. It wishes to see CEA update its decommissioning strategy, giving justification for the time-frames chosen and explaining the technical or other reasons for the delays observed.

Outlook

The research and other facilities regulated by ASN are extremely diverse, but usually small. 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 identify the best one and thus encourage operating experience feedback. ASN considers that by ring-fencing a limited number of high-stakes projects, the "major undertakings" approach, which is currently checked every six months by CEA, aims to avoid postponements for reasons other than justified technical problems. It is important that CEA devote both budget and human resources to the correct performance of these "major commitments". This is why ASN will continue to request that CEA pursue this approach, which should lead to improved project management.

In 2011, ASN will continue its field checks of the CEA internal authorisations system. This will include the overall process, proof of compliance with the criteria for application of the decision which will officially approve the system proposed by CEA, but will also check the independence, within CEA, between the applicants, the support services and the first and second level inspectors.

For the periodic safety reviews, ASN will conduct a safety review of the ÉOLE and MINERVE installations, for which CEA has scheduled shutdown within the coming ten years. It will also examine the safety of the GANIL installation in parallel with its review of the decree modification request for this installation with a view to siting the new accelerator. It will complete examination of the periodic safety review file for the CIS bio international radiopharmaceuticals production facility in order to rule on whether or not its continued medium or long-term operation is acceptable.

ASN will also examine the authorisation application file for the ITER project, which will require a meeting of the members of the Advisory Committee for laboratories and plants as well as of the members of the Advisory Committee for reactors.

ASN will continue its work regarding commissioning of facilities such as STELLA (Saclay effluent treatment plant) or RJH.

Furthermore, in 2011, through its review of the ASTRID prototype project and the work on the fourth generation reactor series, ASN will examine operating experience feedback from the fast neutron reactors (PHÉNIX, SUPERPHÉNIX and RAPSODIE, now shut down), along with data for comparing the safety of the various possible technologies for this generation.

Finally, in 2011, ASN will continue its efforts to promote international harmonisation of research reactor safety, in particular at a European level (WENRA) and within the NEA. ■

15

The safety of basic nuclear installation decommissioning

Decommissioning, a phase covering all the activities performed after shutdown of a nuclear facility, until it reaches a predetermined final state, at present concerns about thirty nuclear installations. This phase entails radiological and conventional risks, some of which are similar to those present during the operation of the installation, while others are more specific.

The main significant events of 2010

Installation decommissioning doctrine, as defined by ASN together with the stakeholders, was published in 2010. In addition, ASN published a final shutdown, decommissioning and delicensing guide for basic nuclear installations (guide n°6 of June 2010) and finalised the draft guide for acceptable complete clean-out methodologies in basic nuclear installations in France (draft guide n°14 of June 2010).

Decommissioning operations are also the subject of campaigns to inform the public and the Local Information Committees. in 2010, ASN chaired a round-table at the national conference of CLIs on this topic.

With regard to the financing of decommissioning, ASN reviewed the two three-yearly reports evaluating the spent fuel and radioactive waste management costs transmitted by the licensees, on which an opinion will be issued in 2011. Based on the experience acquired, ASN has also begun drafting a guide for licensees, specifying how to apply the regulations, in particular with regard to the description of technical scenarios and assessment of the corresponding costs.

ASN assessment

Decommissioning of EDF reactors continued in 2010 and was on the whole satisfactory. The decommissioning authorisation application for the Brennilis NPP, which was the subject of a public inquiry at the end of 2009, was rejected by the inquiry commission in March 2010. Based on this opinion, ASN will propose a partial decommissioning decree to the Government in early 2011. For GCR reactors, the question of what to do with the graphite waste can be an obstacle to correct implementation of the decommissioning strategy. ASN confirmed that it was favourable to the creation of a disposal facility for low-level, long-lived waste, in particular for graphite waste, as rapidly as possible. It set an initial 2012 milestone for an assessment of developments regarding the creation of a repository for graphite waste and will take a decision at that time.

Clean-out of the hot cell of the former TRITON research reactor

Concerning the decommissioning of CEA installations, ASN notes that although the ongoing operations are on the whole satisfactory, a large number of delays have been confirmed or are announced for the forthcoming work sites. It considers that the updating of the CEA strategy and the decommissioning schedules need to be justified, in particular explaining the technical or other reasons for the delays. In any case, the installations concerned will need to retain an acceptable level of safety until delicensing.

Concerning the decommissioning of the AREVA installations, ASN notes that the preparatory operations prior to the decommissioning of the BNIs at La Hague are now well-advanced and that it is essential for decrees to be published regulating AREVA's final shutdown and decommissioning operations. This is already the case for BNI 80 and applications concerning the other three BNIs (BNI 33, 38 and 47) are being reviewed. AREVA will need to be proactive in terms of human, technical and financial resources, if it is to meet the announced deadlines for the recovery of legacy waste and the decommissioning of these installations.

Finally, it should be noted that in 2010 decommissioning of the Strasbourg university reactor was completed, prior to its delicensing. ASN considers that the decommissioning work was carried out satisfactorily and that the clean-out objectives were met.

Outlook

Over and above the individual decommissioning of each installation, ASN ensures that the licensees' overall strategies take full and complete account of safety and radiation protection constraints.

In the licensees' strategies, ASN more particularly examines the availability of waste disposal solutions, the management of flow and capacity, the handling of uncertainties and technical problems, organisational measures, and so on.

Even if the decommissioning of nuclear installations has now reached an industrial stage, ASN considers that there is still room for progress, including in the consistency of the decommissioning strategies implemented by the licensees, the estimation of the cost of decommissioning, consideration of organisational and human factors, and the implementation of all the requirements contained in the TSN Act regarding transparency and involvement of the public in decommissioning projects. ■

16

Radioactive waste and polluted sites

The management of radioactive waste is governed by the 28th June 2006 Act on the sustainable management of radioactive materials and waste. This Act sets out a roadmap for the management of all radioactive waste, including by requiring the adoption every three years of a National radioactive materials and waste management plan (PNGMDR).

The purpose of the PNGMDR is to inventory the existing radioactive materials and waste management methods, to identify the foreseeable needs in terms of storage or disposal facilities and to clarify the necessary capacity for these facilities and the storage durations. PNGMDR defines the objectives concerning radioactive waste for which there is as yet no final management solution.

The main significant events of 2010

The national radioactive materials and waste management plan

The second version of the PNGMDR (2010-2012) was sent to Parliament in early 2010 and was analysed by the parliamentary office for the evaluation of scientific and technological choices (OPECST). The provisions of the PNGMDR will in 2011 be the subject of a decree and an order prepared by the Ministry for Ecology, Sustainable Development, Transport and Housing (MEDDTL) with the assistance of ASN.

Waste management in the basic nuclear installations

In this field, the legacy waste at La Hague must be mentioned. ASN observed recurring delays in the recovery of this waste, along with a lack of an integrated approach by the establishment to the prioritisation of waste recovery projects with respect to the storage safety issues. In late 2010, ASN therefore asked AREVA to define and submit to it a consolidated, binding calendar for recovery of this waste, incorporating both compliance with the storage safety requirements and the need to recover the ILW-LL waste no later than the end of 2030.

Uranium mine-working waste

The final report from the pluralistic expert group on the Limousin region uranium mining sites (GEP Limousin) was the subject of a joint press conference given by the Ministry for Ecology and ASN on 17th September 2010. The GEP examined the problems related to the past management of this dossier and the significant progress achieved in recent years in resolving them, both in the Limousin region and nationally. It considers that this progress must be continued and developed so that within the next ten years a clear vision for the sustainable management of these sites can be defined. The strategy to be

***Contrôle* Magazine N°190 on radioactive waste management – February 2011**

implemented to do this will include all aspects of the problem (technical, institutional, social) and will require the corresponding monitoring and oversight. This strategy will need to be shared with the local players and incorporate specific local aspects. The Ministry for Ecology and ASN examined how best to implement these recommendations and monitor them, within the context of the PNGMDR working group.

Deep geological disposal

ANDRA has drafted a development plan (PDD) for the HLW-LL project, which presents the research and design strategy for the project, covering the period 2007-2014, in order to comply with the objectives of the 28th June 2006 Act. In June 2010, ANDRA submitted the updated scientific programme for 2008-2014, the results of which constitute the basis for the safety demonstration.

The disposal project milestones are as follows:

– 2012: public debate dossier;

– 2014: creation authorisation application file;

– reversibility Act;

– 2025: commissioning.

ANDRA has defined a 30 square kilometre zone of interest for detailed reconnaissance (ZIRA), with a view to siting the underground facilities of the future repository. On 5th January 2010, ASN sent the Government a favourable opinion on the choice of the ZIRA. After the Government approved the ZIRA, ANDRA undertook detailed reconnaissance (3D seismic in particular) in the ZIRA, the results of which should be available by the end of 2011.

In late 2009, ANDRA transmitted a file presenting an update of the repository's safety and reversibility options. ASN asked the Advisory Committee for waste and the Advisory Committee for laboratories and plants to review this file. ASN issued a position statement in early 2011 on this file, along with a certain number of recommendations.

ASN Assessment and Outlook

In 2010, ASN continued its efforts to ensure that radioactive waste is managed safely, right from the moment it is produced. ASN thus regulates waste management within nuclear installations and periodically evaluates the management strategies implemented by the licensees. ASN in particular remains attentive to AREVA's implementation of its strategy for the recovery of the legacy waste stored on the La Hague site.

In accordance with the ASN and DSND joint application, CEA in 2010 sent a summary file to the two Authorities concerning its management strategy for managing the waste produced in its civil nuclear facilities. This file presents the management strategy for the waste already produced and for future waste, identifying the requirements in terms of processing, conditioning, transport packaging and storage of the waste. It will be reviewed by an Advisory Committee, so that ASN can issue a position statement. ASN also observes that CEA is on the whole finding it hard to meet its undertakings, including with regard to deadlines, leading to regular postponement of the dates it had set for removal from storage of the waste present in its older facilities.

With regard to the long-term management of radioactive waste, ASN takes a positive view of the way ANDRA operates its currently operational waste facilities. ASN considers that all waste must eventually benefit from a safe disposal solution. In this respect, it considers it essential for France to acquire a repository for the disposal of low-level, long-lived waste. ASN will therefore continue to closely monitor the process involved in searching for a site and developing the disposal concepts.

It considers that key milestones in the development of the disposal project will be reached in the next few years. In its opinion issued at the end of 2010 on the file submitted by ANDRA in 2009, ASN set the main areas for work that needed to be taken further between now and the creation authorisation application, which should be submitted at the end of 2014. ASN will remain vigilant in ensuring that ANDRA provides the expected elements.

ASN is involved in regulating the management of sites polluted by radioactive materials. The circular published in 2008, which clarifies the roles and responsibilities of the various stakeholders with regard to dealing with polluted sites and soils, reaffirms ASN's duty to provide support for the *préfets*. After consultation, ASN thus issued several opinions in 2010 on polluted site management strategies. Within this new regulatory framework, ASN's actions have been strengthened since 2009, a process that will continue in 2011 in collaboration with the administrations concerned and the other stakeholders. ASN intends in 2011 to publish its management doctrine for sites polluted by radioactive materials. It already points out that it considers the solution whereby the contamination is maintained in-situ should not be the reference solution for management of sites polluted by radioactive materials and that this option can only be an interim solution, or one reserved for cases in which the complete clean-out option is inconceivable owing to the volumes of waste to be excavated. It should also be noted that the radium diagnostic operation being run by ASN, and which began in the Ile-de-France region, will be continuing in 2011.

Finally, ASN will remain closely involved in international work, maintaining its active participation in various working groups, in particular IAEA's WASSC working group validating the requirements concerning radioactive waste management, in WENRA, and in the examination by various international bodies of radioactive waste disposal facilities, particularly with regard to reversibility. ■

NUCLEAR ACTIVITIES: IONISING RADIATION AND HEALTH AND ENVIRONMENTAL RISKS

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 are 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 are defined as being capable of producing ions - directly or indirectly - when they pass through matter. They include X-rays, alpha, beta and gamma rays, and neutronic radiations, 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 interact with the atoms and molecules making up the cells of living matter and alter 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).

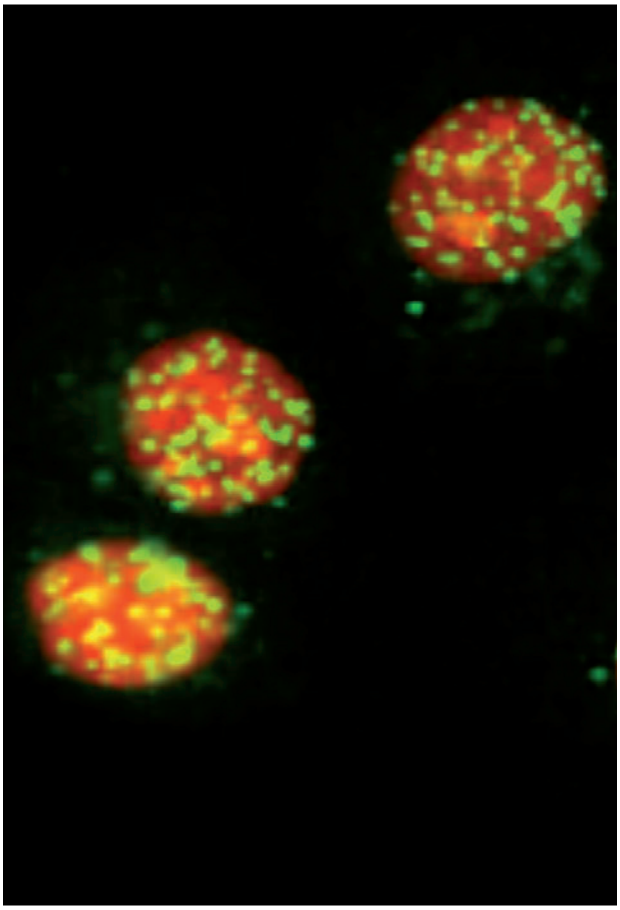
When not repaired by the cells themselves, this damage can lead to cell death and the appearance of health effects once tissues are no longer able to carry out their functions.

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. They are certain to appear when the absorbed quantity of radiation exceeds a given dose level, which varies according to the type of tissue. 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 the occurrence of cancer and exposure to ionising radiation dates from the beginning of the 20th century (observation of skin cancer on radiodermatitis).

Since then, several types of cancers have been observed in occupational situations, including leukaemias, 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



Double-stranded damage to DNA viewed by immunofluorescence marking of gamma-H2AX foci (green) within the nucleii (red) of irradiated cells statistically significant rise in cancers (secondary 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 intentionally descriptive monitoring method cannot identify radiation-induced cancers, as these are not specific to ionising radiation.

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).

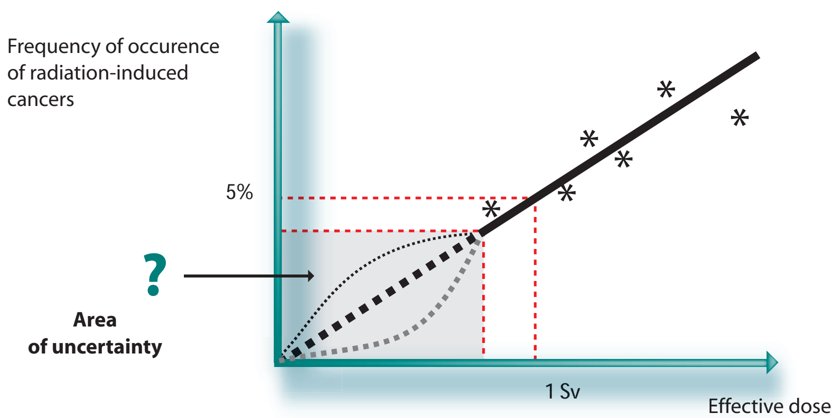
With a view to risk management, use is then made of the risk evaluation technique which uses calculations to extrapolate the risks observed at higher doses in order to estimate the risks incurred during exposure to low doses of ionising radiation. Internationally, this estimate uses the conservative scenario of a linear relationship without threshold between exposure and the number of deaths through cancer (see diagram 1). The legitimacy of these estimates however remains open to debate 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 ICRP publication 103, chapter 3, 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 relationship without threshold for low-dose exposure, the relative risk linked to radon exposure, for a radon concentration of 230 becquerel per cubic metre (Bq/m^3), would be about the same as that associated with passive smoking (USA Academy of Science, 1999).

1. Administrative region headed by a *préfet*.

Diagram 1: "dose-effects" linear relationship (without threshold)



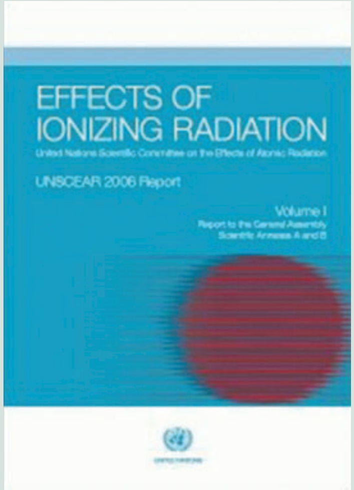
UNSCEAR

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 whose aim is to validate and approve the results of national or international studies into the effects of ionising radiation on man.

Recent publications – Effects of ionizing radiation (2006).

Volume 1 – Annex A (Epidemiological studies of radiation and cancer) and Annex B (Epidemiological evaluation of cardiovascular disease and other non-cancer diseases following radiation exposure).

Volume 2 – Annex C (Non-targeted and delayed effects of exposure to ionizing radiation), Annex D (Effects of ionizing radiation on the immune system) and Annex E (Sources-to-effects assessment for radon in homes and workplaces).



UNSCEAR 2006 Report
« Effects of ionizing radiation »

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 High dose radiation-induced pathologies

Hypersensitivity to ionising radiation – 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 mean that certain patients may display extreme hypersensitivity that can lead to "radiological burns". Finally, some patients are more susceptible to the development of cancers. In total, about 5% of the population is concerned by hyper-sensitivity to ionising radiation.

Questions then arise, some of which are ethical in nature and go beyond the boundaries of radiation protection:

– Do children need to be given particular attention in terms of radiation protection, during the course of exposure to ionising radiation of medical origin?

– Once the radiobiologists have developed tests to reveal individual hypersensitivity to radiation, should individual screening prior to any radiotherapy 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?

1|3|2 Effects of low doses

The linear relationship without threshold – 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, the uncertainties remain and precaution is essential for the authorities.

Dose, dose rate and chronic contamination – The epidemiological surveys performed on individuals exposed to the Hiroshima and Nagasaki bombings have given a clearer picture of the effects of radiation on health, for high dose and high dose rate external exposure. The studies begun in the countries most affected by the Chernobyl accident, i.e. 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 exposure levels, 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 an allele will remain invisible as long as the allele carried by the other 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. Going beyond environmental protection aimed at protecting present and future generations of mankind, one can also envisage the protection of nature in the specific interests of animal species or the rights of nature (see point 3|5). The protection of non-human species is now included in the ICRP recommendations (ICRP 103).

Preparation of tests to verify the ability of certain enzymes to repair damaged DNA

TO BE NOTED

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 group's report, due at the beginning of 2011, will review current scientific knowledge of this disease and make recommendations for new actions to establish a clinico-biological inventory of types of leukaemia, identify and characterise the sites of interest in the area of nuclear activities, engage a reflection on the ethics and ways of providing the population with "clear and honest" information that meets their expectations, and promote the setting up of an international scientific watch and cooperation structure.

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;
– contaminated sites;
– activities enhancing natural ionising radiation.

2|1 Basic nuclear installations

2|1|1 Definition

The regulations classify nuclear facilities in various categories corresponding to more or less restrictive procedures, depending on the potential hazards (see chapter 3, point 3). The main fixed nuclear installations are:
– nuclear reactors, with the exception of those equipping a means of transport (a submarine, for example);
– 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.

ASN "environmental" inspection of the Nogent-sur-Seine nuclear power plant – June 2010

Nuclear installations that are not considered as BNIs can be subject to the provisions for Installations classified on environmental protection grounds (ICPE) (see chapter 3, point 3).

The list of BNIs on 31 December 2010 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 same general rules as those applicable to all workers exposed to ionising radiation (see chapter 3) (work organisation, accident prevention, keeping registers, medical monitoring of workers from outside contractors, etc.).

As regards protection of the population and the environment, the BNI licensee must also implement all necessary means to achieve and maintain optimum protection of the population. More specifically, the impact of liquid and gas effluent releases - radioactive or not - on the health of the populations living in the vicinity of the installations and on the environment must be strictly limited (see chapter 4).

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

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

The consignor is responsible for implementing these lines of defence.

2|3 Small-scale nuclear activities

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

The employer is required to implement all necessary means 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 it holds - 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 reviewed (see chapter 3).

2|4 Disposal of radioactive waste

Like all industrial activities, nuclear activities can generate waste. Some of this waste is 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. For very low level (VLL) waste, application of a management system based on these principles, if it is to be completely efficient, rules out setting a universal threshold below which regulation can be dispensed with.

ASN "waste" inspection at the Penly nuclear power plant – June 2010

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 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.

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 places 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, construction 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 dye 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.

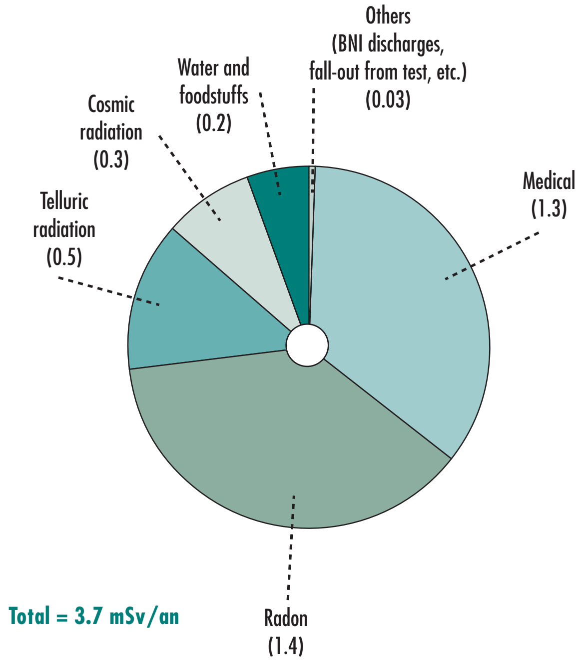
3 MONITORING OF EXPOSURE TO IONISING RADIATION

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 recreate the radiation dose to which the individuals were exposed. In this context, "risk monitoring" is performed by measuring ambient radioactivity indicators, at best by measuring the dose rates associated with external exposure to ionising radiation or internal contamination, or failing this, 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 3.7mSv 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: Exposure of the French population 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 73% of the total annual exposure on average.

3|1|1 Natural radiations (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 (UNSCEAR, 1993).

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 Ministry of Health monitoring of the radiological quality of the tap water distributed to consumers between 2005 and 2007 (DGS/ASN/IRSN report published in 2009) showed that 99.86% 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. A new report on this subject is due at the beginning of 2011.

3|1|2 Exposure to radon

Surveillance of human exposure to radon in premises open to the public is targeted on the risk to the general public but also to workers. It is also a priority radiation protection action in geographical areas in which there is high potential exhalation of radon owing to the geographical characteristics of the terrain. A strategy to reduce this exposure is necessary, should the measurements taken exceed the action levels laid down in the regulations.

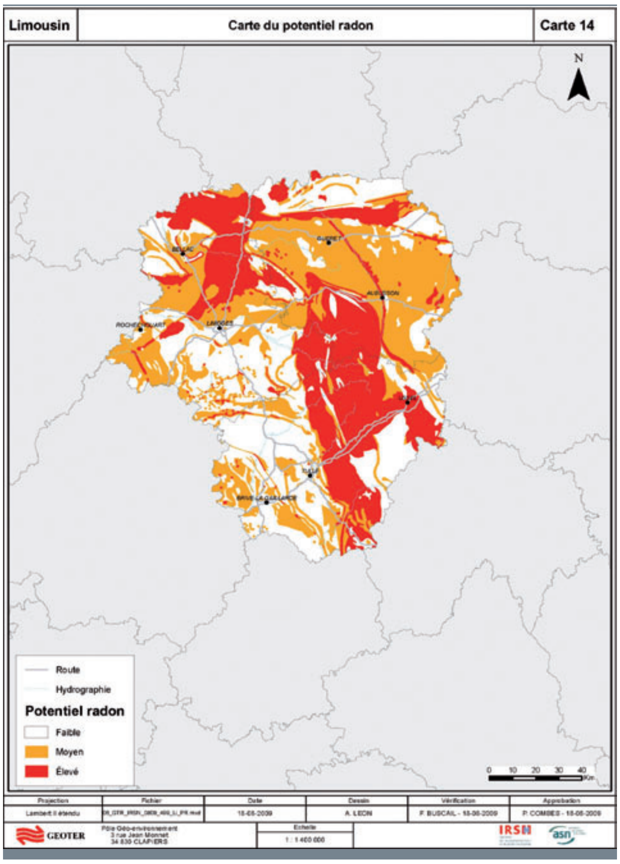
Exposure to radon in the home was estimated by measurement campaigns, followed by statistical interpretations (see IRSN atlas). The average radon activity value measured in France is 63 Bq/m^3, with about half the results being below 50 Bq/m^3, 9% above 200 Bq/m^3 and 2.3% above 400 Bq/m^3.

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. The smaller number of measurements taken during the latest campaign indicates that screening of the establishments, which began in 1999, is practically complete. A new screening cycle (10 years) was started in 2009.



Mapping of the radon exhalation potential in the Limousin *département* in 2009

3|1|3 External exposure due to cosmic radiation

Cosmic radiation is of two types, 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.

Table 1 : results of radon measurement campaigns since 2005

Measurement campaign	Number of establishments	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	2.970	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

Considering the average time spent inside the home (which itself attenuates the ionic component of the cosmic radiation), the average individual effective dose in a locality at sea level in France is 0.27mSv per year, whereas it could exceed 1.1 mSv per year in a mountain locality situated at about 2.800m altitude. The average annual effective dose per individual in France is 0.33mSv per year. It is lower than the global average value of 0.38mSv 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).

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 are used has been in place for a number of decades. It is based on the mandatory wearing of passive dosimeters by workers likely to be exposed and is used to check compliance with the regulatory limits applicable to workers. The data recorded give the cumulative exposure dose over a given period (monthly or quarterly). They are fed into the SISERI information system managed by IRSN and are published annually.

The results of dosimetric monitoring of worker external exposure in 2009 on the whole show that the prevention system introduced in facilities where sources of ionising radiation are used is effective, because for more than 95% of the population monitored, the annual dose remained lower than 1 mSv (effective annual dose limit for the public). However, these statistics do not reflect the whole picture, because in a few cases the dosimeter exposure did not necessarily correspond to exposure of the worker (dosimeters not worn but exposed) and it is possible that some workers do occasionally fail to wear their dosimeters.

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 20mSv was exceeded. They clearly show a considerable disparity between doses according to 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 30% of the collective dose; however the annual limit of 20mSv was exceeded in the medical sector 8 times (out of a total of 14), but no event exceeded 50 mSv.

The latest statistics published by the IRSN in September 2010 show a small but steady increase in the populations subject to dosimetric monitoring since 2005 (see diagram 3), with a

TO BE NOTED IN 2010

Results of dosimetry monitoring of worker external exposure to ionising radiation in 2009 (source: IRSN september 2010)

Total population monitored: 319,091 workers

Monitored population with a recorded dose below the detection threshold: 245.515, or about 77%

Monitored population with a recorded dose of between the detection threshold and 1 mSv: 58.946, or about 18%

Monitored population with a recorded dose of between 1 mSv and 20 mSv: 14,616, or about 4.6%

Monitored population which exceeded the annual effective dose of 20 mSv: 14 including 2 above 50 mSv

Collective dose (sum of individual doses): 65.68 Man.Sv

Annual average individual dose in the population which recorded a dose higher than the detection threshold: 0.89 mSv

Results of internal exposure monitoring in 2009

Number of routine examinations carried out: 311,560 examinations (of which fewer than 0.3% were considered positive)

Population concerned by a dosimetric estimation: 384 workers

Number of special monitoring or verification examinations performed: 10,473 (of which fewer than 0.5% were above the detection threshold)

Population having recorded an effective engaged dose exceeding 1 mSv: 18 workers

Results of cosmic radiation exposure monitoring in 2009 (civil aviation)

Collective dose for 19,830 flight crew members: 43.6 Man.Sv

Annual average individual dose: 2.2 mSv

Table 2: BNI worker dosimetry, excluding defence (year 2009 - source: IRSN)

	Number of individuals monitored	Collective doses (Man.Sv)	Doses > 20 mSv
EDF (employees)	19,647	6.70	0
AREVA	13,333	5.89	0
CEA	7,139	0.33	0
Outside companies	17,743	11.83	1
Others	706	0.07	0

Table 3: dosimetry of workers in small-scale nuclear activities (year 2009 - source: IRSN)

	Number of individuals monitored	Collective doses (Man.Sv)	Doses > 20 mSv
Medicine	140,124	16.56	7
Dental	37,367	1.60	1
Veterinary	15.589	0.43	0
Industry	32,769	17.88	5
Research	8,759	0.42	0
Miscellaneous	15,946	1.24	0

total of almost 320,000 people monitored in 2009. This development is largely due to the increase in monitoring of populations involved in medical and veterinary activities, which has gained momentum since 2005 (see diagram 4), with the progressive implementation of the provisions of the Labour Code and of the application orders updated between 2003 and 2005, accompanied by information and verification campaigns. However, the collective dose, consisting of the sum of the individual doses, has been falling (about 45%) since 1996 at a time when the populations monitored have grown by about 40%. The optimisation approach implemented by the nuclear licensees during the 1990s no doubt explains this positive trend (see diagrams 5 and 6).

Diagram 3: Development of the populations monitored per sector of activity, from 1996 to 2009 (source IRSN)

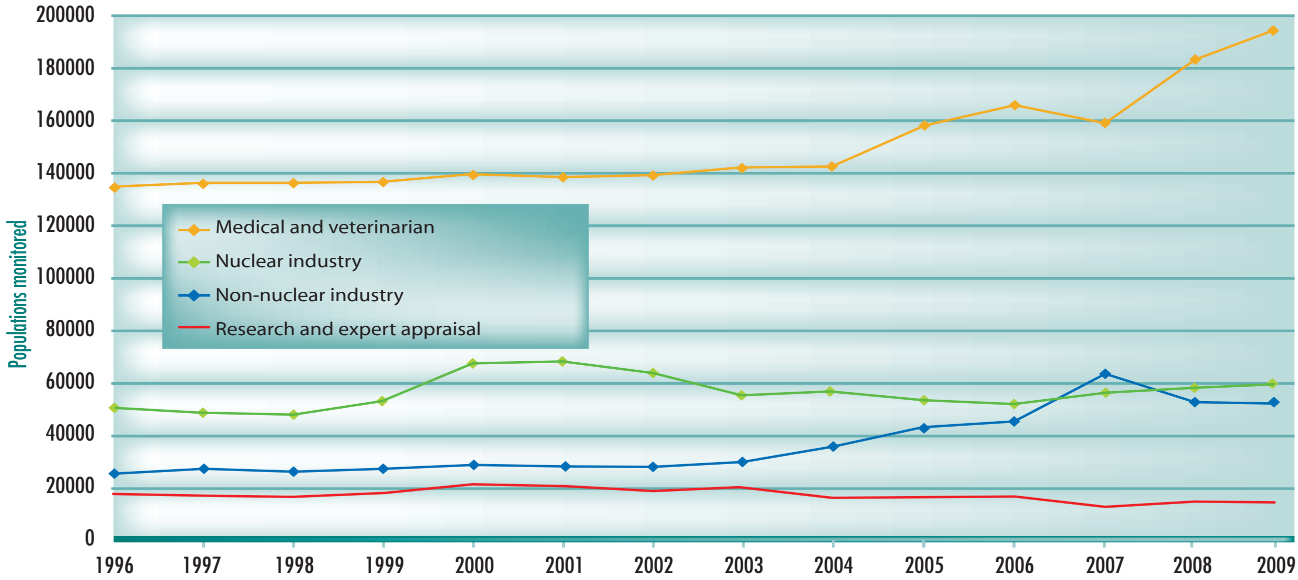


Diagram 4: Development of populations monitored and collective doses from 1996 to 2009 (source IRSN)

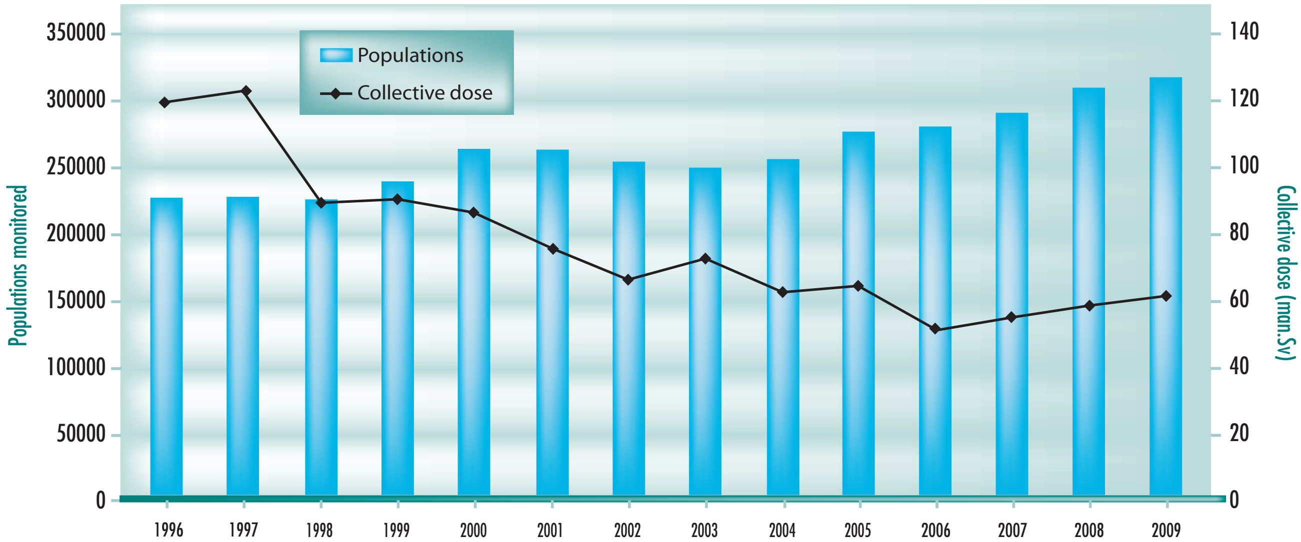


Diagram 5: Development of collective doses per sector of activity, from 1996 to 2009 (source IRSN)

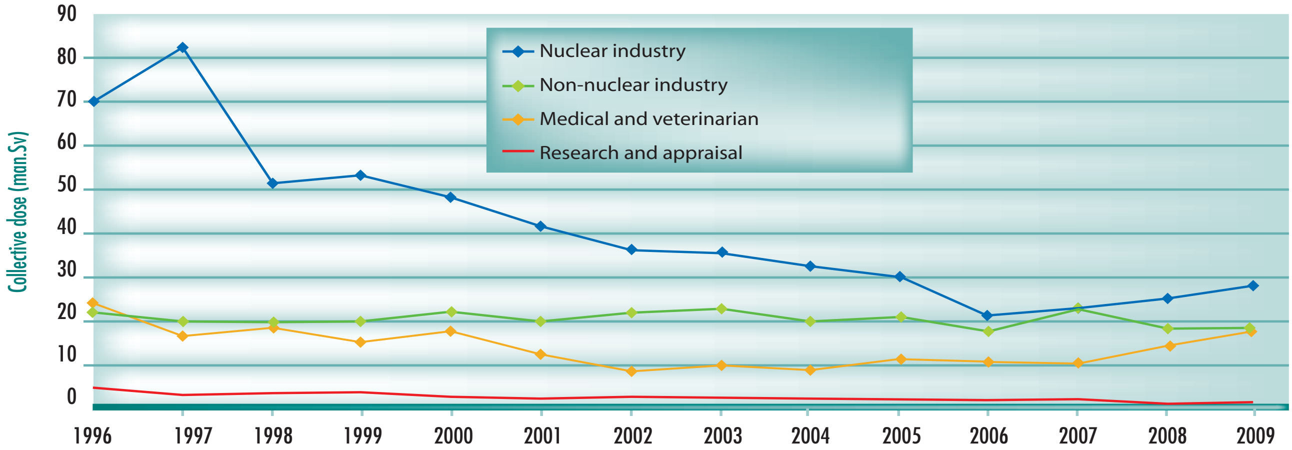
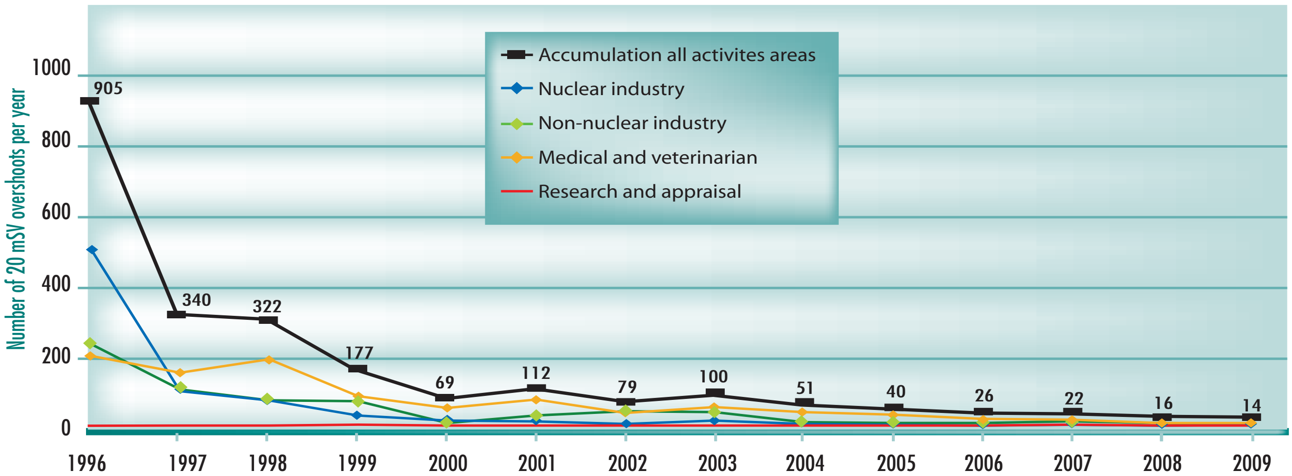


Diagram 6: Development of the number of workers monitored whose annual effective dose exceeds 20 mSv, per sector of activity and cumulative total, from 1996 to 2009



The number of monitored workers whose annual dose exceeded 20 mSv has also been falling significantly (see diagram 6). Each overdose has to be the subject of a significant event notification to ASN by the nuclear activity licensee and of an individual investigation, jointly with the occupational physician and if necessary with the conventional safety inspectorate, in accordance with the circular of 16 November 2007 concerning coordination of the radiation protection inspectors and the conventional safety inspectors for the prevention of risks associated with ionising radiation.

With regard to extremity dosimetry (ring and wrist dosimeters), 21,338 workers were monitored and the total dose was 128.6 Sv. An annual dose at the extremities exceeding the regulatory limit of 500 mSv was recorded on three people working in the medical radiology sector.

3|2|2 Worker exposure to TENORM

Worker 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 83% 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 1mSv/year.

The observation system "SIEVERT" set up by the General Directorate for Civil Aviation, 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 on the flights they make during the course of the year.

The doses received by 19,830 flight crew members were recorded in SISERI in 2009. Fifteen percent of the annual individual doses were below 1 mSv and 85% were between 1 mSv and 6 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 living habits of the reference groups chosen, from a few microsieverts to several tens of microsieverts per year.

These estimates are unknown for nuclear activities other than BNIs. Prior methodological studies are required in order to obtain a better understanding of the impact of these facilities, in particular the impact of discharges containing small quantities of artificial radionuclides originating from the use of unsealed radioactive sources in research or biological laboratories, or in nuclear medicine departments. 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. The average individual effective dose currently being received 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).

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 0.53mSv in 1983 to 3mSv 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

Water sample taken from the water table on the site of the Nogent-sur-Seine nuclear power plant

250%. About 17 million nuclear medicine examinations were carried out yearly in the 1970s, a figure which leapt to 35 million (+200%) in the early years of this millennium.

• the dose share 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 effective average 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 8, 9 and 10):

• 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. Thus:

• 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

Diagram 7: Distribution of procedures and the associated doses per sector

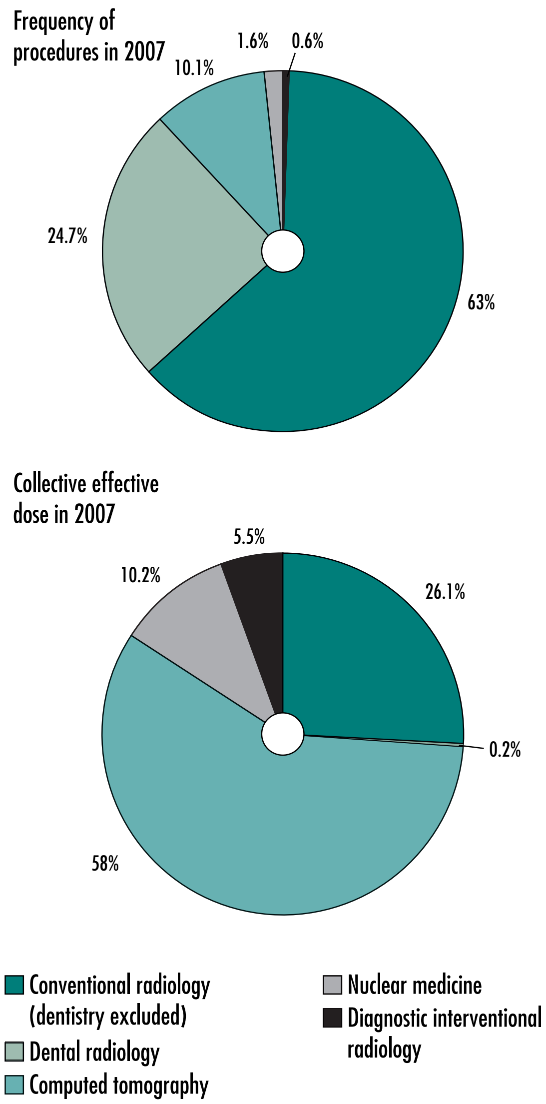


Table 4: Average number of medical imaging procedures and average effective dose in France in 2002 and 2007 (source IRSN)

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

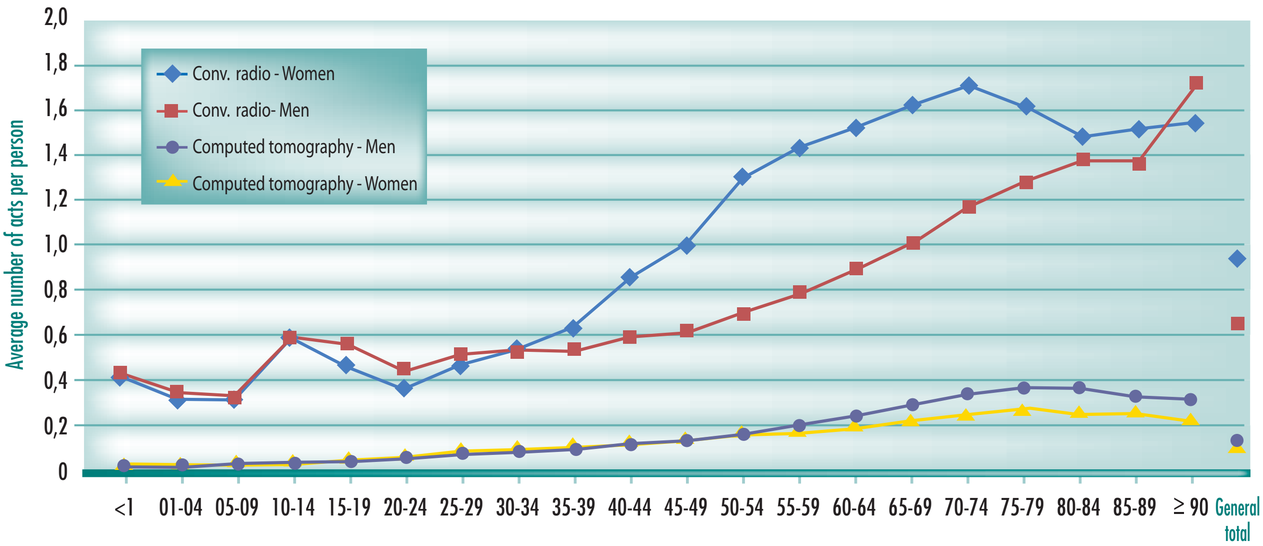


Diagram 9: Average effective dose associated with radiological procedures per inhabitant in 2007 (source IRSN/InVS)

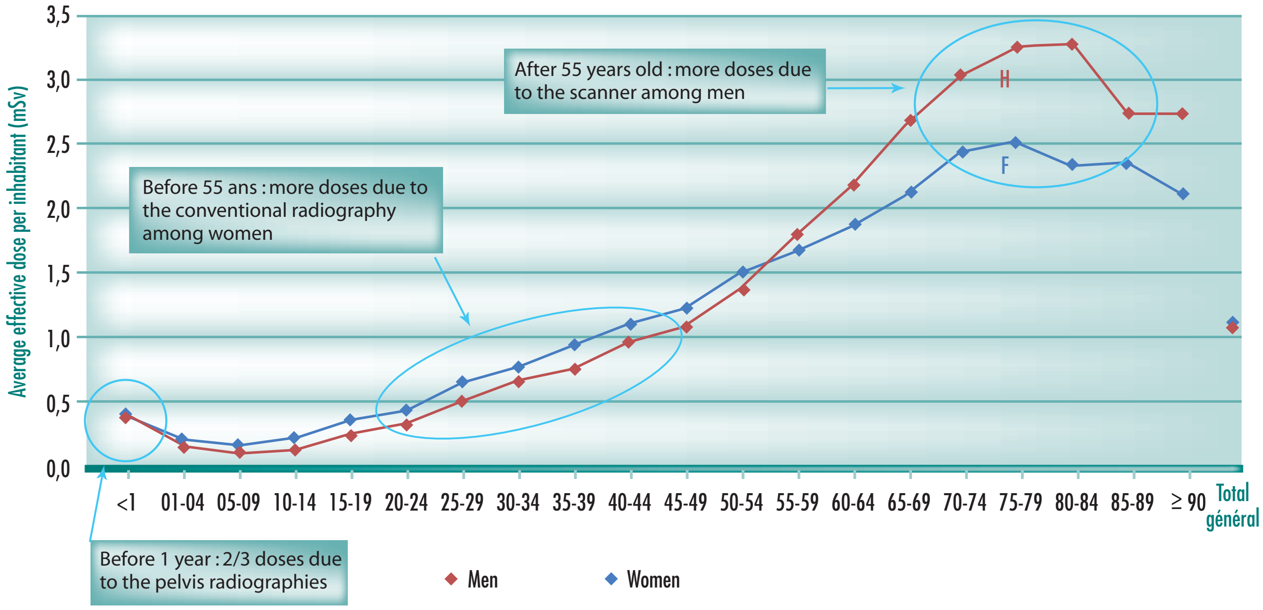
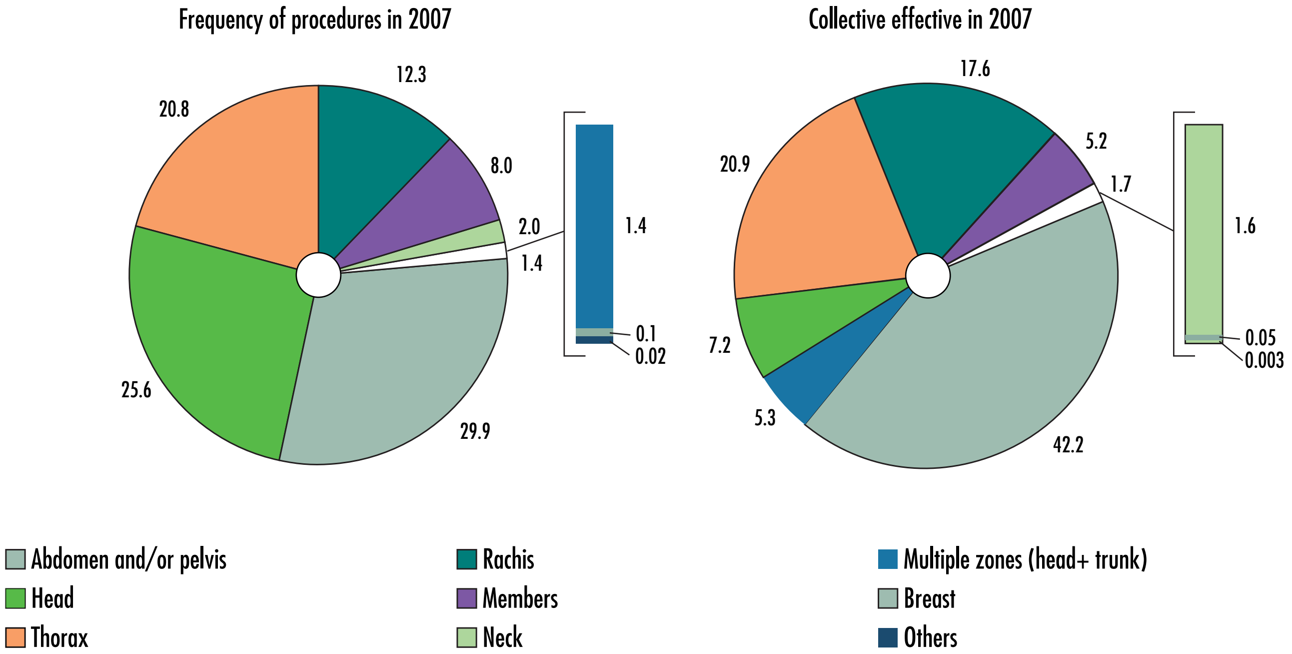


Diagram 10: Distribution of the frequency of procedures and the collective effective dose per anatomical area investigated in computed tomography, for the whole of France - in percentage



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 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 share of 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 seeing greater importance being attached to the impact of ionising radiation on non-human species in the regulations and licensing of nuclear activities. However, scientific data on the effects of ionising radiation on non-human species are limited and ASN considers that further research is needed before being able to propose specific measures for their protection.

4 OUTLOOK

As it is tasked with organising a permanent radiation protection watch, ASN remains particularly attentive to the correct working of the exposure monitoring system set up by IRSN (SISERI), in that the statistics provided constitute valuable national indicators of trends in worker exposure and are useful in assessing the effectiveness of the measures taken by the licensees to apply the optimisation principle. As in the preceding years, the IRSN-published study of worker exposure in 2009 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.

Exposure of the French population to radon is at present inadequately documented, as the estimates produced by IRSN in 1997 (average activity per inhabitant and per *département*) have never been updated and fail to take account of the measurements taken since 1999 in premises open to the public. The second national action plan for radon risks devised in 2010 provides for the creation of a database containing all the available data on radon exposure of the public and workers, which ASN considers a necessary step towards a clearer understanding of the risk.

ASN also emphasises the benefit of the work of the national patient exposure observatory coordinated by the InVS and the IRSN, which confirms the increase in doses delivered to patients in France through diagnostic examinations, as is the case in other developed countries. At the end of 2010, on the basis of this finding, ASN proposed actions to the Minister of Health aiming at controlling the increase in exposure, based on the effective application of the principles of justification and optimisation.

The Versailles International Radiotherapy Conference, organised in December 2009 by ASN, underlined the need to intensify efforts, both locally and internationally, in the field of recording and analysing treatment side-effects and complications, and to develop significant event notification systems for analysis and experience feedback purposes. The conclusions of this conference were subject to joint scrutiny by all the players in order to identify actions to complement the national radiotherapy plan coordinated by the INCa. This subject will be examined by the national plan monitoring committee in 2011. The question of hypersensitivity to ionising radiation shall receive particular attention in applied research at both national and international level, with a view to rapidly devising a radiosensitivity test for patients, especially prior to radiotherapy treatment.

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

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, and now also figure in a European directive.

Control of 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 Prefectures, 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, patients, the public and the environment from risks arising from nuclear activities. It also contributes towards informing 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 or the international standards.

The IAEA's Safety Standards (see chapter 7, point 2|2) establish 10 fundamental safety principles which are applied internationally under the Convention on Nuclear Safety (CNS) (see chapter 7, point 4|1). This convention establishes an international framework for regulation of nuclear safety and radiation protection. At the European Community level they are applied via a directive establishing a Community framework for the safety of nuclear installations. In France, it is via the Environment Charter, appended to the Constitution, and via laws and regulations.

1|1|1 Principle of licensee prime responsibility

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

It applies directly to all nuclear activities.

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.

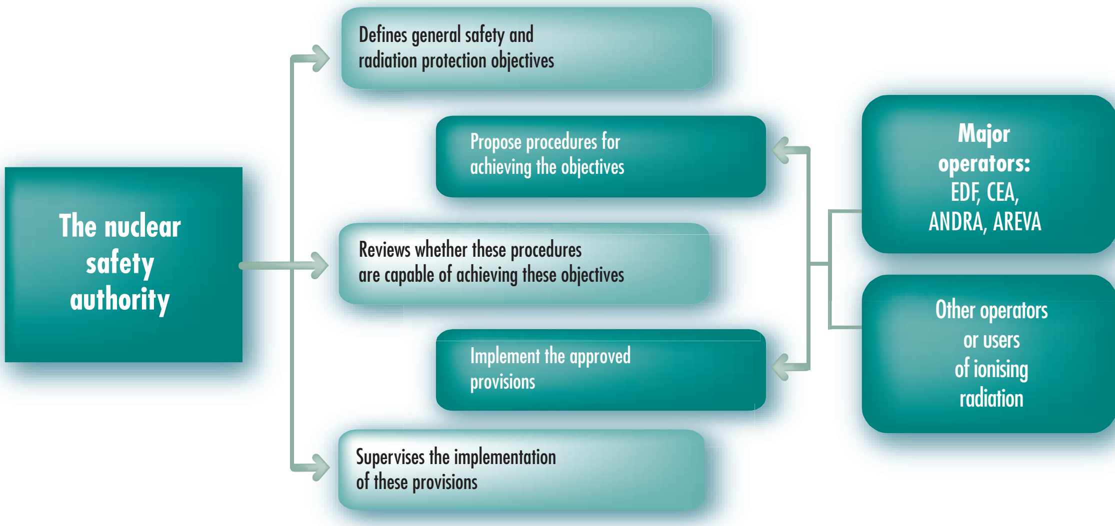
7. People and the environment, present and future, must be protected against radiation risks.

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.

UNDERSTAND



Responsibility of licensees and responsability of ASN

1|1|2 "Polluterpays" principle

The "polluterpays" 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*".

A notable application of this principle in France is the "BNI tax", a tax levied on basic nuclear installations (BNIs), on producers of radioactive wastes (additional tax on radioactive waste) and on installations classified on environmental protection grounds (ICPE) (a part of the general tax on polluting activities - TGAP).

UNDERSTAND

The BNI tax and additional taxes on waste

The ASN Chairman, pursuant to the Nuclear Security and Transparency (TSN) Act, is responsible for assessing and ordering payment of the BNI tax, introduced in 2000 under Article 43 of the Finance Act (Act 99-1172 of 30 December 1999). The revenue from this tax amounted to € 584.6 million in 2010. The proceeds go to the central state budget.

In addition, the "Wastes" Act created three further taxes levied on nuclear reactors and spent nuclear fuel reprocessing plants. Supplementing the BNI tax, these are 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 interim storage. The revenue from these new taxes amounted to € 183.5 million in 2010.

Table 1: breakdown of licensee contributions

Licensee	Amount for 2010 (millions of euros)	
	BNI tax	Additional taxes
EDF	547.3	138.8
AREVA	15.1	8.9
CEA	6.9	31.2
ANDRA	6.5	
OTHERS	8.8	4.6
TOTAL	**584.6**	**183.5**

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 dose-effect relationship without threshold 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 is the principle which, for example, underlies the mandatory national public debates that are held before the construction of a nuclear power plant and the public inquiries held, in particular, during review of cases of creation or decommissioning of nuclear installations. Chapter 6 of this report describes application of the right to 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 a medical procedure can only be undertaken or carried out if its health, social, economic or scientific benefits so justify, given the risks inherent to 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 such as the decision to use nuclear power, 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 CSP, 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 predetermined reference levels.

1|1|7 The principle of limitation

The principle of limitation, expressed in Article L. 1333-1 of the CSP, 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 limits include 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 of 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 principle of prevention, or principle of preventive and remedial action as a priority at source, as set out in Article 3 of the Environment Charter, advocates the implementation of rules and actions to anticipate environmental harm while ensuring use of *"best available technologies not entailing excessive cost".*

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

1|2 Aspects of safety culture

The development of safety is not a linear process. The underlying principles and approaches presented below have been introduced gradually, sometimes on the basis of thinking and studies that have followed accidents. There is therefore a need for a will to progress and to implement what can be done to reduce risks whilst not assuming that an accident will never happen.

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), working closely with 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. As a cultural attitude, it is one of the basic essentials for sustaining 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. In this way, a single technical, human or organisational failure cannot cause an accident.

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:

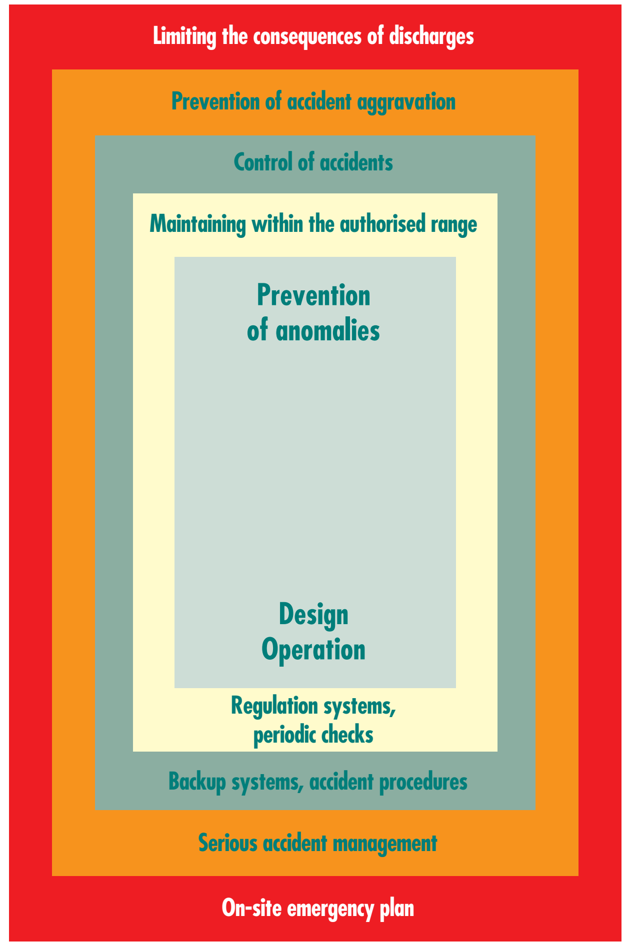
Level 1: Prevention of abnormal operation and failures
This is achieved by opting for robust and conservative installation design that includes safety margins and allows installations to withstand their own failures as well as the consequences of externally initiated events. It implies conducting the fullest possible study of normal operating conditions to determine the most severe loads to which the system will be subjected. Initial sizing for design of the installation can then be undertaken, including the safety margins.

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 limits. For example, if the temperature in a system increases, a cooling system starts up before the temperature reaches the authorised limit. Attention to 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 size systems to withstand those conditions.

Such accidents are generally studied with conservative hypotheses, that is to say the parameters are assumed to be the least favourable. In addition, the single failure criterion is applied (i.e. in addition to the accident itself, failure of any single component is also assumed). This leads to systems that come into play in case of accident (emergency shutdown, safety injection, etc.) having 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 five levels in "Defence in Depth"

Level 5: Mitigation of the radiological consequences of significant releases
This requires implementation of the measures of an emergency plan, including measures to protect the population: shelter, taking of iodine tablets to saturate the thyroid and avoid fixation of radioactive iodine carried by the radioactive cloud, evacuation, restrictions on consumption of water and of agricultural produce, 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 coolant system, and the containment system (see chapter 12).

1|2|4 Deterministic and probabilistic approaches

Postulating the occurrence of a limited number of design accidents constitutes the deterministic approach. This approach is simple to apply and 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 (which includes 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.

2 THE STAKEHOLDERS

The organisation of nuclear safety and radiation protection regulation 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 areas of competence are established by the TSN Act.

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

In the same way as the other independent administrative authorities, and in compliance with 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.

2|1|1 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.

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.

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

The ministers currently responsible for nuclear safety are: the Minister for Ecology, Sustainable Development, Transport and Housing (MEDDTL) and the Minister for the Economy, Finance and Industry (MEFI). On the advice of and, as applicable, following a proposal by ASN, they 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 operation of pressure equipment (PE) specifically designed for these installations.

On the advice of ASN, if an installation presents serious risks, the above-mentioned ministers may pronounce suspension of its operation.

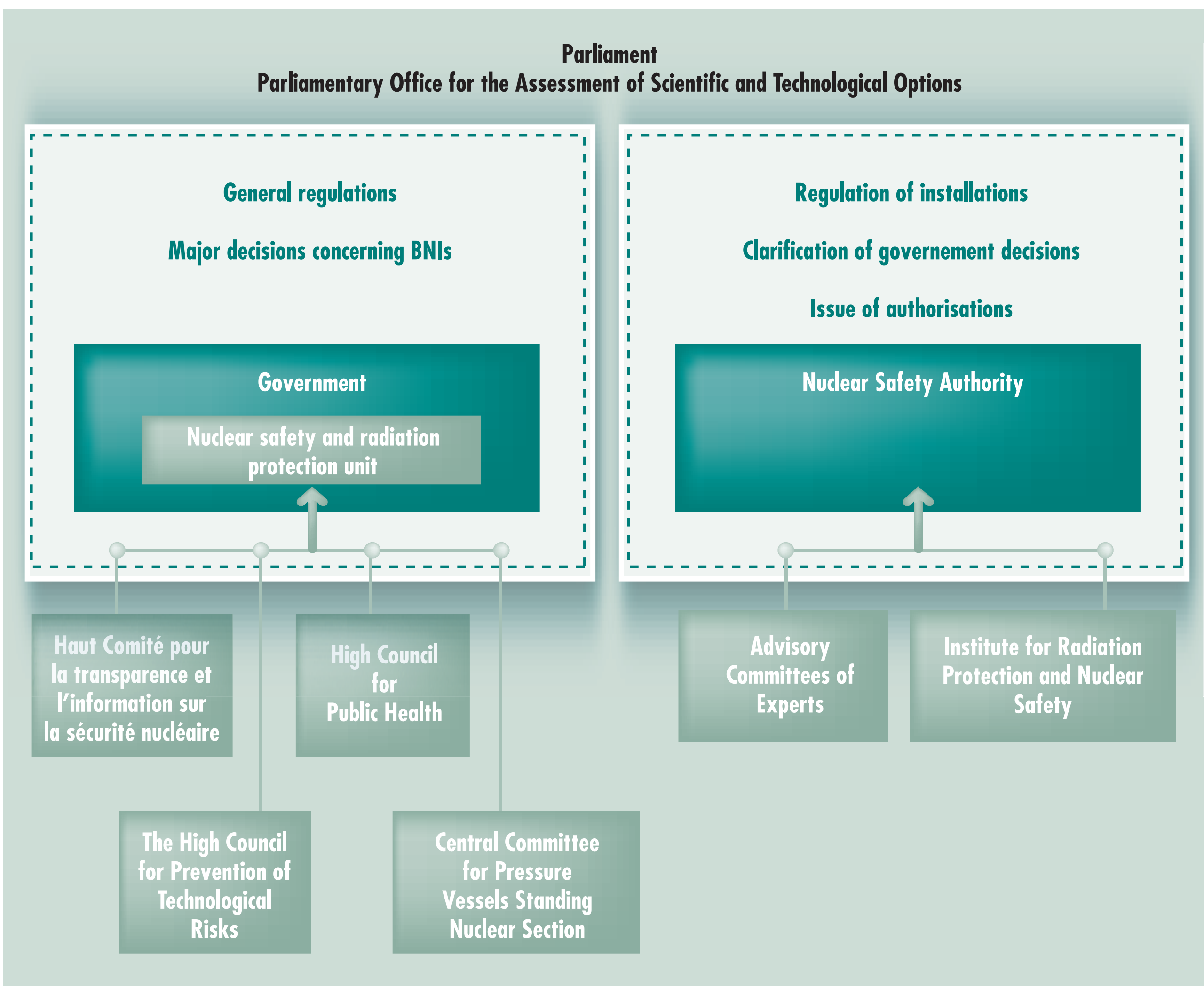
The Minister for Health (Labour, Employment and Health) also has responsibility for radiation protection and determines the general regulations concerning radiation protection, as applicable, on the basis of proposals from ASN.

The regulations covering the radiation protection of workers are the responsibility of the Minister for Labour (Minister for Labour, Employment and Health).

Finally, the ministers responsible for nuclear safety and for radiation protection approve the ASN internal regulations by means of a Government order. These ministers also approve 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 and within the General Directorate for Risk Prevention at the MEDDTL, the Nuclear Safety and Radiation Protection Mission (MSNR), jointly with ASN, is tasked with proposing Government policy on nuclear



Regulation of nuclear safety and radiation protection in France 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*[1] are the State's representatives in the *départements*[2]. 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 population.

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 The Nuclear Safety Authority

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

ASN is made up of a commission and of different 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

Regulations

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 CSP concerning small-scale nuclear activities and issues authorisations or approvals for radioactive material transport operations.

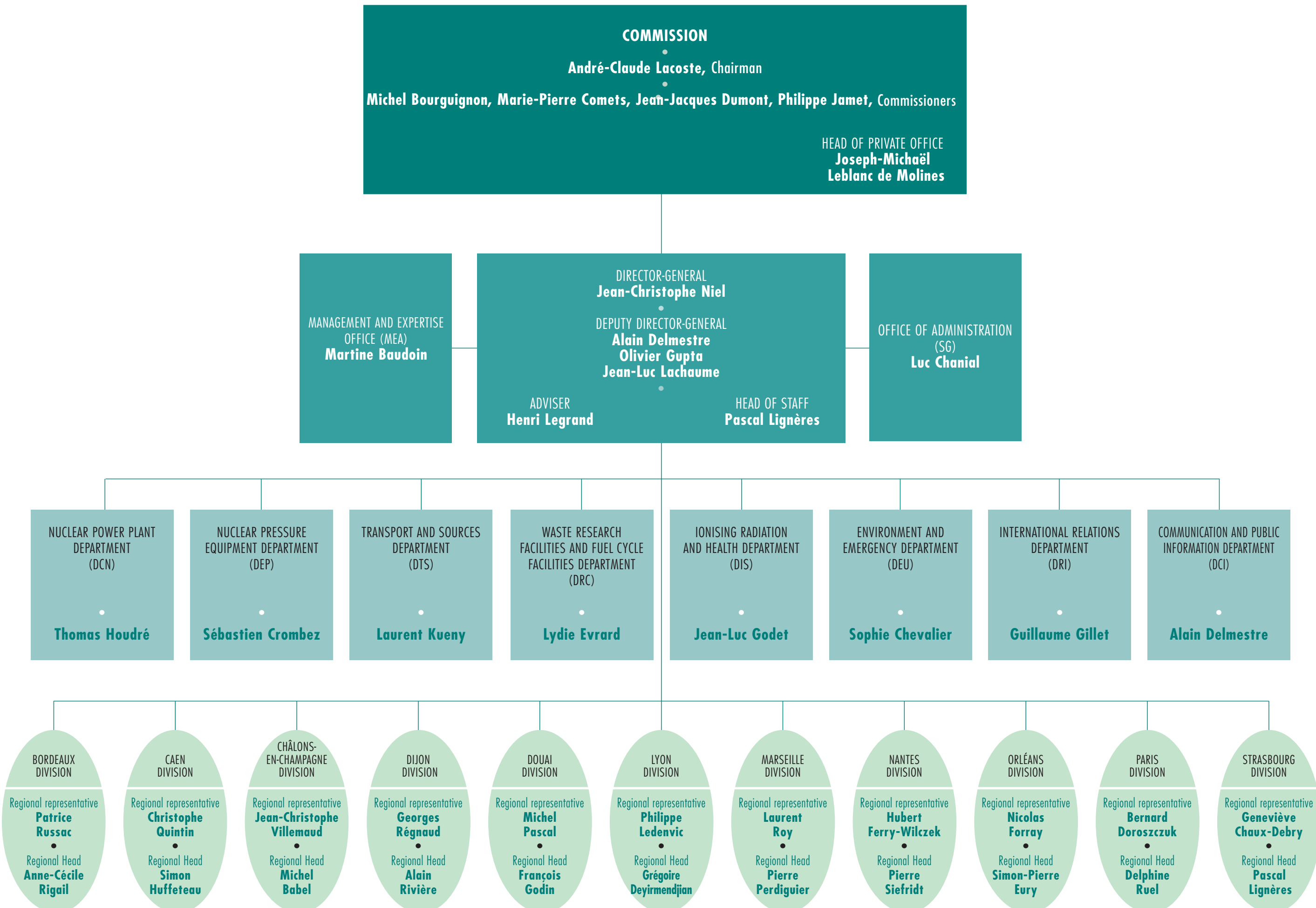
ASN's decisions and opinions are published in its *Official Bulletin* on its website *www.asn.fr.*

The ASN Executive Committee at 1st January 2011 (from left to night):
J. Mochel, A. Delmestre, J-L. Lachaume, J-C. Niel and H. Legrand (O. Gupta missing here)

The ASN Board of Directors at 1st January 2011 (from left to night):
J-L. Godet, A. Delmestre, L. Chanial, M. Baudoin, G. Wack, L. Kueny, S. Crombez, L. Evrard and J. Collet (G. Gillet missing here)

The ASN regional heads at 1st January 2011 (from left to night):
M. Babel, P. Perdiguier, M. Lelièvre, A. Rivière, P. Deyirmendjian, A.-C. Rigail, F. Godin and P. Siefridt (T. Houdré, P. Lignères and S-P. Eury missing here)

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



ASN organisation chart applicable as at 1er March 2011

Controls

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

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.

Support in emergency situations

ASN is involved 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 such an emergency situation occurs, it assists the Government for all matters within its competence. It transmits its recommendations on the medical and health or civil security measures to be taken, it informs the public about the situation, about any releases into the environment and their consequences.

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.

The ASN Scientific Committee

In 2010, ASN set up a Scientific Committee to examine the proposed orientations for new and ongoing research work in the areas of nuclear safety and radiation protection.

The Scientific Committee comprises six members appointed on account of their expertise in the research sector.

The Scientific Committee held two meetings in 2010, under the chairmanship of Ashok Thadani.

It examined the following subjects in particular:
- *organisational and human factors;*
- *radiobiology;*
- *aging of the metal components of PWRs;*
- *serious accidents;*
- *non-destructive testing;*
- *external dosimetry.*

The ASN Scientific Committee at its launch meeting on 8 July 2010

Information

ASN participates in informing the public in its areas of competence. 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.

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 2010, the ASN Commission met 59 times. It issued 24 opinions and took 33 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 chairmanship 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. The DCN contributes to development of regulation/inspection strategies and ASN actions in different areas such as the safety consequences of deregulation of EDF's electricity monopoly, installation 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 – Degradation", "Operation", "Core – Studies", "Radiation Protection – Environment and safety 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, manufacturing 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). The DTS is also responsible for controlling the security of sources.

– 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 the monitoring of facilities concerned by the nuclear fuel cycle, research facilities, nuclear installations being decommissioned, contaminated sites and radioactive waste. It takes part in inspecting the Bure underground research laboratory and the research installations 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/inspecting 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 contributing to ensuring that discharges from BNIs are as low as is 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 inform 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 representation of ASN 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 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 human resources management, including with regard to skills, and for the development of labour relations, as well as being in charge of ASN's real estate and moveable and fixed assets policy. Also responsible for budget issues, the SG oversees optimisation of the use of 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 actions are coherent, by means of a quality approach and by overseeing coordination of the workforce.

– The MEA comprises two branches: "IT and Telephony" and "Expertise and Research".

ASN divisions

The 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 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 population, and supervise the operations carried out to safeguard the installation 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 31 December 2010 stood at 451, with 239 people working in the central services and 212 in the regional divisions.

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

On 31 December 2010, the average age of the ASN staff was 43.

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 or the field of communication, 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 2010, more than 4,100 days of technical training were provided to ASN staff via 230 sessions forming part of 133 different courses. The financial cost of the courses, provided by organisations other than ASN, amounted to €470,000.

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, 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.

TO BE NOTED IN 2010

Revamping human resource management

The objective of the "Management of human resources at ASN" working group initiated in October 2009 by the ASN Chairman, is to ensure that ASN always has the professional skills and profiles it needs, and to offer its staff attractive career prospects.

The working group has studied human resource practices with accredited organisations and met State branch administrators to discuss career management rules for civil servants.

After five months of work, the group submitted its conclusions in May 2010. These include 25 recommendations to enhance the efficiency of ASN's human resource management in terms of recruitment, skills development and enhancement of professional career paths. These proposals - which are currently being applied - are, among other things, intended to increase ASN's independence in these areas.

The Accreditation Committee met twice in 2010 and proposed that 12 inspectors be promoted to senior grade. As of 31 December 2010, 56 ASN nuclear safety or radiation protection inspectors had senior inspector status, representing about 19% 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.

In 2010, the amount from the State budget committed to control of nuclear safety and radiation protection in France was €145.9 million, of which €52.2 million were allocated for the payroll, €15.6 million for the operating costs of ASN's central services and 11 regional divisions, and €78.1 million for the technical expertise provided by IRSN for ASN.

It should be borne in mind that, as stipulated by the TSN Act, the ASN relies on the IRSN for technical expertise backed up, where necessary, by research. ASN is consulted by the Government regarding the corresponding part of the State's subsidy to IRSN. For 2011, under the terms of Act 2010-1658 of 29 December 2010 on financial readjustment for 2010, the subsidy allocated to the IRSN will be supplemented by the proceeds of a tax paid by operators of BNIs and ring-fenced for IRSN.

Efficiency tools at ASN

The strategy-based approach

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

This three-level plan is an essential element for 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. This was a world first.

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 best international practices. The experts also identified some areas for improvement, notably in terms of skills management.

ASN will take advantage of the conclusions of this mission to reinforce the conformity of its practices and its organisation with the best international standards.

Table 2: summary of ASN budget for 2010

Ministry responsible	Programme / Action (2010)	Destination	2010 Budget Act	2011 Budget Act
MEDDTL	**181: Risk Prevention** Action 9: Regulation of nuclear safety and radiation protection	Personnel (including seconded), operation and intervention expenses	€ 52.19 million	€ 51.90 million
MBCPFPRE*	**218: Implementation and oversight of economic and financial policy** Action 5: assistance and support operations	Operation of central sites (Paris and Fontenay-aux-Roses)	€ 6.27 million	€ 6.27 million
MEDDTL	**217: Implementation and oversight of ecology, energy, sustainable development and spatial planning policy** Actions 16, 3 and 4 (personnel, real estate and operations "support" costs	Cost of 11 ASN regional divisions (personnel and operations "support" costs)	€ 9.35 million	€ 9.77 million
MEDDTL	**190: research in the fields of energy and sustainable development and spatial planning** Sub-action 11-02 "IRSN"	ASN technical support activities	€ 78.13 million	€ 46,4 million

The reports can be viewed on the ASN website.

Internal communication

The ASN intranet, OASIS, is the central vector for internal information, providing staff with documents and information about developments within the Authority and the carrying out of its occupational activities. The intranet was fully upgraded in July 2010.

An ASN activity report has been published each year since 2008, reporting on the Authority's activities and human and financial resources.

The quarterly magazine *"Transparence"*, of which the first issue was published in April 2010, is primarily aimed at an internal ASN readership. Its aim is to provide an educational interpretation of ASN missions, its activities, its areas of professional expertise and its internal organisation.

These communication resources are presented in point 1|2 of chapter 6.

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 to 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. Any issue concerning information about nuclear safety and its regulation or inspection can be referred to the High Committee.

The High Committee replaced the French High Council for Nuclear Safety and Information (CSSIN) which was set up in 1973. Its role was similar but less extensive and it was endowed with more modest means. The HCTISN's activities in 2010 are described in chapter 6.

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

As part of the review of the methods of consultation concerning technological risks, the government issued a decree on 27 July 2010 by which it dissolved the BNI Consultative Committee (CCINB), set up by decree on 2 November 2007. The CCINB held its last meeting on 6 January 2010.

The CCINB was a classic consultative body that brought together state representatives, BNI operators and eminent qualified people. It was consulted on texts relating to

TO BE NOTED IN 2010

Strategic plan for 2010-2012

The multi-year strategic plan for 2010-2012

The ASN commission has adopted six strategic lines for the 2010-2012 period, with the aim of affirming and clearly communicating the role and position of ASN to its internal and external audiences, and of ensuring continuing progress in nuclear safety and radiation protection:

- *Develop and enhance skills, reinforce the organisation and affirm the doctrine to fufill our duties and give us the means to achieve our ambitions*
- *Invest in new domains in medicine, safety and research to improve the consistency and effectiveness of the State's actions in the regulation of nuclear activities*
- *Clarify the role and organisation of expertise in the regulation of nuclear activities to guarantee the quality of the regulatory action over time*
- *Clarify and develop institutional relations with the other State players in order to improve our efficiency, while at the same time upholding our independence*
- *Be a driving force in the European construction of nuclear safety and radiation protection, to contribute to shared high standards of requirements and constitute an international reference*
- *Initiate and contribute to public discussion and debate on topics that involve ASN, with a view to informing the citizens and acquiring feedback that helps us take the best decisions*

This strategic plan was drawn up in the context of a participatory approach involving all ASN staff in the spirit that governs the State reform.

regulation of BNIs and on the most important individual decisions affecting such installations. Operators were heard by the CCINB, which would then state its opinion concerning their installations. In line with a proposal by ASN, the decree of 2 November 2007 also allowed Local Information Committees (CLI) to be heard by the Commission.

Henceforth, consultation will take place before the High Council for Prevention of Technological Risks (CSPRT), created by Order 2010-418 of 27 April 2010. The Council will be made up of state representatives, operators and qualified eminent people and of representatives of environmental organisations in the voluntary sector. 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. For the latter, the CSPRT, will give its opinion on regulatory texts applying to them.

Where individual decisions regarding BNIs are concerned, ASN wished to preserve the process of collaboration which existed with the CCINB.

To this end, on 13 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 adoption of certain opinions or decisions relating to BNIs. At the current stage, ASN has decided to introduce hearings by its Commission in all cases where hearings before the CCINB are possible, and under similar arrangements. However, this decision includes the possibility of extending the hearing procedure to other ASN decisions or opinions, particularly in light of appraisal of this initial implementation.

ASN's decision of 13 April 2010 came into force immediately after publication of the decree dissolving the CCINB.

2|4|3 The High Council for Public Health

The High Council for Public Health (HCSP), created by Act 2004-806 of 9 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|4 The Central Committee for Pressure Equipment

The Central Committee for Pressure Equipment (CCAP), created by Article 26 of decree 99-1046 of 13 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), presented in point 2|5|2 of this chapter.

The CCAP can be called on by the Government and by ASN for all issues concerning the legislative and regulatory aspects of pressure equipment. 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 (The Institute of Radiation Protection and Nuclear Safety)

IRSN, created by Act 2001-398 of 9 May 2001 and by decree 2002-254 of 22 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 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 budget

The subsidy from the State's general budget allocated to IRSN is stipulated in action 11 "Research in the field of risk" of programme 190 "Research in the fields of energy and sustainable development and spatial planning" of the "Research and higher education" mission.

IRSN's total state subsidy in 2010 was the same as in 2009: €244.8 million, of which €78.1 million were for technical support to ASN. For 2011, the subsidy is reduced to €213.4

million and is accompanied by the introduction of a tax levied on certain industrial concerns to cover the costs of the expert support ASN requests of the IRSN.

In its statement of opinion of 3 December 2010 on the budget allocated to IRSN's expert support, ASN deemed unacceptable for effective control of nuclear safety and radiation protection a situation that would lead to a reduction, without any compensation, of around €30 million in the IRSN budget allocated to actions performed for the benefit of ASN in 2011, and felt that only state subsidy at a level comparable with that of previous years would allow the establishment of a firm basis that would guarantee the attendant expert capacities.

An agreement was signed by ASN and IRSN to define the dialogue methods and 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.

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, radiation protection in medical and non-medical sectors, 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 academic and associative backgrounds, as well as from the licensees concerned by the subjects being dealt with. Each GPE may call on any person recognised for his or her particular competence. It may hold a hearing of licensee representatives. Participation by foreign experts can help diversify the approach to problems and take advantage of experience acquired internationally.

Under its policy on transparency in the area of nuclear safety and radiation protection, ASN has been making documents on the GPE meetings available to the public since 2009.

In 2010, the ASN budget allocated to the GPE's is around € 200,000.

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.

In 2010, the GPD met twice, visited one installation and organised a meeting with its German counterpart.

The Advisory Committee for nuclear pressure equipment (GPESPN)

Since mid-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 six meetings in 2010.

The Advisory Committee for radiation protection in medical sectors (GPMED)

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

It held five meetings in 2010.

The Advisory Committee for reactors (GPR)

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

It held six meetings and visited two installations in 2010.

The Advisory Committee for radiation protection in non-medical sectors (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 public, for industrial and research applications of ionising radiation, as well as for natural ionising radiation.

It held four meetings in 2010.

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 one meeting in 2010.

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 five meetings and visited two installations in 2010.

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

To diversify its expertise and benefit from other specific skills, ASN also has its own budget allowance, amounting to €1.3 million in 2010.

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

In 2010, ASN continued its cooperation with:
– the Nuclear Protection Evaluation Centre (CEPN): support for the work of the CODIRPA, appraisal of radioprotection of patients training programmes;
– Bureau Veritas: advisory services on the ISO 17 020 accreditation procedure for ASN/DEP, services relating to examination of an AFCEN document justifying the capacity of the RCCM to meet certain essential safety requirements;
– the APAVE Group: measurement of radon in dwellings;
– the pluralistic experts group for the Limousin mines (GEP Limousin) which assists the public authorities on issues concerning the rehabilitation of the former uranium mining sites;
– the Nord-Cotentin radio-ecology group, which assists the public authorities with regard to the environmental and health consequences of the BNIs operated on the peninsula.

2|6 Other stakeholders

As part of its mission to protect the 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*

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*

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*

2|6|4 The 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 in 2010

Committee	Main agenda	Date
GPRAD	Examination of the draft Euratom "European Basic Safety Standards Directive" and of draft decision establishing a regime for authorisation/declaration of carriers	12 January
GPMED	Presentation of the "Radiological Treatments" Working Group	21 January
GPT	Examination of compliance of model R73, with a view to its approval	2 February
GPR	Site visit to Flamanville 3	8 March
GPR	Information on state of progress of Flamanville 3 site	18 March
GPU	Visit to the Agate installation	8 April
GPD	Committee meeting	9 April
GPRAD GPMED	Examination of the report from the Working Group on the Desirable Development and Training of People Competent in the Field of Radiation Protection and examination of the draft Euratom "European Basic Safety Standards Directive"	13 -14 April
GPU GPD	Commissioning of the AGATE installation (BNI 171), at Cadarache	15 April
GPESPN	Capacity of steam generators at Bugey 3 to operate until their replacement in September 2010	19 April
GPR	Review of reference base for study of Loss of Coolant Accidents (LOCA) for pressurised water reactors	6 May
GPR	Examination of orientations of the 3rd safety reassessment for 1300 MWe reactors	20 May
GPD	GPD / ESK meeting in Karlsruhe	25–26 May
GPR	Visit to the ORPHÉE installation (BNI 101)	9 June
GPESPN	Classification of nuclear pressure equipment for pressurised water reactors	9 June
GPRAD	Information on radiation protection issues relative to the operation (or use) of electrical equipment generating ionising radiation and examination of draft Euratom "European Basic Safety Standards Directive"	11 June
GPU GPD	Preparation of GPD session on long-life, low and medium activity waste project	16 June
GPESPN	Keeping 900 MWe reactor vessels in service	16 June
GPMED	Examination of report from Working Group on conditions of provision of radiotherapy in stereotaxic conditions and of the associated radiophysics and examination of the "Radiological Treatments" Working Group report	22 June
GPU GPD GPR GPT	Examination of the coherence of the fuel cycle	30 June
GPESPN GPR	Keeping 900 MWe reactor vessels in service (second and final part)	30 June
GPU	Visit to the CIS bio international installation (BNI 29) (Saclay)	2 July
GPU	Reassessment of safety of the CIS bio international installation (BNI 29) (Saclay)	7 July
GPR	Reassessment of the safety of the ORPHÉE research reactor (BNI 101)	9 September
GPMED	Examination of report from Working Group on conditions of provision of radiotherapy in stereotaxic conditions and of the associated radiophysics and examination of the "Radiological Treatments" Working Group report (second and final part)	28 September
GPD	Visit to the experimental Tournemire facility	29 September
GPR	Reassessment of the safety of the ORPHÉE research reactor (BNI 101) (second and final part)	7 October
GPU GPR	Management of nuclear safety and radiation protection at CEA	18 November
GPMED	Examination of the draft review of diagnostic reference levels (DRL) in radiology and nuclear medicine	23 November
GPESPN	Steam generator partition plate	24 November
GPRAD	Examination of draft dose "passport" proposed by HERCA	25 November
GPD GPU	Examination of basic options for geological storage of long-life, high and medium activity waste	29 November
GPESPN	Inter-professional guide to classification of modifications or repairs to level N2 or N3 nuclear pressure equipment	17 December

3 OUTLOOK

Openness, transparency and international cooperation are determining factors for safety, making the cultural context, the political framework and the existence of a democratic system equally as important as the technical aspects. Nuclear safety is a national responsibility but it can only be envisaged in a context of close and open international cooperation.

The regulation of nuclear safety and radiation protection involves all of the State structures:

– Parliament, in particular the OPECST for definition of the main long-term options;
– The Government, in particular the ministers responsible for nuclear safety and radiation protection and who are given general regulatory and decision-making powers concerning the creation of BNIs;
– the ASN which, in particular, contributes to drafting of technical regulations, to monitoring and regulation of activities and to providing information to the public;
– the IRSN and other bodies providing technical support;
– the consultative bodies, which provide an outside view of the important decisions concerning nuclear safety and radiation protection;
– the *préfets*, who are in charge of protecting the population.

2010, the fourth full year of ASN's existence as an independent administrative authority, was the opportunity for implementation of the ASN 2010–2012 Strategic Plan intended to strengthen the effectiveness and quality of the Authority's regulation and inspection of nuclear safety and radiation protection, in close liaison with other State bodies and with European neighbours, thereby confirming ASN's position and its responsibilities.

By creating a Scientific Committee, ASN has made a commitment to the field of research in order to identify the areas of knowledge that will be necessary for the expert knowledge that it will have to call on in the medium and long term.

The importance that the Authority attaches to having the appropriate skills is also evidenced in its approach to human resource management.

In conducting its activities, and in line with its independent status, ASN maintains strong ties with the other stakeholders involved in regulating or providing information about nuclear safety, radiation protection and protection of the environment.

The sums of money allocated by the State in 2010 to regulation and inspection of nuclear safety and radiation protection in France came wholly from the national budget and were shared amongst four programmes (181, 217, 218 and 190). As of 2011, they will be shared by five programmes (the above-mentioned four and programme 333, addressing pooled state resources in a decentralised context), with the addition of the annual tax raised for the benefit of IRSN and paid by BNI operators.

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 this context, ASN considers necessary a review of its budgetary model and the grouping of the current items under a single programme for nuclear safety and radiation protection in France. The Authority is also of the opinion that the introduction of the tax in favour of the IRSN opens the way, and indeed tends to contribute to, a fundamental change in the way in which the State finances nuclear safety and radiation protection.

REGULATIONS

CHAPTER 3

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 Act of 13 June 2006 relative to nuclear transparency and security (known as the "TSN" act) has profoundly modernized the BNI legal system. 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 REGULATORY REQUIREMENTS 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.

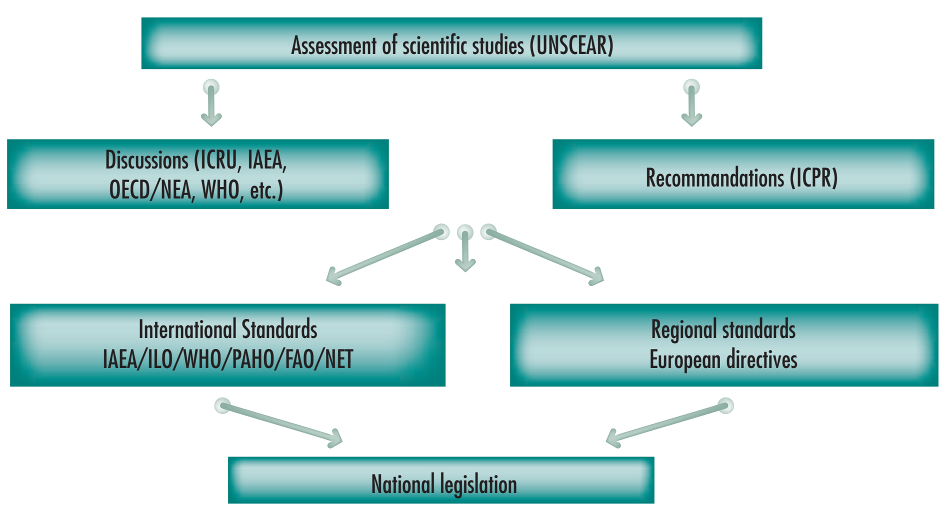
1|1 The regulatory basis

1|1|1 The international radiation protection framework (ICRP, IAEA, EURATOM)

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 diverse disciplines, which publishes recommendations concerning the protection of workers, the population 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. In 2008, IAEA initiated a process to revise the basic requirements, in order to take account of the new recommendations from ICRP (Publication 103), while a new standard for the basic safety principles was published by IAEA at the end of 2006;



Drafting of radiation protection policy

– 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 13 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 30 June 1997 on health protection of individuals against the dangers of ionizing radiation in relation to medical exposure; and directive 2003/122/Euratom of 22 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 draft directive has been issued for review by the Member States since March 2010.

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 and the TSN Act

The most general requirements are contained in the Public Health Code and in the first sections of act 2006-686 of 13 June 2006 concerning transparency and security in the nuclear field (TSN Act). This act is currently being incorporated in 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.

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 benches of the Sénat

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.

As for the TSN Act, its part I defines various concepts:

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"*.

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"*.

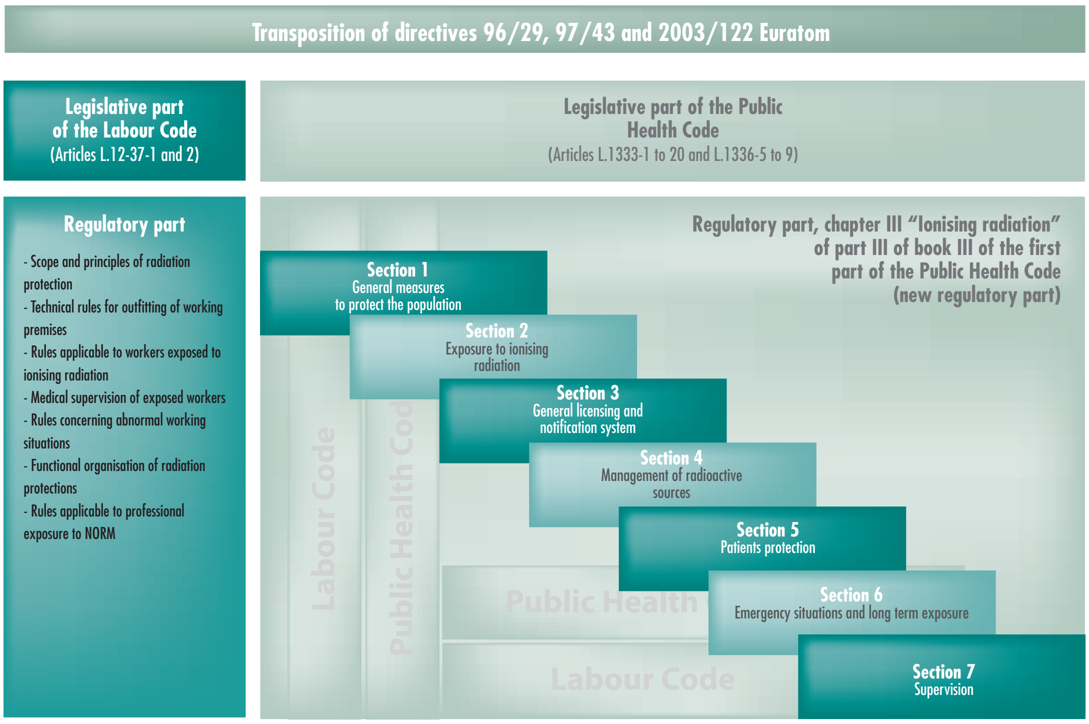
Nuclear transparency is defined as *"the set of provisions adopted to ensure the public's right to reliable and accessible information on nuclear security"*.

Part I of the TSN Act also defines the role of the state with regard to nuclear safety: it *"defines the regulations on nuclear security and implements controls to apply these regulations. It ensures the public is informed of the risks related to nuclear activities and their impact on personal health and security as well as on the environment"*.

Part I of the TSN Act also lays down the general principles applicable to nuclear activities. These principles are presented in point 1 of chapter 2.

Part III of the TSN Act creates the ASN, defines its roles and clarifies its organisation. These aspects are presented in point 2|3|1 of chapter 2.

Part III of the TSN Act deals with public information about nuclear safety. Its main requirements are mentioned in chapter 6.



Legislative and regulatory architecture of radiation protection

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 28 June 2006 on the sustainable management of radioactive materials and waste, called the "Waste" Act, part of which is incorporated into 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.

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

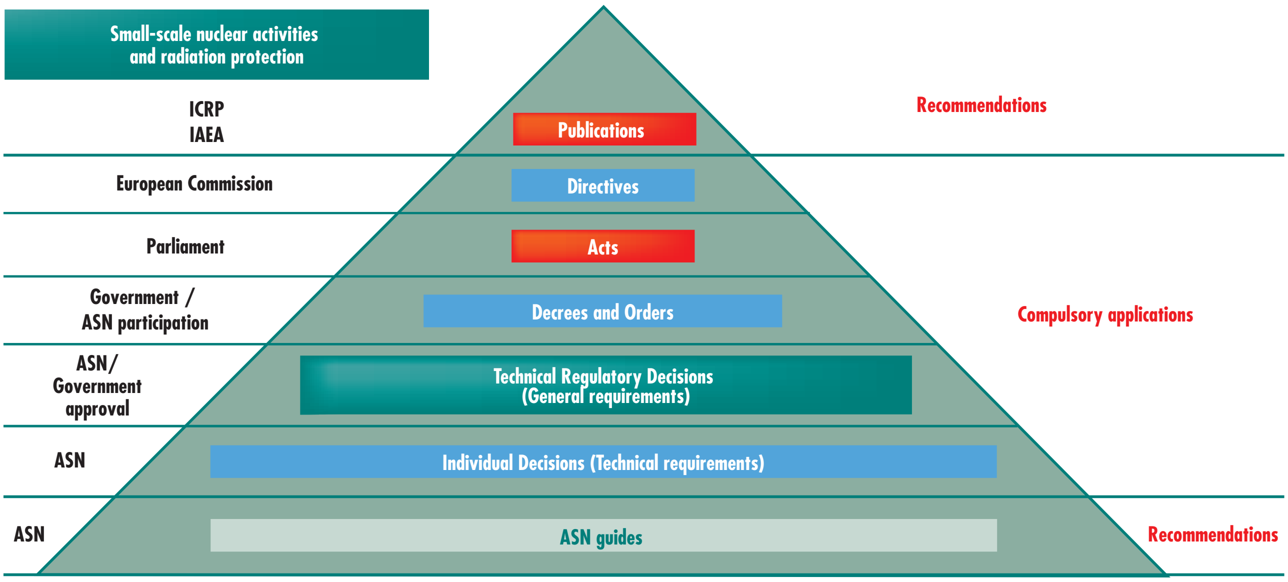
Appendix 1 to this chapter gives the various dose levels and exposure limits set by the regulations.

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 ionizing 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 2 July 2010 relative to the protection of workers against risks due to artificial optical radiation.

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



Schematic of the different levels of regulation in the small-scale nuclear sector in France

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;
– the dose limits (articles R. 4451-12 to 15) were reduced to 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).

These requirements are clarified by the implementing orders.

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 15 May 2006 (O.G. of 15 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 joint General Directorate for Labour/ASN circular of 18 January 2008 specifies the implementation procedures.

The person with competence for radiation protection (PCR)

The duties of the person with competence for radiation protection (PCR) were extended to marking out 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 26 October 2005 concerning training of the person with competence for radiation protection and certification of the instructor distinguishes between three different activity sectors:

Dosimetric finger ring used by the nuclear medicine unit personnel in the North Saint-Denis Cardiology Centre

- 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 "BNI - ICPE" sector, covering establishments containing one or more BNI(s) and those which comprise an installation subject to licensing as an installation classified on environmental protection grounds, with the exception of the nuclear activities in the medical sector 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 16 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.

Dosimetry

The procedures for approval of the organisations responsible for worker dosimetry are defined by the order of 6 December 2003 as amended; the procedures for medical monitoring of workers and the transmission of individual dosimetry data are specified in the order of 30 December 2004. ASN is in charge of examining the approval applications submitted by the dosimetry organisations and laboratories.

Radiation protection supervision

Technical control 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 radiation 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 4 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. The controls are carried out partly as part of the licensee's in-house inspection processes and partly 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). The approval procedures for these organisations were defined in the order of 9 January 2004. ASN is responsible for examining approval applications submitted by the organisations.

The list of approved organisations is available on the ASN website: *www.asn.fr*.

Radon in the working environment

(See point 2 | 3 | 1).

1 | 2 | 2 General protection of the population

Apart from the special radiation protection measures included in individual nuclear activity licences for the benefit of the population as a whole 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 15 mSv/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 1 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 5 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 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.

Taking plant samples in the vicinity of the Marcoule power plant

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.

Radioactivity and the environment

A national network for the measurement of environmental radioactivity 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 population. The network's orientations are defined by ASN and it is managed by IRSN (order of 27 June 2005 on the organisation of a national network for the measurement of environmental radioactivity and setting the conditions of 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.

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

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 12 May 2004. They form part of the sanitary inspections carried out by the Regional Health Agencies (ARS). The order of 11 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 (0.1 Bq/L), the total residual beta activity (1 Bq/L), the tritium activity (100 Bq/L) and the total indicative dose – TID (0.1 mSv/year). The circular from the General Directorate for Health (DGS) dated 13 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 3954/87/Euratom of 22 December 1987, modified by Council Regulation no. 2219/89/EEC of 18 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 appendix 1).

At the international level, exchanges with non-EU countries are governed by the harmonised standards of the Codex Alimentarius Commission, a joint body of the FAO (Food and Agriculture Organisation of the United Nations) and WHO (World Health Organisation), which in July 2006 revised the Guideline Levels (GL) for radionuclides in foodstuffs contaminated as a result of a nuclear accident or a radiological event, for use in international trade. The EU regulation should be updated to take account of the new values in the Codex (see table in Appendix 1 to this chapter).

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 (ASN decision 2008-DC-0095 of 29 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 (10 µSv/year).

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

The population is 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 10 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

Intervention levels were updated in 2009 by ASN regulatory decision 2009-DC-0153 of 18 August 2009, approved by order of the Minister for Health and Sports, dated 20 November 2009, with a reduction in the level concerning exposure of the thyroid. Henceforth, the protection measures to be taken in an

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

emergency situation, and the corresponding intervention levels, are:
– sheltering, if the predicted effective dose exceeds 10 mSv;
– evacuation, if the predicted effective dose exceeds 50 mSv;
– 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.

Public information in a radiological emergency

The ways in which the population is informed in a radiological emergency situation are covered by a specific EU directive (Directive 89/618/Euratom of 27 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 13 September 2005 concerning the off-site emergency plans for certain fixed structures or installations, implementing article 15 of Act 2004-811 of 13 August 2004 on the modernisation of civil security.

Two implementing orders were published:
– the order of 4 November 2005 *concerning public information in the event of a radiological emergency situation;*
– the order of 8 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 population in a long-term exposure situation

Sites contaminated by radioactive materials are sites which had 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.

The approach for determining clean-out thresholds for these sites is defined in the IRSN guide (methodology guide for sites contaminated by radioactive materials). A new version of this guide, produced under the supervision of ASN and the Ministry of Ecology, was the subject of prior consultation on the ASN website in 2010.

Emergency exercise simulating an accident involving the transport of radioactive material – October 2010

2 REGULATORY REQUIREMENTS APPLICABLE TO SMALL-SCALE NUCLEAR ACTIVITIES

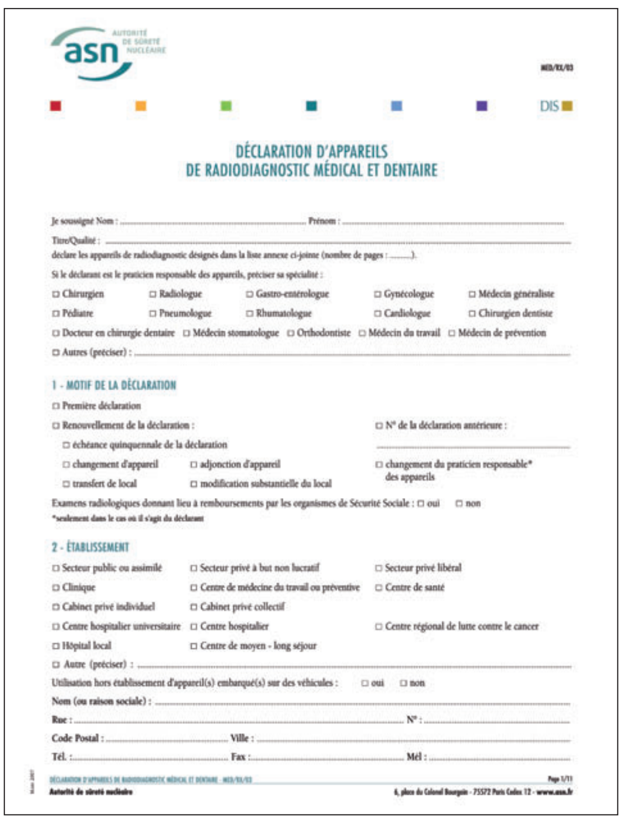
2|1 The small-scale nuclear activities licensing and notification system

2|1|1 Licensing and notification 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 it is planned to subject individuals to ionising radiation (see point 2|2).


asn AUTORITÉ DE SÛRETÉ NUCLÉAIRE

MED/RX/03

DIS

DÉCLARATION D'APPAREILS
DE RADIODIAGNOSTIC MÉDICAL ET DENTAIRE

Je soussigné Nom : .... Prénom : ....

Titre/Qualité : ....

déclare les appareils de radiodiagnostic désignés dans la liste annexe ci-jointe (nombre de pages : ....).

Si le déclarant est le praticien responsable des appareils, préciser sa spécialité :

☐ Chirurgien ☐ Radiologue ☐ Gastro-entérologue ☐ Gynécologue ☐ Médecin généraliste
☐ Pédiatre ☐ Pneumologue ☐ Rhumatologue ☐ Cardiologue ☐ Chirurgien dentiste
☐ Docteur en chirurgie dentaire ☐ Médecin stomatologue ☐ Orthodontiste ☐ Médecin du travail ☐ Médecin de prévention
☐ Autres (préciser) : ....

1 - MOTIF DE LA DÉCLARATION

☐ Première déclaration
☐ Renouvellement de la déclaration : ☐ N° de la déclaration antérieure :
☐ échéance quinquennale de la déclaration
☐ changement d'appareil ☐ adjonction d'appareil ☐ changement du praticien responsable* des appareils
☐ transfert de local ☐ modification substantielle du local

Examens radiologiques donnant lieu à remboursements par les organismes de Sécurité Sociale : ☐ oui ☐ non

*seulement dans le cas où il s'agit du déclarant

2 - ÉTABLISSEMENT

☐ Secteur public ou assimilé ☐ Secteur privé à but non lucratif ☐ Secteur privé libéral
☐ Clinique ☐ Centre de médecine du travail ou préventive ☐ Centre de santé
☐ Cabinet privé individuel ☐ Cabinet privé collectif
☐ Centre hospitalier universitaire ☐ Centre hospitalier ☐ Centre régional de lutte contre le cancer
☐ Hôpital local ☐ Centre de moyen - long séjour
☐ Autre (préciser) : ....

Utilisation hors établissement d'appareil(s) embarqué(s) sur des véhicules : ☐ oui ☐ non

Nom (ou raison sociale) : ....

Rue : .... N° : ....

Code Postal : .... Ville : ....

Tél. : .... Fax : .... Mél : ....

DÉCLARATION D'APPAREILS DE RADIODIAGNOSTIC MÉDICAL ET DENTAIRE - MED/RX/03 Page 1/11

Autorité de sûreté nucléaire 6, place du Colonel Bourgoin - 75572 Paris Cedex 12 - www.asn.fr

Medical and dental radiodiagnosis appliance declaration form, available on *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 2010-DC-192 of 22 July 2010, approved by the order of 22 September 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 16 July 2009, supplemented by ASN decision 2009-DC-0162 of 20 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.

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 of the notification has been abolished, a new notification for regularly notified activities only becomes necessary if significant changes have been made to the installation (change in or addition of an appliance, transfer or substantial modification of the premises or change in the licence holder).

Licencing 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.

Licencing 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 licence exemption criteria adopted in Directive 96/29/Euratom (appendix 1, table A) were introduced into an appendix of the Public Health Code (table A, appendix 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 control organisations

Technical supervision of the radiation protection organisation, including supervision of the management of radioactive sources and any associated waste, is entrusted to approved organisations (article R. 1333-97 of the Public Health Code). The list of approved organisations is available on the ASN website (*www.asn.fr*). The type and frequency of the inspections were defined by the order of 26 October 2005, mentioned in point 1|2|1.

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

Decision 2008-DC-0109 of 19 August 2008 concerns the licensing system for the distribution, import and/or export of radionuclides 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 radio-immunology assay).

Decision 2008-DC-0108 of 19 August 2008 in particular concerns the licence to possess and use a particle accelerator (cyclotron) and the manufacture of radiopharmaceuticals containing a positon 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 inventory of sources is given to IRSN (article L. 1333-9 of the Public Health Code).

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

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

Health and 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 medico-legal 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 procedures

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 procedure and examinations*" guide (also called *"indication 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 (NRD) are one of the tools used for dose optimisation. The NRD are stipulated in article R. 1333-68 of the Public Health Code and were defined by the order of 12 February 2004. 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. These reference levels will be updated by conducting regular measurements or readings in line with the type of examination in each radiology and nuclear medicine department and centralising them at IRSN. The NRDs will be updated in 2010 by order of the Minister of Health.

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 19 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 of presence of radiation physicists in radiotherapy centres have been defined by decree (decree 2009-959 of 29 July 2009). They are applicable until the end of the interim period provided for in the health-care activities licensing system (decree 2007-388 of 21 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.

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 1 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 will be brought progressively into force before 26 September 2011 following a schedule specified in the decision.

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 3 March 2003. External quality control is entrusted to organisations approved by the Director General of the AFSSAPS (French Health Product Safety Agency)

Table 1 : list of Indication 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**	**Indication guide**	**Indication and procedure guide**	**External radiotherapy procedure guide**	**Indication 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

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 informing 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 18 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 22 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.

2|2|3 Forensic applications of ionising radiation

In the forensic field, ionising radiation are 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 are 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.

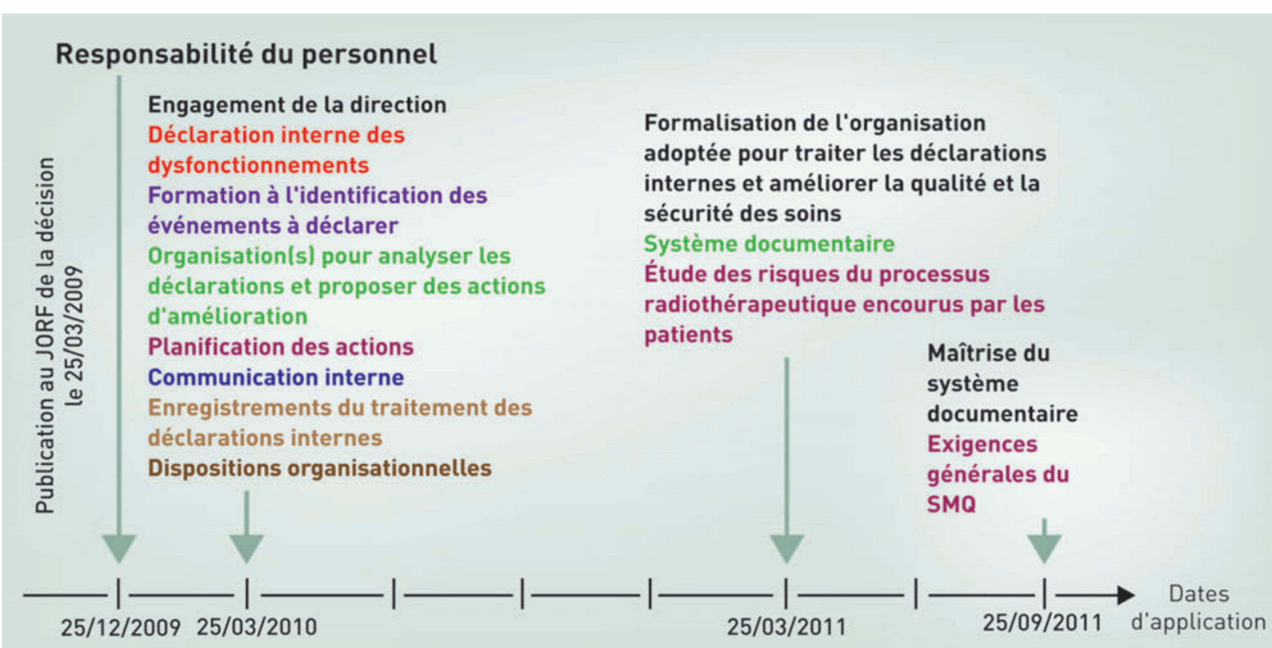
2|3 Protection of individuals exposed to enhanced natural ionising radiation

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;

Application calendar for ASN decision 2008-103 of 1 July 2008



– 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/m³, the implementing order of 22 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*[2] classified as having priority for radon measurement (see map below) ;
– 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 22 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 levels of 400 and 1,000 Bq/m³ were to be exceeded (O.G. of 22 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 7 April 2009, amended by decision 2010-DC-0181 of 15 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*.

Act 2009-879 of 21 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 7 August 2008 defined the workplaces in which these measurements are required and ASN decision 2008-DC-0110, approved by the order of 8 December 2008, specifies the reference levels above which the radon concentration must be reduced.

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

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

Professional activities that 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).

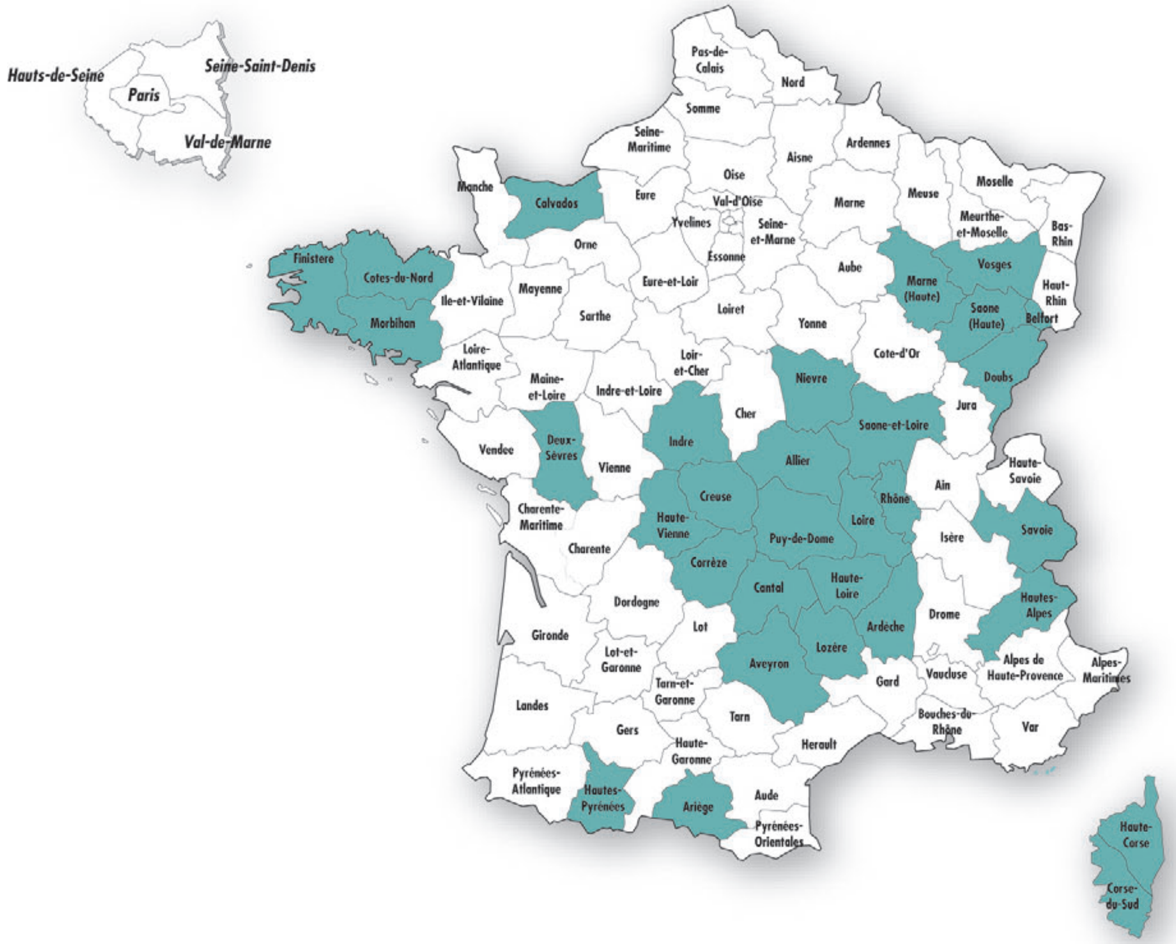
The order of 25 May 2005 defines the list of professional activities using raw materials naturally containing radionuclides, the handling of which can lead to significant exposure of the population or of workers.

For these activities, the Public Health Code requires an estimation of the doses to which the population 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 will also be 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 offers

Aerial view of Le Havre thermal power plant clarification of the technical measurement procedures for evaluating the doses received by the workers[3].

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 the exposure (particularly in the event of a declared pregnancy) and inform the personnel of the health risks. The order of 7 February 2004 defines the procedures for implementing these measures.



Map of the 31 *départements* prioritised for radon monitoring

3. 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.

3 THE LEGAL RULES AND REQUIREMENTS 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 population and the environment.

3|1 The legal bases

3|1|1 International conventions and standards

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 defines the main safety objectives and appropriate measures. Its counterpart 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).

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. These documents are not binding.

3|1|2 European texts

The Euratom Treaty

The Euratom Treaty, which was signed in 1957 and came into force in 1958, aimed at developing nuclear power while protecting the population 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 the informing of the Commission were incorporated into the decree of 2 November 2007. The decrees authorising creation of a BNI, or a modification leading to an increase in the discharge limit values, or final shutdown, can now only be issued after obtaining the opinion of the Commission.

The Directive of 25 June 2009

Directive 2009/71/Euratom of 25 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.

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).

Previously, only two resolutions of the Council in 1975 and 1992 concerning nuclear safety technology-related issues had asked the Member States to work more closely together on addressing basic safety issues.

3|1|3 National texts

The “TSN” Act and its implementing decrees

Part IV of the TSN Act creates the BNI authorisation and inspection system.

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.

Of the fifteen TSN Act implementing decrees, the following specifically concern BNIs:
– decree 2007-830 of 11 May 2007 concerning the list of BNIs;
– decree 2007-831 of 11 May 2007 determining the procedures for designating and approving nuclear safety inspectors;
– decree 2007-1557 of 2 November 2007 (amended) concerning BNIs and nuclear safety aspects of the transport of radioactive materials;
– decree 2010-882 of 27 July 2010 thus abolished the BNI Consultative Committee and transferred its consultative remit regarding certain regulatory texts relating to BNIs to the CSPRT (High Council for Technological Risk Prevention).
– decree 2008-251 of 12 March 2008 concerning the local information committees of BNIs.

The “Waste” Act and its implementing decrees

Act 2006-739 of 28 June 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.

The "BNI procedures" decree

BNI regulations are governed by decree 2007-1557 of 2 November 2007 concerning BNIs and the regulation of nuclear safety aspects of the transport of radioactive materials, known as the "BNI procedures" decree, implementing Article 36 of the "TSN" Act.

The "BNI procedures" decree 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 30 of the TSN Act, comprise all the general texts laying down the technical rules concerning nuclear safety, whether regulatory (ministerial orders and ASN regulatory decisions) or related (circulars, basic safety rules, ASN guides).

3|2|1 Ministerial and government orders

Quality organisation

The order of 10 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 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 public and the environment off the site.

The order of 31 December 1999 amended by the order of 31 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, 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 26 November 1999 order lays out the general technical

TO BE NOTED

Public consultation regarding the planned recasting of the general technical regulations

In the framework of the planned recasting of the general technical regulations applicable to BNIs, several draft regulatory texts (a draft order and ten draft ASN decisions) were submitted to public consultation in 2010.

This broad consultation was addressed to licensees, experts, environmental protection associations, union organisations and European safety authorities. The draft order was moreover posted on line on the MEDDTL (Ministry of Ecology, Sustainable Development, Transport and Housing) and ASN web sites for three months in order to collect comments from the public at large. ASN also posted the ten draft decisions on its web site.

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.

Pressure equipment

The general technical regulations concerning pressure equipment are presented in point 3|6.

3|2|2 Overhaul of the general technical regulations

Pursuant to the publication of the TSN Act 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 new technical regulations shall comprise:
- an order from the ministers responsible for nuclear safety establishing the essential requirements applicable to all BNIs to protect persons and the environment against the risks of accidents, chronic pollution or other detrimental factors;
- some twenty ASN decisions.

The "BNI system" draft order

A "BNI system" order will include in the basic provisions in effect today and integrate the reference levels defined by WENRA. Following the requisite discussions and consultations, this order should be adopted in 2011.

Regulatory decisions

Pursuant to article 4 of the TSN Act, ASN may issue decisions to clarify the decrees and orders in the field of nuclear safety or radiation protection. These decisions have to be approved by the Government.

ASN has defined a programme of regulatory decisions which will clarify the decree of 2 November 2007 and the new "BNI system" order.

The first ASN decision issued for application of the decree of 2 November 2007 is decision 2008-DC-106 of 11 July 2008 relating to the implementation of the BNI internal authorisations system.

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.

They are not, strictly speaking, regulatory documents. A licensee may decide not to follow the specifications of a BSR if it can demonstrate that the alternatives it will employ enable the same safety objectives to be met.

As part of the ongoing reorganisation of the general technical regulations, the BSRs are gradually being replaced by "ASN guides".

There are currently about forty BSRs and other technical rules issued by ASN, available on its website.

UNDERSTAND

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 exchange of experience and 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 to examine 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.

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

Part IV of the TSN Act makes provision for an authorisation decree for the creation of a BNI followed by any necessary licenses during its operation, from commissioning through to final shutdown and decommissioning, and including any modifications to the installation.

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. The review then focuses in particular on the socio-economic and safety aspects. 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.

Public debates were held in 2006 for the construction of an EPR nuclear reactor at Flamanville and for the siting of the ITER research reactor at Cadarache, and in 2010 for the construction of an EPR nuclear reactor at Penly. Smaller-scale projects can also give rise to a "local debate" initiatives. 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 by the industrial concern in charge of operating the installation, which thus acquires the status of licensee, to the ministers responsible for nuclear safety. The application is accompanied by a dossier comprising several items, including the detailed drawing of the installation, the impact assessment study, the preliminary safety analysis report, the risk management study and the decommissioning plan.

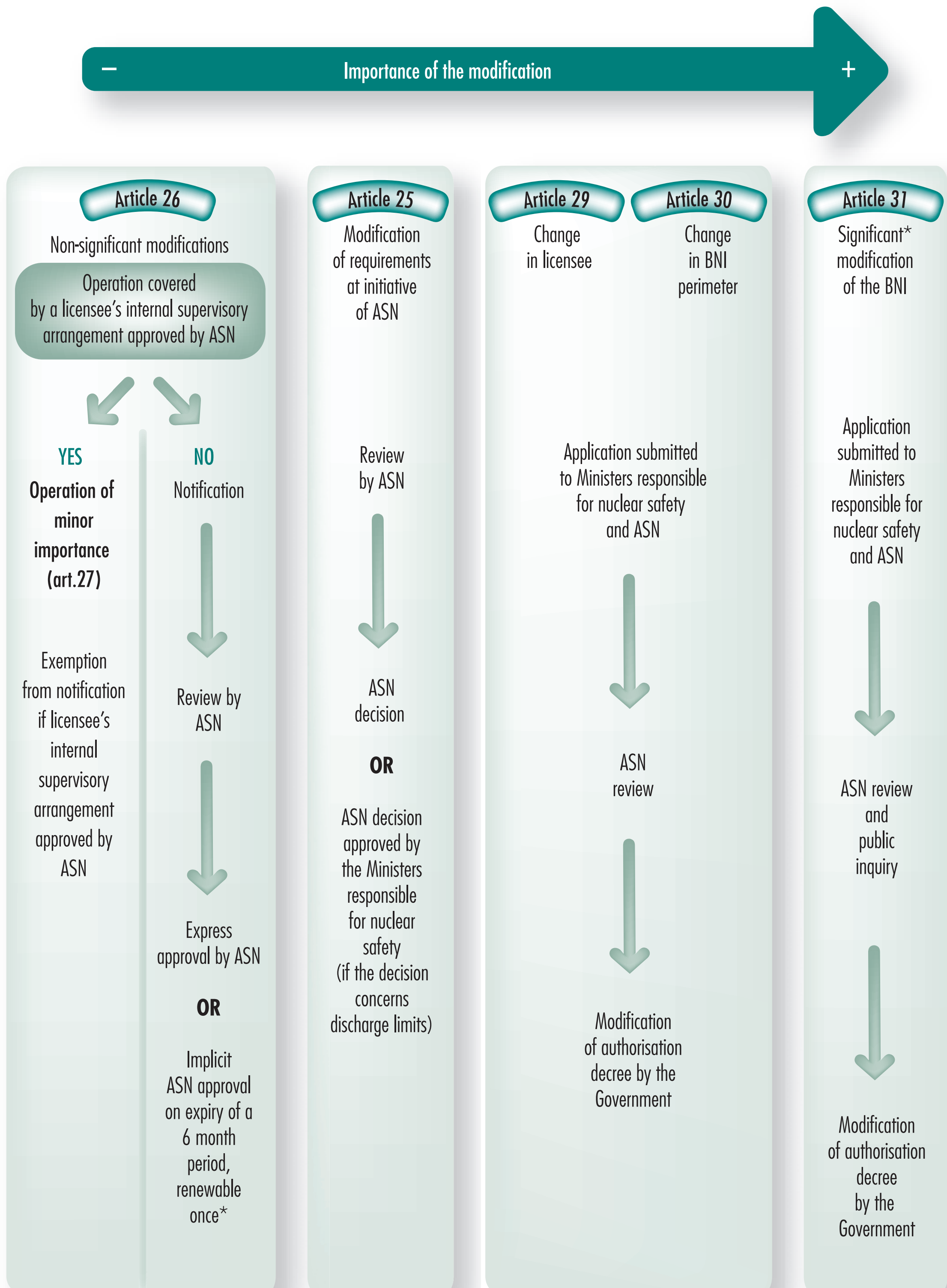
ASN is responsible for reviewing the dossier, jointly with the ministers responsible for nuclear safety. This is followed by a period of parallel consultation of the public and technical experts.

The impact assessment is submitted for its opinion to the environmental authority created within the Departmental Council for the Environment and Sustainable Development (CGEDD).

The public inquiry

The authorisation can only be given after a public inquiry as provided for in Article 29 of the TSN Act. The purpose of the inquiry is to inform the public and collect opinions, suggestions and counter-proposals, in such a way as to provide the

Diagram 1: 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.

competent authority with all the elements necessary for its own information before any decisions are made.

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.

The creation of a local information committee (CLI)

Article 22 of the TSN Act gave a formal status to the BNI local information committees (CLIs). 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

In application of article 37 of the treaty instituting the European Atomic Energy Community and the TSN Act, the authorisation decree for an installation that could discharge radioactive effluents into the environment can only be granted after consulting the Commission of the European Communities in application of article 37 of the treaty instituting the European Atomic Energy Community.

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 2)

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 13 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 authorisation decree sets the perimeter and characteristics of the installation and the particular rules by which the licensee is bound. The authorisation decree 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 II bis of article 29 of the TSN Act, created by the "Grenelle II" Act 2010-788 of 12 July 2010 providing for the French environmental commitment, information on BNI modification projects that could lead to a significant increase in water intakes or effluent discharges into the environment will now be made available to the public.

Modification of a BNI

Any significant modification to an installation is subject to a procedure similar to the authorisation decree application.

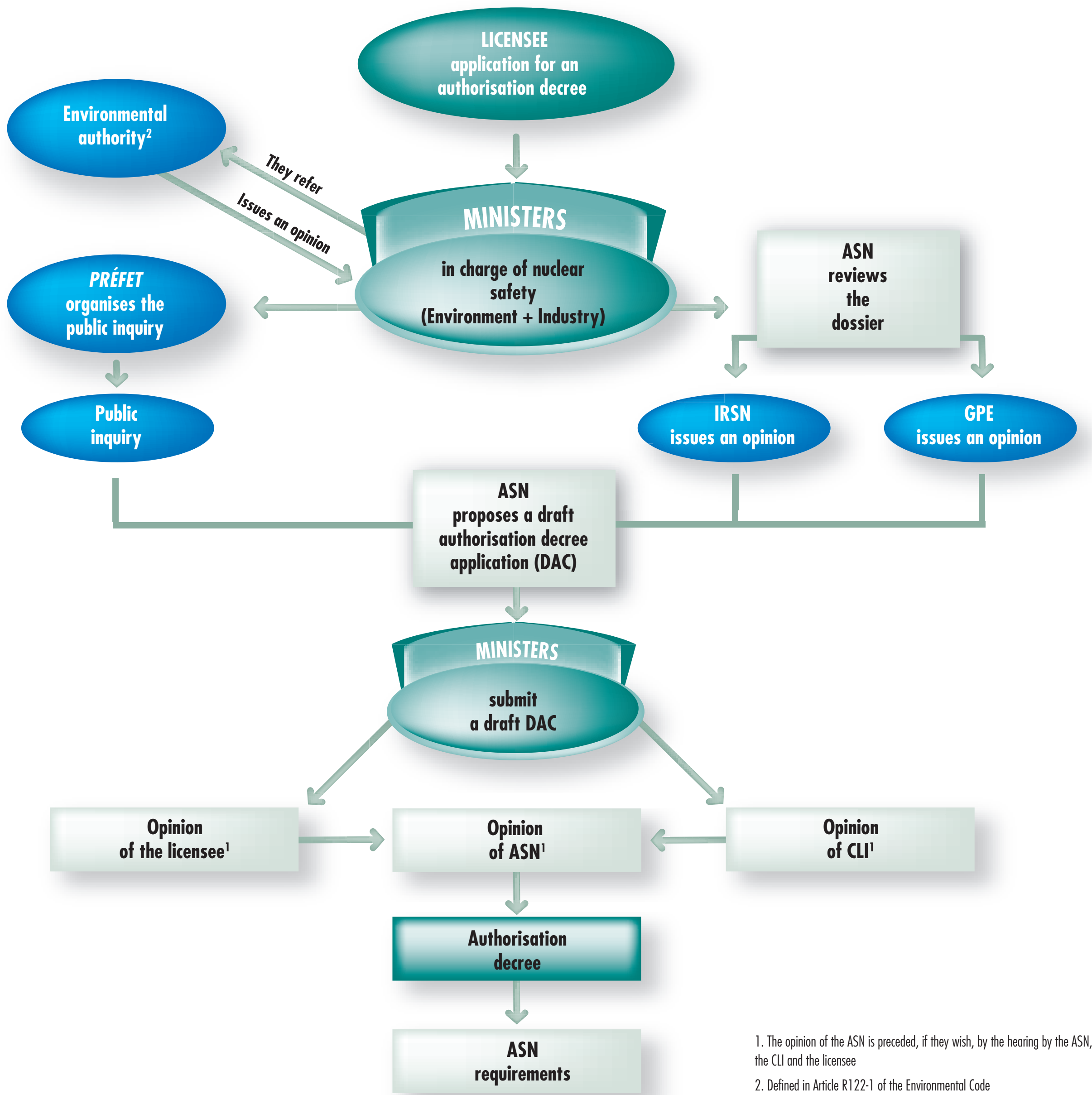
A modification is considered to be significant in the cases mentioned in article 31 of decree 2007-1557 of 2 November 2007, the "procedures" decree:
– a change in the nature of the installation or an increase in its maximum capacity;
– a change in the key elements regarding protection of the interests mentioned in section I of article 28 of the TSN Act, mentioned in the authorisation decree;
– a new BNI mentioned in section III of article 28 of the TSN Act is added within the perimeter of the installation and its operation is linked to that of the installation 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 period of at least six months, renewable once, has expired, unless ASN gives its express agreement. If it deems necessary, ASN can order that the planned modifications be reviewed or be accompanied by complementary measures to guarantee protection of the interests provided for by law.

The other installations located within a BNI perimeter

Two types of installation coexist within a BNI perimeter (TSN Act - article 28-V):
– 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.

Diagram 2: 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

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 (TSN Act - Articles 20 and 21)

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 communicates it to the local information committee.

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. In 2010, France presented a report on the application of the best available techniques for optimising discharges from BNIs.

3|4|2 BNI discharges

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 functioning" - 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, and more generally the technical regulations relative to discharges and the environment, take this matter into account. 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.

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.

IRSN technicians taking grass samples in the vicinity of the Tricastin nuclear power plant

The measures taken following the 2003 heat wave and drought meant that the 2006 drought episode was dealt with in good conditions, in particular ensuring full compliance with the discharge licences applicable. The summer of 2010 did not lead to any severe low-water situations or any very high temperatures in the watercourses concerned by the BNIs.

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.

As part of the revision of the general regulations applicable to BNIs, the requirements of the order of 31 December 1999 shall be taken up both in the “BNI system” order and in several of the decisions developing it, and notably the “environment decision” which was submitted to public consultation from 19 July 2010 to 15 October 2010.

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.

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 in 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 Management of BNI radioactive waste

The management of radioactive waste in BNIs is based more particularly on the provisions of the order of 31 December 1999 which establishes the general technical regulations for preventing and limiting nuisance factors and off-site risks resulting from operation of the BNIs. This order recalls the need for the licensee to take all necessary steps in the design and operation of its installations to ensure optimum management of the waste produced, taking account of the subsequent management solutions. This order requires drafting of a study specifying how the waste produced in BNIs is to be managed. One part of this study is submitted to ASN for approval. In the revision of the technical regulations applicable to BNIs, certain requirements relative to waste management in the BNIs will be integrated in the “BNI system” order. An ASN decision will supplement the requirements concerning management of the waste produced in BNIs. ASN submitted the draft decision to public consultation from 26 May to 31 August 2010.

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

Cleaning out a tank in the vitrification shop of Marcoule – August 2007

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 the TSN Act, final shutdown, followed by decommissioning of a nuclear installation, is authorised by a new decree, subject to the opinion 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 2 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;
– 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 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

Article 20 of the “Waste” Act provides for the securing of the costs associated with the decommissioning of nuclear installations and the 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 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 must also evaluate the cost of managing their spent fuels and radioactive waste (section I of article 20 of the Act of 28 June 2006). 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 28 October 1943 concerning pressure equipment used on land and gas pressure equipment used on land or on-board inland waterway boats, and those of the decree of 2 April 1926 as amended regulating pressure equipment other than that installed on-board ships, decree 63 of 18 January 1943 as amended, regulating gas pressure equipment, or decree 99-1046 of 13 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 13 December 1999 and specific orders. The “BNI system” order, of which the draft is mentioned in point 3|2|2, will replace these orders and will be clarified by ASN regulatory decisions.

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 12 May 2009 simplifying and clarifying the law and relaxing procedures, modified the Act of 28 October 1943, giving ASN additional competence for verification 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 2 April 1926 • Order of 26 February 1974(1)	• Decree of 2 April 1926 • BSR II.3.8 of 8 June 1905(1)	• Decree of 2 April 1926 • Decree of 18 January 1943 or decree 99-1046 of 13 December 1999	• Decree 99-1046 of 13 December 1999
	or Order of 12 December 2005			
Operation	• Order of 10 November 1999		• Decree of 2 April 1926 • Decree of 18 January 1943(1)	• Decree 99-1046 of 13 December 1999 • Order of 30 March 2005

(1) As of 2011, the order of 12 December 2005 will apply 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 24 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 have been fully transposed into French law and have been implemented by government orders. For this purpose, ASN is in contact with the administrations in charge of the various modes of transport (Directorate General for Infrastructure, Transport and the Sea – DGITM – General Directorate for risk prevention – DGPR and General Directorate for Civil Aviation – DGAC) and sits on the French Interministerial Commission for the Carriage of Dangerous Goods (CITMD).

The directive of 24 September 2008 is transposed into French law by a single order covering all land transport on the national territory. This is the order of 29 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.

Other orders specific to a mode of transport are applicable to the transport of radioactive materials:
– the order of 12 May 1997 as modified, concerning the technical conditions for the operation of aircraft by a public air transport operator (OPS1);
– the order of 23 November 1987 as modified, division 411 of the regulation concerning the safety of ships (RSN);
– the order of 18 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

IAEA TS-R-1 and maritime (IMDG) and air (IT ICAO) transport regulations subject to either notification 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 transport regulations

5 REQUIREMENTS APPLICABLE TO CERTAIN RISKS OR CERTAIN PARTICULAR ACTIVITIES

5|1 Installations classified on environmental protection grounds (ICPEs) using radioactive materials

The ICPE system 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, manufacture, transformation, packaging, utilisation, accumulation, storage or disposal of radioactive substances. These activities are subject to notification or licensing, depending on the quantity of radionuclides used. However, these activities are only covered by the ICPE system if the establishment in which they are used is subject to licensing under this system 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 28 of the TSN Act, an installation covered by the list of ICPEs which is also covered by the BNI system would in fact only be subject to the latter system.

By virtue of article L.1333-4 of the Public Health Code, the licences issued to ICPEs in accordance with the Environment Code for the possession or use of radioactive sources act as the licences required under the Public Health Code. However, except with respect to procedures, the regulatory requirements of the Public Health Code apply to them.

5|2 The regulations designed to combat malicious acts in nuclear activities

The systems mentioned above often take account of the fight against malicious acts, at least in part. For example, in the BNI system, the licensee must in its report present a safety analysis of the accidents liable to occur in the installation, regardless of the cause of the accident, even 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 and 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 must be licensed;

– 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 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 population". 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 others, 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 III of Article 2 of the TSN Act, other requirements are specific to defence-related nuclear activities and installations: they are for example subject to particular information rules to take account of the specific requirements of the defence sector. 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 to publish the technical decisions required by the Public Health Code and the Labour Code. Numerous technical decisions are still expected in 2011, including those concerning the design and operation rules for medical facilities using ionising radiation, the recording, monitoring, recovery and disposal of sources, and the identification and marking of high-activity sealed sources.

ASN will moreover assist the Government in the forthcoming consultations on the draft Euratom directive and the subsequent work to transpose this new directive into national law.

As regards BNIs, ASN will continue its revising of the general technical regulations in 2011, in collaboration with the Ministry of Ecology, Sustainable Development, Transport and Housing. Publication of the "BNI system" ministerial order will be followed in the course of the year by the publication of some twenty regulatory decisions clarifying the provisions of decree 2007-1557 of 2 November 2007 and the above order. Several draft decisions were submitted to the stakeholders for consultation along with the "BNI system" draft order in 2010. After analysing their observations, the draft text will be modified as and where necessary and proposed to the ministers responsible for nuclear safety. Entry into force of these decisions will mark the completion of the transposition into French law of the "reference levels" adopted by WENRA.

ASN will also help to produce the implementing decrees for the provisions of the Grenelle II Act relative to impact studies and public inquiries.

Working groups will be set up in 2011 for the forthcoming revision of the radioactive material transport regulations (future 2012/2013 edition). 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, the study into the setting up of a system to control the "security of sources", which began several months ago, should be able to be concluded in 2011. This system will aim at guaranteeing the application of measures to protect the most dangerous sources of ionising radiation against malicious acts, from production through to disposal. If these measures are adopted, they should be incorporated in the legislative part of 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 whole 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 5 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 cm2 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 Article 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 medico-legal 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 14 October 2003, circular of 10 March 2000	Expressed in effective dose (except for iodine), these levels are designed to assist with the relevant response decision to protect the population: • 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

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Action levels (Public Health Code and Labour Code) and activity or dose levels above which actions 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/m^3 1.000 Bq/m^3	☞ 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/m^3	
	Enhanced natural exposure (other than radon)		
Protection of the general public Article 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 Article 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**	**Dairy products**	**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, in particular ^{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 18 July 1989 amending Regulation 3954/87/Euratom of 22 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 29 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	1000	1000
Sulphur 35, cobalt 60, strontium 89, ruthenium 103, caesium 134, caesium 137, cerium 144, iridium 192		
Tritium, carbon 14, technetium 99	10000	1000

Source: Codex alimentarius, July 2006

REGULATION OF NUCLEAR ACTIVITIES AND EXPOSURE TO IONISING RADIATION

CHAPTER 4

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 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. It materialises its action by decisions, instructions, inspection follow-up documents and assessments of safety and radiation protection by 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 where applicable:
– 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, reviewing of operating reports and analysing 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

Pursuant to Article 4 of the Nuclear Security and Transparency (TSN) Act, ASN regulates compliance with the general rules and particular requirements of safety and radiation protection, applicable to:
– licensees of basic nuclear installations (BNIs);
– those in charge of the construction and operation of pressure equipment (PE) in BNIs;
– those in charge of radioactive material transport (RMT);
– those in charge of activities entailing a risk of exposure of individuals and workers to ionising radiation;
– those in charge of implementing ionising radiation exposure monitoring measures;
– the organisations and laboratories it approves, to enable them to participate in safety or radiation protection control and monitoring.

In this chapter, these entities are called the "licensees".

Although historically based on verifying the technical conformity of facilities and activities with regulations or standards, regulation today also covers a broader field incorporating human

ASN inspection on the site of the EURODIF plant in Tricastin – March 2010 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, 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 (publication No. SF-1):
– responsibility for safety lies with the nuclear licensee, who is the originator of the risk;
– the regulatory body has the legal authority, the technical and management skills and the financial resources necessary to fulfil its responsibilities. It must be independent of the licensees and of any other organisations, so that stakeholders cannot exert undue pressure on it.

In France, pursuant to the TSN Act, ASN is the regulatory body meeting these criteria.

Regulating BNIs

The safety of BNIs is guaranteed by a series of strong, leaktight barriers, for which the safety analysis must demonstrate the resistance in normal and accident conditions. There are generally three barriers. For power reactors, these are the fuel cladding, the primary system boundary, the reactor building containment and a secondary containment where applicable.

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 installations, and the waste management, effluents discharge control 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).

Article 4 of the TSN Act 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 pressurised equipment specially designed for these installations". ASN checks implementation of the regulations for pressure equipment used in a BNI. Furthermore, so that the BNI licensees only have to deal with a single point of contact, article 50 of Act 2009-526 of 12 May 2009 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, disposition of non-conformities 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 radioactive material transport (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 the 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.
Radiation protection inspection bodies	Application file for approval to perform the inspections specified in article R. 1333-95 of the Public Health Code and articles R. 4452-12 to R. 4452-17 of the Labour Code. Review of the file and audit of the organisation. Leads to issue of approval. (48 organisations approved as at 31/12/2010).	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 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 subcontractors 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: inspection, 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 conventional safety 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 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 conventional safety 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 for statutory and social issues concerning companies and organisations involved in providing the public gas and electricity service.

In 2009, ASN 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.

Strong-implication activities in 2010 are presented in table 2.

2|2 Setting down the principle of licensee prime responsibility

ASN considers that operations taking place in BNIs that represent 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 "internal authorisations system". It is presented to the competent local information committee (CLI).

Table 2: significant activities in 2010

Field	Strong-implication topics or activities
BNIs including: – NPPs – Research reactors – Laboratories and plants – Installations undergoing decommissioning	– Reactor outages – 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	Compliance with quality assurance requirements for radioactive material transport – Packages not requiring approval – Internal transport

This internal authorisations system is regulated by the decree of 2 November 2007 and by ASN decision 2008-DC-106 of 11 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 with competence for 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, and so on.

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 level 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

Paragraph 2 of article 4 of the TSN Act states that "ASN issues the required approvals to the bodies participating in safety or radiation protection control and monitoring". Depending on the health or safety implications of a nuclear activity or 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 (www.asn.fr "Bulletin officiel de l'ASN/agréments d'organismes" section, available in French only).

In 2010, ASN issued:
– 18 new or renewed approvals for organisations responsible for radiation protection inspections;
– 22 approvals for level 1 radon activity concentration measurements;
– 7 approvals for worker dosimetry (2 for internal monitoring of workers and 5 for external monitoring of workers).
– 208 approvals for measurement of environmental radioactivity.

ASN sends the General Directorate for Health 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 fulfil its regulatory responsibility. 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 inspection of radioactive material transport (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 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.

ASN inspectors examine document conformity during the ten-year inspection of the Tricastin NPP – May 2010

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 those of 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.

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 TSN Act, 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 applications provided for 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:
– 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.

ASN focuses its inspection resources on activities and topics for which the implications are particularly strong. For the other activities, ASN relies in particular on the organisations it has approved. However, to avoid ignoring activities of lesser significance, it does devote a part of its inspection programme to them through targeted action.

ASN inspection of the medicine service of the North Saint-Denis Cardiology Centre – December 2010

TO BE NOTED IN 2010

National inspection campaign in application of radiation protection rules for workers

This inspection campaign, which ran from 3 May to 30 September 2010, was organised jointly by the DGT (General Directorate for Labour), ASN, and the CNAM (French national health insurance fund) for salaried workers. Its main objectives were to review the situation regarding application of the radiation protection provisions of the Labour Code and to identify the main difficulties in applying this regulation.

2,333 inspections, of which 23% were unannounced, were carried out in the following sectors:

– Conventional radiology
- *Medical sector*
- *Dental surgery*
- *Veterinary medicine*

– Industry
- *ICPE (installation classified on environmental protection grounds) classified on account of an industrial activity and possessing a sealed source (category 1715)*
- *Activity possessing a sealed source used as a measuring gauge*
- *Service provider subject to authorisation on account of the Public Health Code (mammography excluded)*

– Baggage inspection

A national report drawn up from the analysis of all the results of this campaign will be released jointly by the DGT and 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.

The inspections are generally carried out by two inspectors, with the support of an IRSN representative specialised in the facility visited or the topic of the inspection. 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.

To achieve its goals:

a) ASN employs inspectors chosen for their professional experience and for their legal and technical expertise.

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.
– adopted a number of foreign practices identified through inspector exchanges between regulatory bodies. 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 on the part of its inspectors to other regulatory practices. 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 11 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).

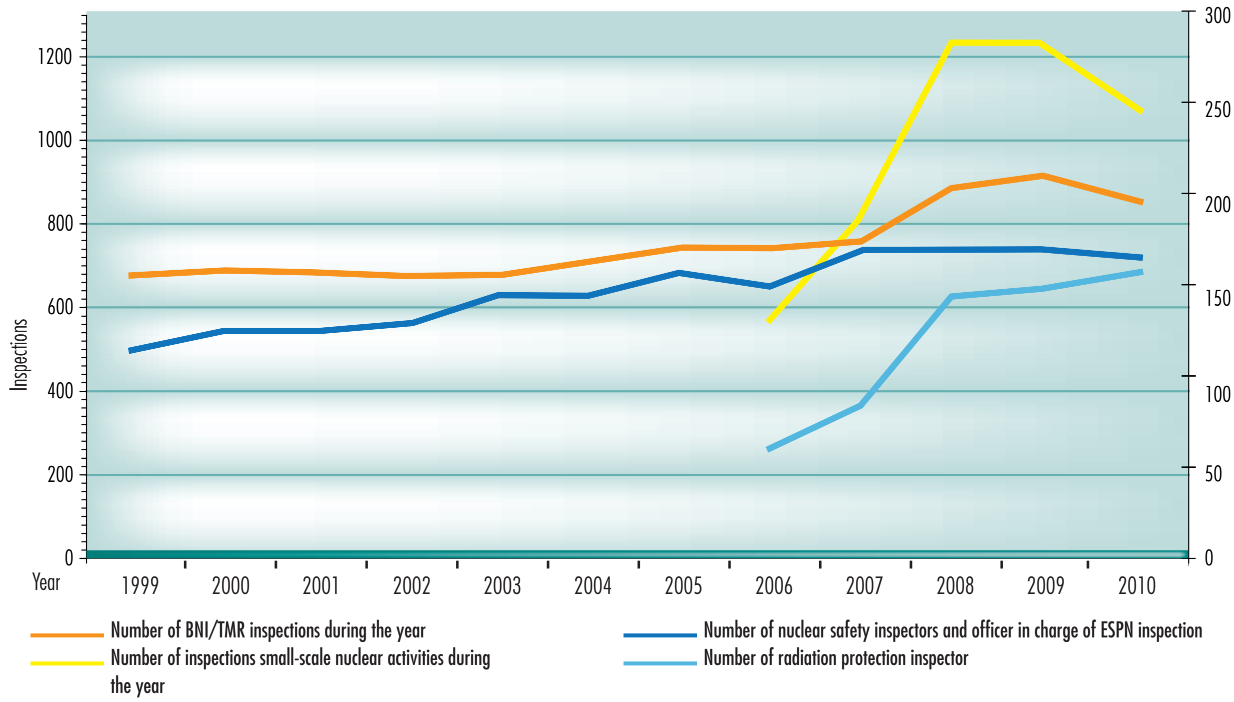
Table 3 presents the inspector staffing levels on 31 December 2010. Some inspectors are qualified in several inspection domains.

In 2010, ASN carried out 1,964 inspections on BNIs, radioactive material transport, activities using ionising radiation, organisations and laboratories it has approved and activities involving pressure equipment.

Table 3: Number of inspectors per inspection domain (as at 31.12.2010)

Type of inspector	Departments	Divisions	Total
Nuclear safety inspector (BNI)	75	85	**160**
Pressure equipment (PE) inspector	11	31	**42**
Nuclear safety inspector (transport)	9	35	**44**
Radiation protection inspector	45	108	**153**
Labour inspector	1	12	**13**
Number of inspectors (all fields included)	101	147	**248**

Graph 1: Trends for the number of ASN inspectors and inspections



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. It identifies the facilities, activities and subjects targeted. This is not known beforehand to those in charge of nuclear activities.

c) ASN trains its inspectors and provides them with inspection guides and decision-making aids concerning any follow-up to deviations observed.

d) 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.

e) ASN informs the public by posting its inspection follow-up letters and publications on its website www.asn.fr (see chapter 6).

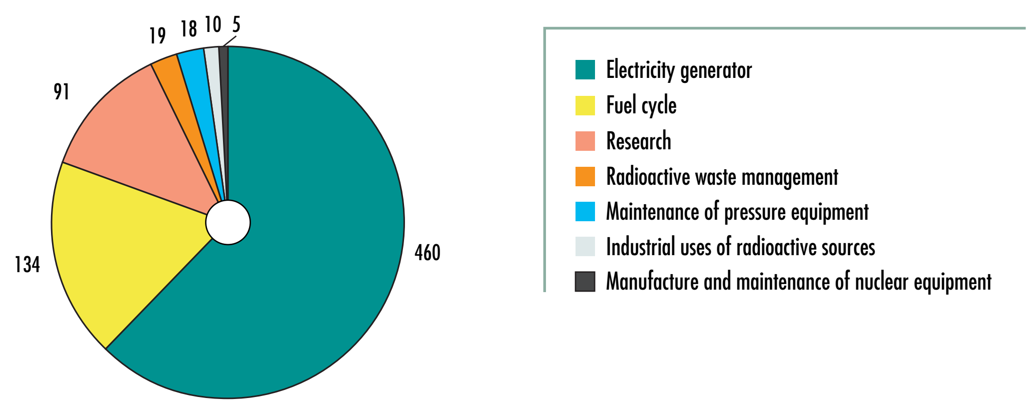
f) ASN is setting up a system for continuous improvement of its inspection process, which can be based on internal and external audits.

3|2|3 Inspection of BNIs and pressure equipment in 2010

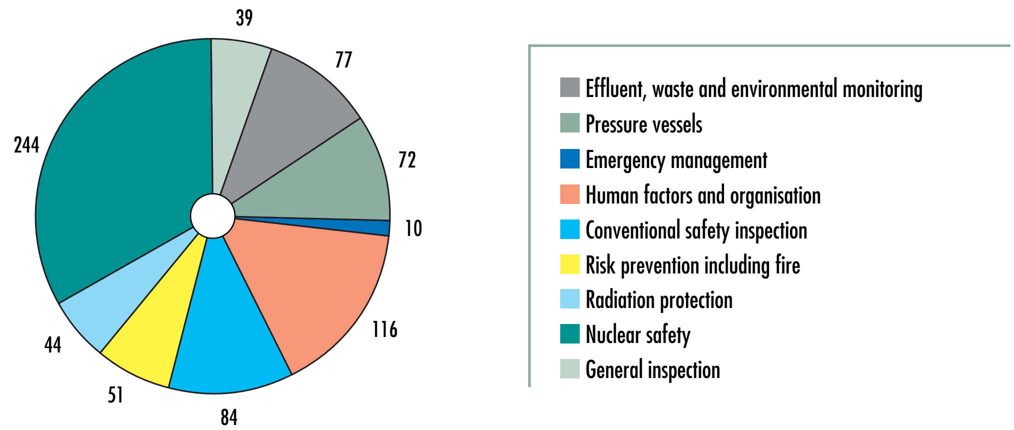
In 2010, 737 inspections were carried out, of which 181 (25%) were unannounced BNI inspections. The breakdown according to the various installation categories is described in the following graphs.

In 2010, ASN also delegated 884 inspections to approved organisations to assess the conformity of nuclear pressure equipment.

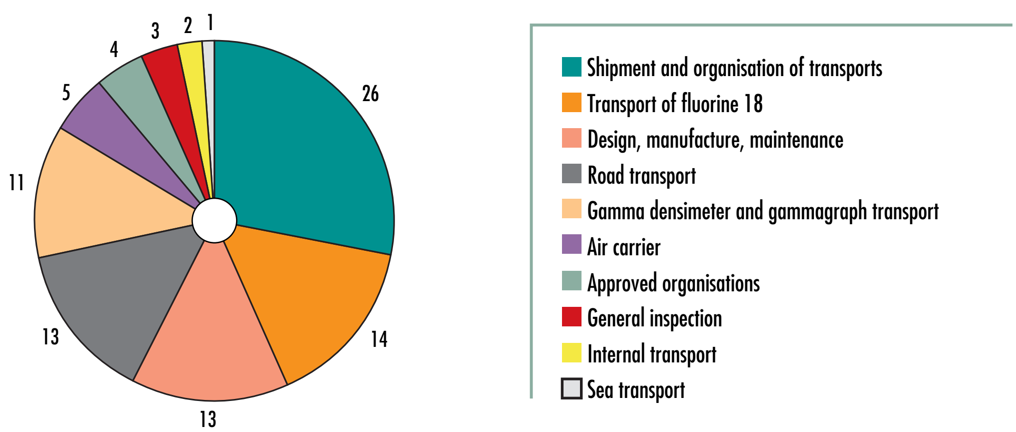
Graph 2: Breakdown of BNI inspections in 2010 by type of activity



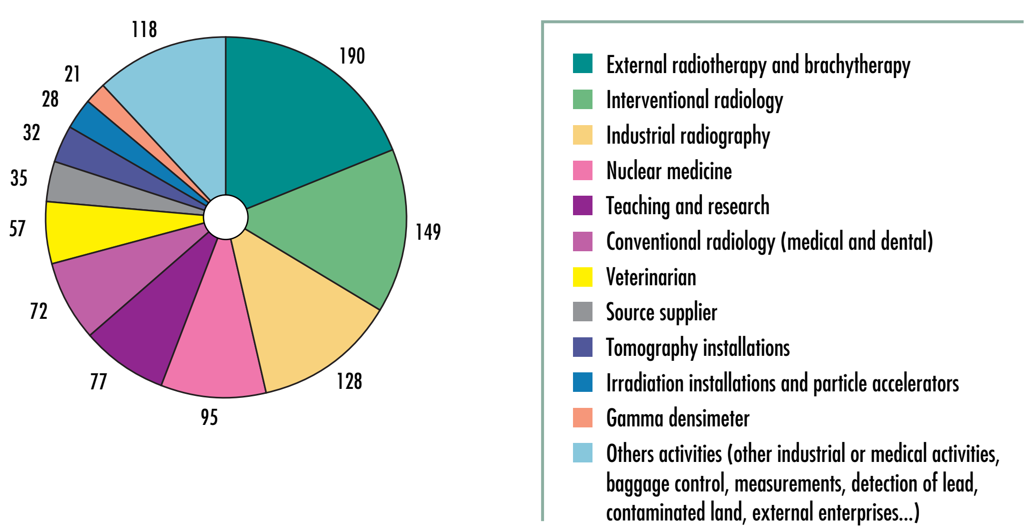
Graph 3: Breakdown of BNI inspections in 2010 by topic



Graph 4: Breakdown of radioactive material transport inspections in 2010 by topic



Graph 5: Breakdown of inspections in the small-scale nuclear sector in 2010, by type of activity



3|2|4 Inspection of radioactive material transport in 2010

The 92 inspections on transport activities in 2010 can be broken down according to topic as shown in graph 4.

3|2|5 Inspection of small-scale nuclear activities in 2010

ASN organises its inspection actions so that they are proportionate to the radiological risks involved in the use of ionising radiation, and consistent with the actions of the other inspection services. On the 50,000 or so nuclear facilities and activities in the sector, ASN carried out 1,002 inspections in 2010, including 549 in the medical sector, 418 in industry or research and 35 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 5.

3|2|6 Inspection of ASN approved organisations and laboratories in 2010

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;
– supervisory checks, which are usually unannounced, to ensure that the organisation's staff work in satisfactory conditions.

In 2010, ASN carried out 133 inspections of approved organisations and laboratories, broken down as follows:
– organisations carrying out radiation protection technical checks: 103 including 66 unannounced supervisory checks;
– organisations evaluating nuclear pressure equipment conformity and inspecting operational equipment: 15 inspections;
– organisations measuring radon activity concentration: 5 inspections;
– laboratories approved for environmental radioactivity measurements: 10 inspections.

3|2|7 Checks on exposure to radon and Naturally Occurring Radioactive Materials (NORM) in 2010

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).

a) 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 15 September and 30 April of the following year.

For the 2010-2011 measurement campaign, the number of approved organisations is indicated in table 4.

b) Monitoring exposure to natural ionising radiation in non-nuclear industries

The order of 25 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 2007-2010 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.

The inspection and evaluation actions taken in collaboration with the conventional safety inspectorate and the ICPE inspectorate were carried out over the period 2008-2010. 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.

c) Monitoring natural radioactivity in water intended for human consumption

Since 1 January 2005 (order of 12 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. The checks take account of the recommendations issued by ASN (DGS circular of 13 June 2008) and the results concerning the radiological

Table 4: Number of organisations approved for measuring radon levels

	Approval until 15 september 2011	Approval until 15 september 2012	Approval until 15 september 2015
Level 1 or Level 1 option A	18	15	8
Level 1 option B	6		
Level 2.	5		1

The Saint-Laurent-des-Eaux NPP viewed from the banks of the River Loire

quality of this water are jointly analysed by the Ministry for Health and ASN. 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 BNI discharges

a) 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 in particular concern effluents (monitoring of discharge activity level, characterisation of certain types of effluents prior to discharge, etc.). They also contain provisions for monitoring in the environment (checks during discharge, sampling of air, milk, grass, etc.). Lastly, the measuring 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 20 inspections - with sampling - every year (16 in 2010).

b) 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.

Accounting 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. 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. All these rules will be put down in writing in the general regulations applicable to BNIs, which are currently being revised.

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.

UNDERSTAND

Reference spectra used for NPPs

As an example, the following reference spectra are used for NPPs

– *Liquide:*
  – ^{3}H,
  – ^{14}C,
  – *Iodines :* ^{131}I,
  – *Other fission and activation materials :* ^{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 materials:* ^{58}Co, ^{60}Co, ^{134}Cs, ^{137}Cs.

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 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/year) defined in article R.1333-8 of the Public Health Code.

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. 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).

Table 5: radiological impact of BNIs since 2004 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					
		2004	2005	2006	2007	2008	2009
AREVA/La Hague	Digulleville (Child / 2.6) Pêcheur 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}	1.10^{-2} 6.10^{-3}	8.10^{-3} 5.10^{-3}	8.10^{-3} 4.10^{-3}
GANIL/Caen	IUT (adult / 0.6)	3.10^{-3}	2.10^{-3}	3.10^{-3}	$< 6.10^{-3}$	$< 9.10^{-3}$ [b]	3.10^{-3}
EDF/Penly	Saint-Martin Plage, Vassonville (2009) (adult / 1.05) (2009: fisherman / 0.7)	1.10^{-3}	9.10^{-4}	5.10^{-4}	6.10^{-4}	3.10^{-3}	9.10^{-4}
EDF/Cattenom	Garche nord, Warpich (2009) (adult / 2.15) (2009: baby / 1.5)	2.10^{-3}	2.10^{-3}	3.10^{-3}	3.10^{-3}	3.10^{-3}	3.10^{-3}
CEA/Cadarache	Saint-Paul-Lez-Durance [adult / 2]	8.10^{-3}	8.10^{-3}	3.10^{-4}	2.10^{-3}	2.10^{-3}	2.10^{-3}
EDF/Chooz	Les Pirettes (gymnase) (adult (2009: baby) / 0.75)	*	*	*	*	2.10^{-3}	1.10^{-3}

Table continued

Licensee/Site	Most exposed reference group (population/distance from site in km)[a]	Estimation of received doses, in mSv					
		2004	2005	2006	2007	2008	2009
EDF/Dampierre	La Maison Neuve, Les Serres (2009) [adult / 0,9 (2009: adult / 0.7)]	*	*	*	*	8.10^{-4}	1.10^{-3}
EDF/Gravelines	Petit-Fort-Philippe, Esp. Cult. Decaestecker (2009) [adult (2009: fisherman) / 1.45 (2009: 1.1)]	2.10^{-4}	2.10^{-4}	3.10^{-4}	3.10^{-4}	3.10^{-4}	1.10^{-3}
EDF/Flamanville	La Berquerie, Hameau es Louis (2009) [adult / 0.8] [2009: fisherman / 0.8]	3.10^{-3}	5.10^{-3}	5.10^{-3}	1.10^{-3}	7.10^{-4}	9.10^{-4}
EDF/Golfech	Pascalet, Labaquière (2009) [adult / 0.85] [2009: adult: 1]	2.10^{-4}	2.10^{-4}	2.10^{-4}	5.10^{-4}	8.10^{-4}	8.10^{-4}
AREVA/FBFC	Ferme Riffard [adult / 0.2]	*	*	*	*	6.10^{-4}	8.10^{-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}	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}
EDF/Belleville-sur-Loire	Neuvy sur Loire [adult / 1.3]	2.10^{-4}	2.10^{-4}	2.10^{-4}	2.10^{-4}	6.10^{-4}	7.10^{-4}
EDF/Civaux	Ervaux sud [adult / 0.7]	*	*	*	*	8.10^{-4}	7.10^{-4}
EDF/Tricastin	Clos du Bonneau, Le Trop Long (2009) [adult / 1.25] [2009: baby / 1.25]	7.10^{-5}	7.10^{-5}	6.10^{-5}	7.10^{-5}	4.10^{-4}	7.10^{-4}
ANDRA/Manche	Hameau de La Fosse [adult / 2.5]	9.10^{-4}	8.10^{-4}	8.10^{-4}	7.10^{-4}	7.10^{-4}	6.10^{-4}
	Fisherman Goury [adult / 8]	7.10^{-8}	7.10^{-7}	8.10^{-8}	9.10^{-8}	5.10^{-8}	8.10^{-8}
EDF/Paluel	Le Tôt [adult (2009: fisherman) / 1.45]	2.10^{-3}	2.10^{-3}	2.10^{-3}	2.10^{-3}	2.10^{-3}	6.10^{-4}
EDF/Nogent-sur-Seine	Port Saint-Nicolas, Maison de l'éclusier (2009) [adult / 2.25] [2009: adult / 1]	6.10^{-4}	7.10^{-4}	8.10^{-4}	9.10^{-4}	7.10^{-4}	6.10^{-4}
EDF/Blayais	Le Bastion [adult (2009: fisherman) / 1.1]	3.10^{-4}	4.10^{-4}	4.10^{-4}	4.10^{-4}	5.10^{-4}	5.10^{-4}
EDF/Bugey	St Etienne d'Hières sud [adult / 0.45]	*	*	*	*	5.10^{-4}	5.10^{-4}
EDF/Cruas-Meysse	Ferme de Grimaud, Serres (2009) [adult / 1.25] [2009: baby / 1.1]	2.10^{-4}	2.10^{-4}	2.10^{-4}	8.10^{-5}	4.10^{-4}	5.10^{-4}
CEA/Saclay	Fisherman, Christ de Saclay [adult / 1] Farmer, Christ de Saclay [adult / 1]	4.10^{-3} 7.10^{-4}	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} *
EDF/St-Alban	Les Crès [adult / 1.45]	9.10^{-5}	2.10^{-4}	2.10^{-4}	7.10^{-5}	3.10^{-4}	4.10^{-4}
CEA/Marcoule (ATALANTE, CENTRACO, PHÉNIX, MÉLOX, CIS-Bio)	Codolet [adult / 2]	4.10^{-4}	4.10^{-4}	4.10^{-4}	5.10^{-4}	4.10^{-4}	4.10^{-4}
EDF/Chinon	Le Neman [adult / 1.25]	3.10^{-4}	3.10^{-4}	3.10^{-4}	2.10^{-4}	4.10^{-4}	4.10^{-4}
EDF/St-Laurent-des-Eaux	Port au Vin [adult / 0.75]	7.10^{-5}	7.10^{-5}	9.10^{-5}	2.10^{-4}	4.10^{-4}	3.10^{-4}
ILL/Grenoble	Fontaine (gaseous discharges) and Saint-Egrève (liquid discharges) [Baby / 1 (Fontaine); 1.4 (Saint-Egrève)]	*	*	*	*	*	1.10^{-4}
EDF/Fessenheim	Cité EDF (Koechlin) [adult / 1.2]	*	*	*	*	8.10^{-5}	8.10^{-5}
EDF/Creys Malville	Ferme de Chancillon [adult / 0.85]	*	*	*	1.10^{-5}	$2. 10^{-5}$	*
CEA/Fontenay-aux-Roses	Fontenay aux Roses [child / 1.5]	2.10^{-5}	2.10^{-5}	2.10^{-5}	9.10^{-6}	1.10^{-5}	5.10^{-6}
ANDRA/CSA	Pont du CD24 [child / 2.1]	8.10^{-6}	6.10^{-6}	5.10^{-6}	3.10^{-6}	2.10^{-6}	5.10^{-6}
CEA/Grenoble [c]	Fontaine (gaseous discharges) and Saint-Egrève (liquid discharges) [baby (2004, 2008: adult) / 1 (Fontaine); 1.4 (Saint-Egrève)]	7.10^{-6}	7.10^{-7}	2.10^{-6}	7.10^{-7}	1.10^{-6}	3.10^{-7}
	Saint-Egrève [baby (2004, 2007: adult) / 1.4 (liquid) ; 3.9 (gaseous)]	3.10^{-6}	4.10^{-7}	8.10^{-7}	3.10^{-7}	6.10^{-7}	*

a: For installations operated by EDF, only "adult" figures are calculated. It is now the dose of the reference group most exposed to every site that is mentioned.
b: This figure is grossly 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.

An estimation of the effective doses from BNIs is presented in table 5.

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 installations. 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 specific to each site, 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 1 mSv 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

a) 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 5 September 1997; Article 19vi of the Convention on Nuclear Safety of 20 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 principles and reiterating the obligations binding on the licensees with regard to notification of incidents and accidents:
– the 21 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 15 June 2007 (modified on 7 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 are used (medical, industrial and research activities). It has been used since 1 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*.

b) 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 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.

This system is not to intended to identify or penalise any individual person or party.

3 | 4 | 2 Implementation of the approach

a) 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

The Tritium White Paper

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, have reached their conclusions and the recommendations of the two think-tanks were submitted 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 underpin 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 has proposed a plan of action on the standardisation of the measurement of tritium, the control of tritiated discharges, the improvement of environmental monitoring and the 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. With regard to the radiological impact, ASN has asked the licensees to supplement their impact studies by a critical study, taking a tritium impact that is twice that considered previously.

The Tritium White Paper and the ASN plan of action are available on the website www.asn.fr
http://livre-blanc-tritium.asn.fr.

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 (see point 3|4|1), is not applicable if the consequences of the event necessitate intervention by the public authorities.

b) 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 and 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 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 radioactive material transport as well as those which can occur during activities entailing a risk of

1. *Département* : administrative region headed by a *préfet*.

human exposure to ionising radiation, in particular activities carried out for medical purposes.

The TSN Act gives ASN the power to set up a board of inquiry, to determine who sits on it, to define the objectives and scope of the investigations and to access the necessary data 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. It is for this purpose that ASN will use the recommendations issued by the board of inquiry;
– the 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 6 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 2010

In 2010, ASN was notified of:
– 1033 significant events for the BNIs, concerning nuclear safety, radiation protection and the environment, 886 of which were classified on the INES scale;
– 62 significant events concerning the transport of radioactive materials;
– 494 significant events concerning radiation protection in small-scale nuclear activities, 159 of which were classified on the INES scale.

This number, which is stable for the BNIs and transport, is regularly increasing in small-scale nuclear activities because the persons in charge of these activities have widely adopted the notification procedure.

The distribution of significant events classified on the INES scale is specified in table 6. The INES scale is not applicable to patients, which are classified on the ASN-SFRO scale of significant events affecting one or more radiotherapy patients, and is described in chapter 9.

Graphs 6 to 12 below describe in detail the significant events notified to ASN in 2010, differentiating between the various notification criteria for each domain.

3|5 Raising awareness

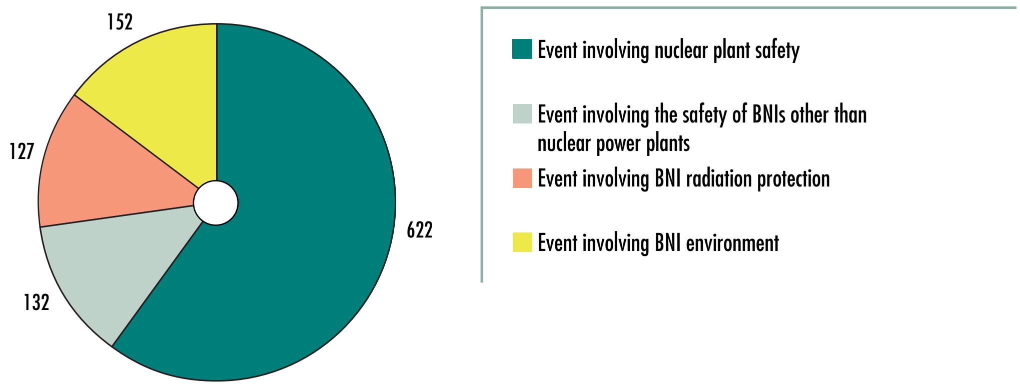
Compliance with the regulations can also be obtained through education. Regulation is thus supplemented by awareness programmes designed to ensure familiarity with the regulations and their application in practical terms appropriate to the various professions. ASN aims to encourage and support initiatives by the professional organisations who implement this approach by issuing good practice and professional information guides (see chapter 9).

Table 6: rating of significant events on the INES scale in 2010

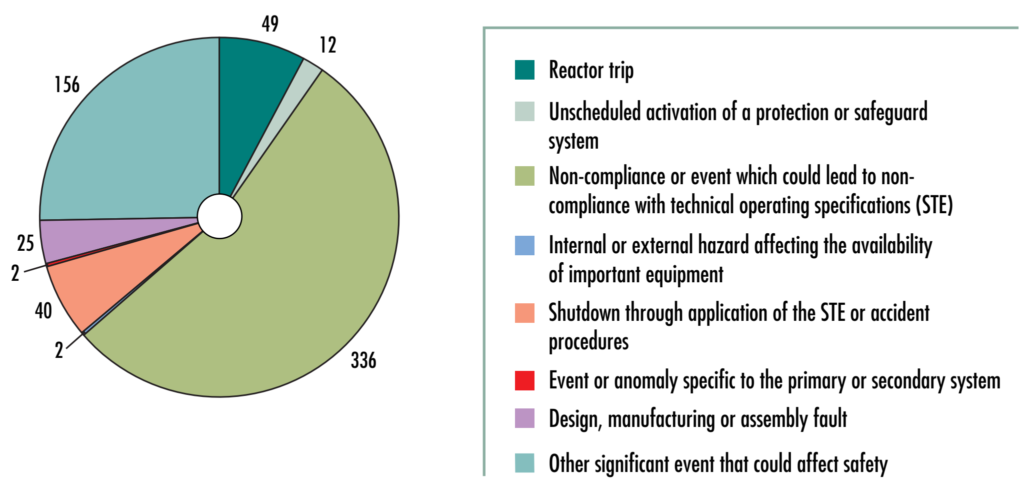
Level	Pressurised water reactors	Other BNI nuclear activities	Transport	Small-scale nuclear activities	Total
3 and +	0	0	0	0	0
2	1	1	0	1	3
1	74	20	9	37	140
0	642	148	53	121	964
Total	**717**	**169**	**62**	**159**	**1107**

2. The French Maritime Events Investigation Bureau (BEAmer), the French Land Transport Accidents Investigation Bureau (BEA TT), the French Aircraft Accident Investigation Bureau (BEA), and their counterparts for events affecting military means of transport

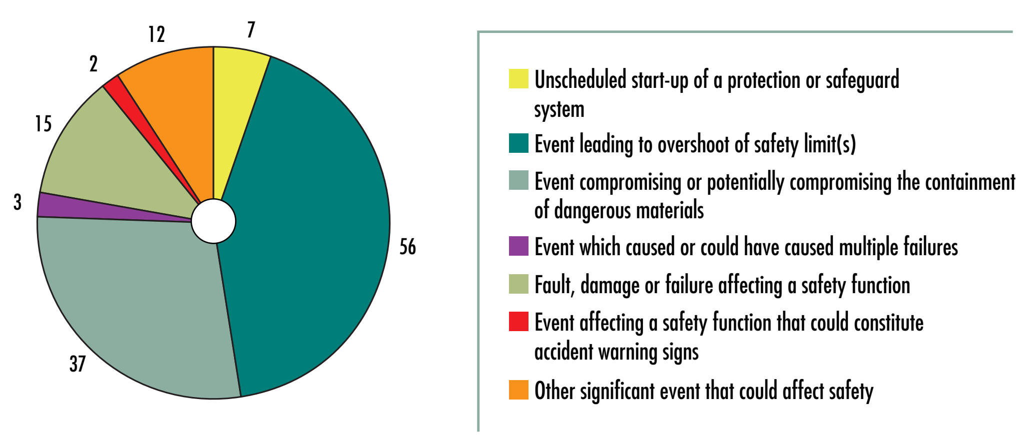
Graph 6: Breakdown of BNI events per type



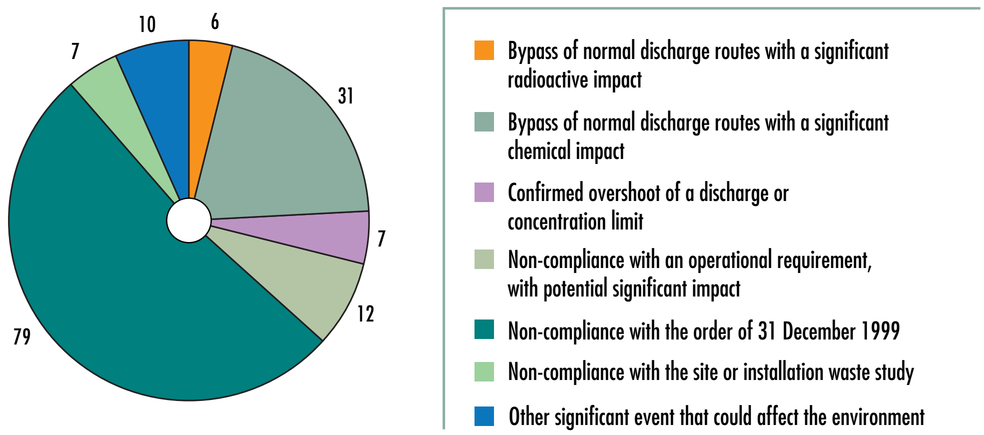
Graph 7: Events involving safety in NPPs



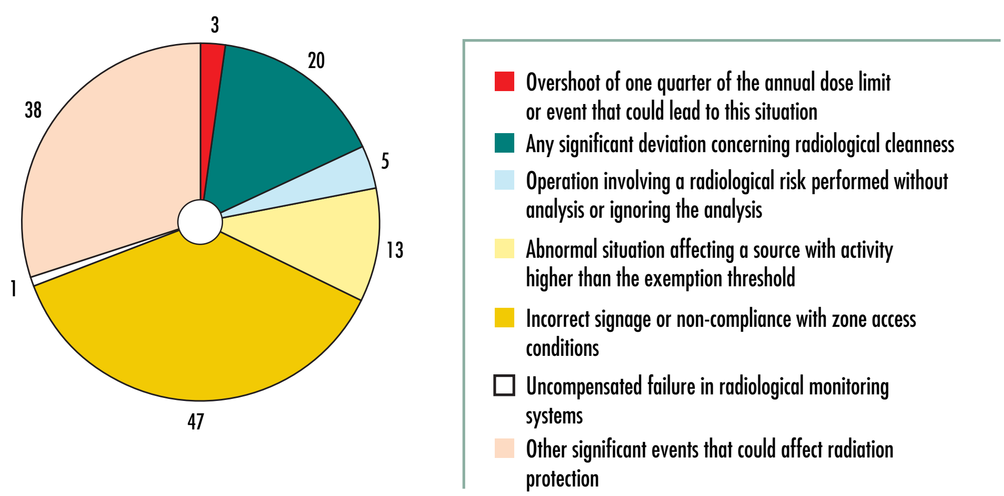
Graph 8: Events involving safety in BNIs other than NPPs



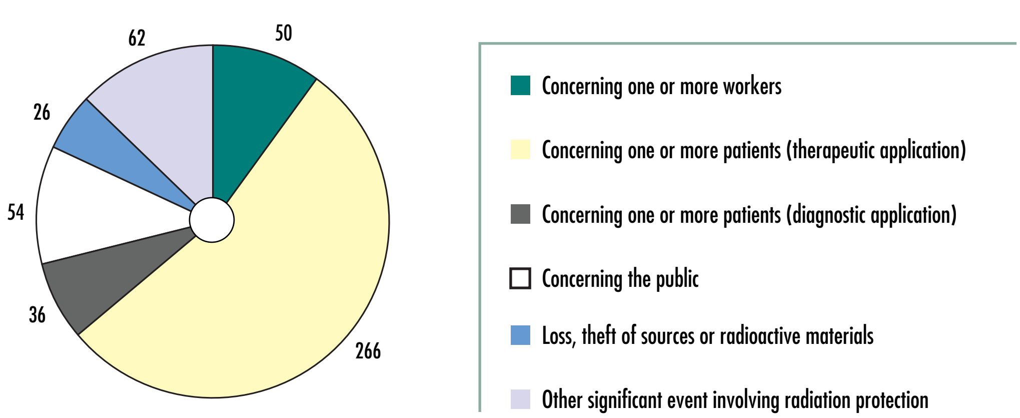
Graph 9: Significant events concerning the environment in 2010



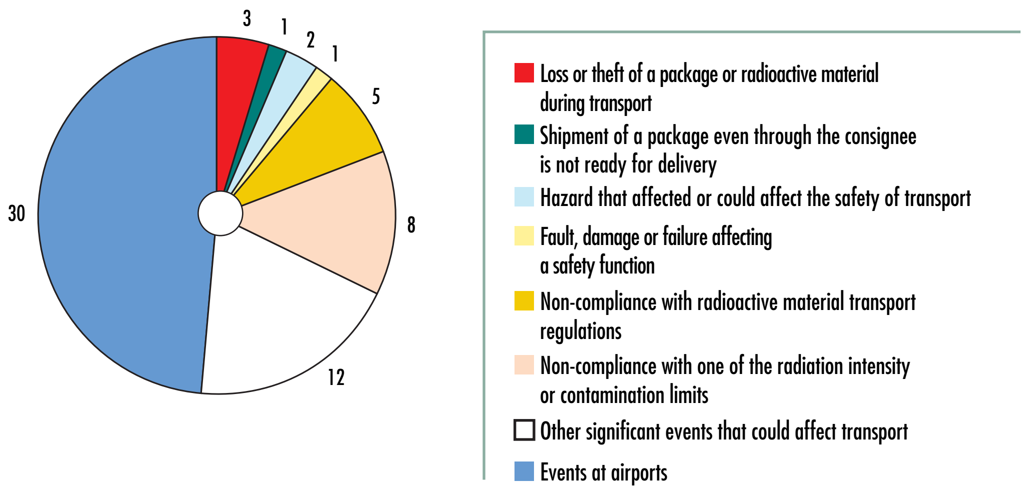
Graph 10: Events involving radiation protection in BNIs



Graph 11: Events involving radiation protection (excluding BNIs and RMT)



Graph 12: Events involving radioactive material transport



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 conventional safety inspection, inspection of medical appliances by AFSSAPS or health inspection as entrusted to the technical divisions of the Ministry for Health.

This approach is illustrated by the joint creation by ASN and the French Society for Radiation Oncology (SFRO) of a common scale for rating radiation protection events affecting patients undergoing radiotherapy treatment.

Finally, jointly with the General Directorate for Labour (DGT), ASN initiated coordination of the conventional safety inspectorate and the radiation protection inspectorate. This includes information exchanges, both local and national, joint inspections and cross-training courses.

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 national network of environmental radioactivity measurement (www.mesure-radioactivite.fr – see chapter 6), 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 population 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 the measurements.

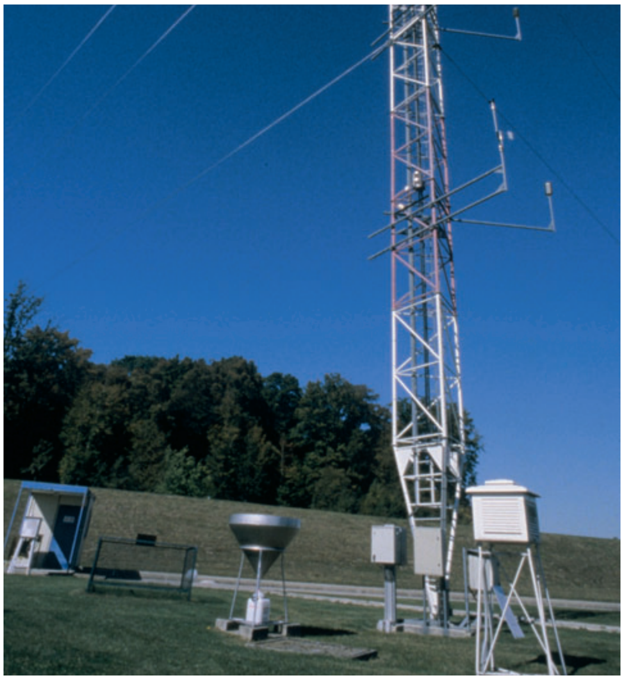
Since 1994, the Commission has carried out the following inspections in France:
– the La Hague reprocessing plant and ANDRA's Manche repository in 1996;
– Chooz NPP in 1999;
– Belleville-sur-Loire NPP in 1994 and 2003;
– the La Hague reprocessing plant in 2005.
– the Pierrelatte nuclear site in 2008.
– the old uranium mines in the Limousin département in 2010.

This latter inspection took place in September 2010 on the AREVA site of Bessines and in neighbouring old uranium mines. The Commission's experts noted the good level of expertise in France, and more particularly underlined the quality of the information furnished to the public. They concluded that France was compliant with the provisions of article 35 of the EURATOM Treaty.

4|1|1 Purpose of environmental monitoring

Licensee 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:
– gives a picture of the condition of the radiological state of the 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;
– verifies that there are no emissions of unauthorised substances;
– contributes to the evaluation of the radiological exposure of populations;
– enables an abnormal rise in radioactivity to be detected as

"Environmental monitoring" inspection by ASN at Cadarache – September 2010



Sampling station on a site of ANDRA

early as possible and to be alerted in the event of a malfunction of the installation, by inspection of the ground water tables among other things;
– provides a means of checking that licensees comply with the regulations;
– contributes to transparency and informing of the public by transmitting monitoring data to the national measurement network.

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 regulatory monitoring of the BNI 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 26 November 1999.

To bring it into line with the progress achieved through the TSN Act, ASN has initiated an update of the general technical regulations applicable to BNIs.

In accordance with these regulatory provisions, the conditions of radiological monitoring of the environment around BNIs can be summarized as shown in table 7.

When several facilities (whether or not BNIs) are present on the same site, joint monitoring of all these installations is possible, 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 French National Network of Environmental Radioactivity Monitoring (see chapter 6).

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 Sara network (radioactivity in atmospheric aerosols);
  • 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 of environmental radioactivity measurements and a procedure for having the radioactivity measurement laboratories approved by ASN.

Table 7: conditions of radiological monitoring of the environment around BNIs

Environment monitored or 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 (βG). γ spectrometry if βG > 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 (ranging from 10 nGy/h to 10 Gy/h) and recording • 10 integrating dosimeters at the site limits (monthly recording) • 4 detectors at 5 km with continuous measurement (ranging from 10 nGy/h to 0.5 Gy/h)	• 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 βG and ^{3}H on a monthly mixture	• 2 continuous sampling stations including one under the prevailing wind with weekly measurement of βG 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 βG, of potassium (K) Continuous sampling of ^{3}H (daily average mixture) • Annual sampling in sediments, aquatic fauna and flora with measurement of βG, K and ^{3}H	• At least weekly sampling of water in the receiving environment with measurement of the total α activity, βG, K and ^{3}H • Annual sampling in sediments, aquatic fauna and flora for γ spectrometry
Groundwater	• 5 sampling points (monthly check) with measurement of βG, K and ^{3}H	• 5 sampling points (monthly check) with measurement of βG, K and ^{3}H • Measurement of total α activity
Soil	• 1 annual sample of topsoil with γ spectrometry	
Plants	• 2 grass sampling points (monthly check) with measurement of βG, K and γ spectrometry. Measurement of carbon 14 (^{14}C) and total carbon (quarterly) • Annual campaign on the main agricultural produce, with measurement of βG, K, ^{14}C and total carbon, and γ spectrometry	• 4 grass sampling points (monthly check) with measurement of βG, K and γ spectrometry • Annual campaign on the main agricultural produce, with measurement of βG, K, ^{14}C and total carbon, and γ spectrometry
	• 2 sampling points (monthly check) with measurement of βG activity (except ^{40}K), K and annually ^{14}C	• 1 sampling point (monthly check) with measurement of βG activity and γ spectrometry (+ ^{3}H and ^{14}C periodically)

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 4-2° of the TSN Act.

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 and natural radionuclides, gamma, beta and alpha emitters, and the ambient gamma dosimetry.

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 29 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 27 June 2005, takes account of the changes to the Public Health Code, the ASN prerogatives defined by the TSN Act and the operating experience feedback acquired since 2003.

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 on the website www.asn.fr.

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 national network of environmental radioactivity measurements, 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 inter-laboratory tests (ILT) 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 4 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 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 inter-laboratory tests (ILT) 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 ILT organised by IRSN can cover up to 70 laboratories in each test, including a few foreign laboratories.

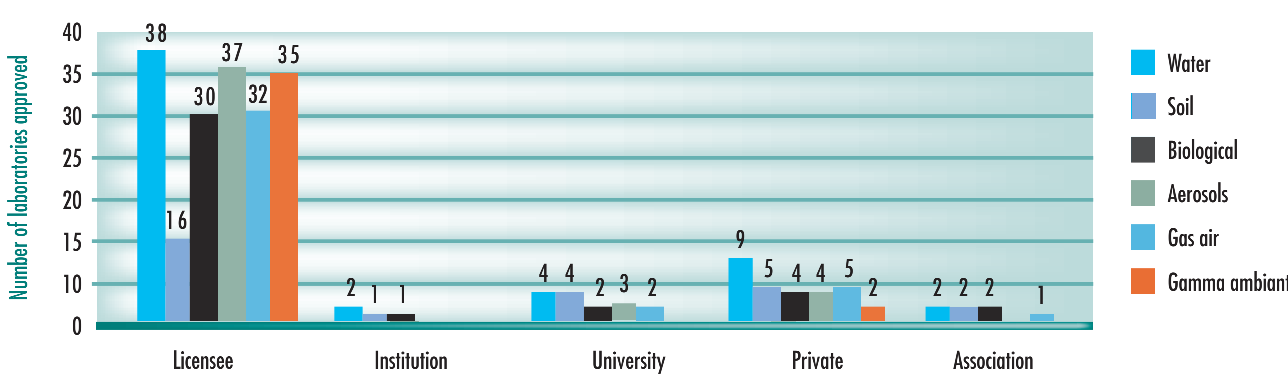
To ensure that the laboratory approval conditions are fully transparent, precise assessment criteria are used by the approval commission. These criteria are published on the national network's website.

From 2003 to the end of 2010, IRSN organised 34 ILT covering 43 approval types. Most of the approved laboratories specialise in water monitoring, with 55 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 and 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, transuranium elements or radionuclides of the natural chains of uranium and thorium in water, soil and biological matrices.

In 2010, ASN issued 208 approvals and extended a further hundred. As at 31 December 2010, the total number of approved laboratories stood at 60, totalling 746 currently valid approvals.

The detailed list of approved laboratories and their scope of technical competence is available on *www.asn.fr*.

Graph 13: Breakdown of the number of approved laboratories as at 31/12/2010



5 IDENTIFYING AND PENALISING INFRINGEMENTS

5 | 1 Ensuring that licensee penalty decisions are 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 of 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;
– 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 penalties policy

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 TSN Act provides for a graduated series of administrative penalties following formal notice and defined in articles 41 to 44 of the Act:
– 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 of the licensee (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 TSN Act makes provision for penalties as detailed in articles 48 to 51 of the Act, ranging from a fine of 7,500 euros to three years of imprisonment plus a fine of 150,000 euros, depending on the nature of the infringement. They may apply to corporate bodies, with the amount of the fine rising to up to 1,500,000 euros.

Decree 2007-1557 of 2 November 2007 concerning BNIs and the regulation of the transport of radioactive materials with respect to nuclear safety, also makes provision for class 5 infringements as detailed in its article 56.

5 | 2 | 2 For persons responsible for small-scale nuclear activities, organisations and approved laboratories

The Public Health Code makes provision for administrative and criminal sanctions in the event of 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 provisions of articles L.1333-2, L.1333-8 (monitoring of exposure, protection and information of individuals), L.1333-10 (monitoring of exposure to enhanced natural ionising radiation and of premises open to the public) and L.1333-20 (decrees implementing certain legislative provisions).

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 euros to one year of imprisonment and a fine of 15,000 euros.

5 | 2 | 3 Failure to comply with labour law

In the performance of their duties in the NPPs, the ASN's labour inspectors have at their disposal all the inspection, decision-making and constraining resources of ordinary inspectors. Observation, formal notice, official report, injunction (to obtain immediate cessation of the risks) or even shutdown of the site, offer a range of enforcement and constraining measures for the conventional safety inspector that is broader than that available to a nuclear safety inspector or a radiation protection inspector.

The labour inspector has special decision-making powers enabling him to check the employer's disciplinary capability, to protect the general interest from an economic standpoint and to act as arbitrator, if necessary by delegation from the Regional Directorate for Enterprises, Competition, Consumption, Work 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 conventional safety inspector is first of all in contact with the unit senior management, the risk prevention departments and the occupational health departments. It is 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 conventional safety 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.

The ASN conventional safety inspectorate sent out four reports, concerning five sites, to the various Public Prosecutor's Offices concerned. These reports recorded infringements relative to health and safety (three cases having caused industrial accidents) or obstructing the conventional safety inspector in the fulfilment of tasks (one case).

5 | 2 | 4 2010 results concerning enforcement and penalties

ASN took administrative action (formal notice, suspension, etc.) against six licensees and managers of nuclear activities. Further to the observed infringements, it sent eighteen reports to the Public Prosecutors, four of which were on account of conventional safety inspection in NPPs (see point 5 | 2 | 3).

On 14 October 2010, the County Court of Carpentras gave its verdict on the event that occurred on the SOCATRI facility in the night of 7 to 8 July 2008, condemning the enterprise for failing to give immediate notification of the incident. ASN had drawn up an infringement report resulting from the findings of an inspection carried out on 10 July 2008, which it had sent to the Public Prosecutor of Carpentras. The Public Prosecutor's office appealed against the verdict of this court action.

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: www.asn.fr
– 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.).

6 OUTLOOK

In 2011, ASN scheduled 1920 inspections on BNIs, radioactive material transport, activities using ionising radiation, organisations and laboratories it has approved and activities involving pressure equipment. Continuing in line with 2010, ASN will give priority to the inspection of the strong-implication activities 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 of notifying 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 BNI sector. The notification criteria and conditions shall be detailed and harmonised between the different sectors.

ASN will continue to deploy its action plan relating to tritium. This action plan will be tracked over time by a monitoring committee, which will hold its first meeting in the first half of 2011.

With regard to the monitoring of environmental radioactivity, ASN will continue the work it has started with all the players in the national measurement network. This will notably include assessing the results after one year of existence of the website of the National Network of Environmental Radioactivity Monitoring and defining the changes in the monitoring strategy around nuclear sites and over the rest of the national territory.

Lastly, ASN is preparing to inspect a new domain, namely the safety of radioactive sources (see chapter 10).

RADIOLOGICAL EMERGENCIES

CHAPTER 5

Nuclear activities are carried out with the two-fold aim of preventing accidents and mitigating any consequences should they occur. In accordance with the "defence in depth" concept, the necessary steps must therefore be taken to deal with a radiological emergency, no matter how improbable. A "radiological emergency" is understood to mean a situation arising from an incident or accident which is liable to lead to the emission of radioactive material or a level of radioactivity liable to jeopardise public health[1]. The term "nuclear emergency" applies to events which could lead to a radiological emergency in a basic nuclear installation (BNI) or during the transportation of radioactive materials. Non-radiological emergency situations can also arise in BNIs.

For activities with a high level of risk, such as BNIs, the emergency arrangements, which can be considered the "ultimate" lines of defence, comprise special organisational arrangements and off-site emergency plans, involving both the licensee and the public authorities. These arrangements, which are regularly tested and assessed, are subject to regular revisions 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 On-site and off-site emergency plans

Application of the principle of defence in depth entails the inclusion of severe accidents with a very low probability of occurrence when drafting the emergency plans, in order to determine the actions necessary to protect plant personnel and the population and to control the accident.

The on-site emergency plan, prepared by the licensee, is aimed at bringing the plant back to a safe condition and mitigating accident consequences. It defines the organisational arrangements and the resources to be implemented on the site. It also comprises arrangements for informing the public authorities rapidly.

The purpose of the off-site emergency plan, drafted by the *préfet*[2] is to protect populations in the short term in the event of an accident and provide the licensee or the party in charge of transport with outside intervention assistance. It specifies the initial actions to take to protect the population, the roles of the various services concerned, the systems for giving the alert, and the human and material resources likely to be engaged.

1 | 1 | 2 Responding to any other radiological emergency situation

Apart from incidents affecting nuclear installations or the transport of radioactive materials, radiological emergency situations can also occur:
– during performance of a nuclear activity, whether for medical, research or industrial purposes;
– in the case 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 2005/1 390 of 23 December 2005. This circular defines how the State departments are organised in the case of an event liable to lead to a radiological emergency situation other than those situations covered by an existing off-site emergency plan.

With the support of IRSN, ASN is responsible for overseeing the actions of the facility head or site owners, for advising the competent police authority with regard to the steps to be taken to prevent or mitigate the direct or indirect effects of ionising radiation on human health, including through environmental hazards, and for taking part in the circulation of information.

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 Departmental Fire and Emergency Response Operations Centre – Alert Processing Centre which can be reached by dialling 18 or 112.

1 | 1 | 3 Role of ASN in the preparation and monitoring of emergency plans

The on-site emergency plan

Pursuant to decree 2007-1557 of 2 November 2007, a BNI licensee is required to send ASN a file containing the on-site emergency plan before commissioning the installation.

The on-site emergency plan must specify the organisational measures, response methods and necessary resources the

1. Article R.1333-76 of the Public Health Code.
2. In a *département*, representative of the State appointed by the President.

licensee implements in the event of an emergency in order to protect its personnel, the public and the environment and to preserve or restore the safety of the installation.

During 2010, ASN continued preparing a draft ASN decision defining the means of managing emergency situations, and the content of the on-site emergency plan. This work is being done within the more general framework of the creation of the new BNI regime as resulting from the TSN Act.

Participation in drafting the off-site emergency plans

Pursuant to the 13 September 2005 orders concerning the off-site emergency plan and the ORSEC plan, the *préfet* is responsible for preparing and approving the plan. ASN assists the *préfet* in analysing the technical data to be provided by the licensees, in order to determine the nature and scope of the consequences of an accident. This analysis is conducted jointly by ASN and IRSN, its technical support organisation, taking into account the most recent available data on severe accidents and radioactive material dispersal phenomena.

Population protection actions

The off-site emergency plans identify the population protection actions to limit the consequences of an accident. The *préfet* decides whether or not to deploy these actions on the basis of levels of action according to the predicted dose that would be received by a person situated in the open air at the time of the accident.

The action levels are defined on the basis of the most recent international recommendations and, since 2003, have been stipulated in regulatory requirements. The action levels are defined by ASN decision 2009-DC-0153 of 18 August 2009, which modified the action level with regard to the administration of stable iodine.

For example, the off-site emergency plans defined for the vicinity of a PWR reactor stipulate sheltering of the population and the absorption of stable iodine within a 10-kilometre radius, plus evacuation of the population within a 5-kilometre radius.

1 | 2 Controlling urban development around nuclear sites

Four main principles underpin the protection of populations against technological risks:
– reducing risks at source;
– implementing off-site emergency plans;
– controlling urban development
– informing the population.

The aim of controlling urban development is to limit the consequences of a serious accident for the population and property. Actions to control urban development around non-nuclear industrial facilities has been deployed since 1987. These actions have been reinforced since the AZF accident of 2001. The TSN Act now empowers the public authorities to introduce public protection restrictions limiting or prohibiting new constructions in the vicinity of BNIs.

The urban development control actions involve the 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 checks the legality of the acts of the municipalities. ASN assists the *préfet* in the urban development control action.

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. Current ASN doctrine regarding the control of urban development around nuclear installations concerns those installations requiring an off-site emergency plan. It primarily aims to guarantee the practical implementation of the actions stipulated in the off-site emergency plan with regard to sheltering and evacuation, particularly in areas that could be impacted by fast-kinetics accidents. 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 40 reserved or unfavourable opinions on some 300 projects submitted.

A circular from the Ministry of Ecology dated 17 February 2010 has asked the *préfets* to exercise tighter vigilance over urban development near nuclear installations. This circular specifies that the utmost attention must be given to projects that are sensitive due to their scale, their intended purpose, or the difficulties they would create in terms of population protection in the zones of immediate danger. 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.

During 2010, ASN thus led wide-ranging discussions with the government administrations, elected officials and licensees concerned. These discussions resulted in the drawing up of a draft guide presenting the broad principles of urban development control. These principles are essentially:
– preserve the operability of the off-site emergency plans;
– favour urban development outside the risk zone;
– allow controlled development that meets the needs of the resident population.

This guide was submitted for consultation to representatives of the elected officials concerned, to the ANCCLI and to the licensees. ASN wants this guide to provide a basis for broad consultation among the local stakeholders so that the urban planning documents take account of the risks generated by nuclear installations.

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 civil defence, as well as by the emergency plans.

Act 2004-811 of 13 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 population, information and training of the population, 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 13 September 2005 concerning off-site emergency plans;
– decree 2005-1157 of 13 September 2005 concerning the ORSEC plan.
– decree 2005-1156 of 13 September 2005 concerning the local safeguard plan.

The scope of radiological emergency situations is clarified in the government directive of 7 April 2005. The response organisation of the authorities and that of the licensee are presented in the diagram below.

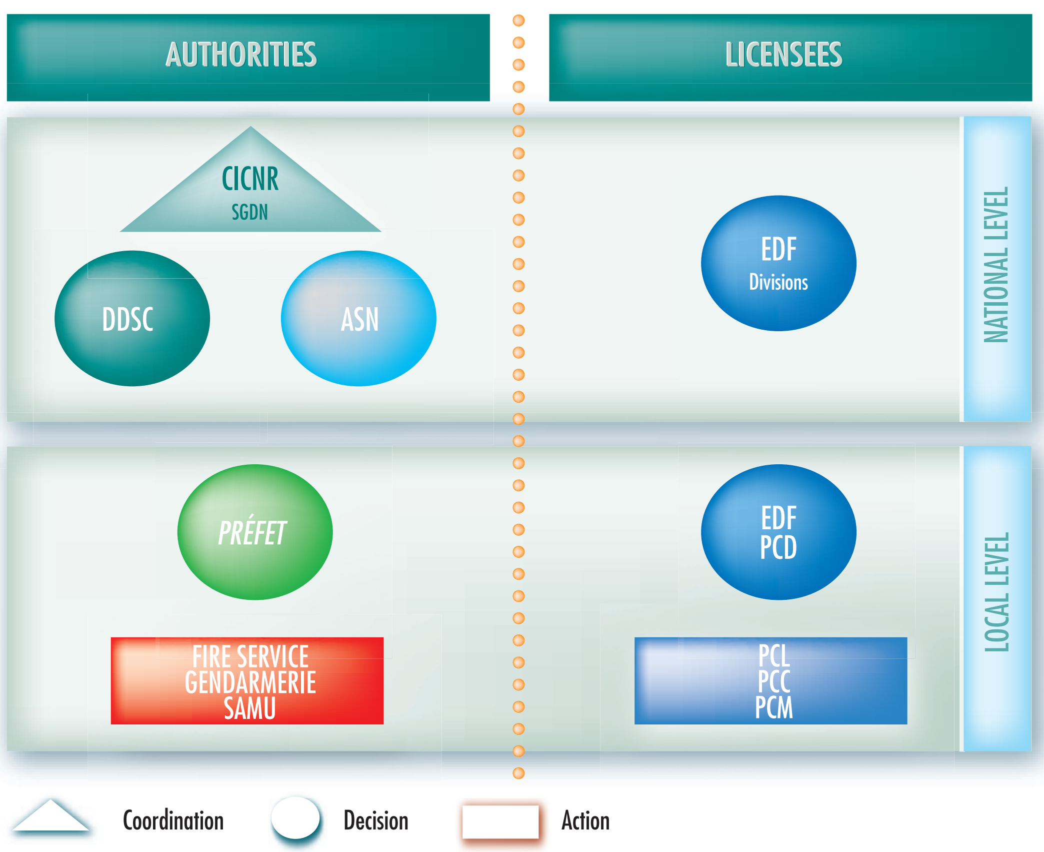
1 | 3 | 1 Local response organisation

In an emergency situation, two parties have the authority to take operational 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 alert and regularly inform the authorities. This arrangement is defined beforehand in the licensee's on-site emergency plan;
– the *préfet* of the *département*[3] 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 acts in the framework of the off-site emergency plan. He is thus responsible for coordinating the resources - both public and private, human and material - deployed in the plan. He keeps the population and the mayors informed of events. Through its regional division, ASN assists the *préfet* in drafting the plans and managing the situation.

ASN relies particularly on its regional divisions for organising local actions.

3. Administrative region headed by a *préfet*

Diagram 1: emergency organisation in an accident situation affecting a nuclear reactor operated by EDF



- CICNR: International committee on nuclear or radiological emergencies
- SGDN: General secretariat for national defence
- DDSC: Directorate for defence and civil security
- PCD: Management command post
- PCL: Local command post
- PCC: Supervision command post
- PCM: Resources command post

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 offer the *préfet* information and advice to enable him to assess the condition of the installation, the scale of the incident or accident and any potential developments.

The main bodies concerned are as follows:
– Ministry of the Interior: the Directorate for Civil Security (DSC) 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 Ecology: 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 those responsible for civil security;
– 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 (SNM) and defence-related transport operations. A protocol was signed by ASN and the ASND on 26 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 DSND (Delegate for Nuclear Safety and Radiation Protection for National Defence Installations and Activities);
– General Secretariat for Defence and National Security (SGDSN): the SGDSN handles the secretarial functions for the Interministerial Committee for Nuclear and Radiological Emergencies (CICNR). It is responsible for ensuring consistency between the ministries concerned regarding the planned actions in the event of an accident and for planning and assessing the exercises. 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;
– ASN is involved in the management of radiological emergency situations. It assists the Government with all questions under its responsibility and informs the public about the safety of the installation 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 population protection actions that can be taken during the emergency phase are described in the off-site emergency plan. The steps taken are designed to protect the population and prevent affections attributable to exposure to ionising radiation or to toxic substances present in the releases.

In the event of a serious accident, the *préfet* can envisage a number of measures to protect the population:
– 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 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 muster point.

In the event of effective release of radioactive substances into the environment, these actions also include the first action that should be decided on exit from the emergency phase to prepare for management of the post-accident phase. The region would then be zoned with:
– a population protection zone (ZPP) within which contamination reduction actions will be rapidly undertaken;
– a tightened surveillance zone (ZST) within which the consumption and sale of foodstuffs produced will initially be prohibited, and subsequently subject to a conditional release inspection based on the maximum permissible radioactivity levels set by the European Commission;
– if necessary, a population clearing zone within the ZPP if external exposure levels due to deposits justify it.

The *préfet* ensures that the population is regularly informed of developments in the situation and its consequences.

1|4|2 Iodine tablets

The administration of stable iodine tablets is one of the population protection measures the *préfet* may decide to order in a radiological emergency situation. 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 nuclear power plants (NPPs), within the zone covered by the off-site emergency plan. 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. In early 2010, the boxes were 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 27 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 case of loss or omission.

The experience feedback will be analysed in 2011 with all the stakeholders, and a more detailed assessment will be made with the *préfectures*. A qualitative investigation will be initiated to determine why people did not collect their tablets, so that the method of distributing stable iodine to the populations can be optimised.

For the rest of the country outside the zones covered by off-site emergency plans, stocks of tablets are held in each *département*. These stocks would be distributed to the populations by the public authorities in the event of a radiological emergency situation. The minister in charge of health is coordinating work to improve the ways and means of mobilising these stocks.

1 | 4 | 3 Care and treatment of exposed persons

In the event of a nuclear or radiological accident, a significant percentage of the people involved could be contaminated by radionuclides. Such contamination could necessitate special treatment by the emergency response teams.

Circular 800/SGDN/PSE/PPS of 23 April 2003 specifies the national policy concerning the use of emergency and care resources in the event of a terrorist act involving radioactive materials. These arrangements, which also apply to an accident, are designed to offer guidelines for the services and organisations in charge of planning and managing emergency situations both on the site of the event and in hospitals.

The "Medical response to a nuclear or radiological event" guide, coordinated by ASN and published in 2008, comes in addition to the circular DHOS/HFD/DGSNR 2002/277 of 2 May 2002 concerning the organisation of medical care in the event of a nuclear or radiological accident. This circular is supplemented by circular DHOS/HFD 2002/284 of 3 May 2002 concerning the organisation of the hospital system in the event of arrival of large numbers of exposed or injured people, setting up a departmental plan of hospital capacity provisions and a zone-based organisation for all nuclear and radiological, but also biological and chemical risks. This guide provides all the information useful to the medical teams in charge of collecting and transporting the injured, as well as for the hospital personnel receiving them in the health care establishments.

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 government directive of 7 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. This committee comprises ASN, as coordinator, and representatives of the various ministerial departments concerned by the subject, health agencies, associations, and 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 their indemnification. 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 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 is preparing 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 of the transition phase, etc.). A first draft of this guide has been proposed. It is currently on trial in several pilot *départements* that host a NPP, as well as in several municipalities involved in the preparation of the radiological section of the Communal Disaster Contingency Plan (PCS). This commission is also preparing guidelines for management of the transition phase (which can range from a few weeks to a few months after the accident).

The second commission is also preparing guidelines for the management of the long-term phase, integrating the international work carried out in Belarus (Core, Corex) after the Chernobyl accident.

In 2009, the first elements of the post-accident doctrine were tested during national nuclear or radiological emergency exercises. The exercise carried out on 8 and 9 April 2010 on the Cattenom NPP included the question of whether or not to evacuate the population in the post-accident situation.

An international seminar will be held in May 2011 to present the work of the CODIRPA to the local actors (*préfectures*, municipalities, CLIs, etc.), to French experts involved in the work, to foreign experts involved in similar initiatives, to foreign radiation protection authorities and the French and foreign organisations concerned.

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.

Overseeing of actions taken by the licensee

In the same way as in normal operating conditions, licensee actions are regulated by ASN in an emergency situation. 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. It does not take the place of the licensee in the technical steps taken to deal with the accident.

Advising the Government

The decision by the *préfet* concerning the population protection actions to be taken depends on the actual or foreseeable consequences of the accident around the site. It is up to ASN to inform the *préfet* of its recommendations on this subject, taking account of the analysis conducted by IRSN. This analysis combines diagnosis (understanding of the situation at the installation concerned) and prognosis (assessment of possible short-term developments, notably radioactive releases). It also concerns the steps to be taken to protect the health of the 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 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.);
– institutional information: ASN keeps the Government informed, along with the SGDSN 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 Acts provides for ASN to act as Competent Authority under the international conventions. 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 concerned by possible consequences on their own territory.

2 | 1 | 2 The 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 the following organisation:

– at the national level, an emergency centre comprising:
  • a decision-making level or strategic management command post (called PCD), located in ASN's emergency centre in Paris. This centre is headed by the ASN Chairman or his representative. Its role is to adopt a stance or make decisions to advise the *préfet* in charge of running the 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, one delegation sent to the *préfecture* and one sent to the accident site, to assist the *préfet* in his decisions and communication actions, and to ensure that the decisions taken by the licensee are justified.

ASN is supported by an analysis team working in 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 presents the overall safety organisation set up, in collaboration with the *préfet* and the licensee.

Diagram 3 shows the structures set up between the communication units and the PCD spokespersons with a view to allowing the necessary consultation to ensure consistency of the information issued to the public and the media.

Organising for any other radiological emergency situation

A dedicated hotline enables ASN to receive calls notifying incidents involving non-BNI 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 and treatment of the individuals involved, confirmation of the radiological nature of the event, securing of the zone and reducing the emissions, and finally, clean-out.

Diagram 2: nuclear safety organisation

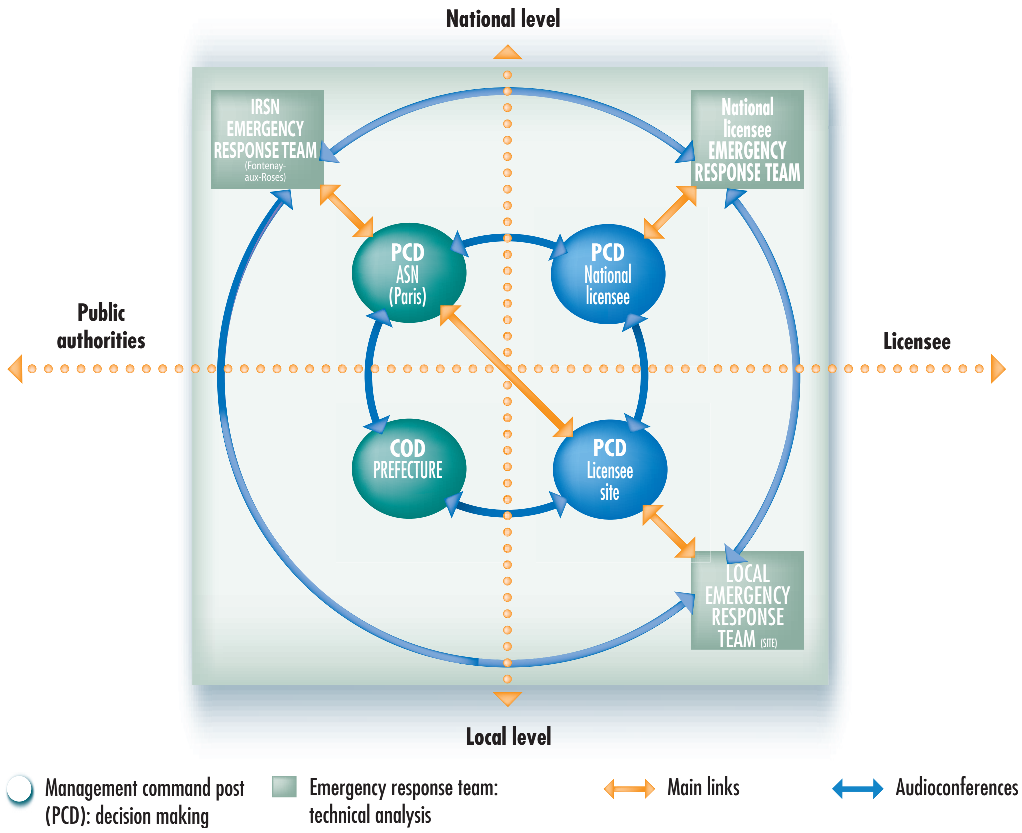
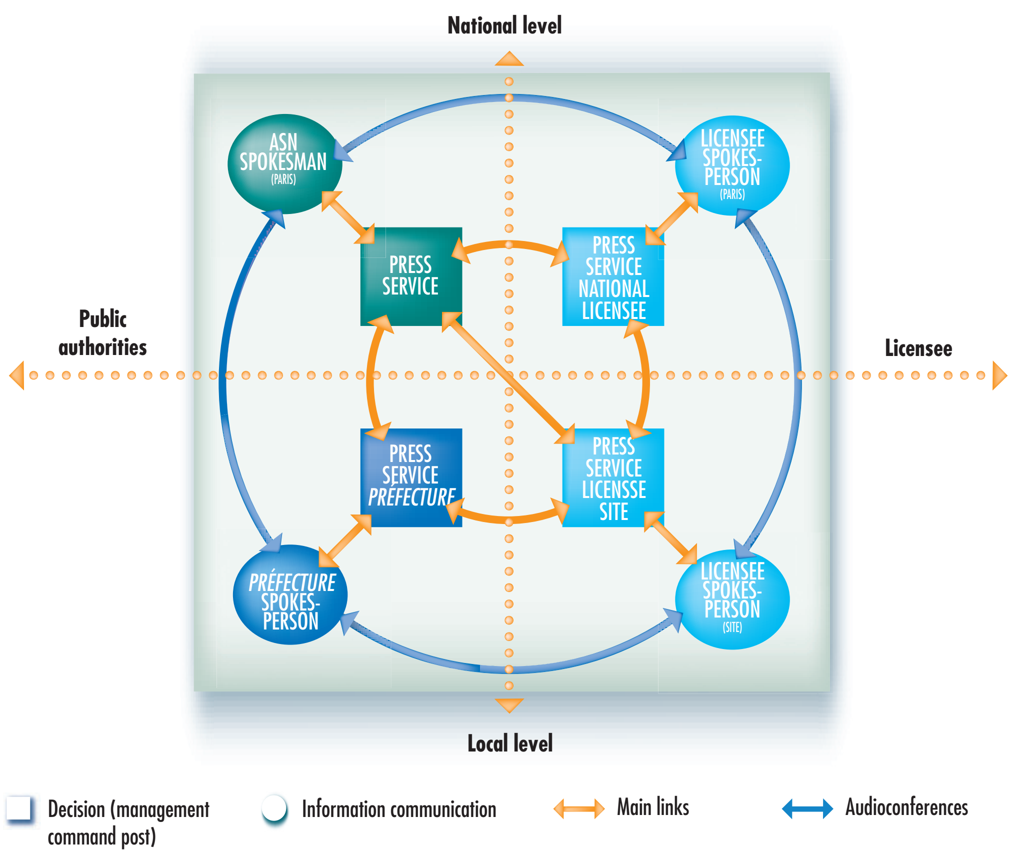


Diagram 3: communication organisation



The mayor or the *préfet* coordinates the intervention teams on the basis of their technical competence and decides on the protection measures for the public.

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 on-site emergency plan 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.

During 2010, ASN continued its efforts to set up a standby duty rota for its teams, but this has been delayed for administrative reasons.

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 gives ASN technical management and communication techniques readily accessible to all the players.

The emergency response centre has been activated in real-life incident situations. In 2009, it was activated five times due to unfavourable climatic conditions threatening the Blayais NPP, a fire that placed the nuclear installations of Cadarache at risk, and the loss of a cold source at the Cruas and Fessenheim NPPs. In 2010, it was activated because of meteorological phenomena that threatened the Blayais NPP (the storm "Xynthia").

As demonstrated by these events, 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 the staff of the DSC, the SGDSN and Météo-France. This system is regularly tested during exercises or when actual emergencies 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 – European Community Urgent Radiological Information Exchange System, ENAC – Early Notifications and Assistance Conventions).

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 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 plays an active role in the preparation of these tools.

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 26 September 1986 by IAEA and the decision of the Council of European Communities of 14 December 1987 concerning community procedures for an early exchange of information in the event of a radiological emergency. On 26 September 1986, France also signed the convention adopted

ASN emergency centre in a nuclear emergency exercise – September 2010

American delegation that attended the Penly nuclear emergency exercise – September 2010

by IAEA concerning assistance in the event of a nuclear accident or a radiological emergency.

The government directives of 30 May 2005 and 30 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 States concerned, 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.

Within IAEA's National Competent Authorities' Coordinating Group (NCACG), ASN has been the elected chair of the competent authorities for Western Europe since 2005.

2|2|1 Bilateral relations

Within the framework of bilateral relations, particularly with neighbouring countries, ASN continued discussions in 2010 concerning the exchanges of information relating to planning and emergency situations.

In 2010, ASN also continued its meetings with foreign counterparts responsible for managing emergency situations (British, Irish, Swiss and German). ASN also hosted an American delegation that came to observe a nuclear emergency exercise on the

Meeting of the Franco-German "emergency" working group – March 2010

Hosting an American delegation

Following on from an ASN mission in the USA in 2009 and observation of the emergency exercise at the Comanche Peak NPP (Texas), an American delegation was invited to France by ASN.

From 8 to 10 September 2010, ASN hosted a delegation comprising three representatives of the U.S. Nuclear Regulatory Commission (US NRC) and one representative of the Federal Emergency Management Agency (FEMA).

On 9 September, the members of the delegation attended the national emergency exercise at the Penly NPP. Two of the members joined the team at the préfecture*, while the other two observed the exercise from the ASN emergency centre.*

ASN presented its organisation and its activities in this domain, and summarized the work of the CODIRPA. Numerous topics relating to emergency situation management were discussed in detail, particularly population protection and public communication actions in accident situations. The American delegation underlined:
– the advantages of separating the functions of spokesperson and head of the ASN emergency centre;
– the good practice of holding periodic audio conferences between the main players;
– the great commitment of all the players;
– the fact that the separation of the ASN and IRSN emergency centres complicates the technical assessment of the situation;
– the first decisions, which went far beyond what would have been recommended in the United states.

TO BE NOTED IN 2010

Penly NPP on 9 September 2010 (see box). In November, ASN was invited by its Spanish counterpart (CSN) to observe an exercise in post-accident management following a dirty bomb attack.

2 | 2 | 2 Multilateral relations

ASN took part in IAEA's work to implement an action plan by the competent authorities to improve international exchanges of information in the event of a radiological emergency situation. For this action plan, ASN is helping to define the strategy concerning international assistance requirements and resources and to set up the Assistance Response Network (RANET). ASN is also working with NEA to define a strategy for carrying out international exercises.

Within the heads of european radiation control authorities group (HERCA), ASN has continued to take part in meetings of the group responsible for proposing harmonised pan-European population protection actions. The work has highlighted the various international approaches to the intervention levels or the messages addressed to the populations in an emergency. In 2010, the work was directed towards harmonised and more operational application of the international recommendations.

2 | 2 | 3 International assistance

The above-mentioned government directive of 30 November 2005 defines the procedures for international assistance when France is called on or when it requires assistance itself. 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 means of assistance (RANET database), ASN takes part in the IAEA's work on the operational implementation of international assistance.

France has been called upon four times since 2008 to assist a foreign country in a radiological emergency situation.

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, which are defined by an annual circular, involve the licensee, the local and national public authorities - particularly the *préfectures* - ASN and IRSN. They are a means of testing the off-site emergency plans, the response organisation and procedures and help 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 population 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 Exercises

Continuing in line with the previous years, ASN - in collaboration with the SGDSN, the DSC and the ASND - has prepared the programme of national nuclear and radiological emergency exercises for 2010, notified to the *préfet*s in a circular of 26 October 2009. In this context, ASN coordinates the meetings to discuss good practices and possible lines of improvement. These meetings serve to establish various objectives that are common to the national stakeholders. The circular proposed new objectives to the *préfet*s for 2010 on the following themes:
– unannounced exercises: performing unannounced exercises tests the alerting system, the responsiveness of the emergency organisations and the circulation of information. The date and place of this type of exercise are not known to the participants;
– post-accident management: some targeted aspects of the post-accident management doctrine figuring in the draft guide for exiting from the emergency phase can be tested;
– strong media pressure: greater realism is achieved by simulating particularly intense and scripted media pressure exerted on a large number of entities via diverse channels;
– extensive health impact: having to manage a large number of injured and/or contaminated people enables the emergency medical chain to be tested from the accident site to the hospital environment;

Radioactive materials transport exercise in Lot et Garonne – October 2010

Measurement teams during the RMT exercise in Lot et Garonne – October 2010

– “minor” accident: an event whose seriousness does not necessitate immediate activation of the off-site emergency plan but allows the organisation’s reaction to be observed;
– extensive radioactivity measurement actions: substantial measuring means are deployed to test their coordination in the field, the feedback and processing of results, and their integration in the decisions.

During most of these exercises, simulated media pressure is placed on the main parties concerned, in order to test their ability to communicate. The following table describes the key characteristics of the national exercises conducted in 2010.

In 2010, France took part in the international exercises organised by the European Community and IAEA. These tests provide an opportunity to check the alert, transmission and information exchange procedures between the competent national authority (ASN) and the emergency centres of the European Commission and IAEA.

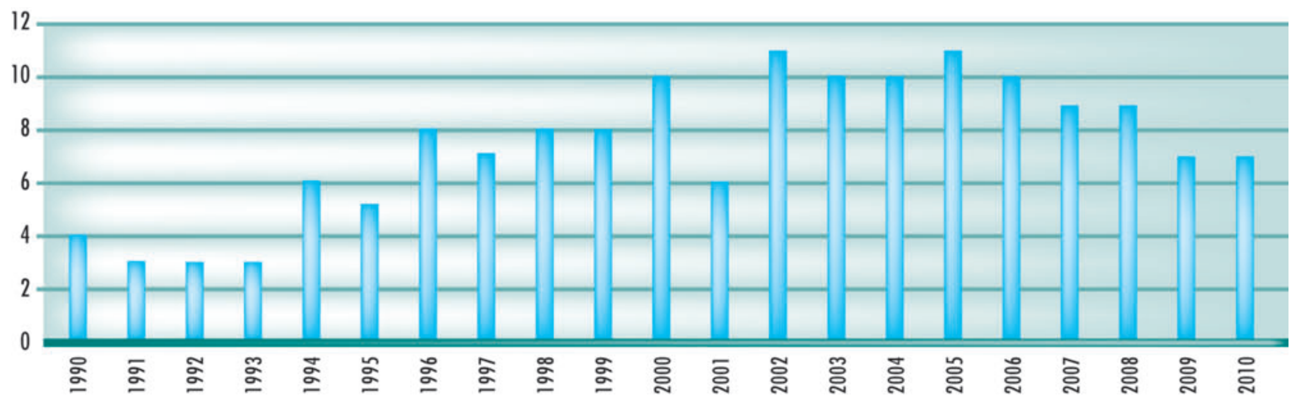
Apart from the national exercises, the *préfets* are asked to conduct local exercises with the sites that concern them, in order to improve preparations for a nuclear or radiological emergency situation, including testing of the time needed to mobilise all the parties concerned.

Carrying out a national nuclear and radiological emergency exercise every 2 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. A total of seven national exercises were carried out in 2010.

Table 1: national civil nuclear and radiological emergency exercises conducted in 2010

Nuclear site	Date of exercise	Particular characteristics
Cattenom NPP	8 April 2010	Cross-border cooperation, validation of evacuation principles, performance and coordination of radiological measurements, testing of post-accident recommendations.
CEA Marcoule	29 April 2010	Population alert, interdepartmental coordination, coordination between the Marcoule site licensees, application of the DSND/ASN protocol.
Chooz NPP	6 May 2010	Testing of population alert systems, exchanges with Belgian authorities, testing of the first post-accident actions.
Civaux NPP	17 June 2010	Population alert, testing of sheltering and listening, post-accident management.
Penly NPP	9 September 2010	Testing of off-site emergency plan in concerted phase, actual evacuation of population after sheltering, use of mobile measuring detectors, strong media pressure and ministerial involvement.
AREVA Pierrelatte	28 September 2010	Population sheltering and listening, population alert, coordination of the site licensees, testing of the medical chain, application of the DSND/ASN protocol.
Civil transport of radioactive material (Lot-et-Garonne)	21 October 2010	Extensive measurement actions, decontamination, recovery of damaged package.

Graph 1: national nuclear and radiological emergency exercises conducted from 1990 to 2010



The number and scale of the national exercises are considerable when compared with practices abroad. The IAEA international review mission in 2006 (IRRS mission) and the follow-up mission in 2009 underlined the importance of this programme of exercises. They enable 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.

3 | 2 Assessing with a view to improvement

Assessment meetings are organised in each emergency response centre immediately after each exercise. Along with the other participants in the emergency exercise, ASN aims to identify the good and bad practices highlighted during the operating experience feedback meetings in order to improve the response organisation as a whole. These same feedback meetings are organised in order to learn the lessons from any real situations that have occurred.

The real situations that occurred thus demonstrated the importance of communication in an emergency, in particular to inform the public sufficiently early and avoid the spread of rumours that could lead to panic among the population. The draft international protocols were modified and aim to inform foreign authorities as early as possible. In certain cases, the licensee is required to send information about an incident directly to the foreign authorities. Specific alert criteria will also be sent out to the air quality monitoring associations.

The emergency exercises have, among other things, led to improvements in procedures and doctrines. For example, to avoid exposure of the personnel in charge of distributing iodine tablets during the release phase, the authorities decided on preventive distribution of iodine tablets within a 10-km radius around NPPs. Furthermore, to take account of rapidly evolving accidents in which the authorities do not have time to react, the decision was taken to incorporate a reflex phase in the off-site emergency plans asking the populations to take shelter by alerting them through a network of sirens or other means of telephone-based alert.

Since 2007, the systematic use of decision-making audio-conferences has led to greater consistency in the steps taken to protect workers and the population as decided on by the licensee and the public authorities.

The purpose of the emergency response organisation is to prevent, inform and protect the public. During the exercises, it became clear that the siren system triggered by the licensees to alert the population did not cover the entire intervention perimeter in all cases. In these conditions, EDF undertook to complement the existing siren system with a system of telephone alerts, called “SAPPRE”. This new additional procedure automatically calls the landlines of the individuals concerned. This experimental system was tested on numerous occasions during the national exercises conducted since 2007. It is currently being deployed by all the licensees concerned.

In a post-accident situation, the doctrine adopted initially left it up to the decision-makers to assess whether the population should be kept at home or evacuated, on the basis of a range of dose values. A number of zones corresponding to specific issues (waste, population protection, ban on consumption, etc.) were also proposed. The exercises carried out showed the difficulty of taking a decision based on overly complex technical criteria. The exercises thus enabled a simplification of the various post-accident zones to be proposed.

The first protective steps taken are generally based on highly conservative estimates and calculations. However, in the longer term, radioactivity measurements from around the installation are vital to determine the public authorities’ response to the events. Experience feedback from the exercises shows that the measurement results took a long time to reach the experts and decision-makers. In the light of these findings, the national stakeholders worked to improve the response organisation and procedures. This led to drafting of the above-mentioned government directive of 29 November 2005. This directive now needs to be implemented in the off-site emergency plans, in order to produce local measurement programmes tailored to the individual installations. ASN has maintained its commitment to this subject, to contribute towards improved access to and utilisation of the radioactivity measurements taken by the various stakeholders (licensees, SDIS, IRSN, etc.). This work led to the issuing of a circular on 12 October 2010 by the Minister of the Interior, relative to the development of a measurement master programme. This document was sent to all the *préfectures* to enable them to draft a specific measurement master plan to be appended to the off-site emergency plan.

The exercises are a means of improving existing procedures:
– the scenarios increasingly frequently include a health component, involving management of the (sometimes contaminated) injured, who have to be given care and be evacuated;
– testing of the information procedures between the *départements* or even the countries in the vicinity of an installation help broaden the scope of mutual communication.

Experience feedback from nuclear or radiological emergency exercises also brings to light those actions or procedures which need to be improved. All the stakeholders take these points on board and actively look for solutions. ASN calls all the stakeholders together twice a year to review good practices and identify areas for improvement.

4 OUTLOOK

In collaboration with the public administrations and public establishments concerned, ASN has coordinated the drafting of an annual circular relative to the national nuclear or radiological emergency exercises. The objectives chosen for 2011 aim at testing the safety/security interface, the implementing of a real-life population evacuation exercise, the population protection actions to be ensured when exiting from the emergency phase, and the integration of extensive communication with the population. It is also planned to carry out exercises with an earthquake or major fire as the originating cause, and a minor accident whose seriousness does not immediate reveal a necessity to activate the off-site emergency plan.

ASN will continue its work to strengthen its doctrine for the control of urban development around the BNIs. ASN wants to better inform the local authorities of the risk generated by nuclear installations so that it is considered to a greater extent in the development strategy of municipalities. This information must be provided coherently and systematically for all installations with an off-site emergency plan. In the longer term, ASN wishes to apply public protection restrictions to limit urban development and therefore the consequences of an accident affecting an installation.

The CODIRPA international seminar scheduled for May 2011 will provide an opportunity to take stock of the work undertaken in the post-accident domain. The awaited publication of the emergency phase exit guide and the guidelines for managing the transition and long-term phases will be accompanied by a reflection on the future programme of work in the post-accident domain, and on how the current organisation of the CODIRPA - which will have fulfilled its mission - should evolve.

PUBLIC INFORMATION AND TRANSPARENCY

CHAPTER 6

The TSN Act of 13 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 1). 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 to promote transparency by the Local Information Committees (CLIs) and the High Committee for Transparency and Information on Nuclear Security (HCTISN).

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 exercising of the independence conferred on it by the TSN Act.

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. To accomplish this, ASN endeavours to make its means of action and the information media it uses evolve to meet the demands of both the general and the professional public.

Since 2002, ASN has published the follow-up letters for all inspections carried out in basic nuclear installations (BNI). Since 2008 it has extended this practice to the radiotherapy inspection follow-up letters and, since April 2010, to the follow-up letters to inspections of small-scale nuclear facilities. Small-scale nuclear activities include the industrial sector (suppliers of medical and non-medical sources), research and the entire medical sector (radiotherapy and brachytherapy, conventional and interventional radiology, nuclear medicine, etc.). Each year ASN thus posts more than 1300 inspection follow-up letters on its website for all the activities it inspects.

Since 1 October 2008, ASN also makes the opinions and recommendations of its Advisory Committees available on its website.

As part of its approach to transparency and public information, ASN wishes to involve the public more closely in its decision-making process and to explain its decisions. It will thus promote public consultations via its website. Thirteen consultations were posted online in 2010 (also see point 2|2 of this chapter and chapter 3).

1|2 ASN 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.

The ASN's will to inform new audiences in new ways led to the creation in April 2009 of an institutional letter - *the ASN Newsletter* - issued in 1800 copies, the introduction of a new version of its website *www.asn.fr* in October 2009, and the recasting of its magazine *Contrôle* in November 2009.

In April 2010 ASN launched its internal newsletter *Transparence,* which is circulated in parallel to an external audience.

ASN now has a full range of media for informing the public about all aspects of its duties and its stance on strategic issues.

1|2|1 ASN's website, *www.asn.fr*

Today, ASN's main vector 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 in its areas of competence. Website visitors are informed about subjects as varied as nuclear installations, radiotherapy, radioactive waste, radon, emergency situation management, industrial uses of ionising radiations, etc.

The website gives access to a unique documentary database on the life of the installations. The website ergonomics and graphics were completely revisited in 2009, resulting in simplified navigation (by category, by sector of activity, etc.), improved access to data and optimised downloading of information and selected publications.

A new sector of activities was introduced on the website in 2010, namely "Déchets/Installations en démantèlement" (Waste/Installations undergoing decommissioning), along with new sections, such as the pages devoted to the Scientific Committee, and to the strategy and doctrine of ASN. Several reports, including "Les sites pollués au radium et par d'autres substances radioactives" (Sites polluted by radium and other radioactive substances) and the Tritium White Paper have been posted online. In addition to the updating of all the regional pages, the 2009 results drawn from the ASN annual report have been integrated for each division. In the "Advisory Committees (GPE)" section of its website, ASN also provides summaries of the IRSN reports presented to the GPEs, and the opinions the GPEs returned to IRSN as technical advisors.

Lastly, to participate in the debate on the theme of nuclear safety, a public consultation was launched in May 2010 on "the revision of the general regulations for basic nuclear installations (BNI)" and will continue into 2011.

RSS web feeds are also available for real-time monitoring of the integration of the latest news and the updating of the ASN *Official Bulletin*. Since spring 2010 the website has been participating in social networks such as Facebook, Twitter and Dailymotion.

More than 300,000 Internet users consulted nearly 2 million pages online in 2010.

An English version of the website exists at *www.french-nuclear-safety.fr.* New sections were developed in the English version in 2010, namely the Scientific Committee and the ASN strategy and doctrine. Lastly, several issues of the magazine *Contrôle* have been fully translated and posted online.

1|2|2 *The French Nuclear Safety Authority's Newsletter*

Since 2009, ASN has supplemented its editorial offering for its institutional audience (members of parliament, local elected officials, senior civil servants, CLIs, licensees and journalists) by launching 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 some 1800 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.

1|2|3 *Contrôle* magazine

Four times a year, ASN publishes the magazine *Contrôle*, with a circulation of more than 10,000 copies both in France (national and local elected officials, media, HCTISN, CLIs, associations, licensees, administrations, private individuals) and abroad (safety authorities of countries with which ASN maintains close ties).

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 special report presents a given subject viewed from different angles so that readers can develop their own opinion.

Cover pages of the *Contrôle* magazine issues published in 2010

It presents the ASN view of the subject addressed and gives the various stakeholders concerned an opportunity to express themselves: licensees, administrations, experts, environmental protection associations, journalists, etc. ASN's foreign counterparts are also asked for their viewpoint and an article is regularly devoted to an example from a sector of activity other than nuclear. The "L'Essentiel" section of the magazine presents extracts of press releases and information memos, summaries of inspection follow-up letters and incident notifications, and the ASN's regional actions.

In 2010 *Contrôle* covered the following subjects:
– Inspection of the nuclear reactor pressure equipment (no. 186 - February);
– ASN Report on the state of nuclear safety and radiation protection in France in 2009: (no. 187 - April);
– Monitoring of environmental radioactivity (no. 188 - July);
– Construction of the European nuclear safety and radiation protection area (no. 189 - November).

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 outlooks on topical issues and to questions of particular importance at regional and national level.

Under the TSN Act, *the annual ASN Report on the state of nuclear safety and radiation protection in France* is submitted each year to the President of the Republic, to the Government and to Parliament. It is also sent to nearly 2,000 addresses: public authority representatives, local elected officials, licensees and heads of regulated activities or installations, associations, professional union organisations, learned societies, private individuals, etc.

The 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.

1 | 2 | 5 Other ASN publications

In 2010, ASN added a written publication to its internal communication media intended more particularly for its staff. The first issue of this magazine, *Transparence*, which is published three times per year, came out in April 2010. Addressing the internal audiences of ASN, it endeavours to present a clear and educational description of ASN's missions, its activities, its specialist fields and its internal organisation. It is also issued to targeted external audiences such as operational partners, CLIs, members of Parliament and engineering schools.

Another communication medium, the *Annual activity report 2009*, was published in the second quarter of 2010. It is an annual publication intended for all ASN employees, and can be distributed at the recruitment forums in which ASN participates. This report highlights information on subjects ranging from training or social dialogue to the quality management system and financial resources.

1 | 3 ASN's audiences

1 | 3 | 1 ASN and the general public

Nuclear safety and radiation protection are not the exclusive preserve of the specialists; they concern all citizens.

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. ASN therefore intends to both initiate and participate in debates with the public.

ASN actions aimed at the general public

a) Brochures presenting ASN and its regional divisions

The ASN institutional brochure describes the status of the ASN, its organisation and its activities. It is available in English.

The presentation brochures for ASN's eleven regional divisions describe the regulation of nuclear safety and radiation protection in the regions, placed under the responsibility of each of the ASN regional representatives, and the contribution of the divisions to public information.

These brochures are widely issued to government departments and ASN stakeholders (CLIs, licensees, professionals, environmental protection associations, the media, etc…).

b) The information sheets

These sheets are distributed among the general public and the teaching sector. 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:
"Administration of stable iodine in the event of a nuclear accident";
"Radiation protection principles";
"Nuclear or radiology: which term to use?"
"Radiation protection values and units";
"The French nuclear fuel cycle";
"Nuclear emergency situations" (sheet updated in 2010);
"Radon".

The collection of ASN information sheets

c) The Public Information and Documentation Centre

The Public Information and Documentation Centre in the ASN's Paris premises has been greeting visitors since 2004, allowing them to consult more than 3,000 documents relating to nuclear safety and radiation protection, and responding to the demands of various publics: private individuals, professionals, students, associations, etc.

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 21 of the TSN Act, deal with the environmental impact of each BNI.

The public has access to all the 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).

In 2010, the ASN Public Information and Documentation Centre responded to more than 2,000 queries from diverse publics. These queries concerned requests for administrative documents, the sending of publications, documentary searches, and taking stances on important issues.

d) Exhibition: "Nuclear applications and society: from understanding to regulation"

ASN and IRSN organise an exhibition travelling around the regions, more particularly aimed at schoolchildren and the general public. The purpose of the exhibition is to provide simple, attractive and direct information on the assessment and management of nuclear energy related risks and the corresponding means of monitoring. Each year, several towns host this 250 m² exhibition for a few weeks.

The regional divisions assist with the events and conferences and the dissemination of information to elected officials, the local press and the general public.

In 2010, the "Nuclear applications and society: from understanding to regulation" travelling exhibition made its first presentation in Cherbourg, after which it proceeded first to Épinal, then to Saint-Étienne. It received nearly 2,200 visitors. The 6 thematic conferences associated with the exhibition were attended this year by nearly 350 participants. ASN has decided, in relation with the IRSN, to conduct a study in 2011 into its general public events strategy, with a view to optimising it.

e) Information on the fourth iodine tablet distribution campaign

The fourth campaign for the distribution of stable iodine tablets around EDF nuclear power plants ran between June 2009 and the first quarter of 2010. It concerned some 500,000 people situated in a 10 kilometre radius around the 19 French nuclear power plants. Particular efforts were made to inform the populations: nominative letters sent to each household concerned, national and local press relations, educational information documents (leaflets, posters, specific website at *www.distribution-iode.com*). Nationwide, 88% of the persons questioned had heard of this campaign, 49.2% of the populations concerned collected boxes of tablets from the pharmacy and more than 338,000 boxes were delivered. This first phase was completed by the posting of boxes of tablets to the persons who had not collected them from the pharmacy. The final level of coverage therefore approached 100%. A quantitative study carried out in November 2010 will provide insight into the major lessons to be drawn and the perception of the nuclear risk by the populations (also see chapter 5).

1|3|2 ASN and professionals

The objective of ASN's relations with its professional audience is to enhance knowledge of the regulations and to cultivate the technical, organisational and human aspects of nuclear safety and radiation protection.

Over and above its professional contacts with the main nuclear licensees, ASN is developing its ties with players in the radioactive materials transport sector and users of ionising radiations in the health sector.

ASN also works to raise the awareness of the major risks associated with the use of gamma radiography equipment and the problem of source theft or loss among stakeholders in industry and research in France.

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.

a) Publications for professionals

ASN produces publications intended for professionals to explain the regulations and encourage their application.

A notable action in the medical field in 2010 was the joint review of methods of experience feedback from the significant event notifications intended for health professionals by the learned societies of radiotherapy (SFRO - the French Society for Radiation Oncology / SFPM - the French Society for Medical Physics/ AFPPE - the French Association of Electroradiology Paramedical Staff) and HAS (French National Health Authority), AFSSAPS (French Health Product Safety Agency) and InVS (French Health Monitoring Institute) . In this context, a half-yearly bulletin has been prepared with the aim of enhancing the progress and experience-sharing action initiated by the radiotherapy centres to promote health treatment safety.

In addition, the second assessment of the significant radiation protection events concerning patients undergoing an external radiotherapy procedure and the equipment monitoring reports concerning radiotherapy devices (hardware and software) declared between 30 June 2008 and 30 June 2010 was published jointly by ASN and the AFSSAPS. It is available on their respective websites.

Other media have been published for professional medical trade fairs:
– the brochure dedicated to quality assurance in radiotherapy was updated at the National Congress of the SFRO held from 6 to 8 October 2010;
– the 2010 edition of the regulations guide on the radiation protection requirements applicable to medical and dental radiology was issued at the Annual Convention of the French Society of Radiology (SFR) in Paris (22-26 October 2010).

Regarding the transport of radioactive material, a survey of consignors, transporters and users of sources conducted by the ASN divisions in 2009 revealed shortcomings in the knowledge of the applicable regulations.

Table 1: the ASN guides

Title	Version date
Guide to methods of declaring and codifying criteria relative to significant events involving safety, radiation protection or the environment applicable to basic nuclear installations and to the transport of radioactive material	21/10/2005
Guide to regulatory requirements applicable to the transport of radioactive material in airport zones	01/02/2006
Guide relating to the order of 31/12/99. Subject: fire	01/04/2006
Safety guide relating to the final disposal of radioactive waste in deep geological formations	12/02/2008
Recommendations for drafting annual information reports for the public concerning basic nuclear installations	05/12/2008
Auto-assessment of risk exposure of patients receiving external radiotherapy	15/10/2008
Management of radiotherapy safety and quality of treatment	15/10/2008
Guide for applicants requesting shipment authorisation and approval of package models or radioactive materials for civil use transported on the public highway	07/04/2009
Evaluation of nuclear pressure vessel conformity	31/03/2009
Significant radiation protection event affecting a radiotherapy patient: declaration and classification on the ASN-SFRO scale	28/09/2010
Studying hazards in transport infrastructures concerned by the transport of radioactive material	30/09/2010

A brochure was issued to the transport professionals summarizing the broad principles of the regulations governing the transport of radioactive material.

• The collection of ASN guides

Ensuring that the professionals fully understand the regulations concerning nuclear safety and radiation protection is one of ASN's prime objectives. The collection of "ASN guides" was created with this educational approach in view. Intended for external audiences, these guides present ASN's doctrine, provide recommendations, propose methods for achieving the objectives set by the texts, and share the methods and good practices resulting from experience feedback; as the term "guide" implies, they are not ruling documents.

Discussion meeting organised by the Marseille division on how the seismic risk is taken into account in the nuclear installations of south-east France – February 2010

The collection of ASN guides grew substantially in 2010 in a context of regulatory change, with the addition of guides in the medical, transport and nuclear fields.

b) 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 regional meetings organised by the ASN divisions

Several discussions with professional audiences were organised by the ASN divisions.

In the health field, meetings with radiotherapy professionals were organised by the divisions of Paris (12 April), Marseille (19 November) and Nantes (16 December) to share experience on ensuring that treatments are safe and the results of the ASN inspections in this field.

In the industrial field, the Lyon division organised a meeting with industrial radiography professionals of the Rhône-Alpes and Auvergne regions on 10 February to sign a good practices charter.

Meetings with transporters, medical institutions, and users of gammagraphs and gammadensimeters were organised by the divisions of Lyon (4 February), Douai (16 June) and Marseille (30 September) to inform and promote awareness of the regulations governing the transport of radioactive material.

As a follow-on to the commemoration of the Provence earthquake of 1909, the Marseille division organised two meetings to discuss how the seismic risk is taken into account in the nuclear installations of south-east France. The first meeting held on 4 February addressed the Cadarache site, while the second on 7 December concerned Marcoule.

ASN participation in symposia and professional events

ASN took part in scientific medical conferences, in particular those organised by learned societies in the medical field: SFRP (French Radiation Protection Society), SFR (French Society of Radiology), SFPM (French Society of Medical Physics), SRFO (French Society for Radiation Oncology), SIRLaF (International society of radiation biology in French language), ATSR (French Association for Technical and Scientific Radiation Protection), AFPPE (French Association of Electroradiology Paramedical Staff).

ASN was thus able to continue its discussions with professionals regarding changes in the regulation of radiation protection or its legislative framework, and answer specific questions.

In addition to its interventions at these events, ASN had stands at the following gatherings:
– the National Congress of the SFRO (6-8 October 2010), where the first convention between ASN and SFRO was signed on 8 October;
– the Annual Convention of the SFR in Paris (22-26 October 2010) where André-Claude Lacoste, ASN Chairman, gave a conference entitled “Findings and prospects in radiology” on 24 October;
– the 7th Meetings of “Persons Competent in Radiation protection” (PCR) (9-10 December 2010); ASN actively supports the PCR networks.

Other ASN interventions at regional events.
– the 5th Meetings of Val-de-Loire (18 June 2010) on the theme of floods and low-water conditions provided the opportunity to discuss the question of reactor cooling;
– ASN contributed to the National Risk Conference (21 October 2010) on the subjects of post-accident actions, control of urbanisation around BNIs and the extension of nuclear power plant lifetimes. This conference is organised every two years by the Nord Pas-de Calais DREAL (Regional Directorate for the Environment, Planning and Housing) and the ANRT (National Association for Technological Risks), under the auspices of the MEDDTL (Ministry of the Environment, Sustainable Development, Transport and Housing).

More generally, the ASN divisions took 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 continuous training courses, in particular for biomedical engineers or radiology operators, and for persons with competence for radiation protection (PCR) as defined by the regulations.

These interventions and presence at both national and regional level help to raise the profile of ASN and establish ties with professionals, particularly in the small-scale nuclear sector, in order to improve implementation of the safety and radiation protection principles.

The presence and contributions of ASN at such events, both regional and national, are a valuable means of informing the professionals and tightening relations with them - particularly in the small-scale nuclear sector - with a view to improving application of the safety and radiation protection principles.

• ASN's contribution to improving international nuclear safety and radiation protection
In 2010, ASN supported the IAEA initiatives to promote the nuclear safety culture internationally.

From 7 to 9 June 2010, ASN helped organise the IAEA seminar on waste management, alongside the DGEC (General Directorate for Energy) and ANDRA (French National Agency for Radioactive Waste Management). 110 participants from more than 50 countries met in Paris to discuss questions of State responsibility and the independence and duties of the national organisations, particularly with regard to informing the public.

During the AIEA "*International conference on operational safety and performance of NPP's and fuel cycle facilities*" held in Vienna from 21 to 25 June 2010, ASN presented a poster showing the process for reporting experience feedback on significant nuclear safety and radiation protection events in France, and to highlight some examples of international experience feedback sharing.

1|3|3 ASN and the medias

a) Press relations
The ASN press service is responsible for liaising with the media on the organisation's activities and the regulation of nuclear safety and radiation protection in France. This information communication action goes on throughout the year, becoming more intense during events that attract greater media attention.

ASN press relations help strengthen the organisation's credibility and legitimacy within its fields of competence.

Journalists were informed of ASN's activities on numerous occasions during the year:
– more than 30 press briefings at national and regional level helped ASN explain its activities and develop particular topics, and bring it closer to its various audiences;
– some twenty press releases, about one hundred information memos and numerous interviews enabled ASN to answer questions from the media, and clarify aspects of nuclear regulation in France, in application of its policy of transparency.

In 2010, the media questioned ASN on topical matters and strategic issues, such as the day-to-day safety of nuclear

TO BE NOTED IN 2010

Information on the environmental radioactivity monitoring network (RNMRE)

Created by article R.1333-11 of the Public Health Code, the role of the RNMRE (French National Network of Environmental Radioactivity Monitoring) is to contribute to estimating the doses received from the ionising radiations to which the population is exposed as a result of all nuclear activities, and to inform the public.

In order to meet this transparency goal, the RNMRE launched a website on 2 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 RNMRE.

To coincide with the launch of the website, a joint ASN and IRSN press conference was held in Paris, in the presence of representatives from the RNMRE (public authorities, licensees, associations, CLIs, etc.). Each year the RNMRE collects 200,000 measurements, of which 120,000 are provided by the licencees.

ASN considers that the launch of the RNMRE 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 public and internauts are consulted about how they would like this website to develop. In 2010, ASN made a study of the data transmitted and proposed some fifty more precise rules governing the declaration of measurement results. Harmonising the declarations in this way will permit better inter-comparison of the data.Furthermore, ASN will ensure that the website can gradually acquire functions and information enabling the public to understand and interpret the results of environmental radioactivity measurements transmitted to the RNM.

More than 178,000 visitors logged on to the website in 2010 and nearly 9 million pages were consulted. After a consultation peak registered when the site was launched, its frequentation has stabilized at 3,000 visitors per month. The website has found a good echo abroad, with visitors from more than 20 different countries.

installations, the EPR reactor construction site at Flamanville, the level-2 incident at the ATPu (Plutonium technology workshop) in 2009 on the CEA (French Alternative Energies and Atomic Energy Commission) site at Cadarache, the EPR instrumentation and control assessment, the continuation of operation of nuclear power plants, or the level of safety of the new reactors built across the world. Some of these subjects aroused a great deal of media attention.

With regard to the radiation protection of patients, the functioning of radiotherapy centres and the ASN recommendations to improve the quality of treatment safety were subjects that interested journalists.

In 2010, ASN also held press conferences in which participated other institutions and working groups on various subjects:
– In February, ASN and the IRSN held a joint press brief on the launching of the RNMRE (French National Environmental Radiation Monitoring Network), in the presence of RNMRE representatives (see dedicated box in this chapter and chapter 5);
– In June, ASN and the MEEDDM (Ministry for Ecology, Energy, Sustainable Development and the Sea) presented the French National Radioactive Material and Waste Management Plan (PNGMDR). This plan is the fruit of the discussions of a pluralistic working group (waste producers, political and administrative representatives, organisations responsible for radioactive waste, associations, etc.) (also see chapter 16);
– In July, ASN presented - along with the Tritium working group - *the Tritium White Paper*, which reviews current knowledge of this radionuclide and presents the recommendations formulated by the pluralistic think tank that worked on it. *The Tritium White Paper,* which has been circulated to the public authorities and environmental protection associations, and presented to the medias, is available at *http://livre-blanc-tritium.asn.fr* (also see chapter 3);
– in September, ASN participated with the MEEDDM in the presentation of report of the Limousin region GEP (pluralistic expert group) on the management of the former uranium mining sites in France.

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;
– in early April, ASN presented its *report on the status of nuclear safety and radiation protection in France* to the OPECST (Parliamentary Office for the Evaluation of Scientific and Technological Choices) in front of some twenty journalists. The 2009 report was presented on 7 April 2010, that of 2010 on 30 March 2011.

Locally, the eleven regional divisions organise several regional conferences (20 press conferences in 2010) to present the ASN report and to sum up the activity of each division and any local particularities.

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

TO BE NOTED IN 2010

The ASN barometer

In 2010, in collaboration with the TNS SOFRES poll institute, ASN once again used the image and recognition barometer, launched for the first time in 2005. 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 sixth wave of this opinion survey took place in October and November 2010 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).

The rise in ASN recognition observed between 2007 and 2008, which was chiefly due to the high-profile media coverage of the incidents of Summer 2008 (SOCATRI site), is falling with the general public (-3 percentage points, 24% of persons questioned). The lack of news-breaking incidents has had a negative impact on public interest in nuclear-related questions, in spite of ASN's public information efforts: some thirty press conferences at national and regional level, some twenty press releases on varied subjects, about one hundred information memos published on www.asn.fr. ASN is nevertheless still spontaneously identified as being the government organisation responsible for nuclear regulation and inspection in France.

This being said, recognition of ASN by the informed public is up by 4 percentage points, giving a total of 79% of surveyed persons who knew the name ASN.

When questioned about the content of ASN's duties, the French population are as numerous as last year in recognising ASN as the organisation in charge of regulating and inspecting nuclear installations and activities in France (79%, -1 percentage point in relation to 2009). This percentage reaches 92% (-1 percentage point) among the more informed public, thus confirming its greater familiarity with this role of ASN.

Identification of the regulation role, which had significantly increased in 2008, is slightly down: 12% of the general public mention it (-3 percentage points with respect to 2009) compared with 30% of the informed public (-3 percentage points).

As for the perception of its informative role, this has remained at the same level as last year with the general public (7%) and is rising with the informed public (20%, +3 percentage points).

understand the various steps in ASN's regulation and inspection work and inform their audiences of the measures taken to guarantee treatment safety.

Throughout the year ASN maintains relations with the international media on subjects relating to nuclear installation safety and responds to their queries.

Demands from the professional press have been increasing, particularly in the field of medical activity inspection.

b) ASN and the media in emergency situations
Under the terms of the TSN Act, ASN's role in the event of an emergency is clear. It must "inform the public of the safety state […] and of the possible releases into the environment and their risks for personal health and the environment" (article 4).

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.

In 2010, the ASN press department dealt with an event that mobilised its emergency centre: on 27 February, the EDF nuclear power plant at Blayais (Gironde *département*[1]) preventively triggered its on-site emergency plan to cope with the possibility of flooding, given that the wind speed had reached and even exceeded the plan activation criteria (also see chapter 5).

c) 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. Administrative region headed by a *préfet*.

1|3|4 ASN and the institutional public

ASN is also active in an institutional sector that comprises a large number of stakeholders: elected officials, public authorities, HTCTISN (French High Committee for Transparency and Information on Nuclear Security).

ASN organises discussions with these institutional audiences 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:
– in April 2010, ASN presented its *Annual Report on the status of nuclear safety and radiation protection in France* to the OPECST. ASN was heard by the CECPP (Public Policies Assessment and Control Committee) chaired by National Assembly deputies René Dosière and Christian Vanneste;
– in May ASN was heard by the President of the Senate commitee for the economy, sustainable development and national planning and development in the context of the bill on the new organisation of the electricity market (Nome);
– in November, ASN was heard by the OPECST concerning the French National Radioactive Material and Waste Management Plan (PNGMDR) ;
– in December, ASN participated in the 4th parliamentary meetings on French nuclear energy.

At 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 subjects.

ASN will continue to develop its relations with its institutional audiences in 2011.

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 developing of rating scales. The first scale was set up in 1987 by the CSSIN. 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.

UNDERSTAND

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.

Table 2: rating of significant events on the INES scale in 2010

Level	Pressurised water reactor	Other basic nuclear installations	Transport	Small-scale nuclear activities	Total
3 and above	0	0	0	0	0
2	1	1	0	1	3
1	74	20	9	37	140
0	642	148	53	121	964
Total	**717**	**169**	**62**	**159**	**1107**

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 (Grades CTCAE[2] *- Common Terminology Criteria for Adverse Events), already used by the practitioners.*

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.

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 be complementary to 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;

– be usable in any place at any time independently of an incident or accident situation and situations managed under the emergency plans; continuation of the group's work in 2010 has resulted in a project that will be experimented in 2011.

2. CTCAE: *Cancer Therapy Evaluation Program*, August 2006, *http://ctep.cancer.gov*

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. Nuclear activities are now among those for which the Act requires the greatest possible transparency.

The Act in particular guarantees *"the public's right to reliable and accessible information on nuclear security"* (article 1 of the TSN Act).

This right to information concerns all fields of ASN activity, and 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 ensures that these measures, which more particularly concern the licensees under its supervision, are applied. 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.

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 public limited companies), or specific, such as those pertaining to the nuclear sector.

The TSN Act now requires that all BNI licensees issue a yearly report on their situation and their nuclear safety and radiation protection actions.

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.

Examples of licensee reports produced in application of article 21 of the TSN Act

As in the previous years, ASN considers the results of the analyses to be positive on the whole. The reports were submitted in good time and comply with the obligations laid out in the TSN Act with regard to the subjects to be addressed.

The effort to produce communication media adapted to the general public was continued.

Posting the reports online on the Internet is now the general practice, and it would be desirable for the reports from previous years to be kept available on the sites.

Contrasting situations do nevertheless exist in spite of the observed progress; some licensees only partially apply the recommendations of the ASN guide.

As a relatively general rule, the reports limit themselves to the headings explicitly mentioned in the Act, without addressing related subjects that would help give the public an overall vision 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, greater emphasis on transparency and on the public's right of access to nuclear information (Articles 19 and 21 of the TSN Act) would be appreciable.

ASN therefore aims to continue working with the licensees to share good practices and monitor progress.

Possible ways of improving the reports in the coming years could be to adopt a common title and include data on long-term objectives and development plans spanning several years.

ASN would like the annual public information reports to gradually replace other reports on similar subjects provided for by the regulations prior to the TSN Act. This worthwhile simplification does however imply that these annual public information reports must always contain all the necessary information, which does not yet appear to be the case.

More precisely, the following observations concern the reports drafted by the main licensees.

ANDRA

ASN considers that the annual public information reports for the two waste disposal centres operated by ANDRA (CSM and CSFMA) increasingly correspond to both the letter and spirit of article 21 of the TSN Act.

Broadly speaking, these reports follow the recommendations of the ASN guide; more particularly, they apply the standard layout recommended in the guide.

They have a common graphic charter - much improved on that of the previous year - with numerous illustrations, and can be readily understood by the general public. The CSM report could nevertheless be usefully supplemented by including a number of general explanations that figure in the CSFMA report.

AREVA

Like last year, ASN observes that the annual public information reports on the installations of the AREVA group are readily accessible and understandable. The standardisation efforts noted for 2008 have been continued; 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 access to the information requested by the public could however be given greater exposure. The presentation of subjects relating to transport could also be improved.

As a general rule, the data presented could be better put into perspective and objectives should be identified.

CEA

On the whole, the annual public information reports on the installations operated by the CEA have changed little with respect to those for 2008; they are generally sound information documents intended for the general public, addressing the headings mentioned in article 21 of the TSN Act. The language is understandable for the public and some explanations are included. The reports all follow the same layout plan, which nonetheless differs from 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 nuisance factors that are not specifically mentioned in article 21 of the TSN Act (microbiological risk, noises, odours, etc.) are never addressed, yet they contribute to the overall impact of the installation.

Public information actions are starting to be mentioned in the reports, but to varying extents.

EDF

As in the previous years, the annual public information reports on the nuclear installations of EDF satisfy the requirements of article 21 of the TSN Act. Moreover, with the exception of the Tricastin operational hot unit report, these reports generally follow the recommendations of the ASN guide.

The reports are sufficiently clear and well-organised to be understood by the general public, even if they still contain few graphics or diagrams.

Like last year, the reports could be improved by giving a more comprehensive presentation of the various sites (organisation, operation of its installations, on-site installations classified on environmental protection grounds), by systematically commenting and putting into perspective the data backed up by figures, by better describing the condition of the containment barriers, particularly with regard to the safety criteria, by mentioning all the ongoing administrative procedures, by expanding on information relative to events declared to ASN and formally presenting the opinions of the CHSCT (Committee for Health, Safety and Working Conditions) in an appendix.

In conclusion, although the quality of the reports has been maintained with respect to the previous year, it can be improved to better achieve the public information objective.

These reports are available from 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.

Previously, access to nuclear-related documents was governed by two general texts which also applied to other fields:
– the Act of 17 July 1978 introducing various measures to improve government-to-public relations and notably instituting freedom of access to administrative documents: the administration must thus communicate all the documents it holds to whoever requests them.
– chapter IV of part II of book I of the environment code which 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 systems for access to documents and information naturally apply to the nuclear field. What they both share is an obligation of communication placed on the public authorities or those acting on their behalf.

By creating a right of access to information that is directly binding on the licensees, the TSN Act made a major innovation. Licensees are now required to communicate to whoever so requests, the information in their possession, whether received or produced by them, concerning the risks related to their activities and the safety or radiation protection measures they have taken to prevent or mitigate these risks.

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 installation, it is also responsible for communicating on the risks created by its installation and the steps it takes to prevent or mitigate their consequences.

As with the other access rights mentioned above, the TSN Act contains provisions designed in particular to protect public safety and industrial and commercial confidentiality.

The procedures involved in the enforcement of this right are similar to those concerning the other access rights: if a licensee refuses to communicate the information requested, the applicant may refer the matter to the Committee of Access to Administrative Documents (CADA), an independent administrative authority, which will then rule on whether or not the refusal is justified. Should the parties involved fail to abide by the CADA ruling, the administrative courts will decide whether or not the information should be released.

This new right is a major change to the legal and regulatory requirements of transparency as applied to nuclear activities. Currently, there is no equivalent applicable to other fields.

This right of access has applied to BNI licensees since the TSN Act was passed. In 2010, ASN initiated discussions on a project to extend this right to the transportation of the main radioactive packages. It will submit a proposal on this subject to the Government at the beginning of 2011, as desired by the HCTISN (French High Committee for Transparency and Information on Nuclear Security).

ASN is monitoring the implementation of this new right. The information collected shows that it is as yet little used. Some organisations have nevertheless already exercised this right, particularly with respect to the Cotentin installations, the Chinon and Fessenheim nuclear power plants, and the Soulaine disposal centre. ASN also contacted those licensees that had refused to communicate information, to encourage them to adopt a more flexible interpretation of the notion of confidentiality as protected by law. ASN also offered to provide CADA with technical opinions, as and when necessary, on whether or not the documents that are referred to this Committee should be released. Since this right came into force, however, CADA has only dealt with a single case.

2|2 Public consultation about projects

2|2|1 Public consultation procedures
(also see chapter 3)

The Charter for the Environment enshrines the participation principle whereby everyone has access to information about the environment, including hazardous activities and materials, and the public is involved in drafting projects having an important impact on the environment.

The TSN Act and its implementing decree of 2 November 2007 reinforced public information and consultation 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 authorisations are also subject to the approval of the *Conseil général*[3], the municipal councils concerned and the CLI (Local Information Committee). Draft requirements to be issued by ASN concerning BNI water intake, discharges or detrimental effects are also presented to the CLI and the CODERST (Departmental Council for the Environment and for Health and Technological Risks).

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. Certain communication restrictions are legitimately planned for in the interests of public safety or industrial and trade secrets, but ASN makes sure that any communication refusal is effectively justified.

3. *département*-level elected council

2|2|2 Developing public consultation
(also see chapter 3)

Further to an ASN proposal, the Government has voted a new provision in the law of 12 July 2010 on the national commitment for the environment ("Grenelle 2" Act), adding a consultation of the public in projects to increase discharges from a BNI by an amount that is not large enough to require a public inquiry (article 243 of the Act).

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 beyond 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 encourage the public to adopt a proactive attitude to certain important issues. It was in this spirit that it organised regional open-day discussions on how the seismic risk is taken into consideration in nuclear installations in the south of France. Held in Marseille in February 2010 and in Avignon in December 2010, these open-days aroused an excellent response.

2|3 Local Information Committees (CLIs) and the National Association of Local Information Commissions and Committees (ANCCLI)

2|3|1 Local Information Committees (CLI) 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 13 June 2006 (article 22). The broad role of the CLIs is to monitor, inform and be a vector 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 12 March 2008 concerning BNI Local Information Committees.

The CLI, whose creation is incumbent upon the President of the *Conseil Général*[4], comprises various categories of members: representatives of *Conseils généraux*[5], of the municipal councils or representative bodies of groups of *communes*[6] 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 CLI is chaired by the President of the *Conseil général* or by an elected official from the *département* designated by him for this purpose.

The CLI receives the information it needs to function from the licensee, from ASN and from the other Government departments. It 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 2010, ASN devoted about 600,000 euros to CLIs and the CLI association. ASN once again submitted a proposal to the Government for implementation of the system provided for in the TSN Act, whereby the budget of the CLIs with association status (there are about half a dozen of them), would be topped up by a levy on the BNI tax, but this system has not yet been put into place.

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 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-supported 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.

2010 heralded the near-completion of implementation of the provisions of the TSN Act, with the setting up of new CLIs for sites that did not yet have one (nuclear centre of Fontenay-aux-Roses, SICN *(Société industrielle de combustible nucléaire - Industrial Nuclear Fuel Company)* at Veurey-Voroize, Strasbourg University reactor) and the updating of the composition and rules of functioning of the existing CLIs. Only one BNI site remains without a CLI (IONISOS at Dagneux in the Ain *département*) at the end of 2010. A CLI must moreover be created in the near future for the COMURHEX site at Malvesi (Aude *départment*), where part of the installation has been reclassified as a BNI (also see chapter 16).

At the end of 2010 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 in application of article L. 542-13 of the Environment Code, along with about fifteen information committees created around defence-related nuclear sites, in application of 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).

4. *département*-level elected council
5. Regional–level elected council
6. Smallest administrative subdivision administered by a mayor and a municipal council

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 one case out of two. Significant events are also generally presented to the CLI.

Nine CLIs responded positively in 2010 to ASN's proposal to accompany an inspection.

Ten or so CLIs were consulted about licensees' projects in application of the procedures of the new BNI system. A similar number had expert appraisals carried out, as is provided for in the TSN Act.

Roughly half of the CLIs have their own website or pages on the site of the local authority that supports them. The same proportion of CLIs publish a newsletter or published an information brochure in 2010.

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 (ANCCLI)

The TSN Act provides for the constitution of a federation of CLIs, and the decree of 12 March 2008 sets forth certain provisions that this federation must adhere to. ANCLI, the National

TO BE NOTED IN 2010

22nd Conference of Local Information Committees

The 22nd Conference of Local Information Committees brought together 180 participants on 8 December 2010 in Paris at the initiative of ASN and in partnership with ANCCLI.

The mobilisation of the CLIs was extensive and diversified: 95 participants represented 33 different CLIs.

As in previous years, the conference brought together CLI representatives, members of the HCTISN, representatives of the Conseils généraux *and the préfectures*[7] *of départements with CLIs, the Government departments concerned, associations and licensees of nuclear installations.*

The conference debated on two topics, each the subject of a round table: control of urbanisation around BNIs and the decommissioning of BNIs. 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 2010.

The conference was preceded by an "inter-CLI meeting" organised by ANCCLI, where CLI representatives and ASN discussed the financing of the CLIs and questions of access to expertise and skills building.

Opening of the 22nd CLI conference in Paris on 8 December 2010

7. Office of the *préfet*

Association of Local Information Committees, created in 2000, modified its articles of association in October 2009 in order to comply with these rules. It became the National Association of Local Information Commissions and Committees (ANCCLI). Pending the designation of new representatives of the CLIs, the association was run by an interim structure in 2010. Finally, the board of governors and the committee were designated at the general meeting of 26 November 2010. Mr. Jean-Claude Delalonde, President of the Gravelines CLI, was re-elected President of ANCCLI.

The activity of ANCCLI in 2010

The temporary nature of its administrative structure did not prevent ANCCLI from conducting its duties in 2010.

It responded to the various questions from the CLIs, ranging from legal or administrative matters to urbanisation and communication aspects.

In 2010 ANCCLI focused in priority on the question of financing the CLIs: many CLIs referred this question to the parliament members of their region.

The ANCCLI authorities

The ANCCLI working groups continued to function, in spite of the major restructuring within the CLIs.

• The ANCCLI Scientific Committee
This committee comprises independent unpaid experts from different horizons.

In 2010, the Scientific Committee published a complete synthesis of current knowledge on tritium, its management and its impact on man and the environment, entitled "*Le tritium - Actualité d'aujourd'hui et de demain*" (Tritium - A topic of today and tomorrow).

The Scientific Committee contributed to the work of the pluralistic tritium think-tank set up by ASN, and to the drafting of the Tritium White Paper (communication on the biological and health effects of tritium).

It also contributed to the feature article of *Contrôle* magazine no. 188, devoted to environmental radioactivity monitoring.

The Scientific Committee gave its opinion on various documents and took part in several working groups and scientific events.

It met five times in 2010.

• The ANCCLI permanent groups and consultative committee
ANCCLI has three "permanent groups":

– the permanent "Radioactive material and waste" group, which studies in particular the notion of reversibility (advantages/drawbacks of irreversible deep storage/reversible storage, the maintenance costs, how to guarantee the memory of storage site locations in the very long term, etc.) and the process to find a storage site for low-level long-lived waste (LL-LL);
– the permanent "Regions - Post-nuclear accident" group, which participated in the creation of NERIS, the European Platform for Preparedness for Nuclear and Radiological Emergency Response and Recovery, in order to integrate the requirements of the CLIs and to keep itself informed of the new decision-making aids, new methods of information and data interchange and the processes of participative governance put in place in the management of emergency and post-accident situations at international level. At the same time, ANCCLI and the IRSN have initiated a pilot action to jointly develop a mapping tool that can correlate the data on the environmental and health consequences of nuclear accidents with the local cartographic representations applying a few selected scenarios. This tool should chiefly serve to help raise the awareness of regional stakeholders - elected officials in particular - to questions of post-accident situation management.
– the "EPR" permanent group which worked more specifically on the monitoring of the EPR construction site at Flamanville.

ANCCLI also has a consultative committee which in 2010 discussed the future orientations of the new federation.

These different working groups met ten times in 2010.

• The ANCCLI senior executives club
In 2010, ANCCLI created the CLI senior executives club to generate a dynamic current between the CLI prime leaders and technicians, and provide a forum to discuss experiences, areas of progress and difficulties encountered by each CLI, in order to have common grounds for work and reflection.

In addition to addressing questions of financing, communication and information procedures, the club devoted time to reflection on the ANCCLI's new website which will come on line in the very near future.

The assignment leaders club met six times in 2010.

ANCCLI partnerships

ANCCLI has very regular contact with ASN and participates in several working groups set up by ASN, such as the PNGMDR (French National Radioactive Material and Waste Management Plan) and CODIRPA (Steering committee for managing the post-accident phase of a nuclear accident or radiological emergency situation).

ANCCLI has concluded a cooperation agreement with the IRSN under which it leads many initiatives. The "ANCCLI/InVS/IRSN health impact" working group set up in 2008, for example, is finalising a guide for the CLIs entitled "Assessing the health risk for populations living near nuclear installations: contributions and limits of health analysis tools, considered in concrete situations".

The European Commission consulted ANCCLI when preparing its draft "Waste" directive.

Ever since the European Nuclear Energy Forum (ENEF) was created in 2007, ANCCLI has actively participated in the meetings of the Transparency working group set up further to the first forum.

• 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 HCTSIN and ANCCLI, the French round table will make recommendations on the following themes: LL-LL waste disposal site selection process, public access to information and participation in decision making, skills-building and access to expertise necessary for truly active participation.

The Secretariat of the Aarhus Convention has accepted to co-organise the final conference of the ACN initiative which should be held in early 2012 under the joint auspices of the European Union and the Aarhus Convention. This will be the first time that these two institutions jointly organise an event.

In the framework of the ACN initiative, ANCCLI took part in the first meeting of the Bulgarian round table in Sofia.

Participation in events

To conclude, ANCCLI contributed to various other events in 2010: the meetings of the Association "Deciding together: shared expertise and decisions: what modes of governance?", the international colloquium on access to civil nuclear energy organised by the Government, the conference of the SFRP, the meeting of the national mirror committee of the working group on "Preparation of the ICRP's new recommendations concerning geological storage of long-lived radioactive waste", the ICSI (Institute for an Industrial Safety Culture) training day on industrial risks, etc.

2|4 High Committee for Transparency and Information on Nuclear Security (HCTISN)

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.

The HCTISN held four plenary meetings in 2010 and ran several working groups.

It also drew up a report on "Transparency and the management of nuclear materials and waste produced at the different stages of the fuel cycle" in response to a demand from the Minister of Ecology, Energy, Sustainable Development and the Sea (MEEDDM) and the OPECST. This report, which was produced by a working group led by Mr. Claude Gatignol, member of parliament for the Manche *département* and member of the High Committee, was handed over to the Minister and the OPECST in July 2010 (the press were invited to the meeting at the OPECST).

The High Committee continued its work on the theme of "Transparency and secrecy" and on the setting up of an Internet nuclear information portal. It raised questions relating to nuclear waste on several occasions (presentation of the PNGMDR, process for choosing the LL-LL waste storage site, situation of the old uranium mines, etc.). The High Committee also discussed aspects of the "cancer" plan concerning radiation protection, and conducted reflections on the environmental monitoring strategy, among other things.

At its plenary sessions the High Committee also addressed various topical questions by inviting the key players to give talks.

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 The French Institute for Radiation Protection and Nuclear Safety (IRSN)

IRSN (see chapter 2, point 2|5|1) 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 2009 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 concerns transparency and the "Nuclear applications and society" exhibition.

In 2010, in accordance with the 2006 Act on transparency and security in the nuclear field and the Institute's undertakings to the State in its objectives contract for developing transparency and greater involvement of society, and concurrently with the ASN letters, IRSN published on its website *www.irsn.fr,* in the "*Avis et rapports*" (opinions and reports) section, the summaries of the reports it presented to the ASN Advisory Committees following the analysis of the corresponding safety cases, as well as the opinions it submitted to the authorities. The Institute is continuing its efforts to make this nuclear safety and radiation protection information more accessible and more informative.

With regard to the "Nuclear energy and society" travelling exhibition, a new model entitled "intervention zones" has been added to the "And what if an accident happens?" module. In addition to this, the presentations integrated in the "environmental monitoring" model were updated further to the creation of the RNM website.

In 2010, the exhibition was presented at the Festival Hall of Cherbourg (Manche *département*), the Congress Centre of Epinal (Vosges *département*) and lastly at the CCSTI of Saint-Etienne (Loire *département*).

2, 200 people visited the exhibition over a total period of eleven weeks. Six conferences were organised in 2010, with attendance in excess of 350 people.

A study of how the current exhibition could be made to evolve is in progress.

For all information concerning the travelling exhibition: *http://expo.irsn.fr/expo/*

To find out more about IRSN: *www.irsn.fr*

The "nuclear energy and society" exhibition was presented in Cherbourg, Epinal and Saint-Etienne in 2010

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, HL-LLW 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.ifen.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 of 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.meah.sante.gouv.fr (site of the national mission for hospital appraisal and audit);
- www.sante.gouv.fr (site of the Ministry of 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 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 and 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 unions
– www.atomique.com (site of CGT trade union members in nuclear power plants);
– 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 upon ASN from its inception, and was reinforced by the Act of 13 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 is materialised through 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, medias, institutional and professional audiences), and of the information means used (press relations, events, publications, Internet, etc.).

In 2011, ASN will continue to enhance transparency and information on the subjects under its responsibility, together with the other players and stakeholders. ASN will develop the organisation of national and international debates on general subjects concerning nuclear safety and radiation protection, but also on society's approach to risk in general. ASN aims to involve the public more closely in its decision-making process and to explain its decisions. It will thus promote public consultations via its website to an even greater extent.

Developing exchanges with the institutions and stakeholders will also be one of the focal points of its public information actions.

As part of its international policy, ASN will actively contribute to the holding of a European conference on nuclear safety and radiation protection in 2011.

In 2011, 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 revising of the procedures for public consultation – where nuclear activities are concerned – provided for in the act on the national commitment for the environment ("Grenelle 2" Act): this chiefly concerns the reforming of 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 takeoffs or discharges into the environment from a BNI, but which does not fall under the public inquiry procedure.

ASN will continue to see to the correct application of the new provisions concerning access to the information held by licensees and to the safety report. On this account it will examine the conditions of implementation of the recommendations the HCTISN should publish in early 2011 on the reconciling of transparency and secrets protected by law.

On completion of discussions that began in 2010, ASN will propose to the Government an extension, in the transport sector, of the right of access to the information held by those responsible for nuclear activities.

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

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.

This international activity is carried out within an explicit legal framework, since article 9 of the TSN Act states that "The Nuclear Safety Authority 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 Community 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 in a multilateral and EU context, and as part of bilateral agreements 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".

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.

As a result of the work of the Western European Nuclear Regulators' Association (WENRA), an informal club created in 1999 at the initiative of the ASN Chair, the safety rules for reactors operating in Europe should become effectively harmonised in 2011. In 2010, WENRA also reached an important consensus on safety objectives for new reactors (see point 2|1|5).

In 2008, ENSREG (European Nuclear Safety Regulator Group, previously known as the High-Level Group - HLG), comprising the heads of the European Union's nuclear regulators, was created at the initiative of the European Council in March 2007. Its work, notably, opened the way for the adoption of a directive on nuclear safety, on 25 June. ENSREG has also worked on a proposed directive on the management of waste and spent fuel; the results have been forwarded to the European Commission and, at the time of writing, the directive is being examined by the EU Council of Ministers.

In the field of radiation protection, the work done by the Heads of European Radiation Control Authorities (HERCA) has strengthened European cooperation. Significant progress has been made by this committee and its working groups since it was created in 2007.

In the European bilateral context, ASN strengthened its ties with countries which announced their intention of building new plants in order to provide safety and radiation protection assistance with future decisions and those already taken. ASN therefore makes efforts to share its experience of licensing new EPR type reactors with the nuclear regulators of such countries and to support countries that do not yet have such a regulator during the essential process of creating one. It maintains close ties with a large number of countries, in particular neighbouring countries.

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.

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 new reactors. Its secretariat is hosted by the OECD's Nuclear Energy Agency (NEA).

1|3 Assistance requests

In 2008, the ASN Commission defined the policy of the French nuclear regulator with regard to the assistance requests it receives. ASN analyses the nuclear safety situation in each country that contacts it for assistance with the regulatory infrastructure and the regulation of safety.

Table 1: table of areas of competence of the main civil nuclear activity regulating authorities

Country/ Safety authority	Status			Activities						
	Adminis-tration	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/ MOST	•			•	•	•			•	•
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.

In 2010, ASN received numerous requests from countries engaging for the first time in a nuclear power programme as well as from countries wishing to know what actions would be necessary in the area of safety if they were to choose this energy source. 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 independence and 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 of the environment.

2 EU 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 and HERCA, today place the European Union at the very heart of regulatory work on nuclear safety and radiation protection. The European Union is therefore one of ASN's main priorities, which is why, in 2010, ASN dedicated the 189th issue of its *Contrôle* review to the creation of a European arena for nuclear safety and radiation protection.

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 10 December 2002 (aff. C-29/99 Commission of European Communities against Council of the European Union), the 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's actions at European level fit firmly into the framework of development of this new area of European Community competence.

2|1|2 The European Nuclear Safety Regulators' Group

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. 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

Publication of the European Commission on 50 years of the Euratom Treaty transparency in the nuclear sector. ASN occupies the position of Vice-Chair of the "safety of installations" group.

ENSREG was a key player in Europe's adoption of a first directive on safety of nuclear installations. The consensus arrived at by its members regarding the broad outline of such legislation helped to relieve the tensions that arose from an initial Commission proposal in 2003 and to achieving passing of the directive in June 2009.

ENSREG met three times in 2010 discussing, in particular, the content of the directive on management of waste and spent fuels. It also initiated consideration of the organisation of the first European Conference on nuclear safety, to be held in Brussels in June 2011. The Chair of ASN, who first suggested such a conference, is also involved in the discussions on the future "waste" directive.

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 25 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.

Although it takes the form of a framework directive laying down the broad outlines of nuclear safety, 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. Its transposition into law should be completed in July 2011.

ASN believes that the regulatory framework should now be completed by a European directive on management of waste and spent fuel. The Commission adopted a draft directive on this subject in November 2010. This directive, being discussed by the Council of Ministers, should have similar aims: to establish the general policy framework for management of waste and spent fuel in the 27 member states, notably requesting that each of them develop and adopt a national plan for management of nuclear waste and materials (see box).

2 | 1 | 4 The European working groups

ASN also participates in the work of the Euratom Treaty committees and working groups:
– scientific and technical committee (STC);

TO BE NOTED IN 2010

Towards a European directive on the management of waste and spent fuel

On 3 November 2010, the European Commission officially adopted a draft directive on the management of radioactive waste and spent fuel. The document will now be submitted to the EU Council of Ministers and to the European Parliament, which will study the terms of the proposal.

In line with the Commission, ASN is of the opinion that there is a need to establish a European regulatory framework devoted specifically to the management of radioactive waste and spent fuels. It therefore supports the steps undertaken at the European Community level aimed at the adoption of a directive in this area.

ASN has been closely involved in the preparatory work carried out within the European Nuclear Safety Regulators' Group (ENSREG) and which led to the proposal to the Commission of a draft directive on the management of radioactive waste and spent fuel.

ASN feels particularly that the setting up in each Member State of a competent regulatory authority in the field of safe management of waste and spent fuel, with sufficient financial and human resources to achieve its ends, would be an important step forward. Similarly, the conditions relating to transparency and peer review, and to the establishing of a national radioactive waste management plan would represent progress for the EU. On this latter point, ASN, which participates in the drafting of France's national plan for radioactive waste and spent fuel management (PNGMDR), is of the opinion that the introduction of such a plan in each Member State would be a major development.

The 27 Member States and European Parliament are now beginning negotiations on the text in Brussels. ASN, whose competence in the area of safety of management of waste and spent fuel is recognised by the Act of 28 June 2006 (known as the "Waste" Act), will follow developments closely.

– 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).

In 2010, ASN's experts were particularly involved in the activities of the Article 31 Group of which the expert members worked actively on the future "basic standards" European directive. This aims, notably, to revise five existing directives: "basic standards" (96/29/Euratom); "medical exposure" (97/43/Euratom); "sealed radioactive sources" (2003/122/Euratom); "outside workers" (90/641/Euratom); and "informing the general public" (89/618/Euratom). It could also include new elements, in particular protection of the environment, protection from natural radiation (radon) and from radiation from building materials, and measures for emergency situations.

The "basic standards" directive

In 2010, ASN engaged in 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.

More generally, regular contacts with the European Commission (and in particular with the Directorate General for Energy, DG/ENER; the Directorate General for Research, DG RTD; and the Joint Research Centre, JRC) provide a means of reviewing progress and upcoming regulatory work in the areas of nuclear safety and radiation protection: notably, the transposition of directives into national legislation and the functioning of Euratom Treaty committees.

2|1|5 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. Mr Jukka Laaksonen (Finland) is currently the Chair.

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.

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 NPP group (see chapter 12) which, after being run by the British regulatory body, is now chaired by one of ASN's Deputy Directors General;
– the group dealing with spent fuel and radioactive waste management and decommissioning operations (see chapter 16), chaired by a 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, 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 major effort was made by the regulatory bodies in the countries in question. In France, for instance, the order currently being drafted on BNI regulation ("régime INB") draws directly on WENRA's work. Elsewhere work on "transposition" of reference levels 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's adoption of safety objectives for new reactors

During the meeting held in Bratislava (Slovakia) on 9–10 November 2010, WENRA's 17 members adopted a common statement establishing safety objectives for new reactors. In issuing this statement the WENRA members have made a *de facto* commitment to requiring that the power reactors they examine in the future meet the objectives specified in the statement. ASN played a determining role in the preparation and adoption of this report.

Although the safety objectives for new reactors do not allow "classification" of the safety levels of reactors currently proposed throughout the world, they do have the major advantage of setting far-reaching safety requirements for all of the reactors that will be built in Europe.

Furthermore, the WENRA statement also embodies the notion that these objectives should be used as a baseline for identification of improvements to safety that could reasonably be achieved during reviews of the safety of existing reactors.

WENRA is planning to continue with its technical work in this area in 2011, with a view to specifying the objectives.

ASN, convinced that these far-reaching safety objectives should be applied to the building of new reactors throughout the world, will make efforts in 2011 to disseminate and advocate them both within Europe and internationally.

WENRA has also begun to consider the issue of safety of research reactors and 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 outside of the EU. As a result, the Armenian, Russian and Ukrainian safety authorities took part in a WENRA meeting in November 2010.

ASN considers that all this work confirms WENRA's ability to carry out "bottom-up" technical harmonisation of nuclear safety, to complement any Community "top-down" initiatives of a political nature and more general scope (see points 2|1|1 and 2|1|2 above).

Lastly, it is worthy of note that, in 2010, ASN made use of the WENRA and ENSREG networks of correspondents to ensure rapid and uniform communication to all of its European partners on events the authority saw as important and, in particular, of the Commission's position on the building of nuclear reactors around the world and the risk of the emergence of two-tier safety.

2|1|6 Meeting of the Heads of the European Radiological Protection Competent Authorities (HERCA)

The national regulations constituting practical implementation of European radiation protection directives comprise significant differences for the same uses of ionising radiation sources, or in the vicinity of the same nuclear installation. This is for example the case for provision of iodine tablets for populations living near a nuclear installation.

Moreover, ASN is convinced that if progress is to be made on harmonisation in Europe, close collaboration is needed between the heads of European authorities controlling radiation protection, in the same way as for nuclear safety.

ASN organised an initial meeting of the heads of the European radiation protection regulatory authorities in Paris on 29 May 2007, followed by a second meeting on 19 May 2008. Given the success of these two meetings, the participants decided to meet more frequently. Most of the EU member states are represented in this group; a delegate from the European Commission participates systematically in plenary sessions.

At present, HERCA's activities are carried out by five working groups in the following areas: outside workers and the radiation passbook; justification, optimisation of sources and non-medical practices; medical applications of ionising radiation; management of emergency situations; and reference levels and collective doses from medical exposures. An additional special working group was created at the fifth association meeting to examine optimisation of HERCA's activities and to consider the association's future.

The fifth and sixth plenary meetings were held in 2010. On 30 June and 1 July 2010, the Norwegian radiation protection authority (NRPA) hosted the association's fifth meeting in Oslo. With Mr Ole Harbitz (General Director of the Norwegian authority and Chair of HERCA since 2008), in the chair, the meeting was attended by 37 delegates from 19 countries.

Discussions centred on the results of work of the five HERCA working groups and, notably, saw the emergence of a consensus on a proposal for harmonisation of the contents of a European radiation passbook. The group created specially to consider optimisation of HERCA's activities and its future also presented proposals on working methodology, governance and communication. The proposals were approved.

The association's sixth meeting was held on 1 December 2010, in Paris, in ASN's offices. Amongst other matters, the meeting allowed approval of the association's new terms of reference and operating rules as well as a joint statement on the justification for body scanners using X-rays in airports.

2|1|7 Multilateral assistance actions

After the Chernobyl disaster of 26 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.

ASN is involved in providing assistance to national safety authorities, notably coordinating the programmes implemented in Egypt, Kazakhstan and Ukraine as well as participating, in 2010, in projects providing assistance with regulation to Egypt, Jordan and Ukraine.

These actions are supplemented by other international technical assistance programmes, in accordance with the resolutions adopted by the G8 (G7 extended to include Russia) 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, chaired in 2010 by Canada.

ASN has observed that significant progress has been made in the three priority areas defined by the G8. It also notes that eight Bulgarian, Lithuanian and Slovakian reactors were decommissioned between 2006 and December 2009, in compliance with their treaties for accession to the EU.

In addition, ASN is examining assistance with the creation of safety infrastructure in emerging countries with its main counterparts, especially within the International Nuclear Regulators Association (INRA) (see point 2|8) with, once again, a concern to promote high levels of safety.

2|2 The International Atomic Energy Agency

The International Atomic Energy Agency (IAEA) is a United Nations organisation based in Vienna, Austria. In December 2009, it comprised 151 member States. IAEA activities of particular relevance to covering ASN's fields of competence consist in:

– Organising discussion groups at different levels and preparing texts known as "Safety Standards", describing safety principles and practices which can then be used by Member States as a basis for 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 safety authorities, appointed for 4 years. It is tasked with final approval of safety standards that have been subject to a long and rigorous process of validation by member states and with proposing these to the IAEA's Director General. 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 27th and 28th meetings of the CSS were held in 2010.

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. 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. In order for lower-level documents (requirements and safety guides) to eventually become a consistent whole without overlaps, the CSS drew up a road map in 2008, fixing the objectives for the development of all safety standards. Two points in particular are worth mentioning: the integration of the ongoing revision of the "Basic Safety Standards", which constitute the radiation protection specifications and the integration of nuclear security aspects. On this latter point, a "think tank" was set up in 2009. Its members are CSS Chairs and those of the AdSec, a committee dedicated to safety in nuclear installations, as well as three members from each entity. The think tank met twice in 2010. Its work concentrates primarily on the establishing of short-term objectives to strengthen synergies between safety standards and safety guides.

– Setting up "services" made available to Member States and designed to give them opinions on specific aspects related to safety and radiation protection.

This category includes the OSART (Operational Safety Review Team) and IRRS (Integrated Regulatory Review Service) missions.

The Saint-Alban NPP received an OSART mission from 21 September to 6 October 2010. This was the 22nd mission of this type conducted in France. The report, drafted by the team of IAEA inspectors, will be published on the ASN website. Previous reports on OSART missions conducted in France are also available on the website. The Cruas plant audit follow-up mission took place from 13 to 17 December, subsequent to the OSART mission in 2008.

Technical meeting on the coordination of the review of the bases of the regulation of radioactive material transport, organised with the IAEA and held from 11 to 15 October 2010 at ASN in Paris

IRRS missions provide an opportunity for safety authorities to subject their safety systems to analysis by other authorities, under the aegis of the IAEA. In 2010, ASN participated in two missions, in China and in the United States. ASN believes that generalised use of these peer reviews will help to create a network of experts from the regulatory bodies and contribute to harmonising of practices.

Finally, ASN takes part in radiation protection courses in the regions and in the appraisal missions organised by IAEA, the main beneficiaries being French-speaking countries. In 2010, ASN participated in radiation protection training in Algeria.

The Douai, Paris, Marseille and Nantes Divisions welcomed interns from French-speaking African countries for four weeks of training during which they attended presentations on experience and practices in the area of radiation protection inspections outside of BNIs.

– Harmonisation of communication tools

Since 2002, ASN has been looking to develop a communication tool for dealing with radiation protection events. ASN therefore contributed energetically to relaunch the process of international collaboration to complete the International Nuclear Event Scale (INES) by addition of a radiation protection criterion. This effort led to adoption by the IAEA Member States of a new part of the INES scale concerning radiation protection events, which takes account of radioactive sources and the transport of radioactive materials. The new version of the INES User's Manual was published in June 2009, in English; it has been applicable in France since May 2010.

ASN would like to see the scale eventually extended to include radiation protection of health-care patients. 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 aware of the stakes involved in radiation protection of patients: Belgium, Finland, France, Germany, Hungary, Japan, Spain, Ukraine and United States. A draft technical document on the "applicability to patients" part of the INES was proposed to this working group in November 2010, at the third meeting.

Lastly, on 15 October 2010, the IAEA and the NEA celebrated the INES' 20th anniversary at a conference that brought together the 69 INES member countries. The event traced the history of the INES and provided an opportunity to consider the outlook for development of this communication tool.

2|3 OECD's Nuclear Energy Agency (NEA)

The NEA, set up in 1958, comprises all the OECD member countries, except for New Zealand, or 29 countries. 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).

Conference on the 20th anniversary of INES, October 14, 2010 at the IAEA in Vienna

In 2010, NEA hosted an international conference, organised at France's initiative, on the topic of access to civil uses of nuclear energy. At the conference, ASN's Chair spoke on the issue of nuclear safety.

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 programme, 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. Its ultimate goal is to improve protection of the public and the environment. An ASN agent was seconded to NEA and is responsible for part of the secretarial duties for the MDEP.

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, works on the AP1000. In November 2010, an EPR Working Group meeting was held in Shenzhen, China. As a side event to the meeting, a visit was organised to the Taishan work site for the two EPR type reactors currently under construction.

ASN's Chairman, André-Claude Lacoste, visits the EPR1 reactor construction site in Taishan (Guangdong province, China) on 10 May 2010

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 design (Codes and Standards Working Group – CSWG), and on design standards for digital I&C (Digital Instrumentation and Control Working Group – DICWG).

MDEP activities

The MDEP Policy Group, comprising leaders of nuclear regulators from the ten participating countries and chaired by the ASN Chair, met in March 2010. During this meeting, the decision was taken not to increase either the number of participating countries or the number of subjects dealt with, in order to maintain the effectiveness of this initiative. More specifically, the Group reviewed and validated the different working groups' short-term, mid-term and long-term work programmes.

The MDEP's 2009 activity report was published in June 2010, providing information about the MDEP to stakeholders, i.e. the regulatory authorities not participating in the MDEP, industry and the public.

Several joint inspections were performed in 2010, based on the work of the VICWG. "Common Positions" were also established on different subjects; their publication is planned for 2011 (see also chapter 12).

In order to establish long-term dialogue with these stakeholders, a first MDEP conference on new reactor design was organised on 10–11 September 2009, in Paris. A further conference is planned for 2011.

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 these radiations represent 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, and at which ASN is represented. The reports published by this scientific body, which constitute the international reference, cover subjects such as the hereditary effects of ionising radiations and the consequences of the Chernobyl accident.

2|6 International Radiation Protection Association (IRPA)

An ASN delegation headed by ASN's Chair took part in the third European IRPA Meeting, held on 14–18 June in Helsinki, Finland. ASN's Chair presented the meeting with a proposed radiation protection action plan for patients in the area of medical imagery, a plan that could be implemented worldwide.

2|7 World Health Organisation (WHO)

ASN Commissioner Michel Bourguignon participated in the WHO consultation meeting on the subject of "Referral Guidelines for Appropriate Use of Radiation Imaging", held on 1–3 March 2010, in Geneva, Switzerland. The meeting examined the work of experts from 23 agencies and professional organisations who pooled their experience to move, eventually, to the establishment of worldwide guidelines on good practices for justification of radiological examinations, under the aegis of the WHO.

2|8 The International Nuclear Regulators' Association

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 April and September 2010, with Dr Mike Weightman, Head of the UK's nuclear safety regulator, in the chair. The meetings highlighted the level of attachment the members of this club feel towards it and stressed their will to be audible in the major debates on nuclear safety in the world. The meetings provided a forum for INRA members to exchange viewpoints on regulators' responsibilities in a context of stated renewed interest in nuclear energy, on subjects that would warrant INRA's intervention and on the model for its position statement of 2008 in the development of nuclear energy in countries wishing to acquire a nuclear generating capacity for the first time. The association also amended its statutes, notably to optimise its mode of operation.

In 2011, the INRA meeting will be in Stockholm, under the Chairmanship of the head of the Swedish nuclear regulator.

2|9 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. The next meeting will be in 2011 in France.

2|10 The European ALARA Network and the European Radiation Protection Authorities Network

ASN took part in two six-monthly meetings of the European ALARA Network (EAN), on 8 June and 14 December 2010. On 7 June ASN hosted the annual meeting of the European Radiation Protection Authorities Network (ERPAN), a subnetwork of EAN. The meetings provided fora for dialogue between counterparts on radiation protection in the networks' 20 member countries and, in particular, addressed the principle of optimisation.

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).

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 2010, more than thirty joint inspections in the field of nuclear safety and radiation protection were organised. ASN inspectors participated in inspections of NPPs in China, Finland, Germany and the United Kingdom and inspectors from abroad (China, Germany, Japan, Spain, Switzerland and the United States) participated in inspections in French plants. Some of these joint inspections also related to radiation protection in the medical and industrial sectors in Belgium, France, Germany, Ireland, Spain and Switzerland. In addition, the U.S. authority took part in an emergency exercise at the Penly NPP in September;
- short-term assignments (2 weeks to 6 months) aimed at studying a specific technical topic. The Douai and Châlons Divisions received three inspectors from the Belgian regulatory authority AFCN, to compare the process of development of a programme of inspections and of monitoring of BNIs and the regulations applying in the two countries on nuclear safety and radiation protection requirements;
- exchanges giving an overview of all of a counterpart's activities. It was in this context that the deputy head of the Nantes Division was seconded to the Radiation Protection Institute of Ireland (RPII) between 21 June and 2 July 2010. This assignment confirmed the advantage of pursuing exchanges with ASN's Irish counterpart. In addition a member of RPII staff participated as an observer in an emergency exercise at the Civaux NPP, organised by ASN on 17 June 2010;
- 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.

Since late 2006, a French inspector from the Lyons Division has been seconded to the British nuclear safety regulator, where he is working on the fuel cycle plants, while a British inspector was seconded to ASN until mid-2009, working in the Nuclear Power Plants Department on the evaluation and licensing of the EPR in Flamanville.

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 1 February 2009, a CSN engineer was seconded to the

Nuclear Power Plant Department until 2011. She also takes part in inspections.

In April 2009, a member of the DEP joined the Nuclear Reactor Regulation (NRC) office for three years. In exchange, a member of the same NRC office worked at DEP from August 2009 until August 2010. A new assignment of a member of NRC staff to ASN is currently being considered.

Staff exchanges are also organised with international organisations. For instance, a member of ASN has been working at IAEA since the autumn, in the team tasked with organising Integrated Regulatory Review Service (IRRS) assignments. Another ASN engineer, now recruited by IAEA, is working at the Agency on safety standards, providing the scientific secretariat for the CSS (Commission on Safety Standards).

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 by ASN and its counterparts 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.

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-sixth meeting of the Franco-German Commission on nuclear installation safety issues (Deutsch-Französische Kommission für Fragen der Sicherheit kerntechnischer Einrichtungen – DFK) took place on 16–17 June 2010 at the Neckarwestheim NPP, near Stuttgart. The meeting provided the opportunity for a round-up on nuclear policy and on the evolution of regulations in France and Germany. The meeting was presented with a report on safety in the NPPs on the borders (Neckarwestheim and Philippsburg for Germany, Fessenheim and Cattenom for France), as well as on the progress made by the DFK's four working groups. In particular, the presentations allowed comparison of the practices addressing organisational and human factors and occupational exposure.

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. Three Belgian inspectors were received for short assignments in the Douai and Châlons regional divisions. The management committee bringing together ASN, AFCN and BEL V met on 21–22 January 2010 in Caen, France. As a side event to the meeting, a Belgian delegation visited the EPR construction site at Flamanville, France.

A meeting was also organised with AFCN on 31 March 2010 in Brussels, to discuss the methods and means employed for human resources management within the two organisations.

China

With renewal of the administrative arrangement between ASN and its Chinese counterpart, the National Nuclear Safety Administration (NNSA), cooperation between the two authorities has been revitalised. An ASN delegation led by the Chair and accompanied by delegates from IRSN visited China on 9-14 May 2010, notably, to take part in a management committee with NNSA and its technical support body the Nuclear Safety Centre (NSC). Topics of mutual interest covered by both Chinese

Bilateral Franco-Chinese meeting between ASN-IRSN and NNSA-NSC, on 11-12 May in Beijing and French presentations included monitoring of construction of the EPRs at Flamanville, France, and Taishan, China; monitoring of manufacture of pressure equipment; the EPR's instrumentation and control system and that of the Chinese CPR1000 reactor; and safe management of radioactive waste. The discussions concluded with a more strategy-oriented meeting to establish an action plan for cooperation between ASN and its Chinese counterpart. Two site visits were organised alongside these meetings: one to the construction site of the Taishan EPR, the other to the site of the AP1000 reactor at Sanmen.

Spain

In addition to the staff exchanges with the Consejo de Seguridad Nuclear (CSN) described above (see point 3|1), ASN held a bilateral meeting with its Spanish counterpart on 7 May 2010, in Madrid, Spain, on the subject of human resources policy. This meeting formed part of the exchanges of information with CSN on the policy of the two regulatory authorities regarding career development and staff training. The ASN Chair was also invited to the CSN's 30th anniversary celebrations on 28 June 2010.

The United States

The common aim of ASN and of the U.S. regulatory authority, the NRC, to maintain close ties results in numerous actions in all areas of cooperation and at all levels. For example, the ASN Chair presented the work of the MDEP at the Regulatory Information Conference (RIC) in March 2010 and, at the same meeting, the General Director gave a presentation on the feedback on monitoring of France's installed base of NPPs. An ASN Deputy General Director also spoke at the Fuel Cycle Information Exchange (FCIX), a conference organised by NRC and focusing on the fuel cycle. In 2010, ASN received a number of American delegations from NRC and other bodies such as the Department of Energy (DoE). These delegations held discussions with ASN, notably on regulation of fuel cycle installations and visited several installations (Georges Besse II, La Hague, MÉLOX and ATALANTE). Representatives of NRC and of the Federal Emergency Management Agency (FEMA) were present as observers at a national emergency exercise at the Penly NPP, on 8 September. There were also opportunities to exchange ideas on the security of sources (meetings, ASN staff attending training given by NRC).

Lastly, the Chair of NRC, who had held discussions with the ASN Chair on several occasions and in several places, contributed an article to the issue of the review by *Contrôle* magazine on the topic of the construction of a European centre for nuclear safety and radiation protection, and two NRC commissioners met with ASN's senior management in November 2010.

The Russian Federation

In April 2010, ASN accompanied the French delegation within the framework of the Franco-Russian meeting on nuclear issues. During the meeting, ASN discussed areas of cooperation to be developed jointly with its counterpart organisation Rostekhnadzor. Following on from these exchanges of views, the ASN Chair and General Director visited Moscow on 19-20 October, meeting with Rostekhnadzor managers. This meeting provided the opportunity to propose resumption of cooperation between ASN and Rostekhnadzor. Resumed cooperation would focus on three topics: cooperation on assistance to countries acceding for the first time to nuclear power, the fuel cycle and continued operation of power plants. The need to clarify and complete the legal framework for floating power plants was also discussed. A decision was also made to work towards a new agreement.

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 by 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, two meetings were organised in May and December 2010 between the ASN and STUK teams responsible respectively for the Flamanville 3 and Olkiluoto 3 projects. Based on technical exchanges and a construction site visit, the meetings helped to reinforce interaction between the two projects, in addition to the work carried out within the MDEP multilateral framework (see also point 2|4).

India

In response to an invitation from the Atomic Energy Regulatory Board (AERB), the Indian regulatory authority, ASN attended a technical seminar providing information on the safety of the EPR, organised in Mumbaï on 22-23 November 2010. Discussions should continue within the framework of a technical seminar to be organised early in 2011 on the topic of integrity of materials and large components. In addition, in December 2010, ASN extended and enlarged the scope of the existing cooperation agreement with AERB.

Ireland

The annual meeting between the ASN Chair and *the Chief Executive or General Director* of the Radiological Protection Institute of Ireland (RPII), currently Ms Ann McGarry, took place on 31 August 2010 in Dublin, Ireland. The cooperation agreement between the two authorities was renewed and the meeting also provided the opportunity for discussions on the numerous radiation protection actions undertaken at the 2009 meetings and on the benefits of staff exchanges in 2010 (see point 3|1). On 1 September, the ASN Chair met the RPII Board, the equivalent of the ASN Commission. Also, in May and October 2010, the ASN's director for ionising radiation and health participated, as a permanent member, in one of RPII's advisory committees.

Italy

Against the background of an announcement by the Italian government of a new nuclear power programme, an administrative arrangement was signed between ASN and ISPRA, the current Italian regulatory authority, in April 2010. The agreement covers the rapid exchange of information in the event of an emergency as well as cooperation in the area of nuclear safety.

Bilateral meeting between ASN and its Japanese counterpart NISA and MEXT held on 1 and 2 November 2010 in Tokyo

The statutes of the future Italian national authority responsible for nuclear safety were published in Italy's official journal in July 2010 and the members of its board of directors were appointed in November 2010. Bilateral relations between ASN and the Italian safety authority will continue with this new body once it has taken up its activities.

ASN took part in a meeting of the joint France-Italy Committee on 19 February 2010 and, on 16 September 2010, received members of the Italian parliament serving on the Parliamentary Environmental Commission. On 22-23 September 2010, ASN attended a meeting in Rome with the VIA (environmental impact assessment) – VIS (strategic environmental assessment) technical commission which is consulted on projects that may have major impacts on the environment.

Japan

The administrative agreements linking ASN to Japan's two safety authorities, the Ministry of Education, Culture, Sports, Science and Technology (MEXT) and the Nuclear and Industrial Safety Agency (NISA), were renewed in March 2009 and April 2010.

Two bilateral committee meetings were held between ASN and its two counterpart organisations under the terms of these agreements, in Tokyo, on 1-2 November 2010. A cooperation action plan is being developed in several clearly identified areas such as addressing the issue of reactor ageing and extension of service life, monitoring of fuel cycle installations and monitoring of safety and security of radioactive sources. A schedule has been fixed for organisation of the next management committee meetings in Paris in the second half of 2012.

In addition to these bilateral meetings, intensive and fruitful in terms of information, 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).

Within the framework of regular exchanges with the Lyons Division, three inspectors from the Japan Nuclear Energy Safety organisation (JNES) participated in the review inspection of the Chooz reactor, in July 2010. Following the inspection, the Japanese delegation gave a presentation to ASN Commissioner Ms Marie-Pierre Comets outlining the main points of interest and unexpected aspects when compared with Japanese practices.

Luxembourg

The ninth meeting of the Franco-Luxembourg Joint Commission on Nuclear Safety was held on 25 November 2010, in Luxembourg. A point of particular interest was the presentation by ASN of a report on monitoring of the EDF plant at Cattenom, located less than 40 kilometres from the border with Luxembourg. Management of emergency situations and the issue of releases of tritium into the environment were addressed.

Czech Republic

Alongside the general IAEA conference, ASN's Chair had a meeting with the head of the Czech Republic's safety authority (SÚJB), Ms Dana Drábová, on 20 September 2010. It was decided at the meeting that the agreement linking the two organisations would be extended. On 13 December 2010, an ASN delegation also participated in a working group on energy that, notably, addressed the issue of nuclear safety. The discussions confirmed the close positions of ASN and SUJB and the will on the part of the two authorities to work together in the future.

The United Kingdom

ASN and the British Health and Safety Executive / Nuclear Directorate (HSE/ND) have cooperated for many years and the arrangement has been enhanced and improved over time. In 2010, cooperation between these two organisations was focused on activities relating to evaluation of new reactors. Furthermore, in order to enable HSE/ND to benefit from its expertise, ASN seconded an agent to HSE from its Nuclear Pressure Equipment Department for two years, under the terms of an assistance contract (see point 3|1).

The annual meeting of the heads of the two entities was held in the U.K. on 8-9 September and was followed by a visit to the Hinkley Point installations. This meeting was an opportunity to review assistance and cooperation between the two regulatory bodies. The ASN-IRSN/ND Franco-British Steering Committee will meet in February 2011 in the United Kingdom.

Switzerland

A meeting took place on 30 April 2010 between ASN and the Swiss safety authority (ENSI) to discuss human resources management procedures in the two organisations.

The 21st annual meeting of the Franco-Swiss Commission (CFS) on Nuclear Safety and Radiation Protectiontook place on 25 June 2010, in Paris. The meeting discussed exchanges of information on the safety of nuclear installations and radiation protection in the two countries, coordination of emergency protection measures, the requirements applicable to new NPPs and radioactive waste management. ASN, notably, presented its monitoring activities on the construction of the EPR at Flamanville and the ongoing work on the ten yearly inspection of the Fessenheim NPP. ASN and ENSI exchanged views on the requirements relating to extended plant service life and on the possibility of cooperation on the mechanical strength of reactor vessels. On 24 June, a Swiss delegation visited the EPR construction site at Flamanville.

On Monday 15 November 2010, ASN's Chair, acting on behalf of the French government, signed an agreement with the Swiss Federal Council and the CERN (the European organisation for nuclear research) on protection against ionising radiation and safety of the organisation's installations. The agreement forms a legal basis that is common to both host countries for monitoring of nuclear safety and radiation protection at the CERN.

Ukraine

ASN Commissioners Marie-Pierre Comets and Michel Bourguignon visited Ukraine on 6-8 September 2010. The visit allowed for a round-up of the radiological evaluation and epidemiological studies conducted since the accident at the Chernobyl power plant and on the management of radioactive waste. In addition to a meeting with the Ukrainian safety Authority (SNRCU), meetings were also arranged with the minister responsible in the event of emergency situations and the Information Commission (Mama86). Visits were also organised to the Chernobyl site and to the ICRSM-Vector industrial complex for management of radioactive waste.

In April 2010, ASN accepted the Ukraine authorities' invitation to participate in a bilateral meeting during which the regulatory framework of nuclear safety in France was presented to the authorities.

In addition, Ms Comets participated in SNRCU's ten-year celebrations on 2-3 December 2010.

3|3 ASN bilateral assistance

At a time when new projects for development of new nuclear power generating programmes are being announced and implemented, ASN is receiving increasing numbers of requests for assistance, with a view to creating a safety infrastructure that is in line with major international principles such as those expressed in the Convention on Nuclear Safety. Requests are coming primarily from countries which have not to date been users of nuclear energy, particularly in Asia and the Middle East.

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.

ASN undertook to establish a realistic and effective system for answering the requests it receives. Implementation of this system, with the corresponding human resources, will enable ASN to conduct this new mission so as to maintain a high level of nuclear safety, worldwide.

The following countries figure amongst those that received assistance from ASN in 2010:

The United Arab Emirates

On 26–27 January 2010, ASN organised a workshop in Paris, with the United Arab Emirates Federal Authority for Nuclear Regulation (FANR) on the topic of regulation in the area of nuclear safety.

Jordan

ASN participated in a Franco-Jordanian seminar held on 8-9 June 2010 in Amman, Jordan, organised within the framework of the bilateral cooperation agreement between the two countries. The aim of the seminar was to present the French approach to nuclear safety, gather information on the situation regarding Jordan's projects in the nuclear safety field and identify possible areas of cooperation. This mission was preceded by a meeting in Paris between the ASN Chair and the President of the Jordanian Senate. The ASN Chair, accompanied by a representative of the European Commission, also visited Jordan on 16–17 October, at the invitation of the Jordanian authorities in order to stress the importance of putting in place a robust nuclear safety framework requiring, notably, the setting up of a competent safety authority having adequate resources to fulfil its mission.

Poland

In the context of the introduction of a nuclear power programme in Poland by 2022, ASN received a delegation from the Polish safety authority on 23-25 June 2010. Possible areas of cooperation were addressed. The Polish delegation, very interested by actions to provide the public with information, took part in a meeting of the SOMANU CLI on 25 June 2010.

In addition, the French delegation – made up of representatives from the Ministry of Ecology, Energy, Sustainable Development and the Sea, ASN, and IRSN – visited Warsaw on 18-19 October 2010 as part of a working group on energy and funding. When nuclear energy was addressed, the safety authority and its technical support were at the centre of discussions.

Vietnam

ASN received a delegation from the Vietnamese safety authority, VARANS, in June 2010. This provided the opportunity for ASN, which had already assisted with the drafting of Vietnam's legislation, to explain to VARANS how it was designing its national report in preparation for the 2011 review meeting for the Convention on Nuclear Safety. The ASN Chair also met his Vietnamese counterpart in July, in Paris, then in September, in Vienna. A cooperation agreement between the two organisations was signed at this second meeting.

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 more than forty requests in 2010 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 (see point 2|1|7).

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. The ASN Chair took part in two plenary sessions, in June and September 2010, and the Authority attended a special working meeting in November 2010 on the assistance to be provided to Jordan's safety authority (JNRC).

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 2010, it was ratified by 71 States.

In ratifying it, the contracting parties agreed to provide a report describing how the fundamental safety principles and good practices are implemented 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 next CNS review meeting is scheduled for April 2011, at IAEA.

This fifth meeting was prepared at a meeting held in Vienna on 29 September 2009. The contracting parties elected Mr Li Ganjie, China's deputy minister for Environment and general director of the Chinese safety authority, and Mr Bill Borchardt (General Director of the U.S. authority) and Mr Patrick Majerus (Minister of Health for Luxembourg) as vice chairs.

The countries were divided into six groups which will discuss the reports presented by the countries forming the group. Ms Marie-Pierre Comets, ASN Commissioner, will chair the discussions of Group 4.

The French report is available on the ASN website, in its French and English versions, in the "ASN à l'international" section (international texts).

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 29 September 1997 and it entered into force on 18 June 2001.

There were 57 contracting parties to the Joint Convention as of 31 December 2010.

The third review meeting for the Joint Convention took place from 11 to 22 May 2009 at IAEA. The meeting observed that progress has been made on implementation of global national plans for management of radioactive materials and waste. Given its experience in these areas, and in order to maintain a degree of continuity between two Joint Convention review meetings,

Opening of the *technical meeting on the establishment of a radioactive waste management organisation* by Pierre-Franck Chevet (DGEC) and Soda Kunihisa (JAEA) on June 7, 2010

France proposed the organisation of technical meetings on these subjects prior to the holding of the next Joint Convention review meeting, scheduled for May 2012.

A first technical meeting on the establishment of a national organisation for management of radioactive waste was held in Paris on 7-9 June 2010. Organised by the IAEA with the support of ASN, the Directorate General for Energy and the Climate (DGEC) and ANDRA, the meeting brought together around 110 participants from more than 50 countries.

The meeting was open to all IAEA member countries and not only to the parties to the Joint Convention, in order to widen the benefit of the experience presented, to allow for dialogue and to promote the Joint Convention.

It provided a forum for fruitful exchanges of views on the topics of state responsibility in the management of radioactive wastes, with the French delegates – including ASN – arguing for a coherent policy under which each type of waste is subject to appropriate management solutions. Discussions also focused on the centralised waste management body model, on the statutes and resources of such bodies, on their independence, R&D programmes and policy on transparency. The meeting therefore provided the opportunity to highlight this model and to compare it with other approaches in the area.

4|3 The Convention on Early Notification of a Nuclear Accident

The Convention on Early Notification of a Nuclear Accident came into force on 27 October 1986, six months after the Chernobyl accident. It had 108 contracting parties as of 29 April 2010.

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 regular exercises are held among the contracting parties. ASN is the competent national authority for France.

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 26 February 1987. As of 14 April 2010 there were 106 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.

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 141 contracting parties in 2009.

Additional information on these conventions may be obtained from the IAEA's website: *www-ns.iaea.org/conventions/*.

In the post-accident field, ASN took part in the CORE Health international programme and the EURANOS programme (stakeholder training) financed by the European Commission. In 2009, with IRSN, it organised the COREX programme (analysis of feedback from actions taken in Belarus by the French teams), of which the last meeting took place at Gomel, Belarus, in October 2010.

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. Table 2 summarises the events in question.

Table 2: events in which ASN took part in 2010

Date	Place and organiser	Subject
8-9 March	Paris (MEEDDM)	Conference on Accession to Civil Nuclear Energy
8-12 March	Athens (IAEA-EU-GAEC)	Conference on Individual Monitoring of Ionizing Radiation
9-11 March	Washington (NRC)	RIC 2010 - Regulatory Information Conference
25-26 May	Bratislava (EU)	European Nuclear Energy Forum
14-16 June	San Diego (ICAPP)	ICAPP 2010 - International Congress on Advances in Nuclear Power Plants
21-25 June	Vienna (IAEA)	International Conference on Operational Safety Experience and Performance of NPPs and Fuel cycle Facilities
16-17 September	Budapest (EU)	Conference on Nuclear Energy in Europe : From Acceptability to Appropriation
12-14 October	Washington (NEA)	Practices and experiences in stakeholder involvement for post nuclear emergency management
19-21 October	Växjö Sweden (KIKA)	Nuclear Cranes Seminar 2010
25-29 October	Tokyo (IAEA-JNES)	International Conference on Challenges Faced by TSO in Enhancing Nuclear Safety and Security
9-12 November	Vienna (IAEA)	International Symposium on Standards, Applications and Quality Assurance in Medical Radiation Dosimetry
17-19 November	Cambridge (NEA)	ISOE International ALARA Symposium
23-24 November	Mumbai (AERB)	Technical Meeting on EPR
24-26 November	Japan (IAEA)	Seminar on Seismic Risk and Nuclear Installations, after the Kashiwasaki Kariwa Earthquake of 2007
14-17 December	Rheims (NEA-ANDRA)	International Conference and Dialogue on Reversibility and Retrievability

In 2010, ASN also took the initiative of organising international meetings and conferences, or hosting them at its premises. The list is given below.

Table 3: international meetings and conferences organised or hosted in at premises by ASN

Date	Place and organiser	Subject
7 June	Paris (ASN)	ERPAN – European ALARA Network – European Radiation Protection Authorities meeting
7-10 June	Paris (ASN/IAEA)	Technical meeting on the establishment of a radioactive waste management organization
11-15 October	Paris (ASN/IAEA)	Technical meeting to facilitate and coordinate the review of the technical basis for the regulations on the safe transport of radioactive material
1 December	Paris (ASN)	6th Head of European Radiological protection Competent Authorities (HERCA) meeting

6 OUTLOOK

In 2011, in the field of international relations, ASN will endeavour to continue to make an active contribution to improving 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.

In Europe, the adoption of the Directive on the Safety of Nuclear Installations in June 2009 has paved the way for the creation of an EU regulatory framework going beyond radiation protection and which will be expanded in the near future. Particular attention will then be paid to the European situation with as a high point the negotiations in Brussels on the directives on "waste management" and "basic standards", without diverting attention from other areas of international action. Also worthy of note is the organisation in Brussels, on 28-29 June 2011, of the first European conference on nuclear safety, an idea suggested by ASN, and which will be held under the aegis of ENSREG. And lastly, it will be essential in 2011 to promote the safety objectives recently adopted by WENRA initially at the European level and then internationally, to ensure that a thorough and far-reaching benchmark for safety predominates in new nuclear power plants. Internationally, ASN will pursue its actions in favour of assistance to "new nuclear countries" so that they create for themselves an effective safety infrastructure. ASN will also very probably be called upon to intensify its relations with countries already using nuclear power that have announced major power plant construction programmes.

REGIONAL OVERVIEW OF NUCLEAR SAFETY AND RADIATION PROTECTION

CHAPTER 8

REGIONAL ORGANISATION

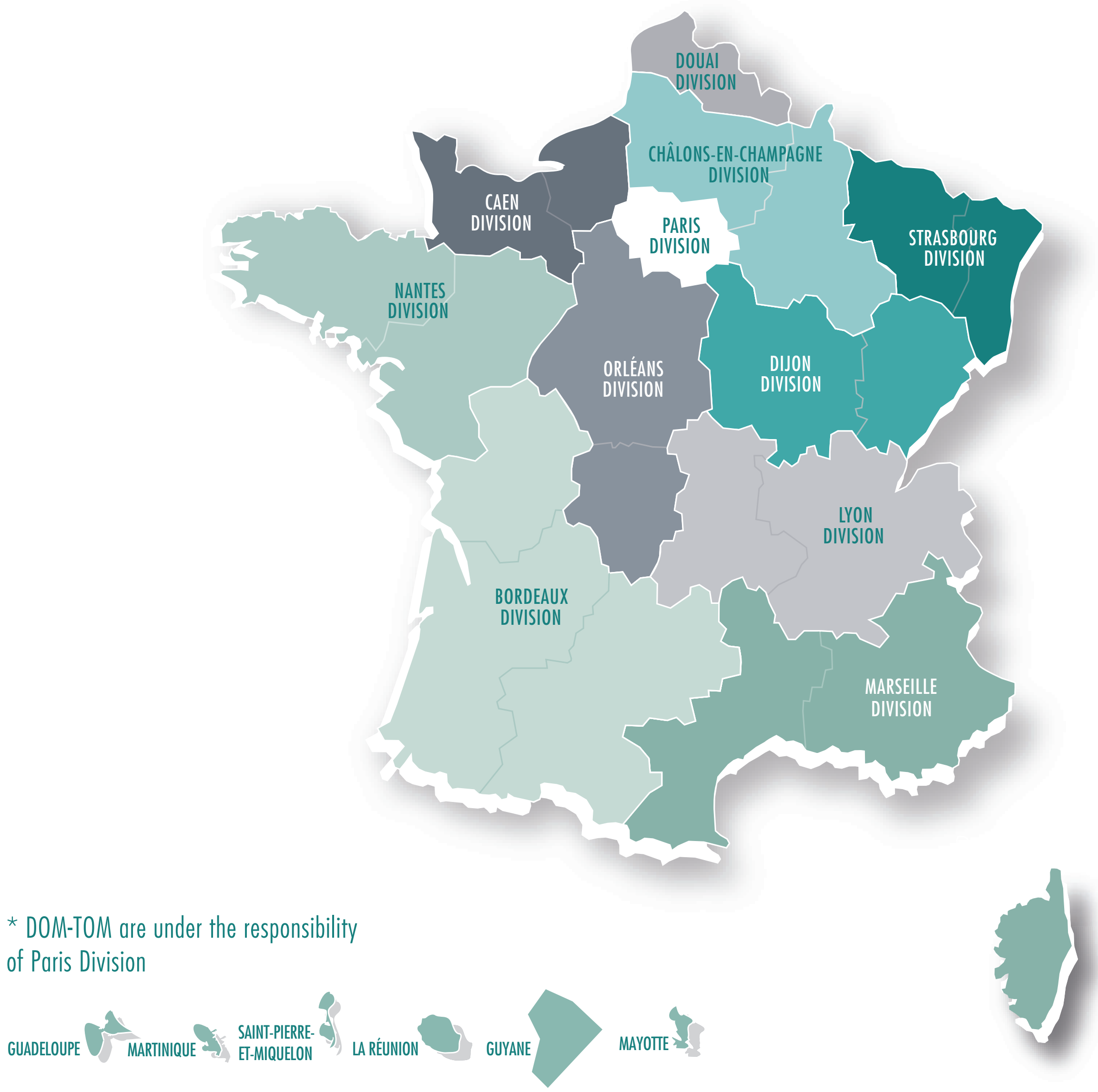
ASN has 11 regional divisions through which it carries out its regulatory responsibilities nationwide and in the Overseas France and Territorial Communities.

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.

In emergency situations, the divisions assist the *préfet*[1] of the *département*, who is responsible for protection of the population, and carry out on-site monitoring of the operations to safely operate the installation. 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) and maintain regular relations with the local media, elected officials, associations, licensees and local administrations.

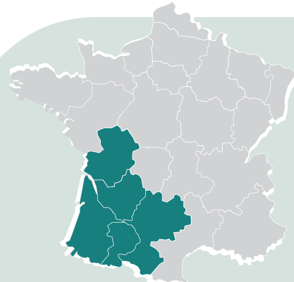


1. In a *département*, representative of the State appointed by the President.

ASN ASSESSMENT OF NUCLEAR SAFETY AND RADIATION PROTECTION AT LOCAL LEVEL

This chapter sets out the nuclear safety and radiation protection situation observed locally by ASN's regional divisions. The BNIs and small-scale nuclear activities (medical, industrial and research) are presented in summary sheets. The following pages expand upon the local actions that are particularly representative of ASN's regional action.

This presentation stems from the same initiative as proposed in ASN's various information media – *www.asn.fr*, and the quarterly magazine *Contrôle* – its aim is to provide easier access to local information.



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*[1] of the Aquitaine, Poitou-Charentes and Midi-Pyrénées regions.
As at 31 December 2010, the workforce of the ASN Bordeaux division stood at 20 officers: 1 regional head, 2 deputies, 13 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.

"Environmental" inspection by ASN at the Golfech NPP – April 2010

In 2010, ASN carried out 53 inspections in the field of nuclear safety and occupational health and safety in the Le Blayais, Civaux and Golfech NPPs, 7 radioactive material transport inspections and 157 small-scale nuclear facility inspections in the Aquitaine, Poitou-Charentes and Midi-Pyrénées regions.

Eleven significant events classified as level 1 on the INES scale were notified by nuclear installation licensees of the Aquitaine, Poitou-Charentes and Midi-Pyrénées regions in 2010. In the small-scale nuclear facilities in these regions, 15 significant events of level 1 on the ASN-SFRO scale and 6 significant events of level 1 on the INES scale were notified to ASN.

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

Le Blayais NPP

ASN considers that the plant maintenance preparation and management problems of 2009 were virtually resolved in 2010.

Likewise, reactor operation has returned to normal. The site must nevertheless improve its system alignments and pre-intervention risk analyses.

ASN considers that worker radiation protection was not always up to standard in 2010. The site must step up its on-the-ground coaching and surveillance to match the good results of 2009.

The plant's response organisation for the management of emergency situations is still satisfactory..

Civaux NPP

ASN considers that the Civaux NPP stands out in the area of worker radiation protection and that it has progressed in the control of maintenance operations and the performance of periodic tests of equipment contributing to reactor safety.

Nevertheless, ASN thinks that the plant should be more rigorous in work preparation and in the monitoring and maintenance of equipment that contributes to environmental protection and monitoring.

Golfech NPP

ASN considers that operation of the Golfech NPP is satisfactory on the whole, and that worker radiation protection on the site is of a high standard.

ASN considers that the quality of maintenance operations in 2010 was lower than in 2009. More specifically, the plant must make its combustion turbine more reliable and be attentive to the integrity of the nuclear fuel cladding.

Moreover, ASN observed that less rigour was exercised in certain operating operations in 2010.

1. Administrative region headed by a *préfet*.

ASN notes the site's dynamic approach to controlling its chemical discharges into the environment. It must nevertheless be more rigorous in its follow-up and maintenance of equipment contributing to environmental protection and monitoring.

1|2 Assessment of radiation protection in the medical field

The inspection of radiotherapy departments in 2010 revealed varying degrees of progress in the organisation and traceability of interventions and the initiation of operating experience feedback. This proactive move to improve treatment safety will need to be consolidated in 2011, including with regard to the formalisation of procedures, the organisation of the medical physics teams and the notification to ASN of undesirable 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 during the course of the 38 inspections carried out in operating theatres, including the failure to wear dosimeters by the health professionals and a lack of optimisation of the equipment delivering the ionising radiation. In 2010, several cases were observed where regulatory exposure limits were exceeded by interventional radiology practitioners. ASN's inspections show that efforts must be made to optimise the doses received by these workers.

1|3 Assessment of radiation protection in the industrial and research sector

ASN is continuing to regularly check industrial radiology techniques, which are activities with high radiation protection stakes. The 17 inspections carried out in this area in 2010 confirmed that the companies generally comply with the regulations concerning ionising radiation, and particularly with regard to personnel monitoring. ASN moreover sees progress in the precise delimiting of radiation protection zoning and site preparation. Improvements must however be made in the internal technical inspections and checking that the equipment used on the sites is in good working order.

ASN noted that several companies and research laboratories used radioactive sources without holding the regulatory license required by the Public Health Code.

ASN also considers that certain research centres need to apply more rigour in their management of radioactive sources and nuclear waste. The way the various entities and organisations handling ionising radiation sources are coordinated needs to be more clearly defined, and possibly even governed by a contract.

1|4 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

ASN carried out seven inspections concerning the transport of radioactive material in 2010. On the whole, it finds the organisation and procedures to be satisfactory. However, more rigour is required in pre-departure verifications of packages and the radiological risk analyses need to be updated to allow actions to reduce the doses received by the personnel.

2 Additional information

2|1 International action by the Bordeaux division

Within the framework of ASN's regular relations with CSN, the Spanish nuclear safety authority, two inspectors from the Bordeaux division took part in a cross-inspection of an industrial radiology company and a nuclear medicine service in the Madrid region. In return, three CNS inspectors came to France and took part in inspections at the Civaux and Golftech NPPs. These inspections provided the opportunity to discuss inspection and regulating practices in the two Authorities, and the means used to evaluate the standard of the inspected sites and the equipment used.

2|2 Other significant events in the Aquitaine region, Poitou-Charentes and Midi-Pyrénées

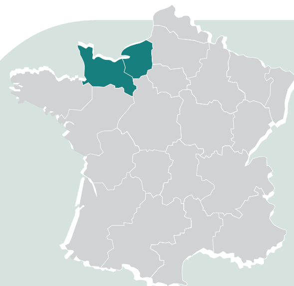
In Autumn 2009, ASN coordinated a radon detection campaign in houses built in areas where the land could have been filled with tailings from the old uranium mines worked by AREVA. Measurements were taken in private homes by an organisation approved for measuring radon in public buildings.

After circulating the individual results in April 2010, an information meeting and personalised assistance were organised for the campaign participants, in relation with the Regional Health Agencies (ARS) and the CETE (Amenities Technical Studies Centre) of Nantes.

2|3 Public information actions in 2010

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.

ASN held two press conferences, one in Toulouse on 27 May 2010 and the other in Bordeaux on 3 June 2010.



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 2010, the workforce of the Caen division stood at twenty-seven officers: one regional head, four deputies, eighteen inspectors and four administrative officers, under the authority of an ASN regional representative.

The activities and facilities to regulate in Normandie and Bretagne 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 departments;
– 60 users of scanners;
– 35 interventional radiology departments;
– 750 medical radiodiagnostic devices;
– 1,400 dental radiodiagnostic devices;
– 18 industrial radiography companies;
– 250 industrial and research equipment items.
– 6 head offices and 19 agencies of organisations approved for radiation protection inspections.

In 2010, ASN carried out 178 inspections of nuclear installations in Normandie and Bretagne: 76 inspections in the NPPs of Flamanville, Paluel and Penly; 37 inspections on the construction site of the future EPR reactor Flamanville 3; 65 inspections on fuel cycle or research installations or installations undergoing decommissioning, including 58 inspections on the AREVA NC plant in La Hague; 88 inspections were carried out on small-scale nuclear facilities in Normandie in 2010.

During 2010, one event classified as level 2 on the INES scale and 20 events classified as level 1 were notified by the nuclear installation licensees in Normandie and Bretagne. In addition, 7 events classified as level 1 on the ASN-SFRO scale were notified by the heads of radiotherapy departments in Normandie.

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, particularly with regard to personnel exposure and discharges. One internal contamination incident did nevertheless arise in November 2009 during a clean-out operation in a shut-down workshop of the first UP2 400 reprocessing plant of the AREVA NC La Hague plant. This incident was classified as level 2 on the INES scale in March 2010 after medical monitoring of the worker concerned.

ASN considers that AREVA must step up its efforts to improve the safety standards of its plants which to date do not meet the ASN requirements. AREVA must more specifically define the elements that are important for the safety of its installations, in accordance with the order of 10 August 1984[3]. In 2010, AREVA submitted a methodology for identifying these elements to ASN, but it must be revised to meet ASN's requirements. AREVA must then precisely identify the elements that are important for safety and the associated requirements in the general operating rules and general surveillance and maintenance rules for installations undergoing decommissioning, which at present are not specific enough. These aspects will be examined under the safety review of plant UP3-A which is currently under progress.

ASN considers that, on the whole, the significant events notification process of the AREVA NC plant at La Hague is still unsatisfactory. On several occasions in 2010, ASN took steps with this plant to have internal deviations notified as significant events or to change classification levels proposed by AREVA. ASN has therefore asked AREVA to once again review its internal procedure for the notification of significant events.

With regard to the decommissioning and legacy waste recovery operations, ASN is going to impose a schedule on AREVA to set the principal milestones for the waste recovery and disposal operations, to prevent them falling further behind schedule. ASN already gave instructions to this end in 2010 for silo 130 and will oversee the programme more closely in 2011.

Flamanville NPP

For several years, ASN considered that the nuclear safety performance of the Flamanville site was below average in its general assessment of EDF performance, and could be improved.

3. Order of 10 August 1984 relative to the quality of design, construction and operation of BNIs.

These difficulties were linked more particularly to organisational problems, insufficient coordination of safety improvement actions, a large maintenance backlog, and shortcomings in its safety culture.

In 2010, the Flamanville site began a programme to improve its safety performance, refocusing on clear and targeted objectives that correspond to the weaknesses identified by ASN. ASN noted that this initiative had been slowed down by contingencies during the shutdown of reactor 2, but estimates that positive changes have been observed since mid-2010 in several areas. These improvements are not yet cast in stone, and will have to be continued and consolidated, taking advantage of the period of a few months without scheduled reactor shutdowns.

Paluel NPP

ASN considers that the Paluel NPP has kept up its progress in the quality of maintenance operations and equipment requalification. However, installation management rigour is down, in spite of the progress observed in 2009. The site management must undertake new actions to lastingly improve the site's safety results.

ASN has observed that the major investments made in the installations are continuing to have a positive impact on environmental protection, radiation protection and safety.

Penly NPP

ASN considers that the performance of the Penly site regarding environmental protection and radiation protection of the workers is globally satisfactory. Regarding nuclear safety, ASN considers that the site's performance stands out positively with respect to its assessment of EDF as a whole.

The oversight of the Penly NPP in 2010 did not reveal any particular difficulties, even though ASN was particularly attentive to the monitoring of pressure equipment.

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. Installation of the first components (tanks, pipes, cables and electrical cabinets, etc.) began in 2010.

On completion of the inspections carried out in 2010 on the Flamanville EPR reactor construction site, and the review of the deviations reported by EDF, ASN considers that EDF's organisational setup for the civil engineering operations is on the whole satisfactory. ASN observed an improvement in the technical and documentary rigour in comparison with the previous years.

With regard to the activities that were greatly intensified in 2010, such as mechanical and electrical assembly work, ASN notes that as a general rule, EDF has not sufficiently anticipated the difficulties contracting companies have in adapting to the requirements of the nuclear industry: these difficulties chiefly concern application of the provisions of the order of 10 August 1984 and notably the prior identification of activities concerned by quality, and compliance with all the associated requirements.

Night-time inspection on the EPR Flamanville 3 worksite – July 2010

ASN has evolved its monitoring work to take account of the new activities being carried out on the site. ASN keeps a particularly close watch over the way EDF manages interacting activities that could lead to organisational or technical difficulties. At the technical level, for example, incorrect positioning of attaching devices anchored in the civil engineering can affect the positioning of mechanical components.

ANDRA's Manche repository

In February 2010, ASN took a stance on the safety of the centre after examining the final report on the safety of the installation as a whole, and a dossier on the benefits of installing a new cover to ensure the long-term passive safety of the repository.

ASN considers that the behaviour of the repository is globally consistent with ANDRA's forecasts and currently shows no signs of an abnormal change in its containment capacity. ASN has nevertheless asked ANDRA to tighten the monitoring and go further in modelling the repository's behaviour, to produce further evidence justifying the progressive installation of the new cover and to consolidate the work on the long-term memory of information concerning the repository.

During 2010, ANDRA continued the cover repair works by reducing the gradient of the embankments in its eastern section. ASN considers that this work has increased the stability of the embankments and is part of a more general process to ensure the long-term integrity of the repository cover.

GANIL (national large heavy ion accelerator)

ASN has remained particularly attentive to the licensee's safety review of the existing GANIL. As the licensee has fallen behind schedule, the review file is now expected to be submitted in 2011.

More generally, ASN considers that the licensee must be very careful to take into account all the nuclear safety and radiation protection issues relating to the GANIL.

The Brennilis NPP undergoing decommissioning

In a decision of 8 October 2007, ASN set the regulatory framework applicable to the plant, as well as the operations that could be carried out pending the issue of a new decree authorising its decommissioning. This decision required the licensee to repackage and evacuate from the site the legacy waste for which a disposal route existed or was about to exist, within two years following publication of the decision, that is to say before 8 October 2009. During an inspection carried out on 13 October 2009, ASN observed that despite the many actions taken, a limited quantity of this waste was still stored on the site pending receipt of a waiver obtained by the waste producer. In its decision of 22 December 2009, ASN ordered that this waste be evacuated by 30 June 2010. An ASN inspection carried out on 13 July 2010 confirmed that this deadline had been met. ASN considers that these repackaging and disposal operations have enabled a significant percentage of the legacy waste to be dealt with.

A new complete decommissioning authorisation application was submitted by EDF on 25 July 2008. On 15 March 2010 the commission set up for the public enquiry 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 did nevertheless consider that EDF should be immediately authorized to complete the inventory of the initial radiological and chemical status of the site, complete the effluent processing station decommissioning operations, clean-out and fill in the effluent discharge channel in the River Ellez, clean out areas of diffuse pollution, and lastly, start the decommissioning of the heat exchangers following their radiological characterization. In the opinion ASN submitted to the Government, it recommended authorising EDF to perform the operations to complete Phase II of decommissioning - remaining consistent with the opinion of the investigation commission - and that EDF should initiate a new application for complete decommissioning.

1|2 Assessment of radiation protection in the medical field

In 2010, ASN inspected nearly all the radiotherapy departments in Normandie. 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. However, despite the personnel increases in some centres, most radiotherapy centres in Normandie are under-staffed, including in medical radiological physics. 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 that have to be managed. 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 2010, ASN completed its inspection of all the nuclear medicine services in Normandie, which extended over three years. The inspections revealed a situation that is relatively satisfactory, although improvements can be made in protecting workers' extremities (hands) against exposure and in the management of effluents and wastes.

1|3 Assessment of radiation protection in the industrial and research sectors

Inspection of industrial radiology is a priority for ASN, with its unannounced night-time inspections on work sites being repeated in 2010. 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, ASN is working with the Haute-Normandie Regional Directorate of Enterprises, Competition, Consumption, Labour and Employment (DIRECCTE) and the Health and Retirement Insurance Fund (CARSAT) of Normandie, on promoting and disseminating good practices in this area by encouraging the ordering companies and the radiology contractors to become party to a regional charter drawn up in December 2007 at the behest of ASN and the conventional safety inspectorate. To date, about forty companies have signed up.

1|4 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

ASN carried out ten inspections in the transport of radioactive materials, focusing on different priority subjects, firstly in the BNIs - in particular the packages that are not subject to an ASN approval, and secondly in the small-scale nuclear sector.

ASN considers that the organisational measures in the BNIs Normandie are on the whole satisfactory, with a good level of involvement of the transport safety advisors. 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 operation. The deviations concerned 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 verified that the packages were correctly approved and that the dose rate around the convoy did not exceed 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.

A cross-inspection of the Olkiluoto 3 site took place in 2010, attended by two inspectors from the ASN Caen division; 6 inspectors from the Finnish nuclear safety authority took part in a cross-inspection of the Flamanville 3 site and in a day of technical discussions in early January 2011.

As part of the bilateral relations with ASN's American counterpart, the U.S. Nuclear Regulatory Commission (NRC), two NRC specialists in the inspection of nuclear installation construction participated in an inspection on the Flamanville 3 site. These inspections were complemented by technical discussions in which experience feedback specific to each site could be shared. In addition, two commissioners from NRC visited the construction site of the EPR reactor Flamanville 3 and the AREVA NC plant in La Hague.

With regard to the nuclear plants in operation, an inspector from the Caen division took part in a cross-inspection of the Golftech NPP (France) with CSN, the Spanish nuclear safety authority.

These cross-inspections enabled the participants to have in-depth discussions on the inspection methods specific to each country.

2|2 Public information actions in 2010

ASN and IRSN jointly presented the exhibition "Nuclear energy and society: from knowledge to regulation" in the festival hall of (Manche *département*[4]). This educational exhibition gives visitors of all ages the opportunity to further their knowledge of radioactivity and find out about the means of overseeing, appraising and regulating nuclear safety and radiation protection in France.

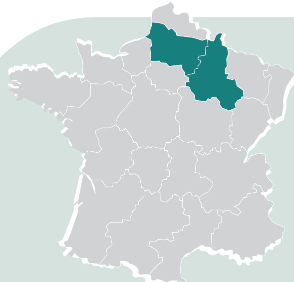
The Caen and Nantes divisions held three joint press conferences in Caen, Rouen and Rennes, on the nuclear safety and radiation protection situation in 2010.

ASN took part in various meetings of the CLI of Normandie and Bretagne. At these meetings, ASN presented its assessment of the safety status of the nuclear installations concerned, the setting up of the French National Network of Environmental Radioactivity Monitoring (RNMRE), the revising of the regulatory system governing nuclear installations, and the publication of the Tritium White Paper.

Visit of the EPR worksite at Olkiluoto by ASN and STUK, the Finnish nuclear safety and radiation protection authority – 2010

4. Administrative region headed by a *préfet*.

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 2010, the workforce of the Châlons-en-Champagne division stands at thirteen officers: one regional head, two deputies to the regional head, eight 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 reactors of 1,450 MWe);
– the Nogent-sur-Seine NPP (two reactors of 1,300 MWe);
– 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 twelve research laboratories, mainly situated in the universities of Champagne-Ardenne and Picardie.

"Environment" inspection in the Nogent-sur-Seine NPP by ASN – June 2010

In 2010, the ASN Châlons-en-Champagne division carried out 45 inspections on nuclear installations (EDF NPPs, radioactive waste processing facilities) and 64 inspections in small-scale nuclear activities.

Five significant events classified as level 1 on the INES scale were notified by nuclear installation licensees in 2010.

1 Assessment by domain

1|1 Assessment of BNI safety

Nogent-sur-Seine NPP

ASN considers that the results from the Nogent-sur-Seine NPP are on the whole satisfactory with respect to safety, pressure equipment, the environment and radioactive material transport.

ASN noted a reduction in environmental performance, associated more particularly with discharges of cooling fluids and a lack of rigour in effluent management.

When reactor 2 was shut down for its ten-year inspection, the inspections that are decisive for safety - the primary cooling system hydrostatic test and the reactor containment test in particular - gave satisfactory results. The inspectors noted the professionalism of the maintenance teams and a slight improvement in fire risk control through more efficient evacuation of inflammable waste.

Tracking corrective actions following the ASN inspections and further to the significant events occurring on the site has been improved with the setting up of a more robust organisation, but the plant must continue its efforts to catch up on prior deviations.

ASN nevertheless wants to see improvements in operating rigour. Several significant events have been notified as a result of excursions from the normal operating range of the reactor or lockout errors during plant unit shutdowns.

Chooz NPP

In ASN's opinion, the Chooz NPP has made considerable improvements in its nuclear safety and radiation protection performance. Significant progress was observed when performing the ten-year inspection of reactor 1, and at the ASN's review inspection in July. Deficiencies have nevertheless again been observed in the decision-making process. The Chooz B plant licensee must therefore improve its control over maintenance operation preparation and the management of transient sensitive situations.

Radiation protection and radiological cleanness at the Chooz NPP has been returned to a satisfactory level, by paying particular attention to the risk-prone work sites, among other things.

From the environmental aspect, ASN considers that the licensee has not fully integrated the new decisions of 2009 regulating its waste. The site must make improvements in this area in 2011.

As for the control of the risks associated with pressure equipment, recognition of the EDF inspection service was renewed in 2010.

With regard to the Chooz A decommissioning site, the licensee is now demonstrating better control over its safety and radiation protection requirements. It must absolutely maintain its vigilance over the safety and security of the work sites now that the intensity of decommissioning work is going to increase.

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 its Bure underground laboratory continued in 2010 with a good level of quality that is comparable with the performance of previous years.

A diagnostic health study was carried out around the Aube waste repository in 2010 by the French health monitoring institute InVS, at the request of the group of associations "*Les citoyens du coin*" relayed by local elected officials. The results of this study were communicated to the Soulaines CLI end of October 2010. In the light of the results, which reveal no link between the waste repository and any effects on health, it was decided not to further the study. This being said and given the concerns of the population, the trend in the development of cases of cancer - lung cancer in particular - will continue to be monitored.

1|2 Assessment of radiation protection in the medical field

For the fourth year in succession, all twelve external radiotherapy centres were inspected in 2010. Very real progress was observed, particularly in the deployment of the quality management systems. Likewise, four of the six centres considered to be borderline in terms of sizing (technical platform, staff numbers), were able to carry out appropriate actions in 2010 to remedy this situation.

In April 2010, ASN organised a regional seminar on radiotherapy attended by about fifty people representative of all the personnel categories and all the radiotherapy centres established in Champagne-Ardenne and Picardie. This seminar provided an opportunity to draw the attention of the profession to the new provisions in terms of radiation protection and quality assurance. The participants were so satisfied with the ensuing discussions that they asked that this type of event be repeated periodically.

Interventional radiology was also subject to considerable inspection efforts, particularly in the operating theatres. Significant progress in work and patient radiation protection is expected. Personnel training and the conditions of use and inspection of equipment constitute the main lines of work. Considering this context, the level of inspections applied in 2010 will be maintained in 2011, that is to say about ten inspections.

1|3 Assessment of radiation protection in the industrial sector

Given the potential implications in terms of radiation protection, ASN performed a large number of inspections on worksites using gamma radiography. The lines for progress in this domain include personnel training, development of the safety culture and preparation for incident situations.

A sampling inspection campaign targeting holders devices for detecting lead in paint evidenced numerous deviations with respect to the regulations: regulatory inspections omitted, expired licenses, transfer of devices to unlicensed users, etc.

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 based in Pargny-sur-Saulx (*département* 51). The first clean-out operations, which began in 2010, should normally end in 2011.

1|4 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

ASN carried out ten inspections into the conditions of radioactive material transport, at each of the BNIs and seven other facilities, focusing more specifically on the transport of radiopharmaceutical products.

It emerges from these inspections that the regulations pertaining to radioactive material transport are generally applied satisfactorily, particularly by the NPPs. In the transport of radiopharmaceutical products, compliance with the regulations depends largely on the shipper and the transport agent. All the transporters inspected need to show greater rigour in the monitoring and accessibility of certain safety equipment items (handheld torches, fire extinguisher) or the securing of packages.

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. It developed cross-inspections in small-scale nuclear activities and hosted a trainee Belgian inspector for three weeks. It took part in the meetings of the Franco-Belgian steering committee meetings and the work of the Franco-Belgian "safety" working group. It also took part in the Franco-Luxembourg committee meeting.

Lastly, it helped host several foreign delegations that came to visit sites such as the Bure Laboratory, the Soulaines-Dhuys repository, and the Nogent-sur-Seine NPP, and it accompanied a delegation of the Bure CLIS (local committee for information and follow-up), which travelled to Sweden to visit facilities associated with radioactive waste treatment there.

2|2 The other significant events in the Champagne-Ardenne and Picardie regions

As part of the major risks prevention actions, the ASN division took part in the emergency exercise organised on the Chooz site, and contributed to the reflections on the updating of the off-site emergency plans (PPI) of the Chooz and Nogent-sur-Seine NPPs.

2|3 Public information actions in 2010

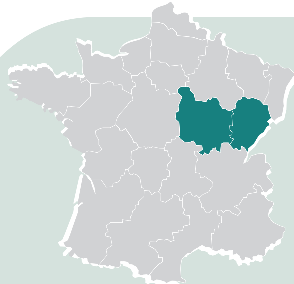
The Châlons-en-Champagne division held two press conferences on the status of nuclear safety and radiation protection in spring 2010, one in Châlons-en-Champagne, the other in Amiens.

ASN took part in various meetings of the Chooz, Nogent-sur-Seine and Soulaines CLIs. At these meetings, ASN presented, for example, its assessment of the safety status of the nuclear installations concerned, the results of the iodine table distribution campaign, the setting up of the French National Environmental Radioactivity Monitoring Network (RNMRE), the French National Radioactive Material and Waste Management Plan (PNGMDR), the revising of the regulatory system governing nuclear installations, the system for controlling urban development around BNIs, and the creation of the ARS.

ASN 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.

Lastly, at the end of the year, it organised, in partnership with the Chooz CLI and EDF, a discussion forum on the decommissioning of the Chooz A NPP, that was open to the press and the public. Some fifty people from the neighbouring population - including a good number of Belgians - attended this event and asked many questions, focusing chiefly on the modes of communication with the public.

First seminar on external radiotherapy in Rheims – April 2010



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* in the Bourgogne and Franche-Comté regions.
As at 31 December 2010, 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 (17 accelerators, 1 contact radiotherapy device);
- 3 brachytherapy departments;
- 13 nuclear medicine units;
- 51 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 33 inspections in 2010, of which 5 addressed radioactive material transport and 28 were in small-scale nuclear facilities.

Five radiation protection incidents affecting patients and classified as level 1 on the ASN-SFRO scale were notified to the Dijon division in 2010.

1 Assessment by domain

1|1 Assessment of radiation protection in the medical field

External radiotherapy

In 2010, ASN inspected five of the eight external radiotherapy centres of Bourgogne and Franche-Comté.

The problem of personnel shortages in medical radiation physics observed in the preceding years is much less acute, but the situation remains tenuous given the numerous job opportunities for radiation physicists, so ASN will maintain its vigilance in this respect.

All the centres have started putting in place a quality assurance system pursuant to the ASN decision of 1 July 2008. The process is however very often in the very early stages and the implementation schedules are not always met. The formalising of the establishments' medical physics organisation plans has been started, but many are still at the draft stage. The systematic validation of the different stages of a treatment by all the persons concerned has not yet become standard practice, despite the clear desire of health care establishment directors to move forward on this subject.

The centres have set up an organisation to ensure the internal 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 internal checks are not carried out in full. Definite progress is required in this area.

ASN observes a clear improvement in the extent to which the health professionals are aware 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

The lessons drawn from the inspections conducted in 2010 show an improvement in the dosimetric monitoring of workers, particularly through the implementing of operational dosimetry in many establishments. Likewise, the training of practitioners and the other personnel involved in X-ray treatments in patient radiation protection has resulted in an awareness of the doses delivered and optimising of practices and device settings. There are however still large differences between establishments: there are large disparities in the performance of the devices used and in the performing of the quality checks of these devices as required by AFSSAPS.

ASN has observed unsatisfactory application of the new provisions setting the conditions of exercising the functions of an external person competent in radiation protection (PCR). This is because the PCRs of companies providing radiation protection services are not always present on the days the activity is carried out.

ASN was consulted several times for the creation of new operating theatres. This provided the opportunity to point out the regulatory requirements for the design of the premises and the good practices to apply when choosing equipment in order to limit exposure of patients and workers.

1|2 Assessment in the industrial sector

The inspections conducted by ASN in industrial radiography in 2009 and 2010 reveal an improvement in the awareness of the risk of exposure of workers.

Progress has been observed in particular in the use of gamma radiography appliances on external worksites. However, the conditions of work and performance of regular radiographic

Inspection if the irradiator at the INRA in Bretenière – 2010

inspections (virtually permanent external worksites) by subcontactors can still be improved.

ASN is pleased to see that increasing use is being made of electrical X-ray generators on worksites, in place of traditional high activity sources. This alternative solution seems to be preferred by non-destructive testing equipment manufacturers, rather than using lower energy radionuclides (selenium).

1|3 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

ASN notes an improvement in the conditions of transport of radiopharmaceutical products, and greater rigour in regulatory documentation management and verification of safety equipment, even if there is margin for improvement in the securing of loads.

The same goes for the holders of radioactive sources who transport their equipment themselves. This being said, the documentation relative to the transport operations is not always subject to quality assurance management.

2 Additional information

2|1 The other significant events 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 in December 2010, ASN assisted the Bourgogne DREAL (Regional Directorate for the Environment, Planning and Housing) in an unannounced inspection of two treatment residue storage sites where surface water and sediment samples were taken from the surrounding environment. They are currently being analysed.

Examination of the operating results of all the mining sites revealed the need to perform additional investigations on the Issy l'Évêque storage site and tighten the environmental monitoring of other sites.

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. The population and local associations were informed regularly of the progress of the works and involved in the surveillance actions.

Polluted sites in Franche-Comté

With regard to the management of polluted sites and soils, ASN is involved in informing the population and reviewing the proposed rehabilitation levels, to ensure the radiation protection of the public and the future users of the cleaned-out sites.

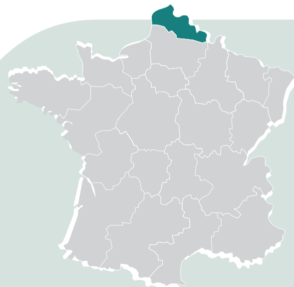
Franche-Comté is the birthplace of French clockmaking. This industry used radionuclide-based coatings with photoluminescent properties in the manufacture of clock hands and watch dials.

The clean-out operations of a former clockmaking site in Charquemont (Doubs *département*) initiated in 2009 were partly carried out under the joint surveillance of ASN and the Franche-Comté DREAL. The radiometric results obtained after completion of these operations led to a portion of the premises being reused. Other operations to rehabilitate older buildings remain to be carried out.

2|2 Public information actions in 2010

At the end of June 2010 the Dijon division held a press conference on the status of nuclear safety and radiation protection in the Bourgogne and Franche-Comté regions.

DOUAI



5 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE NORD-PAS-DE-CALAIS REGION REGULATED BY THE **DOUAI** DIVISION

The Douai 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 2010, the workforce of the Douai 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 installation to be monitored by ASN comprise:
– 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:
– 13 external radiotherapy departments;
– 2 brachytherapy departments;
– 14 nuclear medicine departments;
– 75 tomography devices;
– 3,000 medical and dental radiodiagnostic devices;
– 1,500 industrial devices;
– 30 research laboratories.

ASN inspection of the Gravelines NPP – September 2010

In 2010, ASN carried out 139 inspections: 36 nuclear safety inspections in the Gravelines NPP and the Société de Maintenance Nucléaire (SOMANU) in Maubeuge, 97 small-scale nuclear activity inspections in the medical, industrial and research sectors and 6 radioactive material transport inspections.

The Gravelines NPP notified 4 significant safety events classified as level 1 on the INES scale.

The radiotherapy centres notified 8 events classified as level 1 or less on the ASN-SFRO scale. ASN nevertheless observes a large drop in the number of event notifications.

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 ASN's general assessment of EDF performance.

ASN does nevertheless feel that the site must seek improvements in the rigour and reliability of certain operations. Moreover, several events that could have had an impact on nuclear safety or security were not addressed appropriately by the site. ASN more specifically demanded the temporary shutdown of reactor 2 to correct a setting error observed on a steam evacuation line whose seismic resistance was no longer guaranteed.

As in 2009, ASN considers that the site must step up its resources for treating environmental protection problems, given its size and location in a dense industrial environment.

The Société de Maintenance Nucléaire (nuclear maintenance company) in Maubeuge

ASN considers that operation of its installations is satisfactory. Improvements are noted in the treatment and evacuation of radioactive waste. Avenues for improvement have been identified in the signalling of regulated access areas and the preparation of activities in these areas.

1|2 Assessment of radiation protection in the medical field

Radiotherapy

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 2010, 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 physicist staff numbers improved during the year. Over the last few years, the region has widely benefited from the arrival of physicists qualified in Belgium. The region's centres are nevertheless still more affected than the national average by the shortage of radiation physicists. 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. Since 2008, all the centres have put in place procedures for recording and analysing undesirable events.

Lastly, ASN organised a discussion and experience-sharing forum with the professionals of the sector, where testimonials and of national and regional summaries of the ASN inspection campaigns were presented.

Nuclear medicine

ASN continued its inspections in the nuclear medicine sector. These inspections revealed that these structures are actively involved in making progress in radiation protection. ASN nevertheless notes that certain departments fail to make their license renewal applications on time.

Interventional radiology

ASN has intensified its inspections in interventional radiology, and in operating theatres in particular. Margins for progress have been identified, particularly in personnel dosimetry and training in radiation protection.

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 2010 showed continuing improvement in the organisation of radiation protection in the companies and satisfactory worker monitoring. The unannounced night-time inspections on worksites nevertheless revealed cases of inadequate compliance with radiation protection rules by subcontracting companies.

Veterinary clinics: targeted inspections campaign

Working in partnership with DIRECCTE in the field of conventional safety, ASN carried out a one-off series of inspections in 32 veterinary clinics in the Nord-Pas-de Calais region on 14 and 15 June 2010. This revealed 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 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 nuclear safety and radiation protection in the transport of radioactive materials

In 2010, ASN continued its regulation activities in the radioactive materials transport sector. An inquiry conducted with the licensees identified the need for training in regulatory aspects. On 7 June, ASN organised an information meeting for the regional transporters of the industrial sector.

2 Additional information

2|1 International action by the Douai division

In 2010, the division developed its international exchanges, including with the Belgian nuclear safety authority, for 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. In addition, the division hosted four foreign inspectors for training purposes: two at the request of the Belgian safety authority, and two (from Gabon, Algeria) at the request of the IAEA. Lastly, the Polish nuclear safety authority took part in the setting up of the CLI of SOMANU - a nuclear maintenance company - in Maubeuge.

2|2 The other significant events in the Nord-Pas-de-Calais region

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 this basis, ASN has continued its action aiming at setting up radiological surveillance of the sites, in collaboration with the DREAL.

Working in partnership with DIRECCTE, ASN 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 companies in the region. A monitoring committee has been set up. Exchange and work protocols between ASN 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.

2 | 3 Public information actions in 2010

The status of the CLIs of the Gravelines NPP and the SOMANU in Maubeuge were brought into line with the requirements of the TSN Act.

The CLI of the Gravelines NPP was preparing for the 3rd ten-year inspections which started in 2011, and the national exercise scheduled for 18 January 2011. In addition, several members of the CLI attended an ASN inspection.

In 2010 ASN held two press conferences on the status of nuclear safety and radiation protection, one in Lille, the other in Dunkerque.

Press conference in Dunkerque – May 2010

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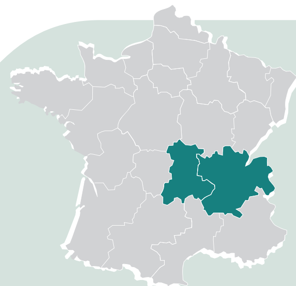


6 THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN THE RHONE-ALPES AND AUVERGNE REGIONS REGULATED BY THE **LYON** DIVISION

The Lyon division regulates nuclear safety and radiation protection in the 12 *départements* of the Rhône-Alpes and Auvergne regions.
As at 31 December 2010, the workforce of the Lyon division stood at 37 officers: 1 regional head, 3 deputies, 17 nuclear safety inspectors, 9 radiation protection inspectors and 7 administrative officers, under the authority of an ASN 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, 1,300 MWe), Cruas-Meysse (4 reactors of 900 MWe) and Tricastin (4 reactors of 900 MWe);
– the FBFC nuclear fuel fabrication plants in Romans-sur-Isère;
– the nuclear fuel cycle plants on the Tricastin industrial platform;
– the high flux reactor in the Laue-Langevin Institute (ILL) in Grenoble;
– Bugey NPP reactor 1 undergoing decommissioning
– the SUPERPHÉNIX reactor undergoing decommissioning at Creys-Malville, as well as its auxiliary installations;
– the IONISOS irradiation facility in Dagneux;
– the SICN nuclear fuel fabrication plant pelletising unit in Veurey-Voroize, undergoing decommissioning;
– the CEA (French Alternative Energies and Atomic Energy Commission) Grenoble reactors and plants, undergoing decommissioning;
– the small-scale nuclear activities, comprising about 4,500 dentists, 500 radiologists, 700 veterinary surgeons, 100 tomography devices, 22 radiotherapy departments (including 6 which also conduct brachytherapy), 23 nuclear medicine departments, 20 gamma radiography devices, 190 electrical generators of X-rays, 30 users of unsealed sources, 200 users of lead detectors and 20 users of gammadensimeters.

ASN conducted 270 inspections in Rhône-Alpes and Auvergne in 2010. Of these inspections, 89 were carried out in the four NPPS, and 24 of these were conventional safety inspections. 101 inspections were carried out in the small-scale nuclear activities sector, 70 inspections concerned the other nuclear facilities monitored by the division, and 10 inspections concerned the transport of radioactive materials.

twenty six significant safety events classified as level 1 on the INES scale were notified by licensees of nuclear installations in the Rhône-Alpes region in 2010.

In the small-scale nuclear sector in the Rhône-Alpes and Auvergne regions, 23 significant events of level 1 on the ASN-SFRO scale were notified in the medical sector and 2 events in the industrial sector, one of level 2 and other of level 1 on the INES scale. The level 2 event occurred on the Feursmétal site (*département* 42).

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

Nuclear power generating reactors

Bugey NPP

In terms of nuclear safety, the Bugey NPP stands out with respect to ASN's general assessment of EDF plants, mainly due to the quality of the independent safety route. Nevertheless, operational shortcomings were observed in 2010 in the quality of alignments and lockouts, and compliance with the operational technical specifications.

ASN observed that the conditions of work safety deteriorated during replacement of the steam generators of reactors 2 and 3 in 2010.

After thirty years of service, reactor 2 underwent its third ten-year inspection from February to November 2010. The boiler requalification test was performed in August 2010. On 25 October 2010, ASN gave its authorisation to restart reactor 2 for a cycle, and will state its position on the continuation of reactor operation in 2011.

Some deviations in radiation protection were recorded, but ASN observes a slight improvement on the whole.

Lastly, ASN notes the growing involvement of site management and of the teams on the ground in matters of environmental protection.

Bugey NPP reactor 1 undergoing decommissioning

2010 saw the completion of the preparation and fitting-out operations for the projected dismantling of reactor 1, such as the creation of the waste transit areas and hot and cold storage areas, and upgrading of the activity measurement chains at the discharge stack. ASN approved the framework authorising starting of the cutting operations on contaminating systems in October 2010, thereby enabling EDF to start the first phase of decommissioning, outside the reactor vessel.

The activated waste packaging and interim storage installation (ICEDA) at Bugey

The ICEDA was licensed by the decree of 23 April 2010. ASN carried out two inspections on the civil engineering site to verify the quality of the first structures, and in particular the drilling and concreting of the 292 rigid inclusions reinforcing the ground. ASN considers that EDF shows rigour in its management of the construction site, be it from the documentary organisation aspect or contingency management.

Saint-Alban NPP

The Saint-Alban NPP remains below average with respect to ASN's overall assessment of the EDF plants. The structural weaknesses diagnosed in 2009 were observed once again in 2010, particularly during the reactor 2 refuelling shutdown.

Since mid-2009, the site has deployed a plan to improve operating rigour. ASN notes a slight positive trend in the way in which the safety requirements are taken into account, notably by the independent safety route.

The site's results in terms of radiation and environmental protection remain tenuous, as these subjects are not addressed with sufficient rigour.

ASN notes that there is substantial room for progress in pressure equipment monitoring.

More generally speaking, ASN wants to see improvements in the Saint-Alban site's responsiveness and communication with ASN in 2011.

The site underwent an international audit coordinated by the IAEA in 2010. The conclusions of the audit confirm the opinion ASN has held on this site since 2009.

Cruas-Meysse NPP

In terms of nuclear safety, the Cruas-Meysse NPP reaches the average with respect to ASN's general assessment of EDF plants. The efforts it has been making since 2008 to improve the rigour of control operations must be continued.

With regard to radiation protection, the site displayed contrasting results in 2010. The results of inspections in gamma radiography were satisfactory, whereas the control of access to limited-stay radiological areas must be improved.

Lastly, ASN observed weaknesses in catering for the environmental implications for new installations.

Tricastin NPP

Following the third ten-year inspection of reactor 1, which lasted from May to August 2009, and after analysing the final report of the safety review presented by EDF, ASN deemed on 4 November 2010 that this reactor was fit to be operated for a further period of ten years.

With regard to radiation protection, ASN observes a significant improvement in radiological cleanness, particularly during reactor shutdowns.

ASN nevertheless considers that work safety dropped markedly in 2010, with three serious accidents occurring on the site, without the personnel or management taking any truly positive action to remedy the situation.

Nuclear research facilities or facilities undergoing decommissioning, nuclear plants and units

The FBFC nuclear fuel fabrication plants in Romans-sur-Isère;

ASN considers that the FBFC installations display a satisfactory standard of safety. The plant's industrial equipment renewal programme is nearing completion and the renovated production lines function correctly. Some shortcomings were nevertheless detected in the site's management of inspections and periodic tests. Lastly, the clean-out and upgrading work on the effluent networks is progressing satisfactorily and should be completed in 2011.

The high flux reactor in the Laue-Langevin Institute (ILL) in Grenoble

ASN considers that the safety of the ILL is satisfactorily ensured. 2010 saw the completion of the work to reinforce the handling crane in the reactor building to guarantee that it can withstand an earthquake of the "safe shutdown earthquake" type. The ILL also installed a buffer device on the gaseous discharge system in 2010. Lastly, in the context of denuclearisation of the CEA centre in Grenoble, responsibility for waste management and environmental monitoring of this site has been transferred from CEA to the ILL.

The Superphénix reactor at Creys-Malville

ASN considers that the safety of Superphénix is satisfactorily ensured. 2010 was marked by the start-up of the sodium treatment facility and storage on the site of the first concrete blocks produced by this process (about 5,000 blocks produced in 2010). In parallel with this, EDF updated the off-site emergency plan to cater for the risks associated with this new facility. EDF also removed the tank of large primary system components (pump, intermediate heat exchangers). These components were treated, cut up then disposed of as nuclear waste.

The Ionisos irradiation facility in Dagneux

Although ASN considers that safety is ensured satisfactorily, it does observe than it was notified in 2010 of an incident relating to

Inspection of the control room during the ten-year inspection of the Tricastin NPP – May 2009 compliance with the conditions of transport of legacy sources held in the installation. The incident was classified as level 1 on the INES scale. ASN also reiterated the obligation to set up a CLI for this installation.

The SICN nuclear fuel fabrication plant in Veurey-Voroize

ASN considers that the licensee did not satisfactorily monitor the end of the SICN plant decommissioning operations in 2010. ASN detected many anomalies during its inspections. ASN moreover refused the delicensing of certain buildings in 2010, due to incorrect application of the clean-out procedures. This situation had already arisen in 2009.

The CEA centre reactors and plants in Grenoble

Decommissioning of the CEA's nuclear installations in Grenoble progressed in 2010. The delicensing application for the Mélusine reactor was submitted and the Siloe clean-out operations are coming to an end. ASN considers that CEA is a rigorous licensee but must nevertheless remain vigilant in the control of installation safety and security, as it makes extensive use of subcontractors.

The nuclear fuel cycle plants on the Tricastin industrial platform

Areva NC – W and TU5 plants in Pierrelatte

The level of safety in the Areva NC installations is considered satisfactory. The means devoted to safety have been stepped up, notably with the creation of a safety and environment hub within the industrial chemistry department. The site has made progress in the preparation and management of maintenance operations. A few events did occur that led to the dispersal of small quantities of uranium in the installations, but without reaching the environment.

Comurhex's – Company for the conversion of uranium into metal and hexafluoride - Pierrelatte

As in 2009, ASN considers that Comurhex's safety results are unsatisfactory. Numerous events were notified, most of which were caused by organisational deficiencies (inappropriate procedures, poor work preparation) and human deficiencies (failure to comply with instructions). Furthermore, the inspections of the installation showed that the reality on the ground did not always comply with the installation's safety standards. Lastly, COMURHEX has shown failings in meeting its commitments.

Eurodif - European gaseous diffusion enrichment plant in Pierrelatte

The level of safety of the Eurodif installations is considered satisfactory. Nevertheless, two recurrent incidents of overfilling of a tank with uranium hexafluoride (UF_6), classified as level 1 on the INES scale, prompted a reactive inspection by ASN. The licensee finally changed the way it manages the filling of its UF_6 tanks. Concerning radiation protection, the exposure levels reached in 2010 remain low.

ASN inspection of a convoy of enriched uranium hexafluoride, ready to leave the Eurodif plant on the Tricastin site – March 2010

SET Georges Besse II – Uranium enrichment plant in Pierrelatte

Construction of the Georges Besse II plant for uranium enrichment by centrifugation continued satisfactorily in 2010. The safety tests prior to the introduction of uranium into the supply stations for the South unit centrifuges began in late 2010.

Socatri – Company operating a clean-up and recovery installation – Bollène plant

The improvements in safety and pollution prevention in the Socatri facilities continued in 2010. Several facilities were modernised. A modification of the stormwater collection systems engaged jointly with EURODIF and designed prevent to the overflow of an accidental pollution spill into the River Mayre-Girarde, was presented to ASN.

1|2 Assessment of radiation protection in the medical field

On the whole, ASN considers that radiation protection in the medical sector in the Rhône-Alpes and Auvergne regions is satisfactory.

Radiotherapy

In 2010, ASN inspected half of the radiotherapy centres in the Rhône-Alpes and Auvergne regions. This enabled the setting up of the quality assurance system to be inspected. This system addresses aspects such as the responsibility of the workers, management of resources, delivery of treatments and the management of undesirable situations and malfunctions. This inspection campaign also provided an opportunity to monitor physician, radiological physicist and technician staffing trends.

The results of these inspections show that the large majority of the centres have taken organisational steps to implement a quality assurance approach to improve the delivery of treatments to patients. The initiative - which began in 2009 - must be completed in 2011, therefore the efforts must be maintained.

Regarding the numbers of radiological physicist staff, ASN considers that the situation is improving. The summer vacation period did not lead to interruptions in the activity of radiotherapy departments due to personnel shortages. This being said, radiological physicists are still limited in number and tenuous situations persist.

Interventional radiology

The establishments concerned on the whole comply with the worker radiation protection regulations, often calling on the services of an external person competent in radiation protection (PCR).

ASN is more reserved regarding the radiation protection of patients however. Although the paramedical teams are usually properly trained, considerable differences between the medical teams were observed. Good practices are on the whole well understood and applied, but only a few establishments optimise the doses delivered.

1|3 Assessment of radiation protection in the industrial radiology sector

ASN considers that on the whole the radiation protection situation in the industrial radiology sector is satisfactory. The inspections carried out in 2010 brought to light no significant regulatory non-conformities, even if there is still room for improvement in radiation protection of workers.

ASN also took part in the drafting of a charter of good practices in industrial radiology, signed by the sector stakeholders on 10 February 2010.

1|4 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

In 2009, ASN conducted a survey involving more than 1,000 entities concerned by the transport of radioactive materials. The conclusions of this survey led it to hold an information day on 4 February 2010, covering the safety requirements applicable to the transport of radioactive materials. Attended by some 150 professionals, this event addressed the regulatory requirements and means of complying with them.

The inspections and monitoring actions carried out in the Rhône-Alpes and Auvergne regions in this sector in 2010 revealed no worrying situations.

2 Additional information

2|1 International action by the Lyon division

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. An international convention on protection against ionising radiation and safety was moreover signed between the CERN, France and Switzerland.

Division inspectors also participated in discussions with the Japanese and Chinese safety authorities on the inspection practices during reactor shutdowns, and with the UK safety authority on the inspection of plants carrying out enrichment by centrifugation.

These discussions allowed the sharing of good practices in the inspection of nuclear installations.

2|2 The other significant events in the Rhône-Alpes and Auvergne regions

Monitoring of the former uranium mines

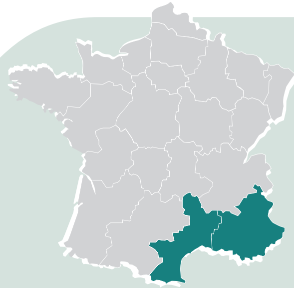
ASN considers that the work carried out by Areva on the sites of Saint-Pierre du Cantal (Cantal *département*) and Saint Priest-la-Prugne (Loire *département*) ensures good control over the risk of the neighbouring populations being exposed to ionising radiation. Nonetheless, public protection restrictions should be put in place, particularly at Saint-Pierre-du-Cantal. Such restrictions would enable the future occupation of the sites in question to be controlled and the industrial history of these sites to be kept on record.

2|3 Public information actions in 2010

In 2009, a CLI was created for the SICN plant operated by Areva at Veurey-Voroize (Isère). The activity of the CLIs in the Rhône-Alpes region developed significantly during 2010.

In 2010, ASN held a press conference on the state of nuclear safety and radiation protection.

asn MARSEILLE



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 2010, the workforce of the Marseille division stood at 19 officers: 1 regional head, 2 deputies, 12 inspectors and 4 administrative officers, under the authority of an ASN regional representative.

The activities and installations to regulate comprise:
26 BNIs;
– the CEA centre in Cadarache (Bouches du Rhône *département*) which counts 20 BNIs under construction, in operation, or undergoing decommissioning;
– the international project for the construction of the ITER facility dedicated to nuclear fusion research, adjacent to the Cadarache CEA centre;
– the CEA centre in Marcoule (Gard *département*) which counts two BNIs: Atalante and Phénix (final shutdown of the Phénix reactor prior to decommissioning took place in March 2010);
– the Mélox "mox" fuel production facility (Areva NC), on the Marcoule platform;
– the Centraco waste treatment facility (Socodei, EDF group), also on the Marcoule platform;
– certain ponds of the Comurhex uranium ores conversion facility in Malvési (Aude *département*);
– the Gammaster industrial irradiator in Marseille;.

Small-scale nuclear facilities, sources and equipment
– 22 external radiotherapy departments (52 accelerators, 1 cyberKnife®, 2 gammaknifes, 1 tomotherapy accelerator);
– 8 brachytherapy departments;
– 26 nuclear medicine departments;
– 140 departments practising interventional radiology;
– 112 computed tomography departments (126 diagnostic scanners);
– 2,424 medical radiodiagnostic devices (including 429 mammography units);
– 4,412 dental radiodiagnostic devices;
– 5 blood product irradiators
– 899 equipment licenses or industrial and research sources (including 446 lead detectors).

In 2010, ASN carried out 90 inspections in BNIs, 98 inspections in small-scale nuclear activities (including 52 in the medical sector, 27 in the industrial sector, and 4 in the polluted sites or enhanced natural radioactivity sector) and 15 audits or inspections of approved organisations in the three regions of Languedoc-Roussillon, PACA and Corsica.

During 2010, the division was notified of 5 nuclear safety incidents and 2 radiation protection incidents, all of level 1 on the INES scale, and 24 patient radiation protection incidents of level 1 on the ASN-SFRO scale.

1 Assessment by domain

1|1 Assessment of BNI safety

CEA's centre in Cadarache

ASN considers that the level of safety of the CEA centre in Cadarache has improved in 2010, with the safety cell being more closely involved in the verification operations. Progress has been observed in event notification times, public information and transparency. Although ASN observes an improvement in the way subcontractors are instructed on safety requirements, it nevertheless remains vigilant regarding the way CEA oversees these subcontractors.

ASN has observed an improvement in the way CEA organises the control of the civil engineering operations for the construction of the new nuclear facilities AGATE and the Jules Horowitz Reactor (RJH) and for the renovation of old facilities (LEFCA, CABRI).

In other areas, ASN finds that CEA lacks foresightedness, particularly in waste management. The review of the AGATE installation commissioning dossier, for example, clearly revealed the lack of a disposal solution for the concentrates produced by the installation. Even if several possibilities are being studied by CEA, it must still present a robust solution to ASN.

ASN asked CEA for a global assessment of how the seismic risk is catered for on the Cadarache nuclear site. The provisions for managing a seismic event in the centre require particular efforts on the part of the licensee. On account of this, a nuclear emergency exercise with a seismic component is planned for the end of 2011.

More generally, ASN considers that the licensee must remain very attentive to the progress of the decommissioning and clean-out work on the shutdown facilities (ATUe, ATPu and LPC, Rapsodie, experimental circuits of Phébus).

ASN had suspended the decommissioning operations further to the level 2 incident that occurred on the ATPu facility in 2009.

ASN continued the investigation of that incident in 2010 with a view to fully resuming the decommissioning activity by the beginning of 2011.

The ITER project

Together with its technical support IRSN, ASN began to review the creation authorisation application for the ITER facility, first submitted on 31 January 2008. At that time, ASN had informed the ITER Organization that several technical points in the dossier would need to be supplemented before the public inquiry procedure could start. The new dossier submitted to ASN in April 2010 was judged admissible. The public inquiry should be able to be held in the first half of 2011.

CEA's centre in Marcoule

ASN considers that the safety organisation and management of the CEA's centre in Marcoule are progressing, having been subject to improvement actions by CEA in 2010. CEA gave ASN commitments to carry out major works to improve the safety of its facilities. ASN nevertheless remains vigilant as to the meeting of these commitments, and makes sure that budget choices within CEA are not made at the expense of safety, given the schedule deviations observed in the last tracking assessments. The organisation of radiation protection on the PHÉNIX facility was judged satisfactory, as was the safety of performance of the end-of-life tests.

The Mélox facility

Several malfunctions relating to criticality risk prevention, and inconsistencies between the applicable procedures and actual practices were observed by ASN on the Mélox facility. Furthermore, about ten significant events relating to the criticality risk and organisational aspects have been reported since 2008. Given this situation, ASN summoned the facility director on 20 January 2010 to reiterate the regulatory requirements and prepare a plan of action. ASN also organised a three-day in-depth inspection on this subject within the facility in June 2010. An improvement in management of the criticality risk was observed due to better integration of organisational and human factors. ASN nevertheless observes that the means deployed today still fall short of site management's stated goal in this domain.

The Centraco facility

Faced with the safety culture failings in the Centraco facility, the ASN Director-General asked the licensee to define and implement measures to improve operating safety. The checks carried out by ASN in 2010 show that the remedial measures taken by the licensee are beginning to have an effect in the field. Although the new measures implemented show that the licensee is truly committed to remedying the difficulties encountered, ASN will nevertheless keep a watchful eye to ensure that the strategy enables this progress to be maintained over the long term.

The Comurhex Malvési facility

At the end of 2009 ASN had considered that some of the treatment and storage ponds of the Comurhex Malvési facility constituted a BNI pursuant to the regulations in effect, and came under ASN control. In a decision dated 22 December 2009, the ASN Commission therefore asked COMURHEX to submit a BNI authorisation decree application file before 31 December 2010. During 2010, ASN also carried out two inspections relative to environmental monitoring and the transport of radioactive materials.

1|2 Assessment of nuclear safety in the transport of radioactive materials

Included for the first time among the eight inspections ASN carried out in the area of radioactive material transport in 2010 was the Grand Port maritime of Marseille. ASN identified avenues for progress concerning the work of the handling teams and the need to clarify the conditions of radioactive material transport on ships. ASN also met land transport inspectors of the PACA region (from the DREAL service), who have extensive experience in the transport of hazardous materials, complementary to that of ASN. This meeting brought to light several areas for collaboration in 2011.

1|3 Assessment of radiation protection in the medical field

Radiotherapy

ASN's inspections in radiotherapy centres in 2009 had confirmed the national shortage of medical radiation physicists. The radiotherapy centres inspected by ASN in 2010 showed a slight improvement in the situation. Some centres have managed to recruit, but other are still in a tenuous situation.

The inspectors observed real progress in quality assurance in all three regions in 2010 - the centres mobilised their efforts on this issue, some advancing more than others.

Since 2008, ASN has targeted radiotherapy departments with special actions to raise awareness on the importance of incident notification. In 2010, the inspectors noted that all the radiotherapy centres had an internal incident reporting system, but progress must still be made in the actual notification of events to ASN.

Professional radiotherapy groups were created in the Languedoc-Roussillon region in 2010, and a project for a tomotherapy activity group is emerging in the PACA region. These "associations" of radiotherapy centres take the form of "health cooperative groups" (GCS) or "economic interest groups" (GIE). The inspectors have observed that the creation of such structures poses many problems. The setting up of a GCS or GIE implies bringing together two or perhaps three radiotherapy centres. Consequently, the activities often have to be grouped on a single site, which implies major changes in terms of medical activity and internal organisation for the centres concerned. The problems result essentially from a lack of foresight on the part of the professionals in the group and inadequate communication between the players. The inspectors also noted a lack of formal structure and problems in the implementation of a common quality assurance approach. ASN will remain attentive to compliance with requirements - particularly organisational - aiming at guaranteeing the safety of patient care.

Interventional radiology

ASN wishes to further its knowledge of the interventional radiology facilities. It therefore sent out a questionnaire to nearly

600 establishments potentially concerned in the three regions, to find out firstly the medical procedures practised in them and secondly to identify the ionising radiation sources used in these procedures. When this survey is completed, ASN will organise professional information sessions by activity sector.

1|4 Assessment of radiation protection in the industrial and research sectors

Research laboratories

ASN has observed noteworthy progress in radioactive source management in the Universities of Montpellier and Perpignan. In the latter university, the identified wastes have been recovered by ANDRA and the room that contained them has been verified as contamination-free. A few products remain, identified and characterised by IRSN at the end of the year, that will be able to be evacuated in 2011. Once this has been done, the University of Perpignan will be in conformity with the regulations.

A similar lack of rigour in the University of Aix-Marseille II had resulted in legacy waste being stored in an unauthorised room that did not meet the necessary safety requirements. ASN had asked that this situation be remedied as of 2006, and checked corrective action progress in 2010. This interim storage situation should satisfactory by mid-2011.

Besides this, ASN is continuing its action concerning the University of Toulon, where orphan sources[5] were discovered by the faculty personnel. ASN carried out an on-site inspection and will closely monitor implementation of the corrective actions demanded.

The industrial sector

Industrial radiology remains a high priority for ASN, with unannounced night-time inspections on the work sites being continued in 2010. ASN has moreover continued its prevention actions in a framework complementary to that of inspection, by publishing and updating a charter of good practices in the domain, in collaboration with the professionals and other government administrations.

1|5 Assessment of radiation protection in the sector of polluted sites, former uranium mines, and enhanced natural radioactivity

ASN is continuing its monitoring and awareness-raising actions in companies that use processes which could concentrate natural ionising radiation. ASN was thus led to carry out an inspection within a thermal establishment (spa). ASN ensures that any preventive measures necessary for the workers are taken. ASN and the PACA DREAL also worked together in this domain, by jointly inspecting bauxite residue deposits.

Jules Horowitz Reactor (RJH) worksite in Cadarache – October 2010

ASN is continuing to ensure that sites polluted by radioactive materials, such as Bandol (Var *département*), Ganagobie (Alpes-de-Haute-Provence *département*) and Marseilles, have been identified and are secure. A new clean-out operation on the Gangobie site took place in spring 2010. Before starting these new clean-out operations, a public meeting was held in the town hall, during which the various entities involved went over the state of the site, the phasing of the clean-out steps and the rehabilitation objectives. The Bandol site for its part is subject to regular monitoring.

ASN continued its collaboration with the DREALs of the PACA and Languedoc-Roussillon regions regarding the "post-uranium mines" issue. Joint inspections were also carried out in these two regions.

2 Additional information

2|1 International action by the Marseille division

In 2010, one person from the division took part in an IAEA seminar on the safety culture, another participated in an IAEA advisory assignment in Mauritania and in an international working group to draft a guide on the management of this type of assignment.

5. An orphan source is a source that is no longer under proper regulatory control, either because it has never been subject to control, or because it has been abandoned, lost, mislaid, stolen or transferred without due authorisation.

Two people from the Marseille division attended an international seminar in Japan on how the seismic risk is taken into account in nuclear installations.

The division also hosted two Algerian trainees for one month as part of IAEA's programme concerning inspection and the examination of dossiers.

2|2 Public information actions in 2010

In 2010, ASN held three press conferences in Marseilles, Montpellier and Nice on the state of nuclear safety and radiation protection, which raised subsequent intense media interest.

Further to the commemoration of the Provence earthquake, ASN organised two public information sessions on how the seismic risk is taken into account in the design and operation of nuclear installations in southern France, held on 4 February 2010 in Marseille and 7 December 2010 in Avignon. This initiative was a great success in terms of attendance and media coverage.

ASN also organised a professional forum on radioactive waste and effluent management and the transport of radioactive materials in the medical and research sectors. 110 people attended this forum.

A second forum on the quality and safety of radiotherapy treatments in the PACA region was held on 19 November 2010 with the professionals of the sector, following on from a similar forum held on 6 February 2009.

ASN organised several information meetings with the elected officials of the region.

It also 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. ASN more particularly contributed to the public meetings of the Cadarache CLI in April 2010 presenting ASN's annual results, and in September 2010 presenting the licensee's annual reports.

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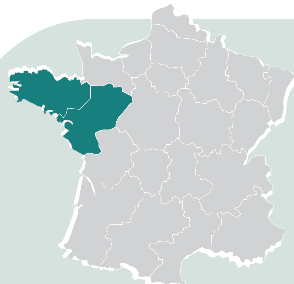
Regional day of discussions on "nuclear installations and the seismic risk" in Marseilles – February 2010

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 2010, 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 Pays de la Loire and in Bretagne comprise:
– three BNIs in the Pays de Loire region: the Monts d'Arrée site NPP*, the IONISOS irradiation facility at Sablé sur Sarthe and the IONISOS irradiation facility at Pouzauges;
** The Monts d'Arrée site (Brennilis plant currently being decommissioned) is regulated by the ASN Caen division.*
– medical departments in the Pays de Loire and Bretagne regions: 15 radiotherapy centres (17 locations), 9 brachytherapy departments, 18 nuclear medicine departments, 70 interventional radiology departments, 92 tomography devices, about 5,000 medical and dental radiology devices;
– industrial and research uses in the Pays de Loire and Bretagne regions: 29 industrial radiology companies, including 8 gamma radiography contractors, about 750 licences for industrial and research equipment, including more than 300 users of devices to detect lead in paint and containing a radioactive source;
– 11 head offices of organisations approved for radiation protection technical checks (2) and for radon checks (7), and two head offices of laboratories approved for taking environmental radioactivity measurements.

In 2010, ASN carried out 123 inspections, including 4 inspections in BNIs and 4 in the transport sector.

IONISOS notified 1 event classified as level 1 on the INES scale for its Sablé-sur-Sarthe site in 2010. In small-scale nuclear activities, the radiotherapy departments of Bretagne and the Pays de la Loire notified 1 significant event of level 2 and 37 significant events of level 1 on the ASN-SFRO scale. In addition, 1 event of level 1 on the INES scale was notified in nuclear medicine, and 2 events of level 1 on the INES scale 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 bunker access door on the Pouzauge site, the licensee has implemented the transient technical measures demanded by ASN to reinforce security of access to the irradiation cell. IONISOS submitted its safety study on the overall management of cell access at the end of 2010.

ASN's monitoring actions in 2011 will focus on the disposal of numerous radioactive sources having reached their service life limit.

1|2 Assessment of radiation protection in the medical field

Of the small-scale nuclear facility inspections, 48 were in the medical field, including 12 carried out during inspection campaigns on dentists and radiologists. These inspection campaigns evidenced continuing progress in raising the awareness of the professionals in the radiation protection of both personnel and patients, and increasing use of Persons with Competence for Radiation protection (PCRs). On the other hand, they also revealed shortcomings in compliance with administrative procedures, periodic external radiation protection checks, and in the justification of radiology procedures.

Radiotherapy

Thirteen of the fifteen external radiotherapy centres were inspected in 2010. ASN observes continuing progress in treatment safety (progress in the quality initiative, handling of undesirable events in radiation protection, etc.). ASN guides nos. 4 and 5 relative to radiotherapy facilitate the engaging of quality assurance actions by the centres. ASN will continue its inspection actions with the centres; the Nantes division will submit to ASN a report on the assessment of risks in brachytherapy, produced in partnership with the regional health professionals.

Interventional radiology

Nine establishments were inspected in 2010, with the inspections focusing primarily on coronarography (coronary angiography), angiography/angioplasty and cardiology. ASN observes that continuing progress is necessary in the quantification of doses received by health professionals in their extremities (hands), and in the information on delivered doses in medical procedure reports, owing notably to the existence of old machines that do not provide useful dosimetric information.

1|3 Assessment of radiation protection in the industrial and research sectors

Forty six inspections were carried out in the small-scale nuclear activities sector, 13 of which were part of the inspection campaigns on possession of devices for detecting lead in paint. This inspection campaign revealed progress in professional awareness of worker radiation protection. However, there were still shortcomings in compliance with administrative procedures and assimilation of the observations made during the external radiation protection inspection.

Industrial radiography

Seventeen inspections were carried out in 2010, 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 technical radiation protection checks. Two incidents classified as level 1 and implicating electric remote controls connected to gamma radiography appliances revealed a generic problem with this type of equipment (see chapter 10). Moreover, improvements are required in the notification to ASN of worksites using radiography devices, in the optimising of dosimetric exposures on worksites using gamma radiography, and the conditions of radiologists' access to bunkers. A regional charter for industrial radiography, produced in collaboration with the DIRECCTEs of Pays de la Loire and Bretagne and the professionals of the sector, will be finalised in early 2011.

Research

Five inspections have been carried out in this field during the past 5 years, covering 70% of the public research sector. ASN observes a remedying of irregular administrative situations and strong involvement of PCRs, allowing in particular the adoption of techniques that involve lower doses for the personnel, or even non-radioactive techniques. The periodic external radiation protection inspections and the annual waste inventory communicated to ANDRA are carried out satisfactorily.

2 Additional information

2|1 International action by the Nantes division

On the international front, the Nantes division participated firstly in a two-week assignment with the Irish Nuclear Safety Authority, and secondly, in a course organised by the IAEA on the regulation of radiation sources dispensed to some thirty African decision-makers in Algeria in October 2010.

2|2 The other significant events in Pays de Loire and Bretagne regions

The former uranium mines

ASN carried out six inspections on the former uranium mining sites in the Bretagne and Pays de la Loire regions. It also carried out an unannounced sampling campaign around the sites of L'Écarpière (Loire-Atlantique *département*) and La Commanderie (Vendée *département*) in collaboration with the Pays de la Loire DREAL. The results (available on *www.mesure-radioactivite.fr*) confirm the self-monitoring measurements taken by the licensee.

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.

2|3 Public information actions in 2010

In 2010, ASN held two press conferences in Nantes and Rennes on the state of nuclear safety and radiation protection.

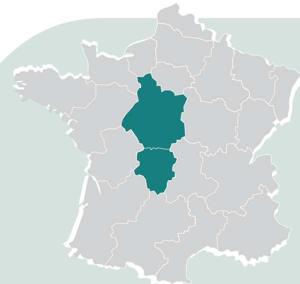
It also participated in training courses on patient radiation protection for electrocardiology technicians and on personnel radiation protection awareness for conventional safety inspectors in the framework of the radiation protection inspection campaign organised by the DGT and ASN in 2010.

ASN participated in the three CLI meetings in 2010, held on 18 June in Sablé-sur-Sarthe, on 10 February and 8 September in Pouzauges.

Lastly, it organised a regional seminar on radiotherapy that was attended by more than sixty professionals from the two regions.

Forum in Nantes on "sharing experience in the safety of treatments" – December 2010

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 ASN Orleans division is responsible for regulating nuclear safety and radiation protection in the 9 *départements* of the Centre and Limousin regions. The Orleans 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[6].
As at 31 December 2010, the workforce of the ASN Orleans division stood at 28 officers: 1 regional head, 4 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 departments in the Centre and Limousin regions using ionising radiation: 11 radiotherapy centres, 5 brachytherapy departments, 12 nuclear medicine departments, 33 interventional radiology departments, 60 tomography devices, 1,600 medical radiology devices and 2,100 dental radiology 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 2010, ASN carried out 183 nuclear safety and radiation protection inspections: 90 inspections of the nuclear installations on EDF's Belleville, Chinon, Dampierre and St-Laurent NPPs, 37 inspections on the nuclear sites in the Ile-de-France region (CEA Saclay and Fontenay centres, CIS bio on the Saclay centre, French National Centre for Scientific Research – CNRS centre at Orsay), 56 inspections on small-scale nuclear facilities in the Centre and Limousin regions.

In 2010, 11 significant events of level 1 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 small-scale nuclear facilities, 1 significant event of level 2 on the ASN-SFRO scale, and 12 significant events of level 1 on the ASN-SFRO scale, and 2 significant events of level 1 on the INES scale were notified in the Centre and Limousin regions.

An incident classified as level 2 on the INES scale occurred at the Chinon NPP, in which a worker received a dosimetric exposure of the extremities that exceeded the regulatory limit.

A brachytherapy incident classified as level 2 on the ASN-SFRO scale occurred at the University Hospital (CHU) of Tours due to the movement of a uterine probe during application of the brachytherapy treatment that potentially led to unintentional vaginal and vulvar irradiation.

1 Assessment by domain

1|1 Assessment of BNI nuclear safety

Belleville-sur-Loire NPP

ASN considers that the safety performance of the Belleville-sur-Loire NPP improved in 2010 and now matches the average level of the EDF nuclear fleet. Progress was noted in the control of the installations and the rigour of interventions, but the latter nevertheless needs to be reinforced. ASN effectively noted during the ten-year inspection of reactor 1 that there are still deviations in maintenance operations. Although these deviations are detected and managed at the proper hierarchical level, they require closer tracking. With regard to radiation protection, ASN also noted shortcomings in radiological cleanness during the reactor shutdowns in 2010, resulting in late detection of external contaminations.

Lastly, ASN considers that the Belleville-sur-Loire NPP must make further progress in the area of environmental protection. Consequently, the fundamental actions initiated in 2010 to ensure the conformity of the installations that could have an impact on the environment and to prevent incidents must be continued in 2011.

6. Radiation protection in Ile-de-France is ensured by the Paris division.

Chinon site

ASN considers that the nuclear safety and radiation protection performance of the reactors in operation at the Chinon NPP is below the average assessment level for EDF. Safety in 2010 was characterized by insufficient operating rigour. The number of significant events relating to the management of the installations remains very high, chiefly due to failure to strictly apply the procedures and general operating rules. ASN moreover observed that the licensee inadequately masters the planning, performance and tracking of the periodic tests.

Furthermore, the Chinon site's performance in radiation protection has deteriorated significantly. 2010 was marked by the notification of two significant events concerning the inappropriate handling of highly irradiating bodies. ASN also recorded serious shortcomings in the preparation of interventions, particularly with respect to prior radiological mapping and establishing accesses to limited-stay areas.

ASN considers that the improvements in fire protection in the irradiated materials shop (AMI), which were finalised in 2010, represent a significant development in the safety of the installation. However, in a context marked by fragile organisational functioning and transfer of the expert appraisal activities to a new installation in 2012, ASN considers that the licensee must more particularly tighten compliance with the requirements of the safety standards and its control over service providers.

Lastly, ASN considers that the level of safety of the Chinon A reactors undergoing decommissioning is on the whole satisfactory. Management of the worksites has improved, but further progress is required in the application of the safety standards.

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. ASN nevertheless estimates that the NPP's safety results, in the continuity of those for 2009, are down compared with those obtained in the previous years. For example, worker compliance with the instruction texts, which previously was exemplary, is now less rigorous. Furthermore, deficiencies in the licensee's monitoring of maintenance service providers were again noted in 2010.

In the area of worker safety and radiation protection, the inspected worksites still display recurrent deviations from the regulations, which must incite the site to step up its actions, and notably the presence of managerial staff on the worksites. As regards the environmental impact of the installations, ASN underlines the good control over radioactive discharges and the noteworthy commitment of the site to the process of reviewing its discharge and sampling authorisations.

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. In terms of safety, progress has been observed in the management of the transient reactor shutdown and restarting phases in 2010. ASN does however consider that efforts must be maintained in the preparation of work interventions, for which the number of deviations remains high.

ASN inspection during the ten-year inspection of reactor B4 of the Chinon NPP – August 2010

The situation in radiation protection, which is characterized by a reduction in the number of significant events and maintaining of the radiological cleanness indicators at a satisfactory level, is generally improving. ASN nevertheless thinks that progress must still be made in the assimilation of the radiation protection implications by the workers. On the environmental front, the optimising of radioactive discharges remains one of the site's positive points. The licensee must nevertheless endeavour to comply with the new ASN instructions concerning its water take-offs and its discharges.

ASN considers that the level of safety of the Saint-Laurent A reactors undergoing decommissioning is satisfactory on the whole. Improvements have been noted in the monitoring of service providers. On the other hand, the site must make further progress in the tracking and maintenance of certain equipment items. Lastly, the installation of geotechnical containment around the silos for interim storage of irradiated graphite sleeves enhances the protection of this facility from 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 level of safety in the CEA nuclear facilities in the Saclay centre is on the whole satisfactory. At the end of the review inspection carried out from 31 May to 4 June 2010, it gave a positive judgement on the efficiency of the centre's safety management. The centre has different levels of management and contractualisation aids that are subject to regular monitoring, allowing the various priorities associated with BNI safety to be managed. Improvements must nevertheless be made in the quality of the internal diagnosis and the actions of the safety unit that could result from it. Management of the commitments taken with ASN also deserves to be clarified and harmonised for all the BNIs, more particularly in defining the priority levels and informing of deadline extensions.

Control of service providers remains an important issue in a context of increasing subcontracting (decommissioning of the high activity Laboratory, entry into service of the new STELLA workshop, etc.). ASN considers that the procedure implemented by CEA for this purpose is effective, given the results obtained, but it would nevertheless merit being consolidated.

Furthermore, following entry into effect in early 2010 of ASN decisions regulating the discharges and water take-offs of the centre's BNIs, CEA has set up a monitoring committee to take the required actions. Despite delays in carrying out some actions, the organisation established that on the whole the monitoring of discharges and of the centre's environment meet ASNs requirements in this respect. Lastly, after noting several deviations, ASN has asked CEA to conduct actions on the site to remedy the malfunctions of the alarm transmission channels.

The CIS bio international plant in Saclay

Although the renovation work in progress should help improve the safety of the plant, the weaknesses observed in plant operation and the delays in production of the safety analysis files and the shortcomings in their content, particularly the safety review file, required sustained monitoring by ASN in 2010. Moreover, this situation prevented the Advisory Committee of Experts, in its meeting of 7 July 2010, from reaching a conclusion on whether the provisions adopted in the safety review file are sufficient to ensure lasting operation of the BNI. The file must therefore be supplemented following a schedule set by ASN decision, and resubmitted for review in 2011. However, it has already turned out to be necessary to reduce the plant's radioactive iodine inventory in order to mitigate the potential consequences of a serious accident.

Given the persistence of the identified weaknesses, ASN's monitoring has highlighted the need for the licensee to step up safety management, with a view to achieving a true continuous improvement process. Consequently, a more structured and prioritised approach using appropriate means is required in this area.

The CEA's Centerin Fontenay-aux-Roses

ASN considers that top management's involvement in nuclear safety constitutes one of the centre's strong points. However, the commitments made to ASN must be monitored more closely. ASN also considers that the organisation and means deployed for radiation protection are satisfactory. Beside this, 2010 was marked by several deviations relative to the confinement of radioactive materials despite having conducted improvement actions on this theme. Lastly, the fire-fighting teams were found to lack manpower and have shortcomings in their training resulting in reduced operational effectiveness of the centre's fire-fighting organisation.

1|2 Assessment of radiation protection in the medical field

In 2010, ASN considers that the radiotherapy centres in the Centre and Limousin regions on the whole progressed since the inspection campaign carried out in 2009. Most of the centres have initiated programmes to achieve progress in treatment safety, including through more formalised practices, implementation of a quality management system, recording of incidents and malfunctions and regulation and inspection of equipment. Moreover, nearly half of the radiotherapy centres in the Centre and Limousin regions (five centres out of eleven) will benefit from the support of the INCa (French National Cancer Institute) which is financing assistance from a consulting firm to improve the safety and quality of treatments. Department staff numbers have increased overall in comparison with 2009, which was necessary to meet the regulatory obligation of having medical radiation physicists (or a medical physics team) present when the ionising radiation dose is delivered to the patient.

In the nuclear medicine field, ASN considers that the facilities are on average well maintained, even though few departments manage to maintain their ventilation systems in strict compliance with the conditions set out in the regulations. Furthermore, ASN considers that the progress in determining a precise zoning of the installations is still insufficient. ASN also judges that there is room for improvement in the management of contaminated waste and effluents. Lastly, it notes an increase in

Inspection in an interventional radiology department in Fleury-les-Aubrais – December 2010

the number of significant event notifications in the domain of radiation protection of patients subject to exposure for diagnostic purposes.

The inspections carried out by ASN in medical departments practicing interventional radiology confirmed the gradual implementation of internal and external quality checks. They also confirmed the improvement in personnel training, which was visible in their practices. ASN nevertheless considers that optimising radiation protection in the operating theatre is a major avenue for progress that must be taken further: better knowledge of the devices, presence of dosimetric information on the medical procedure reports, integration of this technique in the medical physics organisation plan, etc.

1|3 Assessment of radiation protection in the industrial and research sectors

There is a contrasting picture of gamma radiography and X-ray radiography carried out in the Centre and Limousin regions on behalf of large customers in the armaments industry and in NPPs. ASN considers that the intervention conditions on the worksites of non-destructive testing contractors are constantly improving, as is the integration of radiation protection in the practical utilisation of their equipment.

However, ASN feels that preparation of the work needs to be improved, as it is often constrained by the tight deadlines between the order and the performance of the work, in terms of both radiation protection (dose forecasting, definition of operating areas) and overall risk prevention (prevention plan). The shortcomings observed could prejudice rigorous optimisation of the exposure to ionising radiation of the workers concerned.

1|4 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

ASN carried out ten inspections of radioactive material shippers in 2010 – with highly diverse movements, materials and types of package shipped – and one new road transport carrier. The inspections, which focused mainly on the operational measures applied and the organisational structures in place, show overall compliance with the regulatory requirements. Significant events, whose origins were essentially human or organisational, had no significant impacts and were limited in number except in airport zones, where handling conditions must be improved.

2 Additional information

2|1 International action by the Orleans division

Since 2002, the Orleans division and the department responsible for regulating safety at the Ministry for the Environment in the German State of Lower Saxony have been discussing their respective practices and carrying out cross-inspections and visits. In this framework, in 2010 the Orléans division hosted two German inspectors and one expert from the TÜV, who participated in an inspection of the worksites for the shutdown of the Chinon NPP reactor 4.

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 move to improve knowledge of the environmental and health impacts of the former Limousin mining sites must be continued. From November 2009 to April 2010, AREVA conducted a helicopter flyover campaign in the Limousin region to detect cases of use of mining tailings outside the perimeter of the extraction sites. The identified geographic zones will need to be analysed to verify the compatibility of the land uses in the immediate environment of these beneficiation zones.

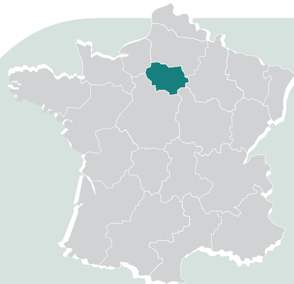
The pluralistic expert group (GEP) on the Limousin uranium mines handed over its final report on 15 September 2010. ASN will make judicious use of this reports' recommendations to orient its future site monitoring action.

2|3 Public information actions in 2010

The process to bring the CLIs for the nuclear sites of the Centre and Ile-de-France regions into compliance with the provisions of the TSN Act was completed in 2010, with among other things the creation and first meeting of the Fontenay-aux-Roses CLI. Pursuant to the new regulatory provisions, the Saint-Laurent-des-Eaux and Dampierre CLIs were consulted on ASN's draft decisions defining the requirements applicable to the NPP's water take-offs and discharges.

In 2010, ASN held two press conferences in Orléans and Evry on the state of nuclear safety and radiation protection.

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 four overseas (Outre-Mer) *départements*. It also fulfils duties as expert to the competent authorities of French Polynésie and Nouvelle-Calédonie.
As at 31 December 2010, 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:
– 34 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 220 inspections in small-scale nuclear activities in 2010. These inspections covered a variety of areas: radiotherapy, nuclear medicine, interventional radiology, industrial radiology, radioactive material transport, monitoring of organisations approved by ASN, etc.

During 2010, 10 events classified as level 1 on the INES scale were notified: 3 concerned the transport of radioactive materials, 4 concerned nuclear medicine departments and 3 concerned industrial activities. In the small-scale nuclear activities sector, 31 significant events classified as level 1, and 2 significant events classified as level 2 on the ASN-SFRO scale were notified to ASN by the radiotherapy departments.

1 Assessment by domain

1|1 Assessment of radiation protection in the medical field

External radiotherapy

ASN carried out 60 inspections of radiotherapy departments in the Île-de-France region and the overseas *départements* in 2010.

The 34 radiotherapy departments were all inspected for the fourth year in succession.

Significant progress was observed in the actions contributing to treatment safety (analysis of deviations, *in vivo* dosimetry, etc.). Contrasting situations were observed in the development of the quality assurance procedures and compliance with the regulatory requirements demanded by ASN in this area.

During summer 2010, ASN organised a campaign of inspections of 18 radiotherapy departments in Ile-de-France to check the medical radiation physics organisations and verify compliance with the regulatory requirements. ASN found that for the time being, although no centre is in a critical situation, none has an organisation that fully complies with the regulations in force. The structures must increase their robustness by recruiting personnel and/or teaming up with other centres.

Two incidents classified as level 2 on the ASN/SFRO scale were notified to the ASN in 2010 out of a total of 39 events. The first incident was due to an error in patient positioning for treatment, as a result of confusion in anatomical location. The second incident notified to ASN resulted from the simultaneous application of two treatment phases that should have been applied consecutively. 26 incidents were classified as level 1 and 11 at level 0 on the ASN-SFRO scale.

Nuclear medicine

ASN carried out 24 inspections in 2010. It was notified of three events concerning radioactive effluent leaks that led to reactive inspections. These three events had no consequences on either worker radiation protection, the public or the environment.

Interventional radiology

ASN carried out 25 inspections in 2010. In collaboration with the Ile-de-France ARS, it identified all the structures in which interventional radiography was performed, and the associated issues, according to the known practices declared to the health authorities. The inspections during the year confirmed the strong radiation protection implications for patients and workers during interventions carried out using ionising radiation. ASN noted that in this sector the way the radiation protection requirements have been integrated varied according to departments and specialities. Progress must be made in the harmonisation of professional practices to optimise the doses delivered to patients.

1|2 Assessment of radiation protection in the industrial and research sectors

During an inspection of a company located in Seine-Saint-Denis, ASN discovered the storage of approximately two hundred radioactive lightning arrester heads containing americium 241 and radium 226. ASN drew up a report recording serious deviations from the regulations. The deviations concerned the fact that the activity was not licensed and the failure to apply the majority of the regulatory requirements stipulated in the Public Health Code and the Labour Code. Given the significant levels of radiation measured, the *préfet* of Seine-Saint-Denis, on the advice of ASN, signed a prefectural order requiring the evacuation of all the radioactive products and the implementation of measures to protect the public and workers pending evacuation. ASN and the services of the Seine-Saint-Denis *préfet* are checking that this prefectural order is duly applied. As a general rule, ASN remains vigilant and monitors the recovery of legacy radioactive objects such as the lightning arresters.

During an inspection of the CNRS in the Val-de-Marne, ASN found numerous radioactive sources in disused premises. ASN drew up a report recording serious deviations from the regulations. These deviations included the fact that the activity was not licensed. ASN and the services of the Seine-Saint-Denis *préfet* are monitoring the CNRS to ensure that all the radioactive products are evacuated and that the site undergoes a radiological diagnosis.

In November 2010, ASN was informed of a tritium contamination situation on the premises of a contractor working for CEA (French Alternative Energies and Atomic Energy Commission), situated in Saint-Maur-des-Fossés in the Val-de-Marne *département* (94). The incident that caused this situation was notified to the authorities and classified as level 2 on the INES scale. ASN, in collaboration with the services of the Val-de-Marne *préfet*, oversaw and checked all the site clean-out operations conducted by CEA. ASN also participated in public meetings to inform neighbouring populations.

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. ASN has thus organised, in collaboration with offices of the *préfet* and the mayors of the first seven sites concerned, contacts with the occupants and owners to propose a free diagnosis to detect any signs of pollution resulting from past small-scale and medical activities. Forty two diagnostics were carried out. They found thirty-three premises free of pollution and detected traces of radium on nine premises. For the occupants and owners of the nine polluted premises, personalised assistance is being provided to apply the necessary precautionary measures and start the rehabilitation works - paid for by the State - as quickly as possible. The measured levels of activity are low and the exposure does not present a health risk for the occupants. Ultimately, a certificate guaranteeing the measurement results is given to each person concerned.

Inspection of the nuclear medicine department of the North Saint-Denis Cardiology Centre – December 2010

2 Additional information

2|1 ASN's action in the overseas *départements* and territories

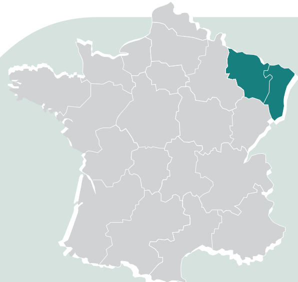
ASN carried out two inspection campaigns representing 21 inspections in the overseas *départements*, as it does each year. ASN considers that assimilation of the radiation protection requirements overseas is on average the same as in the metropolitan facilities.

ASN continued its cooperative work with French Polynesia during 2010. This consisted primarily in giving its support to the Polynesian authorities in order to develop the regulatory framework governing nuclear activities in Polynesia.

2|2 Public information actions in 2010

ASN held a press conference in the Essonne *département* to give a run-down of its regional activity. It also organised a press breakfast briefing on the progress of the Radium Diagnostic operation in the Ile-de-France region.

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 2010, the workforce of the Strasbourg division stood at 17 officers: 1 regional head, 2 deputies, 11 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);
– The Strasbourg university reactor
– 10 external radiotherapy departments;
– 3 brachytherapy departments;
– 13 nuclear medicine units;
– about fifty interventional radiology departments;
– about sixty scanners;
– 4,000 medical and dental radiodiagnostic devices;
– 200 industrial research establishments;
– 2 cyclotrons producing fluorine 18.

ASN carried out more than 140 inspections in 2010: 50 inspections on the nuclear sites of Fessenheim and Cattenom; 3 inspections concerning the transport of radioactive materials; 90 inspections in small-scale nuclear activities.

Nine events classified as level 1 on the INES scale were notified by nuclear installation licensees of the Alsace and Lorraine regions in 2010. In the small-scale nuclear sector in these regions, 1 significant event of level 2 on the ASN-SFRO scale and 1 significant event of level 1 on the ASN-SFRO scale were notified by the radiotherapy departments, along with 2 events of level 1 on the INES scale relating to industrial activities.

Hydrostatic test during the ten-year inspection of the Fessenheim NPP – December 2010

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. The ten-year inspection of reactor 1, which lasted from October 2009 to March 2010, showed that the condition of the installations - and the containment barriers in particular - was satisfactory. ASN is currently reviewing the results of all the inspections performed on this occasion and will communicate its opinion on the continuation of operation of reactor1 to the Government in 2011. The ten-year inspection of reactor 2 will also be carried out in 2011. The steam generators will be replaced during this inspection, further improving the state of the installations. ASN nevertheless considers that the site must remain vigilant on the question of worker radiation protection and take appropriate action.

Cattenom NPP

ASN considers on the whole that Cattenom NPP's performance in nuclear safety, environmental protection and radiation protection is satisfactory. More specifically, it considers that the actions taken by the site in 2010 have improved the radiation protection of workers and must be continued. As regards the fight against

Legionella, ASN notes that the makeup water treatment experimentation did not lead to an industrial solution and will see to it that the site continues its efforts in this area, by integrating all the safety, environmental protection and public health issues. ASN considers that the Cattenom site must be more rigorous in the management of radioactive materials transport. Several deviations occurred in 2010, including the shipping of a radioactive waste in an unsuitable package, which was classified as level 1 on the INES scale.

The Strasbourg university reactor

This research reactor has been entirely decommissioned, and in 2010 ASN began taking steps to delete it from the list of BNIs. In accordance with the regulations in effect, ASN consulted the *Préfet* of the Bas-Rhin, the recently constituted CLI, and the 21 *communes*[7] situated less than 5 km from the reactor. ASN will analyse their opinions and take its decision in 2011.

1|2 Assessment of radiation protection in the medical field

Radiotherapy

In 2010, ASN inspected five of the ten radiotherapy centres in Alsace and Lorraine. These inspections confirmed that the radiotherapy departments in Alsace and Lorraine are continuing their action to improve treatment safety. ASN observed that progress has been made in the formalising of procedures and the verification of the quality of the devices. It did nonetheless observe a reduction in the number of events notified to it by the radiotherapy centres of Alsace and Lorraine in 2010. Although these events have no expected consequences on the health of patients, they are analysed to draw conclusions and prevent them from occurring again. ASN therefore encourages the Alsace and Lorraine centres to continue notifying and dealing with their significant events. The inspections conducted by ASN in the Metz-Thionville regional hospital (CHR) revealed a tenuous situation regarding medical personnel numbers in the radiotherapy department of Thionville. This finding led the CHR management to temporarily suspend the radiotherapy activity on this site in July 2010. ASN will assist with the reopening of this centre ensuring that the regulatory safety criteria are satisfied. Lastly, ASN was notified in August 2010 of an incident involving an error in patient positioning that occurred in the Metz radiotherapy department of the Metz-Thionville CHR. This incident was classified as level 2 on the ASN-SFRO scale.

Interventional radiology

ASN rendered public the result of its investigations and the corrective actions carried out further to the event notified by interventional neuroradiology department of the Strasbourg university hospital (CHU) in March 2009. This extensive and innovativel action plan enabled the CHU to substantially reduce the doses delivered to patients in interventional radiology (by 50 to 70%) and to position itself among the most advanced hospitals in patient radiation protection management in France.

Computed tomography (CT)

CT examinations represent one of the leading causes of radiation exposure of the French population. Faced with this fact, and without calling into question the undeniable medical benefits of this activity, ASN - through its contacts with the medical institutions - has undertaken actions with a view to better knowing the conditions of use of CT scanners and identifying ways of reducing the doses delivered during the examinations.

1|3 Assessment of radiation protection in the industrial sector

In 2010, ASN noted a deterioration in radiation protection on the worksites where two companies in Alsace and Lorraine perform gamma radiography services. During its inspections on the worksites where these two contractors were working, ASN noted numerous deviations: warning sign deficiencies, poor maintenance of devices, deviations in worker training, unsatisfactory tracking of the doses received by the workers, etc. Moreover, ASN discovered that in 2008, an employee performing radiographic inspections of metal pipes had been exposed to a dose of 20.8 mSv, whereas the annual regulatory limit is 20 mSv. This event was classified as level 1 on the INES scale. ASN asked the two companies concerned to take immediate corrective action to remedy these deviations.

1|4 Assessment of radiation protection in small-scale nuclear activities

On 15 and 16 June 2010, ASN carried out a large number of unannounced inspections in the Meuse *département* (vets, dentists, radiologists, lead-detection companies, etc.). The twenty-nine inspections revealed a few cases of non-compliance with regulations, but which did call into question the safety of the workers or the public.

ASN continued its inspections of polluted sites and land in 2010. Apart from the treatment and monitoring of three legacy pollution sites in the Haut-Rhin, ASN was notified in 2010 of the disposal by the University of Strasbourg of a collection of radioactive uranium ore samples. ASN is currently monitoring the decontamination of the laboratory that stored the samples.

1|5 Assessment of nuclear safety and radiation protection in the transport of radioactive materials

In 2010, ASN carried out three inspections concerning the transport of radioactive materials and monitored the safety of transport from France to Germany of 308 containers of vitrified radioactive waste originating from the reprocessing of spent German fuel on the La Hague site. ASN checked that the packages were correctly approved and that the dose rate around the convoy did not exceed the regulatory limits.

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

2 Additional information

2|1 International action by the Strasbourg division

Under the bilateral exchanges with its German, Luxembourg and Swiss counterparts, the ASN Strasbourg division took part in 7 cross-inspections in NPPs and in medical and industrial establishments.

In addition, a joint comparative study of the operating rigour in the French Fessenheim NPP and the German Neckarwestheim NPP was carried out with Germany. This study showed that there are great similarities in the way these two NPPs are operated and that the level of safety of the two installations meets international standards.

Furthermore, the French and German nuclear safety authorities made a comparison of the regulations governing radiotherapy. This study revealed that although the regulatory conditions relating to worker radiation protection are virtually identical in the two countries, the obligations regarding the presence of radiation physicists are greater in Germany, whereas quality assurance obligations are greater in France.

2|2 Public information actions in 2010

ASN held two press conferences on the status of nuclear safety and radiation protection, one in Strasbourg, the other in Metz, and took part in the “Industrial environment and risks in Lorraine” press conference organised by the Lorraine DREAL in Metz.

MEDICAL USES OF IONISING RADIATION

CHAPTER 9

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 population to ionising radiation. Behind exposure to natural ionising radiation, they represent the second source of exposure for the population 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 doses must reach a certain level to obtain an image of diagnostic quality or the desired therapeutic effect.

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 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 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. however can be that more images can be taken, which runs contrary to the

Computed tomography scanner control station

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 a practitioner can ask a teleradiologist (a radiologist specialised in remote radiology) to give 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

This involves techniques that use fluoroscopy with an image intensifier 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.). They often require long-term exposure of the patients, who then receive high doses which can sometimes lead to radiation deterministic effects (cutaneous lesions, etc.). The staff are usually working in the immediate vicinity of the patient and also exposed to higher 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 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.

Interventional radiology inspection by ASN at the university hospital (CHU) of Villefranche-de-Rouergue – December 2010

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 practical means of guaranteeing operator protection, based on the conclusions of the IRSN assessment of the risks of external exposure linked to the use of this new equipment.

1|2 Technical rules for radiology and tomography installations

Radiology installations

A conventional radiological installation comprises a generator (high-voltage unit, radiation generating tube and control unit), a stand 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 installations must be equipped with a generator less than 25 years old (medical devices used for medical care) and carrying the CE marking that has been mandatory since June 1998. This certifies that the device is in conformity with the main health and safety requirements mentioned in articles R. 5211-21 to 24 of the Public Health Code.

Tomography installations

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 tomography device can therefore only be installed in a room with a surface area of at least 20 m^2 and in which no linear dimension is less 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 1.5 mm of lead, depending on the purposes for which the adjoining rooms are used. In addition, tomography equipment more than 25 years old must not be used.

The French radiological equipment pool comprised 905 computed tomography installations in 2009 (figure provided by the Revenue Court). This figure would rise to about 1150 if the devices used for radiotherapy simulation were included.

Inspection of the nuclear medicine unit of the North Saint-Denis Cardiology Centre by ASN – December 2010

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 installations[1] (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.

1. The roentgen therapy installations mentioned in this standard are radiotherapy installations

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 70 positron emission tomographs (PET) in service.

Nuclear medicine involves about 500 specialist practitioners in this field, to which must be added 1,000 physicians working in the nuclear medicine units (housemen, cardiologists, endocrinologists, etc.).

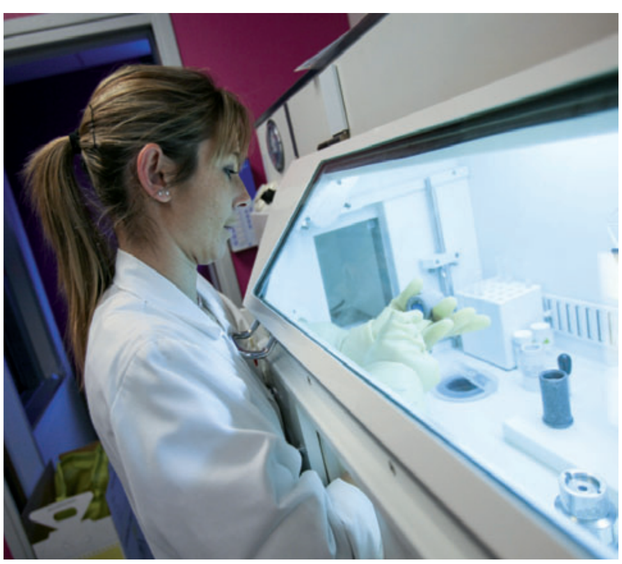
Table 1: some of the main radionuclides used in the various nuclear medicine examinations

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

2|1|1 *In vivo* diagnosis

This technique consists in examining the metabolism of an organ by administering a specific radioactive material – called a radiopharmaceutical – 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.

The radioactive material administered, usually technetium-99m, is located in the organism by a specific detector – a scintillation camera or gamma-camera – which consists of a crystal of sodium iodide 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.



Handling radioactive products during ASN's inspection of the nuclear medicine unit at the North Saint-Denis Cardiology Centre – December 2010

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 internal radiotherapy.

In 2009, clinical tests continued into the use of various fluorine 18 tracers in PET and antibodies labelled with yttrium 90 in 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 organisation 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). Provisions are 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;
– 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 the updating of the design rules for nuclear medicine units (due for completion in 2011).

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.

3 EXTERNAL RADIOTHERAPY AND BRACHYTHERAPY

3|1 Presentation 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 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.

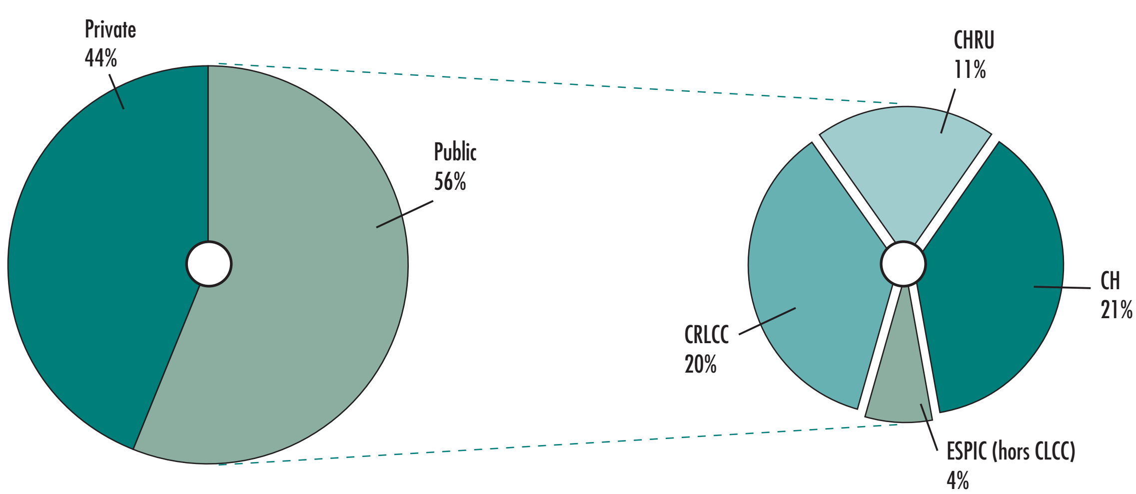
The French pool of external-beam radiotherapy facilities comprises a total of 429 treatment machines, namely 412 conventional linear accelerators, 1 telecobalt therapy unit and 16 "innovative" installations (see points 3|1|1 and 3|1|3). These facilities are installed in 178 radiotherapy centres, half 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).

3|1|1 External 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 (dosimetry), as well as the duration of each treatment session. Preparation of this plan, which aims to set conditions for achieving a high, uniform dose in the target volume while protecting healthy tissues, requires close cooperation between the radiation oncologist and the medical physicist, but also the dosimetrists.

Irradiation is carried out using either linear accelerators producing beams of photons or electrons with an energy level of between 6 and 25 MeV and delivering dose rates of between 2 and 6 Gy/min, or telegammatherapy devices equipped with a source of cobalt 60 whose activity level is about 200 terabecquerels (TBq), although the number of these devices is declining in France. They are gradually being replaced by linear accelerators, whose superior performance offers a more complete range of treatments.

Diagram 1: Distribution of the number of linear accelerators in France according to type of establishment



CRLCC : Regional anti-cancer centre
CHRU : Regional university hospital centre
CH : Hospital centre
ESPIC : Private health establishment in the public interest

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 localising techniques to ensure precise localisation of the damage. It is being increasingly used to treat cerebral metastases.

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 (4 units are currently in service in three establishments), and CyberKnife® which consists of a miniaturised linear accelerator mounted on a robotised arm (see detail in point 3|1|3);
- dedicated linear accelerators offering dynamic mode irradiation (Novalis®, 4 units currently in service);
- “conventional” linear accelerators, providing dynamic mode irradiation 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 ENT field, as well as of the skin, the breast or the genitals.

The main radionuclides used in brachytherapy are caesium 137 and iridium 192, in the form of sealed sources. Brachytherapy techniques use three types of applications, low dose rate brachytherapy, pulsed medium dose rate brachytherapy and high dose rate brachytherapy.

With low dose rate brachytherapy, which requires the patient to be hospitalised for several days, dose rates of 0.4 to 2 Gy/h are delivered. The sources generally come in the form of wires 0.3 to 0.5 mm in diameter, with a maximum length of 14 cm and whose linear activity is between 30 MBq/cm and 370 MBq/cm. 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.

In recent years, low dose rate brachytherapy techniques have been supplemented by the use of sealed sources of iodine 125 (half-life of 60 days) to treat prostate cancers. The iodine 125 sources, just a few millimetres long, are permanently installed in the patient’s prostate. Their unit activity is between 10 and 30 MBq and treatment requires about one hundred grains representing a total activity of 1,500 MBq, delivering a prescribed dose of 145 Gy to the prostate.

Injecting iodine 125 seeds in prostate brachytherapy

Pulsed medium dose rate brachytherapy uses dose rates of 2 to 12 Gy/h delivered by a small dimension iridium 192 source (a few millimetres), with maximum activity limited to 18.5 GBq. This source is applied with a specific source applicator. This technique delivers doses identical to those of low dose rate brachytherapy, and over the same period, but given the higher dose rates, irradiation is split up into several sequences (pulses). The patient does not therefore carry the sources permanently, which is more comfortable and enables him to receive visitors during the time he is hospitalised.

High dose rate brachytherapy uses a small dimension iridium 192 source (a few millimetres) with a maximum activity of 370 GBq delivering dose rates higher than 12 Gy/h. A source projector comparable to that used for pulsed brachytherapy is used. The treatments performed using this technique involve several sessions of a few minutes. These sessions are spread out over several weeks and conducted on an out-patient basis (no hospitalisation required). 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 radiotherapy treatment.

3|1|3 The new radiotherapy techniques

New techniques, called “robotic” tomotherapy and 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 computer 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 damage which may be in anatomically independent regions. It is also possible to acquire images in treatment conditions and compare them with reference computer tomography images, in order to improve the quality of patient positioning. Eight devices of this type have been installed in France since the end of 2006, including 2 in 2009, and have been used to treat patients since the first quarter of 2007.

Stereotactic radiotherapy with a robot arm consists in using a small particle accelerator producing 6 MV photons, placed on an industrial type robot 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 slaved to the patient's breathing.

Given the movement capabilities of the robot and its arm, the radiation protection of the treatment room does not correspond to the usual standards and will therefore require a specific study.

A new radiotherapy technique called volumetric modulated arc therapy (VMAT) has emerged and is progressively coming into use in France. Also known as RapidArc, after a manufacturer, VMAT is an intensity-modulated radiation therapy (IMRT) technique that consists in irradiating a target volume with continuous irradiation that rotates around the patient. Several parameters can vary during irradiation: the shape of the opening and the direction of the multi-leaf collimator, the dose rate, and the speed of rotation of the arm.

This type of treatment is performed using conventional linear accelerators that feature this technological option.

Five installations of this type are in service in France in 2010, in Nancy, Nice, Lille, Lyon and Tours.

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 radiotherapy installations

The devices must be installed in rooms specially designed to guarantee radiation protection of the staff, turning them into true 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 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 radiotherapy room and fitted with the same safety systems.

The CyberKnife®

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 an 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 2009, the French pool of installations of this type totalled 30 irradiators in operation in blood transfusion centres, 16 with radioactive sources and 14 with electrical X-ray generators.

The trend is towards replacement of source irradiators with X-ray devices, in particular to eliminate the constraints involved in radioactive source management. This move has been under way for a number of years now, but intensified in 2009, with the scrapping of 9 irradiators using caesium 137 sources.

The rate of replacement of source irradiators by X-ray irradiators nevertheless slowed down in 2009 due to the lack of reliability of the X-ray irradiators. Frequent failures have meant that the continuity of service to patients cannot be guaranteed.

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.

Blood product irradiator

5 THE STATE OF RADIATION PROTECTION IN THE MEDICAL SECTOR

Radiation protection in the medical sector 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 visiting family or friends in hospital, or population groups that could be exposed to waste or effluent from nuclear medicine units.

As of 2008, ASN began to prepare regional summaries 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. In 2009, two reports were published on the basis of the inspections carried out in 2008, one focusing on the state of radiation protection in nuclear medicine units, the other concerning safety in radiotherapy treatments. In 2010, two new reports to be published early 2011 were drawn up on the basis of the inspections performed in 2009: one concerns radiation protection in interventional radiology, while the other updates ASN's assessment of the radiation protection of radiotherapy patients.

As in 2009, ASN and the AFSSAPS jointly prepared a report of the radiation protection events notified by the radiotherapy centres. It is planned to publish this report, which concerns the years 2008-2009, early 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.

Thanks to all these actions, ASN can assess the situation of radiation protection in the medical field.

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, population) because it is not subject to any limitations, with only the justification and optimisation principles being applicable. This is in fact 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, preparation and planning systems, etc.). All of these systems must be periodically inspected. The examination and treatment procedures and the equipment settings and programming also play an important role in implementing the optimisation principle.

Lastly, the progressive implementation of training of health professionals in the radiation protection of patients, which became compulsory in 2004, is of major importance to improve the radiation protection of patients in all domains.

5|1|3 Exposure of the population and impact on the environment

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 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

Positioning a patient for a computed tomography scan

Set-up for measuring wastewater radioactivity

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 registrations

In 2010, ASN issued:
- 5,367 acknowledgements of receipt of declarations of medical and dental radiodiagnostic devices, of which nearly 71% concerned dental radiology devices;
- 614 authorisations (for entry into service, renewal or cancellation), of which 266 were in computed tomography, 169 in nuclear medicine, 133 in external-beam radiotherapy, 34 in brachytherapy and 12 for blood product irradiators.

5 | 2 | 2 The dosimetry of medical staff

According to the data collected by IRSN in 2009, 179,045 people working in sectors using ionising radiation for medical purposes, that is to say more than 56% of all exposed workers monitored, all activity sectors included, were subject to dosimetric surveillance. Medical radiology alone accounts for nearly 65% of the medical staff exposed.

In all, more than 98% of the health staff monitored in 2009 received an annual effective dose of less than 1 mSv, while 8 cases exceeding the annual effective dose limit of 20 mSv, and 3 exceeding the annual dose limit at the extremities (500 mSv) were recorded (in the radiology sector).

5 | 2 | 3 Assessment of significant radiation protection events

ASN was notified of 419 significant radiation protection events (ESR) in the medical domain in 2010, compared with 318 in 2009. This increase probably results from stricter application by the health professionals of the notification obligation, which was created in 2001, combined with ASN's publishing of a notification guide in 2007.

It is thus found that, depending on the domain of activity:
- 66% of significant events were notified in radiotherapy, of which 4% were in brachytherapy;
- 18% in nuclear medicine;
- 13% in diagnostic and dental radiology;
- 3% in interventional radiology.

According to the signification radiation protection event notification criteria defined by ASN (see ASN Guides 11 and 16):
- 63% of ESRs concerned exposure of a radiotherapy patient;
- 9% exposure of a radiodiagnosis patient (wrong patient, error in the administration of a radiopharmaceutical, appearance of a radio-induced effect);
- 8% exposure of the foetus in women unaware of their pregnancy at the time of a radiodiagnostic examination;
- 7% exposure of medical staff;

– 6% 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);

– 5% any other event that can have radiation protection consequences (software malfunction, incorrect packaging, incorrect procedure, etc.);

– 2% exposure of the public.

Diagram 2: Distribution of the monitored populations and collective doses in the medical sector in 2009 (source: IRSN 2010)

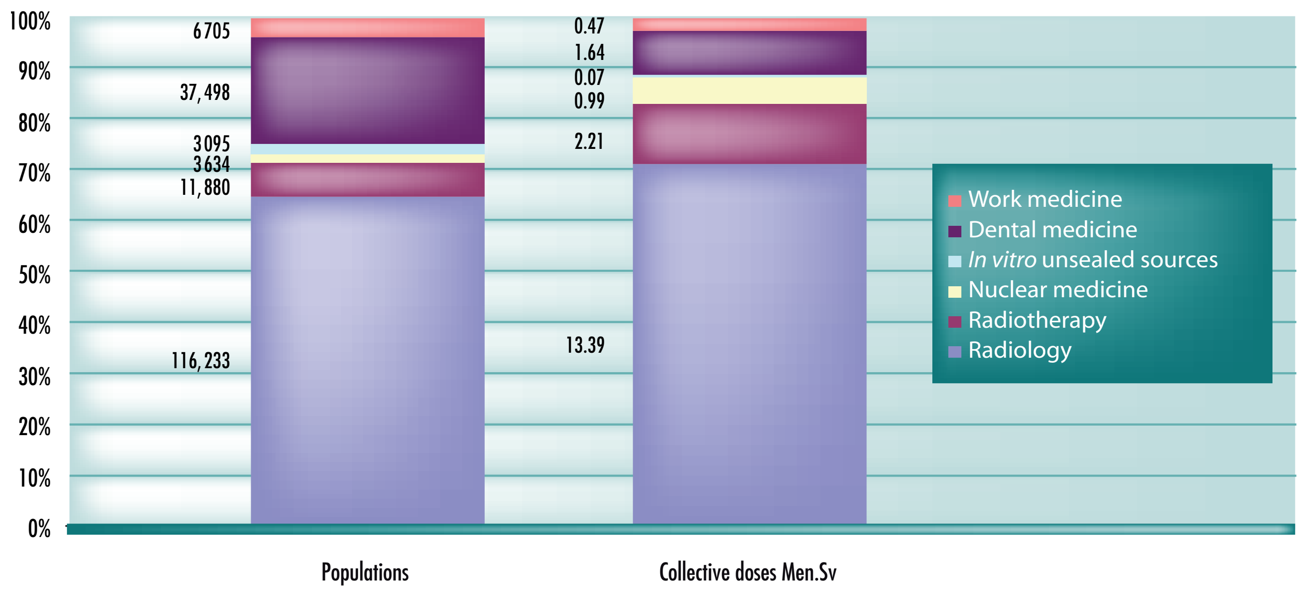


Diagram 3: Distribution of significant radiation protection events notified to ASN in 2010, per sector

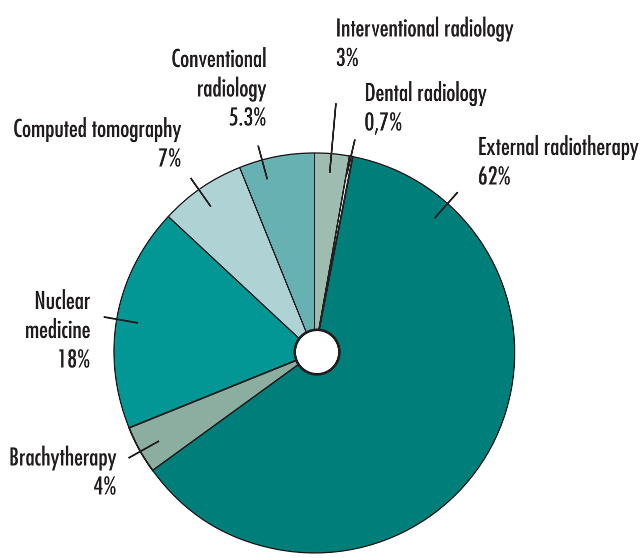
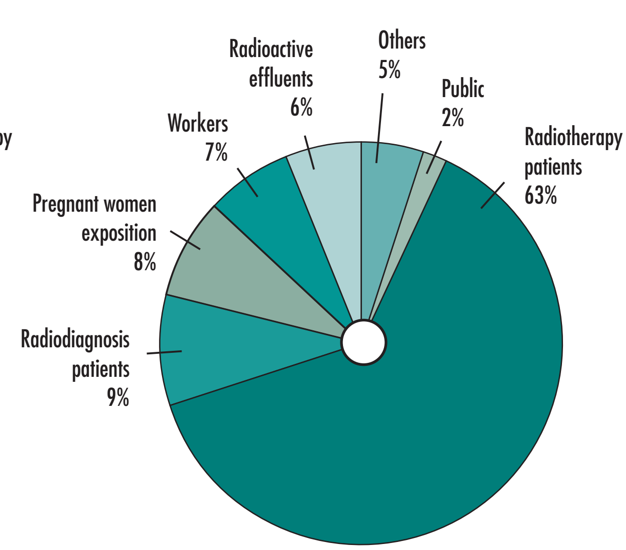


Diagram 4: Distribution of significant radiation protection events notified to ASN in 2010 per notification criterion



Events concerning medical staff: 31 events notified in 2010 compared with 9 in 2009

During 2010, ASN received 31 notifications of significant radiation protection events concerning persons working in medical facilities:

– 11 in nuclear medicine (exposure or contamination of staff when handling or preparing radiopharmaceuticals);
– 4 in radiotherapy (unexpected presence of staff in room during patient exposure);
– 5 in interventional radiology (significant exposure of operator's extremities with exceeding of the annual dose limit);
– 11 in radiology, of which 4 were in computed tomography (exposure of staff in room during the examination) and 2 in dental radiology (significant exposure of workers recorded by passive dosimetry).

It is noteworthy that 5 events were classified level 1 on the INES scale: they concern workers having exceeded one of the annual exposure limits in interventional radiology (2 cases of exceeding the annual exposure limits for the fingers), in diagnostic radiology (2 cases of exceeding the annual exposure limits due to failure to wear personal protective equipment, PPE, and inappropriate practices in dental radiology) and in nuclear medicine (a pharmacy dispenser exceeded the annual dose limit further to iodine 131 contamination after taking a sample of liquid iodine 131 solution for a therapeutic treatment).

Events concerning patients: 302 events reported in 2010 compared with 271 in 2009

In 2010, 302 significant events concerning patients exposed for diagnostic or therapeutic purposes were notified to ASN. The events were divided as follows: 254 in external-beam radiotherapy and 11 in brachytherapy, 19 in nuclear medicine and 18 in radiology.

Events concerning radiotherapy patients: 265 events notified in 2010 (of which 11 were in brachytherapy) compared with 244 in 2009

The notification of significant radiation protection events in radiotherapy has become predominant, representing nearly 66% of the notifications. The number of notifications received by ASN is slightly up on 2009. Furthermore, the number of centres having made at least one notification has increased to 80% of centres compared with 71% at the end of 2009. Seven external radiotherapy events were classified level 2 on the ASN-SFRO scale (versus 16 in 2009) and 171 events were classified level 1.

The second ASN/AFSSAPS report to be published in early 2011 presents a synthesis of the 519 significant radiation protection events in external radiotherapy notified to ASN, and of 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.

The trends observed during the experimental period (July 2007 to June 2008) have been confirmed, since the majority of events notified in 2008 and 2009 were linked to organizational and human failings (96%). ASN observes that the immediate causes (patient identification error, reference point error, omission of wedge filter, etc.) are usually identified by the notifying establishments, as are the first-level causes such as operator carelessness, communication error, failure to follow a protocol or to seek aid. This being said, the analysis made by the establishments still usually remains focused on the individuals involved in the event, and too rarely on the aspects relating to the context, work organisation, etc., which are nevertheless often predominant.

Consequently, the analysis of these events leads to corrective measures such as "reminder of operating instructions", "training of the operator who made the error", and sometimes the "addition of check points", but the underlying root causes associated with the organisation of the units, the working environment or the institutional context are insufficiently examined. If the root causes are not addressed by suitable corrective measures, they could cause further events.

On the whole, ASN found that the analyses were performed without applying a set methodology (analysis methods inexistent or only partially deployed) resulting from a lack of skills, and above all a lack of time, on the part of the teams. This situation should change for the better with the obligations concerning the management of malfunctions and undesirable situations imposed by ASN decision 2008-DC-103 of 1 July 2008.

Moreover, since July 2008, the significant radiation protection events classified as level 1 on the ASN-SFRO scale - apart from serial events - are summarized in quarterly reports that do not indicate the names of the notifying establishments. These quarterly reports are published on the ASN website.

Events concerning nuclear medicine and radiology patients: 33 events notified in 2010 compared with 27 in 2009

These significant radiation protection events are often associated with a patient identification error (same name, lack of identification vigilance) or a radiopharmaceutical administration error (syringe labelling error, sample taken from wrong bottle).

Two events in interventional radiology were reported, one further to the observation of transient alopecia, the other due to the probability of occurrence of erythema.

Events concerning pregnant women: 39 events declared in 2010 compared with 12 in 2009

ASN was notified of 39 significant events concerning the public during 2010. They were essentially notifications of foetal exposure in women who were unaware of their pregnancy during a diagnostic radiological examination (14 in nuclear medicine and 25 in radiology).

Events concerning radioactive sources: 7 events notified in 2010, the same number as in 2009

In 2010, ASN was notified of five significant events involving losses of radioactive sources used in the medical field. These were sources used in nuclear medicine (technetium generator) and brachytherapy (iodine 125 seeds).

Two notifications reported a delivered source activity (iodine 131 capsule) that did not correspond to the activity that should have been administered.

Finally, ASN was notified of 16 events involving the dispersion of radionuclides, compared with five in 2009. 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 (5 events) or the discharging of waste to an inappropriate treatment process (9 events).

To summarise:

Since 2008, the reporting of significant radiation protection events in the medical field has increased by more than 50%, reaching 419 annual notifications at the end of 2010 (i.e. an average of 35 declarations per month).

The reporting of significant radiation protection events is highest in radiotherapy, which accounts for nearly 66% of the notifications, and the numbers of centres that have never notified an event is dropping.

Although there are few significant radioprotection events concerning medical staff, the number is rising and their level on the INES scale shows that these events reflect either particularly exposing practices (long-duration interventional radiology procedures, radiopharmaceutical preparations), or professionals who are particularly and regularly exposed due to their expertise or their area of competence (“senior” consultants or radiopharmacists), whether in interventional radiology or nuclear medicine.

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 in 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 studied in 2010. The conclusions of this conference were jointly scrutinised by all the players concerned in order to identify the actions to supplement the national radiotherapy plan coordinated by INCa. This subject will be examined by the national plan monitoring committee in 2011.

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 notice 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 a notice at the end of 2010 on the conditions of practising stereotactic radiotherapy and the associated medical physics. The opinion of GPMED, the report of the associated working group and the position of ASN on this subject will be made public in 2011.

5 | 3 | 1 Radiation protection of radiotherapy staff

The results of the inspections performed in 2009 and published in early 2011 revealed that in many centres there are large deviations from the provisions of the Labour Code relative to the procedures and safety instructions for the prevention of the irradiation risk after being accidentally shut in the treatment room.

TO BE NOTED IN 2010

Event notified by the GROP (Pau, June 2010)

In June 2010, the GROP (Pyrenees Radiotherapy and Medical Oncology Group) in Pau notified ASN of a significant radiation protection event affecting a patient. The event resulted from a problem in the transfer of irradiation parameters between the treatment planning system (TPS) and the record and verify (R&V) system. The result was that the patient, who was being treated for a head and neck cancer, received an overdose on the spinal cord. This significant event was provisionally classified at level 2 on the ASN-SFRO scale because the clinical consequences were not confirmed on the date of event classification.

The investigations conducted by ASN and AFSSAPS after AFSSAPS had sent a national alert to those centres that used a similar software combination, concluded that three centres had heard about the problem before the national alert was initiated, and that the majority of the centres did not use the configuration at risk used by the GROP. One centre found, through a retrospective analysis, that it had delivered fields with an incorrect jaw position to nine patients. For these nine patients however, the use of a multi-leaf collimator had limited the excess dose delivered, estimated by the centre at between 0.5% and 1%.

5|3|2 Radiation protection of radiotherapy patients

Status of human resources in medical physics

The inspections carried out by ASN in 2009 confirmed the increase in human resources dedicated to medical physics, which began in 2008. The third interim report of the national committee for radiotherapy monitoring (July 2010) states that the number of medical physicists working in radiotherapy at the beginning of 2010 attained 448 full-time equivalent (FTE), that is to say an increase of almost 50% since 2003.

Nevertheless, as in the previous year, ASN observed that at the end of 2009, the situation with regard to the organisation of medical physics remained fragile in several centres (about a dozen), notably those staffed with too few medical physicists. This situation has led ASN to declare the temporary closure of four centres. Furthermore, the measures taken in these centres to cope with absences of medical physicists of less than and more than 48 hours should be more clearly specified.

Assessment of treatment safety

The inspections also confirm a positive development in the implementation of management of the safety and quality of radiotherapy treatments. Inspection results show a true mobilisation of the health professionals under the national radiotherapy plan coordinated by INCa. ASN nevertheless notes considerable differences in progress and levels of involvement of departments, from one centre to another.

The situation regarding control of treatment preparation and delivery is considered satisfactory on the whole. With regard to risk management, however, the preliminary risk analyses are not widely implemented, firstly because they will not be obligatory for some time yet, and secondly owing to the lack of time and/or more specific skills in this field.

Making internal notifications of malfunctions and analysing them, on the other hand, are now common practice. This being said, further progress is required in the analysis of causes, in the medium- and long-term follow-up of treatment safety and quality management system improvements, and in the internal circulation of information on malfunctions and the improvements made.

5|3|3 Summary

To conclude, the progress made by radiotherapy centres in terms of organisation and control of patient care is considered encouraging. The effort must nevertheless be continued, when one considers that about half of the centres did not comply with certain regulatory obligations - that were not binding in 2009 - designed to ensure treatment safety (*in vivo* dosimetry, double calculation of monitor units, etc.).

ASN therefore considers highly positive the findings that demonstrate the awareness and responsiveness of the professionals regarding safety culture, the formalising of practices and the management of treatment-related risks. Mobilising the players in these areas must remain a priority in order to meet all the regulatory obligations that will be binding by the end of 2011.

5|4 The radiation protection situation in nuclear medicine

5|4|1 Radiation protection of nuclear medicine staff

The assessment of radiation protection in nuclear medicine in 2009 drawn up and published by ASN, and based on the inspections carried out in 2008 on approximately one third of the installations, underlined the shortcomings in worker radiation protection in many nuclear medicine units. The inspections carried out by ASN in 2009 on another third of the installations confirmed this result.

Thus, of the nuclear medicine units inspected, nearly half (34 units) still do not have supervised areas established on the basis of a risk assessment. This situation can be partly explained by the difficulties professionals have had in implementing the requirements of the order of 15 May 2006 relative to the delimiting and signalling of regulated areas in nuclear medicine services.

5|4|2 Radiation protection of nuclear medicine patients

The report published in 2009 on the inspections carried out by ASN in 2008 had also shown that on the whole the regulatory requirements for the radiation protection of patients were satisfied in the nuclear medicine units. It also indicated that the majority of the nuclear medicine units had a medical physicist. This observation must however be qualified, as the conditions of intervention of these physicists remain to be specified in most nuclear medicine units.

Lastly, the ASN inspections in 2008 had shown that few nuclear medicine units had been able to stay ahead of the regulatory deadlines for training staff in the radiation protection of patients, except as far as physicians were concerned. The inspections carried out in this area of activity in late 2009 show that a percentage of the medical staff concerned has still not received this compulsory training.

5|4|3 Protection of the population and the environment

Several significant radiation protection events notified in 2009 and 2010 chiefly concerned overflowing of contaminated liquid effluent storage tanks, leaks of pipes carrying contaminated liquid effluents, and triggering of radiation portal monitors. This led ASN to organise information actions to reiterate the prevention rules for nuclear medicine units.

The inspections conducted by ASN in 2009 show that nearly 80% of the nuclear medicine units inspected, i.e. some 60 units, have a waste and contaminated effluents management plan. Drawn up by the authorisation holder or the head of the establishment, this document specifies the provisions for disposing of contaminated waste and effluents. Although this aspect is globally satisfactory, progress must be made in numerous other areas to meet all the regulatory requirements introduced by ASN decision 2008-DC-0095, which sets the technical rules for the disposal of contaminated waste and effluents.

5|4|4 Summary

The main problems encountered in nuclear medicine concern non-compliance with the Labour Code requirements regarding risk and work station analyses, which often are not carried out, and application of the ASN technical decision on the disposal of (low-level) radioactive effluents in the public sewage networks.

While quite aware of the licensee's responsibility in these matters, ASN has decided to prepare recommendations (guidelines) to facilitate application of the regulations. They should be available in 2011.

5|5 The radiation protection situation in conventional radiology and computed tomography

5|5|1 Radiation protection of radiology staff

Targeted inspections in some one hundred radiology centres in 2008 and 2009 showed that the radiation protection regulations for staff were fairly well adhered to in the majority of cases, although some centres were to rapidly implement corrective measures to remedy the observed deviations. These inspections were not updated in 2009. The possibility of calling upon an external person with competence in radiation protection (PCR) (ASN decision 2009-DC-0147 of 16 July

Dosimeter rack in the nuclear medicine unit of the North Saint-Denis Cardiology Centre

UNDERSTAND

Experience feedback on the prevention of leaks in the effluent pipes coming from nuclear medicine units

The nuclear medicine units of the Val d'Aurelle - Paul Lamarque Regional Centre for Cancer Care (CRLC) in Montpellier, and the La Pitié Salpêtrière Hospital Group in Paris, in collaboration with the Marseille division of ASN, published a thematic poster (see below) at the Conference of the SFRP in June 2009.

This poster was inspired by the lessons drawn from leaks in pipes in these two establishments carrying contaminated liquid effluents from the hospitalisation rooms of patients treated with iodine 131.

The analysis of these events moreover revealed that certain regulatory obligations had not been fulfilled, and notably:

- *the obligation to identify visible pipes containing or transporting hazardous substances or preparations;*
- *the obligation to train the staff likely to work in monitored and controlled zones, by informing them of the general rules of prevention and radiation protection, the particular risks and procedures associated with the work station occupied, and the course of action to follow if an abnormal situation arises;*
- *the obligation to draw up a prevention plan describing the prevention measures for workers from outside companies performing or helping to perform operations in the establishment.*

2009) appears to provide an initial solution to the shortcomings, but this new measure must nevertheless be assessed.

5|5|2 Radiation protection of radiology patients

The increase in doses delivered to patients in medical imaging in France (average increase approaching 50% since 2002)- as in all other western countries - and especially in computed tomography, should lead ASN to adopt a position on this subject in early 2011, with the publication of the conclusions of the seminar it organised on 16 September 2010 with all the professionals and organisations concerned.

The upward trend in the exposure of patients in medical imaging can be attributed to several factors:
– the increase in the number of examinations performed because of their diagnostic value;
– the increase in the number of computed tomography scanners, which deliver higher doses than conventional devices;
– the increase in the number of new examinations delivering high doses (whole body tomography, virtual colonoscopy, heart scan, etc.).

On the basis of the recommendations made at this seminar, ASN stresses the importance of the following two actions:
– the first aims at facilitating access to MRI by influencing the regional planning of high-investment equipment and promoting pricing policies that give more incentive to MRI;
– the second aims at continuing the training and recruitment of medical physicists: this began in 2008 to meet the urgent needs in radiotherapy, and must be continued for at least five years in succession to satisfy demand for medical imaging professionals.

5|5|3 Summary

Conventional radiology and computed tomography are not priority inspection areas for ASN, given the low risks of staff/worker exposure and the dose levels delivered to patients, which are much lower in medical imaging than in radiotherapy. This being said, the continuing increase in average doses for patients in France and internationally, due to the increase in computed tomography procedures and insufficient utilisation of the optimisation potential of the new equipment has led ASN to boost its actions in this area in 2011. At European level, ASN is participating in the initiative taken by HERCA (heads of the European radiological protection competent authorities) to encourage computed tomography scanner manufacturers to improve the optimisation tools on their equipment.

5|6 The radiation protection situation in interventional radiology

Since 2009, the regulation of radiation protection in interventional radiology has become the second subject of concern 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. The results of this work will be published at the beginning of 2011, along with the position of the ASN, and the results of the inspections carried out in 2009.

André-Claude Lacoste, Chairman of ASN, giving a conference at the SFR Annual Convention – October 2010

5|6|1 Radiation protection of interventional radiology staff

The report on the inspections performed in 2009 (published in 2011) is drawn from the results of more than one hundred inspections of some 250 units practising interventional radiology. It shows that the radiation protection of workers, particularly where professional exposure is concerned, is better integrated in fixed radiology facilities than in operating theatres where mobile devices are used. Considered as a whole, the inspections reveal incomplete application of dose optimisation due to lack of training and/or inappropriate equipment, negligence in the wearing of personal protective equipment and dosimeters, the lack of medical monitoring of the practitioners, the lack of monitoring by dosimetry of extremities, and deficiencies in knowledge of the obligations to notify ASN of significant radiation protection events.

This report also highlights methodological and organisational difficulties encountered by PCRs in fulfilling their duties..

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 equipment to the medical procedures performed. On the whole, the inspections reveal incomplete application of dose optimisation due to a lack of training and/or appropriate equipment, the lack of medical physicists to set up dose optimisation, the absence of radiation protocols for the majority of procedures performed in the operating theatre, and sub-optimal knowledge of the doses emitted during the procedures.

5|6|3 Summary

The expert investigations by the GPMED in 2010 and the results of the inspections performed in 2009 show that there is substantial room for improvement in the radiation protection of staff and patients in interventional radiology, and in particular in the operating theatres in which numerous image-guided surgical procedures are performed.

The question of human resources and the associated skills, particularly for the tasks assigned to PCRs and medical physicists, is determining for effective implementation of optimisation procedures, especially given that the new devices have considerable potential for dose reduction without compromising medical precision.

User awareness-raising and training also represent a major avenue for progress.

Dosimeter worn by medical personnel in the nuclear medicine unit of the North Saint-Denis Cardiology Centre

6 OUTLOOK

With a cure rate of about 80% of patients treated (i.e. some 50% of patients suffering from cancer), radiotherapy is a fully justified method of cancer treatment. However, given the organisational weaknesses detected by inspection in some radiotherapy centres, ASN - with the assistance of its regional divisions - will be maintaining its inspections in all radiotherapy centres at least until 2012. It will be particularly vigilant with regard to the effective increase in medical physics staffing levels, to compliance with the interim criteria published in July 2009 by the Minister for Health and to the gradual development of quality assurance, for which the first requirements have been binding since the beginning of 2010.

2011 is a reference year in that the activity authorisation criteria for radiotherapy care, defined by INCa become fully applicable, especially the criterion concerning the presence of the medical physicist during treatments. In this context, ASN shall be particularly attentive to the centres in which, due to staff shortages, it will be necessary to call upon external service providers or to set up inter-centre cooperation arrangements to meet the medical physics needs. Over and beyond the difficulty of strictly complying with the formal obligation to ensure the effective presence of the medical physicist during treatments, ASN shall endeavour to verify the robustness of the medical physics organisation, particularly in the GCS's (health care cooperation groups). In this respect, ASN would not be against clarifying the regulatory criterion concerning the presence of the medical physicist during treatments, by introducing the notion of a medical physics team comprising medical physicists and dosimetry technicians.

As far as staff radiation protection is concerned, compliance with the provisions of the Labour Code relative to prevention of the irradiation risk after being accidentally shut in a treatment room, and the associated safety rules, is a priority short-term objective. Radiation protection inspectors shall be instructed to apply coercive measures in cases where these divergences are not remedied in 2010.

Recourse to increasingly high-performance medical imaging, particularly in computed tomography, seems justified to improve diagnostic quality and better orient therapeutic strategies. With interventional practices, imaging can also be used to guide the intervention and ensure greater precision for the benefit of the patient.

Particular attention must nevertheless be paid to the increases in doses of ionising radiation delivered to patients. Consequently, ASN will closely monitor the national implementation of actions under the responsibility of the Minister for Health, particularly regarding the development of the number of non-irradiating imaging techniques (MRI in particular). It will also, in cooperation with the professionals, actively support the development of decision aids to support application of the principle of justification, and the continued increasing of staffing levels in medical physics, which guarantee true application of the principle of optimisation of doses delivered to patients.

As of the beginning of 2011, ASN should state its position on the necessary improvement of radiation protection of staff and patients in interventional radiology, especially in the operating theatres in which numerous image-guided interventions are performed. The question of human resources and the associated skills - particularly for the tasks ensured by PCRs and medical physicists - and the question of user training when new equipment is put into service will be at the core of ASN recommendations.

NON-MEDICAL USES OF IONISING RADIATION

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 is to check that, despite this great diversity, the safety of workers, the public and the environment is ensured. This safety includes source management, supervision of the conditions in which sources are held, used and disposed of, from fabrication 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 ASN's actions.

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 which are not carried out in basic nuclear installations (the BNIs are presented in chapters 12, 13 and 14). However, all the other applications are concerned. The main activity sectors are presented below.

1 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 as follows.

1|1|1 Industrial irradiation

This is used for sterilising medical equipment, pharmaceutical or cosmetic products and for conservation of foodstuffs.

Irradiation is also a means of voluntarily modifying the properties of materials, for example, to harden polymers.

These consumer product irradiation techniques may be authorised because once the products are treated, they show no signs of added artificial radioactivity. 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 sources of iridium 192, cobalt 60 and, more recently, selenium 75, the activity level of which does not exceed about twenty terabecquerels. 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;
– an ejector 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.

Gamma radiography projector - CEGELEC - and accessories (remote control, ejection tube, irradiation endpiece)

– a radioactive source inserted into a source-holder.

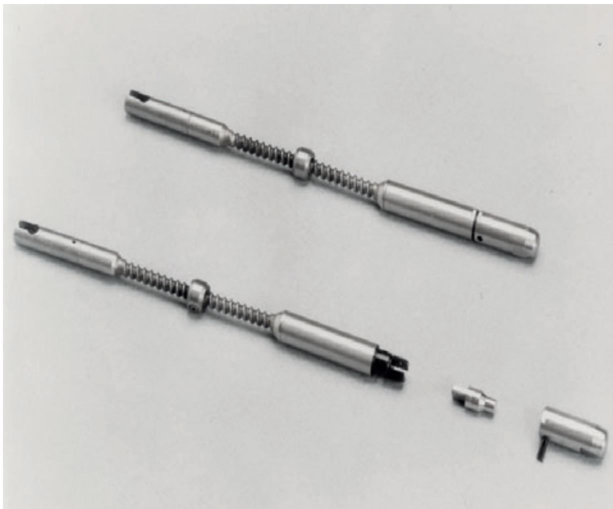
Gamma radiography devices mainly use high-activity sources that present substantial operator risks. As such, it is an activity with high radiation protection implications that figures among ASN's inspection priorities.

1|1|3 Verification of physical parameters

The operating principle of these 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 kBq and a few 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



Source and source-holder assembly contained in a gamma radiography device

the filter, which enables this amount to be determined. The most commonly used sources are carbon 14 (activity level: 3.5 MBq) or prometheum 147 (activity level: 9 MBq). 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 lower than 3 GBq;
- 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:1.7 GBq), caesium 137 - barium 137m (activity level: 37 MBq) 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: 2 GBq), caesium 137-barium 137m (activity level: 100 MBq) or cobalt 60 (30 GBq);
- 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 subsoil to be examined by inserting a measurement probe comprising a source of cobalt 60, caesium 137, americium 141-beryllium or californium 252.

1|1|4 Neutron activation

Neutron analysis is based on the following principle: a beam of neutrons bombards a volume of material and excites its atoms. The number, the energy and the direction of the gamma photons emitted in response to neutron bombardment 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 chemical analysis of the cement constituents. Of the thirty or so cement works in France, three use this technology. As this technology can activate the analysed material, it requires the granting of a waiver as provided for by article R.1333-4 of the Public Health Code. In 2010, the Government asked ASN to examine a waiver application concerning the utilisation of a neutron analysis device in a cement works, and to give its opinion.

Reminder: article R.1333-3 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 the Public Health Code makes provision for a waiver from this prohibition if the addition of radionuclides is justified by the benefits it brings in relation to the health risks it can represent. In this respect, the article holds that this waiver is established by an order of the ministers in charge of health and, depending on the case, either the minister in charge of consumption or the minister in charge of construction, after obtaining the opinion of the 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 devices. This technique is particularly useful in detecting lead in paint. The portable devices used today contain sources of cadmium 109 (half-life 464 days) or cobalt 57 (half-life of 270 days). The activity of these sources can range from 400 MBq to 1,500 MBq. This activity, which represents 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 1 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 how they evolved from 2006 to 2010.

It should be noted that a given facility may carry out several activities and therefore appears in graph 1 and the following graphs for each activity.

1|2 Unsealed radioactive sources

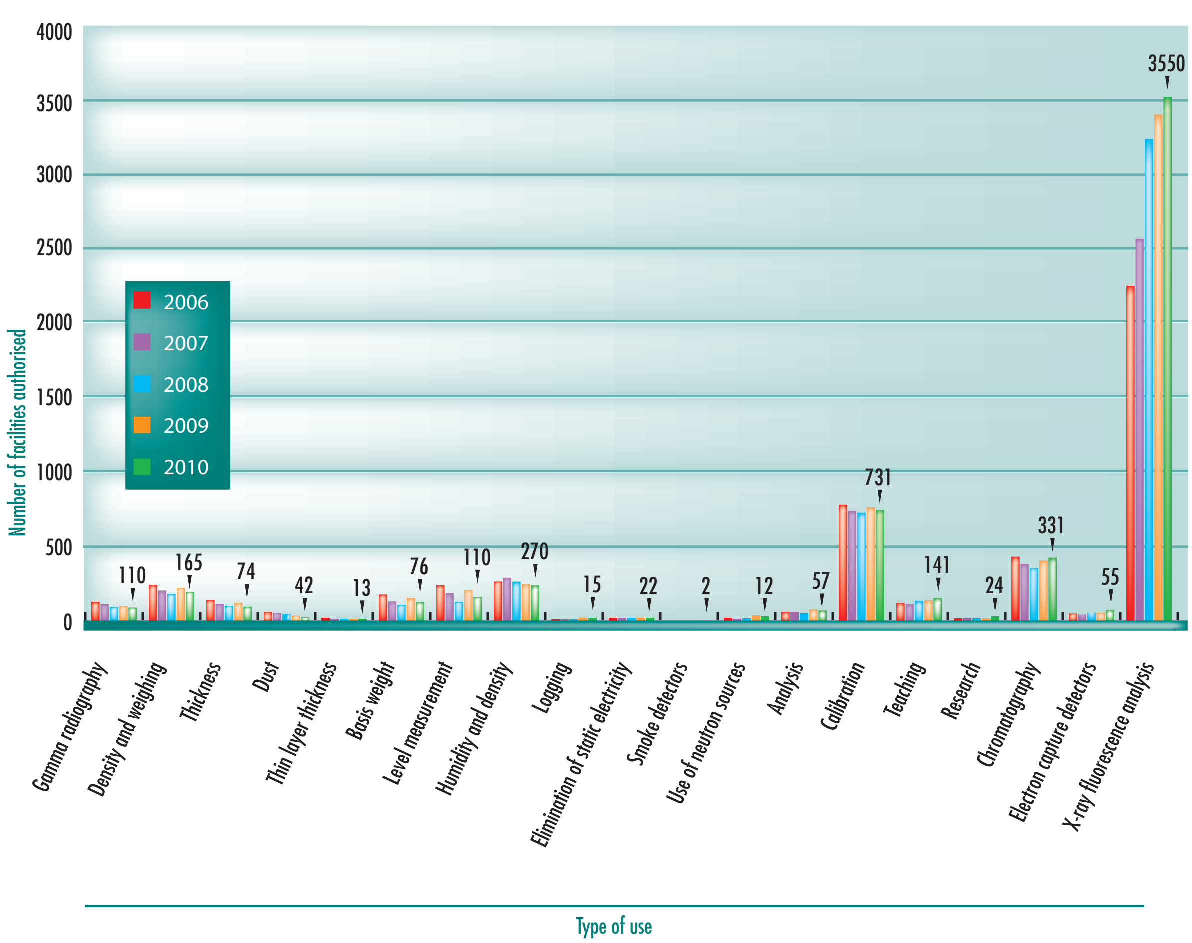
The main radionuclides used in the form of unsealed sources are phosphorus 32 or 33, carbon 14, sulphur 35, chromium 51, iodine 125 and tritium. They are used as tracers for calibration and teaching. Using radioactive tracers incorporated into molecules is common practice in biological research. They are thus a powerful investigative tool in cellular and molecular biology. Unsealed sources are also used as tracers for measuring wear, searching for leaks, for friction research, for building hydrodynamic models and in hydrology.

The number of facilities authorised to use unsealed sources stands at 961.

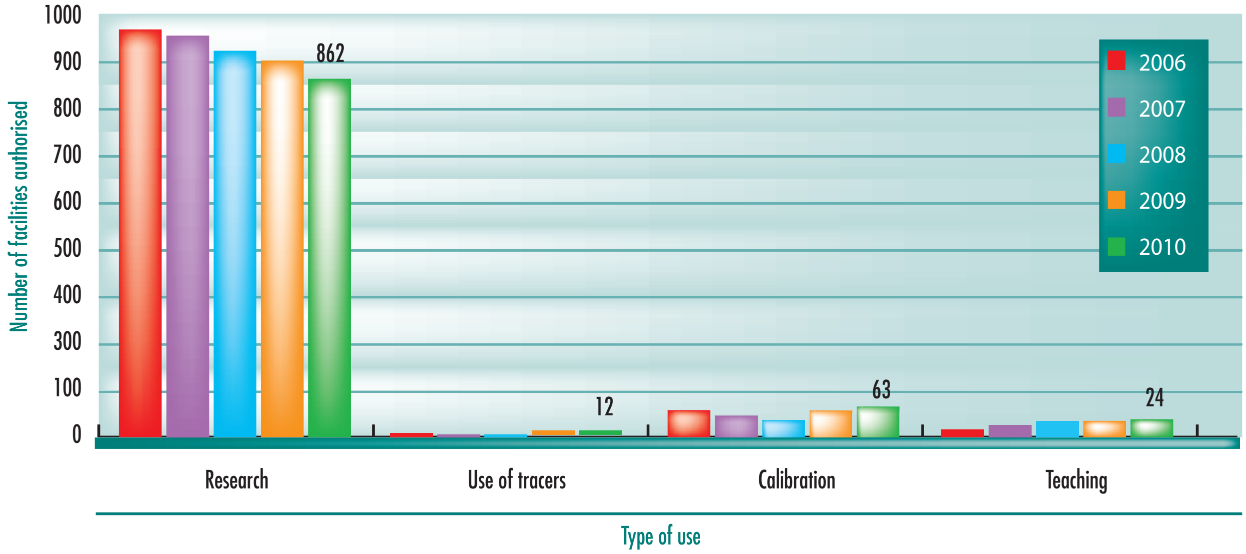
Graph 2 specifies the number of facilities authorised to use unsealed radioactive sources in the applications identified from 2006 to 2010.

Device for detecting lead in paint

Graph 1: use of sealed radioactive sources



Graph 2: Use of unsealed radioactive sources



1|3 Electrical devices emitting ionising radiation

1|3|1 Industrial applications

The electrical devices that emit ionising radiation are primarily X-ray generators. Like devices containing radioactive sources, they are put to a very wide variety of uses in industry, including non-destructive structural analyses (analysis techniques such as computer tomography, diffractometry. (also known as radiocristallography diffractometry- also know as radiocrystal- etc.), inspecting the quality of weld beads or inspecting materials for fatigue (particularly in aeronautics).

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. When in use however, the exposure levels are comparable with those emitted from devices containing radioactive sources.

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.

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 uses, such as radiography for restoration of musical instruments or paintings, archaeological study of mummies or analysis of fossils.

Baggage inspection

Ionising radiation are 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 filtering checkpoints in airports, in museums, at the entrance to certain buildings, etc.

The devices with the largest inspection tunnel areas are used in the airports for screening air freight, large baggage items and hold baggage in airports. Computer tomography scanners complete this range of appliances.

The irradiation zone inside these appliances is sometime delimited by doors, but most often by one or more lead curtains.

X-ray body scanners

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. Image-generating technologies based on millimetre waves, which are not ionising, are currently being experimented in France.

Various technologies using X-rays do however exist: backscatter of X-rays and transmission of X-rays.
– 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 0.1 microsievert/scan (µSv/scan). This technology is very widely used in the United Kingdom and the USA.
– 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

X-ray baggage scanner 620XR

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).

There are also appliances for screening specific parts of the body: limbs (to check for weapons hidden in an artificial limb), feet and shoes.

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

Veterinary surgeons also use these devices for normal radiodiagnostic purposes. More recently, tomography devices have become more common in veterinary applications.

The veterinary care given to domestic animals requires the use of veterinary radiodiagnostic appliances at fixed sites only, and intra-oral radiography devices. The treatment of horses, however, requires more powerful devices installed in specific premises (radiography of the pelvis, for example) and portable X-ray generators, used inside premises – dedicated or not – or externally.

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.

Unlike electrical generators used for medical applications, there is no CE marking obligation for these devices.

Graph 3 specifies the number of facilities authorised to use electrical generators of ionising radiation in the listed applications. It illustrates the diversity of these applications and how they evolved from 2006 to 2010. 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. The situation of the professionals concerned has now begun to be brought into compliance in many activity sectors, but a large number of users have not yet taken any action.

1|4 Particle accelerators

The Public Health Code defines an accelerator as a device or installation in which 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.

Veterinary radiographic examination

A number of research facilities produce synchrotron radiation, such as the ESRF (European Synchrotron Radiation Facility) in Grenoble, and the Soleil synchrotron in Gif-sur-Yvette (maximum characteristics of the electron beam: 2.75 gigaelectronvolt (GeV), 500 mA).

1|5 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.

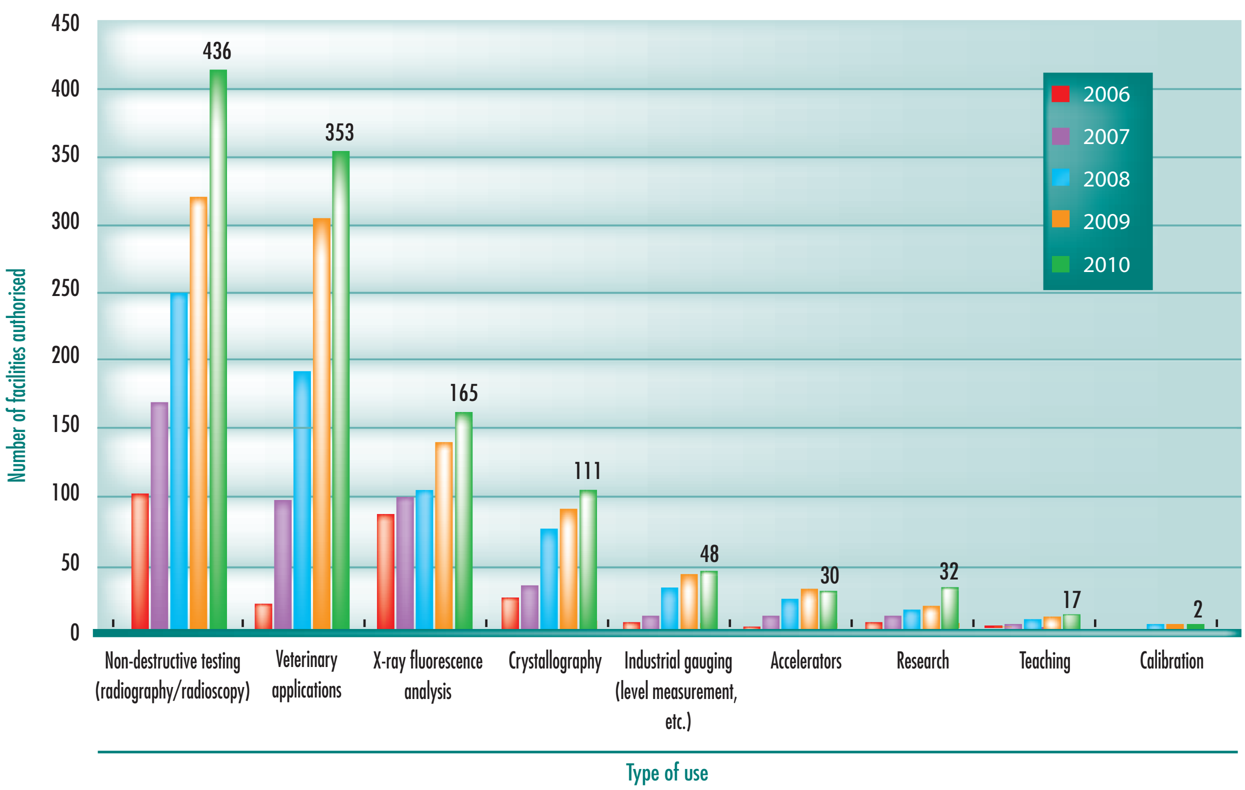
This category includes the other accelerators generating ionising radiation (not covered by the Public Health Code or the BNIs), ion implanters, electron-beam welding equipment, klystrons, certain lasers, certain electrical devices (example of high-voltage fuse tests).

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:

- a ban on activation of construction products, consumer goods and foodstuffs as specified by article R.1333-4 of the Public Health Code, ensuring that the maximum energy of the particles emitted by the accelerators used rules out all 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.

One of ASN's concerns is also to ensure that the imaging systems using ionising radiation, which are regularly used to inspect transport vehicles, do not lead to accidental exposure of

Graph 3: Use of electrical devices emitting ionising radiation




Mobile accelerators used for inspecting vehicle loads


Diagram of the inspection area

individuals. Procedures must be established to ensure that the driver is kept away from the vehicle during irradiation, and prior checks must be made to ensure there are no illegal immigrants inside the vehicles before they pass through the scanning facility (see point 3⎪2). France does not use ionising radiation emitting devices to detect the presence of illegal immigrants in transport vehicles.

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 Licenses and notifications in the non-medical sector

2⎪1⎪1 Authorities regulating ionising radiation sources in France, and the other applicable regulations

The licensing system applies equally well to companies or facilities which have radionuclides on-site and to those which trade in them without directly possessing them.

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 Health Code does however provide for a series of waivers. 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 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 installations licensed in accordance with the system for basic nuclear installations (BNIs) under the act relative to nuclear transparency and security, ASN regulates the sources necessary for the functioning of these 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 are not concerned by these waivers, and come under the authority of ASN.

ASN has reminded all licensees that call upon contractors that if these contractors have to use sources of ionising radiation, including if supplied by the licensees, they must hold a license issued by ASN pursuant to article R. 1333-17 and following of the Public Health Code.

These actions led to the drafting of a guide by the licensees for their contractors to help them in their dealings with ASN.

Graph 4 gives a breakdown of the sealed radioactive sources held on French territory according to the authorities regulating this possession.

Nuclear materials are not included in this table in that the license for import, export, production, possession, transfer, utilisation and transport, covered by article L. 1333-2 of the Defence Code, is issued by the Minister of Defence with regard to nuclear materials intended for defence purposes and by the minister responsible for energy for materials intended for all other purposes.

2|1|2 Licensing and notification frameworks for ionising radiation sources used for non-medical purposes

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 project conducted in 2008 and 2009 to revise all the forms and manuals with a view to simplification, grading of risks and harmonisation was continued, resulting in 2010 in an approved ASN decision defining the content of the files to enclose with the license applications (decision 2010-DC-0192). The new forms integrating the provisions of this decision are currently being published.

Furthermore, to achieve a better balance in the sectors of activity subject to notification or licensing, and therefore better adapt the regulatory requirements to the radiation protection implications, ASN continued its work on the introduction of a notification system in the non-medical sector. 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).
– electrical devices emitting ionising radiation, for which the equivalent dose rate at 10 cm from all accessible surfaces in normal conditions of use and as a result of their design, is less than 10 µSv.h-1.

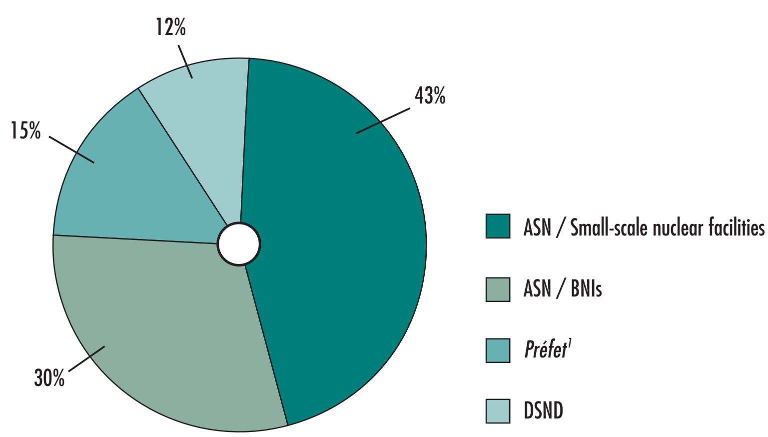
ASN also drew up a notification form to facilitate implementation of decision 2009-DC-0148 detailing the information to be enclosed with the notifications. This form has been designed so as to simplify its use and processing. No document has to be added to the notification form if the devices declared meet the requirements specified in ASN's decisions and are eligible for this system.

2|1|3 Integration of the fundamental radiation protection principles in the licensing procedures

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.

With regard to the monitoring of non-medical activities, ASN is particularly attentive to its inspection duties where radioactive source suppliers are concerned, because they play an important role in the marketing of new devices and the optimising of radiation protection from the equipment design stage.

Graph 4: Breakdown of sealed radioactive sources held in France according to the authority regulating their possession



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

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 would not seem to outweigh the risk. Either prohibition is declared generically, or the license required on account of radiation protection will not be granted.

For existing activities, justification is reassessed when license renewal applications are made if current know-how and technology so warrants.

On this subject of justification, ASN has initiated discussions with its European counterparts concerning the issues involved in implementing this principle arising from directive 96/29 of 13 May 1996. The particular aim is to harmonise practices with the other member countries, while preserving the way France applies the justification principle.

Furthermore, though application of the dose limiting principle is precisely transcribed in the regulatory texts, optimisation is a notion that must be assessed according to the technical and economic context, and its integration must primarily be the concern of the licensees. ASN encourages strong stakeholder involvement in this area, and implements an awareness-raising policy. As part of its duties, ASN checks compliance with the optimisation principle at several levels:
– when reviewing the files:
  • when new products or devices are put onto the market, and when renewing their licenses;
  • before the licensee exercises an activity that is subject to licensing;
  • when the licensee gives notification of a modification in its activity or its installation;
– during on-site visits and inspections;
– by collating experience feedback from investigations following significant radiation protection event notifications.

2|1|4 Statistics for the year 2010

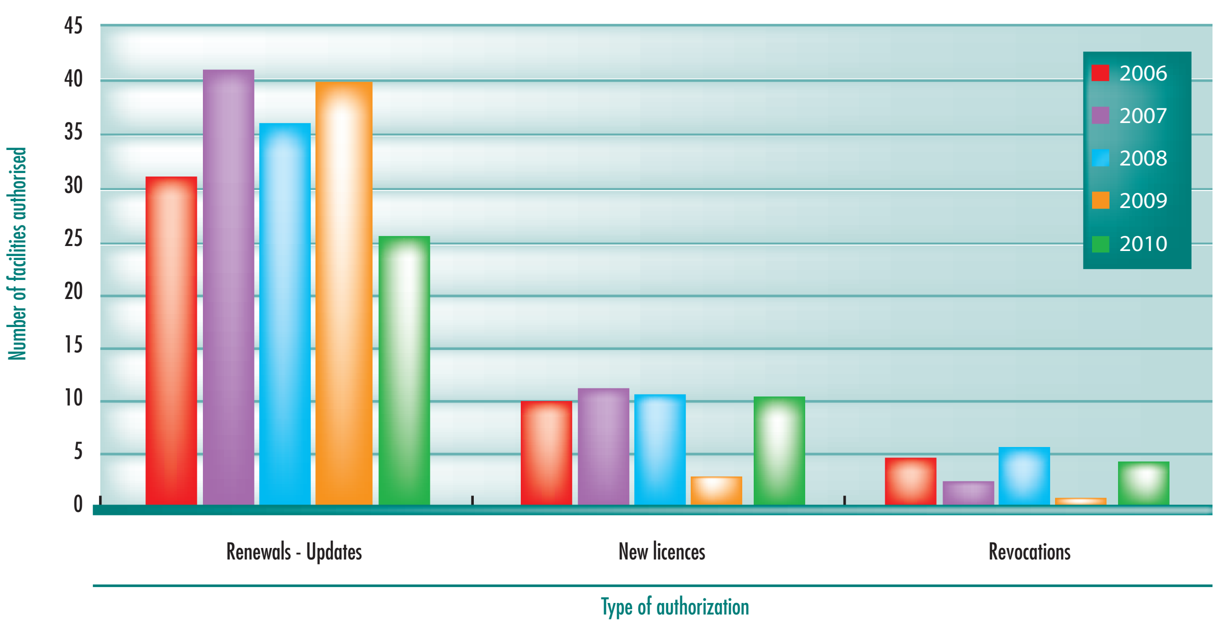
Suppliers

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.

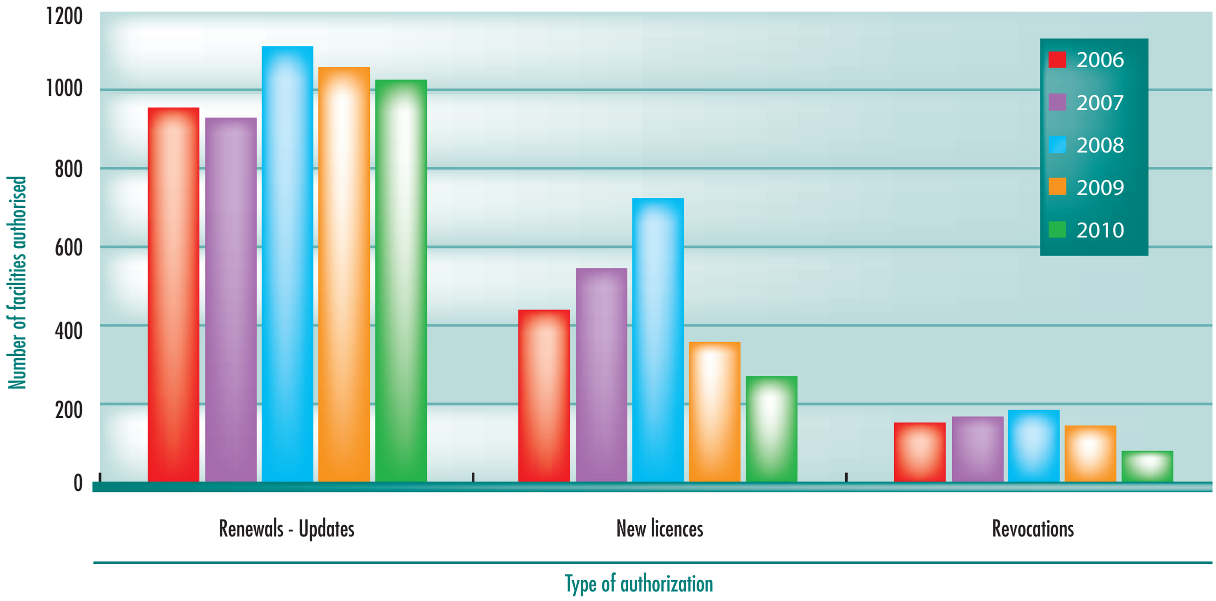
In 2010, 37 licenses were issued to suppliers.

Graph 5 presents the licenses issued or cancelled in 2010 and trends in this area between 2006 and 2010.

Graph 5: Radioactive source "supplier" licenses issued



Graph 6: Radioactive source "user" licenses issued



Users

In 2010, ASN reviewed and notified 279 new licenses, 1049 license renewals or updates and 88 license cancellations. Graph 6 presents the licenses issued or cancelled in 2010 and trends in this area between 2006 and 2010.

Once the license is obtained, the licensee may procure sources. To do this, it collects supply request forms from IRSN, enabling the institute to verify that the orders are in accordance with the licenses of both the user and the supplier, as it is one of the institute's duties to update the inventory of ionising radiation sources. If the order is correct, the movement is then recorded by IRSN, which notifies the interested parties that delivery may 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 170 licenses and 98 license renewals for the use of electrical X-ray generators in 2010. Given the new regulatory provisions allowing the implementation of a notification system in place of the licensing system, ASN also delivered 759 notification receipts in 2010. A total of 1134 licenses and 759 notification receipts have been issued since decree no.2002-460 came into force.

2|2 Revocation of unjustified or prohibited activities

The Public Health Code imposes compliance with the principle of justification and specifies "the intentional addition of radionuclides in consumer goods and construction products is prohibited" (articles R. 1333-2 and 3 of the Public Health Code).

By virtue of the ban on the intentional addition of radionuclides in consumer goods and construction products (articles R. 1333-2 and 3 of the Public Health Code), the trade in irradiated gemstones, accessories containing tritium sources such as key-chains, hunting equipment (sighting systems) navigation equipment (compasses) or river fishing equipment (strike indicators) is prohibited.

Lightning arrester containing radium

For existing activities, justification will be reassessed if current know-how and technology so warrants. This is the case with smoke detection systems (see box) and various other activities that are disappearing, in particular owing to technological changes: dew point determination, level measurement and density measurement, for which X-ray or ultrasound techniques are tending to replace those using radionuclides, or snow height measurement and cable car gondola positioning systems using a radioactive source fixed in the support cable splices.

Box containing radioactive surge suppressors

Interior of box containing radioactive surge suppressors - radioactivity measurement in progress

Nevertheless, certain legacy objects containing radioactive sources are still present in France. Such is the case with lightning arrestors and surge suppressors installed on telephone lines.

The ban on the sale of radioactive lightning arresters was declared in 1987. At the present time, several thousand radioactive lightning arresters are allegedly still in service in France, and are sometime only discovered and removed during building maintenance or demolition operations. These objects contain sources with a significant level of activity that present exposure risks for people who come into contact with them, for example, when they are removed. The removal operations must therefore be carried out by specialised companies, and the objects must subsequently be directed to specialised disposal routes put in place by ANDRA, the French National Agency for Radioactive Waste Management.

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. This risk must be taken into account in removal, interim storage and disposal operations in order to protect the public and workers, as required by the regulations.

ASN considers that even if these radioactive objects do not generally present a risk as long as they are not handled, they must be removed in a gradual and organised manner by specialised companies. For several years now, ASN has been informing the professionals to ensure that these radioactive objects are removed in a way that guarantees radiation protection of the workers and the public. ASN stepped up this action in 2009 and 2010 by sending reminders of the regulations to all the professionals concerned that it has identified, and by conducting on-site inspections of the companies involved in the recovery of these objects.

2|3 Determining the equipment inventory and ensuring compliance with the regulations

In 2010, in addition to drafting regulations, ASN continued with its more general work to improve familiarity with and understanding of the regulations and to promote compliance with them, both nationally and locally, through its regional divisions.

This enables ASN to reiterate the requirements of the regulations, to specify what it expects and to obtain direct feedback from the users concerning the constraints and problems they encounter.

ASN also pursued its action across the country to seek out any unlicensed suppliers distributing products in France. This action is aimed chiefly at the distributors of radioactive sources.

In this context, after having set up a licensing procedure for the use of electrical generators of ionising radiation in 2002, ASN wishes to supplement the provisions introduced into the Public Health Code in 2007, and thereby complete preparation of the regulatory framework enabling the distribution of these devices to be subject to licensing, as in the system applicable to radio-

UNDERSTAND

Smoke detection

The aim is to signal an outbreak of fire as early as possible, by detecting the smoke produced. The devices used to date comprise two ionisation chambers, including one reference chamber being tight to the ambient gas, while the other lets combustion gases enter. The intensity of the current passing through the reference chamber is compared with that of the current passing through the measurement chamber. When the difference in intensity exceeds a predetermined threshold, an alarm is triggered. The gases contained in the reference chamber are ionised by emission of radiation from a sealed source. Although several types of radionuclides used to be utilised (americium 241, plutonium 238, nickel 63, krypton 85), at present only americium is marketed, with an activity level not in excess of 37 kBq for the most recent of them.

However, if just a few years ago this situation could be justified owing to the human safety advantages of this technique, this is no longer the case given that new detection techniques using alternative technologies have been developed and can comply with fire detection regulations and standards.

Radioactive smoke detector

Pursuant to article L.1333-1 of the Public Health Code, this change puts an end to the existing waiver arrangements allowing the addition of radionuclides to a construction product and requires that existing facilities be monitored with a view to replacing their ion detectors by an alternative technology. To implement this measure, ASN has submitted to the government a draft government order and two draft decisions proposing and regulating gradual replacement. These projects were submitted for consultation to various groups and entities representative of the stakeholders involved. They were also reviewed by the Advisory Committee for Radiation Protection.

It is estimated that 7 million ionic smoke detectors still exist, spread over 300,000 sites. In normal use, the structure of the device prevents any propagation of radioactive substances into the environment. ASN is preparing a process to inform the public on this subject.

active source suppliers. Experience shows that, in this respect, having the suppliers/manufacturers submit a technical file for review by ASN, brings substantial improvements in compliance with the optimisation principle.

However, for this equipment category, there are no technical references that can constitute a basis recognised by all stakeholders. ASN notes that for devices used for non-medical purposes, there is no counterpart to the medical CE marking confirming conformity with several European standards, covering a variety of fields, including radiation protection.

Operating experience feedback shows that a large number of devices carry no certificate of conformity with the standards applicable in France, even though this has been mandatory for many years, but which have become in part obsolete, owing to the absence of recent revisions.

Back in 2006, ASN contacted the Ministry of Work, the 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 initiated the revising of standards NF-C 15-160 and the associated specific standards (installation standards) that are currently being published.

With regard to equipment design, ASN has undertaken a reflection on the content of the radiation protection appraisals that have to accompany license applications. In 2010, it presented the state of progress of its work and the orientations envisaged for its Advisory Committee of Experts on radiation protection.

2|4 Monitoring of 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 the most 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 therefore decided to task ASN with monitoring the security of radioactive sources, that is to say monitoring the prevention and the combating of terrorist acts targeting these sources. ASN has agreed to this mission on condition that it is given the necessary resources and can apply its rules of public information transparency. This mission will be accomplished in steps, according to the availability of the means, and if necessary ASN's monitoring action priorities will be reconsidered.

TO BE NOTED IN 2010

Reminder of the regulations following the incident on the DCNS site in Indret (Loire-Atlantique *département*[2])

Further to the incident of 5 January 2010 on the site of the DCNS group in Indret, ASN sent a letter stating the applicable regulations to gamma radiography companies which could use type TE 2000 electric remote controls.

The incident involved a company radiologist who entered the irradiation chamber before the radioactive source had fully retracted to its safe position. The radiologist was thus exposed for several seconds to a source of iridium 192 with an activity of about 1 TBq. The dose received by the radiologist in the incident was estimated at 0.3 mSv, which remains well below the annual regulatory dose limit of 20 mSv for persons who can be exposed to ionising radiation in the course of their professional activity.

ASN's investigations revealed numerous technical and organisational malfunctions behind this incident, including the use of a type TE 2000 remote control with a projector not equipped with a basic electric system. When a remote control of this type is used with an unequipped projector, the true positions of the source and of the radiation beam blocking device cannot be displayed on the remote control console. Yet it is vital to know these positions to ensure worker protection by avoiding involuntary exposure to doses that could be far higher than the dose estimated for the DCNS incident. Moreover, pursuant to article 9 of decree 85-968 of 27 August 1985 relative to gamma radiography devices, it is obligatory for electric remote controls to display the positions of the source.

ASN restated this regulatory requirement and the ban on the use of such remote controls with projectors not equipped with a basic electric device, and is continuing its investigations into the other electric remote controls used in gamma radiography.

Feursmetal incident in Feurs (Loire *département*)

On 26 May 2010, six people, premises and items of tooling were contaminated in the Feursmetal foundry during an attempt to retrieve a high-activity (1.25 TBq) cobalt 60 radioactive source that was jammed in the ejector tube of a gamma ray projector.

The gamma ray projector and the jammed source had been situated since 7 May in a bunker on the Feursmetal site where the projector is regularly used to inspect castings. After failure of the first attempt to release the source on 10 May assisted by the technical teams of Cegelec, the manufacturer, a second operation was scheduled for 26 May with the assistance of IRSN. It was during this second operation, carried out using robots that the source was accidentally sheared, resulting in the dispersal of radioactive contamination within the bunker and the adjacent premises, where the six workers were present.

The six people were placed in the care of specialist teams and transferred to the specialised medical unit of EDF's Saint-Alban nuclear power plant. The dosimetric impact on the workers was evaluated at between 0.2 mSv and 0.6 mSv depending on the individual. Although the human consequences were limited, the material consequences were quite considerable, as significant contamination was detected in the bunker, in the adjacent premises and in certain peripheral areas within the company. Furthermore, foundry moulds stored in the premises adjoining the bunker were also contaminated, and these items are necessary for the fabrication of the steel castings that Feurmetal produces.

ASN classified this event at level 2 on the INES radiological events scale (which goes from 0 to 7).

The first phase of the decontamination work, regulated by a prefectoral order, began in June with the moulds and the peripheral areas. Decontamination of the foundry moulds is progressing and clean-out of the peripheral areas is completed. Bunker decontamination operations will be carried out in a second phase to allow clean-out of the bunker and adjacent premises.

2. Administrative region headed by a *préfet*

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.

In the industrial sector, ASN is particularly attentive to facilities using gamma radiography devices, accelerators and high-activity sources. ASN has placed the inspection of these facilities among its priority inspection themes.

For the implementation of its industrial inspection programme, ASN has identified other high implication areas, notably suppliers of sources and electrical devices emitting ionising radiation, their utilisation on work sites, and the inspection of facilities that fail to comply with the regulations.

3|2 Main incidents in 2010

ASN also controls the handling of the incidents notified to it. These primarily concern loss or theft of radioactive sources or portable devices containing them (lead detection, etc.), inappropriate use, or total or partial accidental destruction of a radionuclide source, in addition to accidental irradiation of individuals.

ASN was notified of 75 radiation protection events in the non-medical and non-BNI area in 2010. Some of these events are recurrent.

One incident was classified level 2 on the INES scale (see box on the Feursmetal incident). Of the others, 23 were classified level 1 (anomaly) and 51 were classified level 0 (deviation).

The main event categories are exposure of individuals and the discovery, loss or theft of sources.

Losses usually concern calibration sources, especially those used to calibrate or verify measuring instruments.

Thefts mainly concern devices for detecting lead in paint which are kept in attache-cases or in strongboxes. They are sometimes found a short time after the theft.

Discoveries concern a wide variety of objects, mainly detected by the gates at BNI exits or at the entrances to landfills and scrap yards. These sources can come from private individuals, they can be found in establishments which had forgotten they had them, or can be left on the street, for example in front of a police station. Events concerning contaminated metals are also considered to be source discoveries (see box).

Human exposures are chiefly due to irradiation. Industrial gamma radiography practices were again incriminated in the majority of cases this year. A new type of generic event is the involuntary irradiation of individuals by tomography devices during verifications by the authorities to detect illegal items in containers or lorries.

3|3 Dosimetry in the non-medical sector

According to the most recent data collected by IRSN concerning external occupational exposure in 2009, more than 83,000 people working outside BNIs and the medical sector are subject to exposure monitoring.

Of these workers, in the year, 92% received an effective dose below 1 mSv, 6.4% an effective dose between 1 and 6 mSv, 1.5% received between 6 and 20 mS, and 0.01% exceeded 20 mSv. This distribution results from the new activity sectors nomenclature established by IRSN this year. The average dose received by these workers is 360 µSv.

TO BE NOTED IN 2010

Imports of items contaminated by Cobalt 60 – Radioactivity detection

As in previous years, cases of contamination by radioactive cobalt 60 were detected in imported industrial parts. Several events of this type have continued to be reported across the world. More particularly:

- *an accident occurred in April 2010 on a metal recycling site in India, and was classified level 4 on the INES international radiological events scale;*
- *more recently, in July 2010 in the Italian port of Gênes Voltri, a container shipped from Saudi Arabia was found to have a contact dose rate of more than 600 mSv/h.*

Although ASN has observed an improvement in the management of this type of incident by companies, it also notes their increasing numbers. These recent events show that when radioactive materials are not specifically labelled as such, they can be sent to France or other countries with no specific and systematic checks at the borders. At present, the French regulations concerning the transport of goods at the French borders do not provide for specific checks to search for radioactive materials.

In this context, ASN has several times alerted the ministries concerned of the worrying increase in events of this type, the health and economic consequences of which can be considerable, and has proposed a national reflection on the deployment of radioactivity detection systems at strategic points around the country (ports, road hubs, airports).

4 ASSESSMENT OF RADIATION PROTECTION IN THE NON-MEDICAL SECTOR

Industrial radiography

In this sector, where the radiation protection stakes are high and incorrect use of devices can rapidly have serious health and financial impacts, especially in the case of gamma radiography, ASN places high priority on inspection actions.

ASN finds contrasting situations in the way companies take into account the risk of worker exposure to ionising radiation, and considers that further improvements can be made. 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 the contractors, to enhance work preparation and allow the application of effective preventive measures. Regional programmes to draw up good practice charters have been initiated in the Provence-Alpes-Côte d'Azur, Haute-Normandie and Rhône-Alpes regions and more recently in Nord-Pas de Calais and Bretagne/Pays de Loire. These initiatives, some of which are more recent than others, must be continued in order to allow regular exchange between the stakeholders.

Foodstuff X-ray scanner

More broadly, as regards justification and optimisation, continuation of the reflections initiated by the non-destructive testing professionals and application of the available guides will be impossible without the active involvement of the ordering companies. This includes the Alter'x association project, which started in 2006 and was coordinated by the Institut de Soudure and comprised EDF, GRTgaz, Technip and Total. At the end of 2009, it published a guide offering solutions to industrial firms looking for an alternative to gamma radiography of piping welds using Iridium 192. This guide was drafted with a view to reducing operator dosimetry and public exposure and contains aspects regarding both optimisation (selenium 75, X-rays) and justification (alternative techniques not involving ionising radiation). More recently, Cofrend and various stakeholders undertook work on the justification of gamma radiography, and finalised a study that aims at explaining the principle of gamma radiography justification in the field of non-destructive testing. The purpose of this document, which will contain functional tools such as a flowchart identifying the conditions in which gamma radiography can be replaced, and tables describing the tests and their purpose, is to promote the use of alternative methods.

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.

Veterinary

The veterinary profession uses X-ray generators for radiodiagnostic purposes in the standard radiography context. eighty-five percent of the 6,500 veterinary clinics have at least one radiography installation. These installations also include some fifteen computer tomography scanners, three scintigraphy centres and one brachytherapy centre.

The profession counts approximately 15,500 veterinary surgeons and 14,000 non-veterinary employees. Veterinary radiodiagnostic activities essentially concern pets.

The inspections carried out in 2010 showed that the administrative situation of veterinary installations was still not satisfactory (lack of license or notification). The radiation protection technical inspections, the workstation studies and risk analyses must be improved. ASN has nevertheless observed major progress over the last years. At present, the large majority of structures have a PCR and the workers are subject to exposure monitoring.

Nearly 850 veterinary offices have put their administrative situation into order (notification or license). Implementation of the notification system for certain veterinary activities led to a large increase in the number of files submitted to ASN in 2010.

ASN maintains regular contact with the professional veterinary organisations. This has resulted in significant improvements in radiation protection in this sector, which is gearing itself to improve the integration of radiation protection aspects and to disseminate good practices. A website dedicated to radiation protection has been set up, along with a network of national and regional referral agents, to support the profession's 3,500 PCRs. Their actions are also materialised by the drafting of typical documents and guides for veterinarians, and the publication of radiation protection articles in the professional press. A first guide for the canine sector has already been finalised, along with good radiodiagnostic practices sheets for the equine sector, where the radiation protection implications are highest.

5 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. Recent incidents in France and serious accidents abroad, for example in the field of gamma radiography, demonstrate once again the need for scrupulous implementation of the regulations and stringent operations. With this aim in view, as in 2010, ASN will continue the monitoring of radioactive source suppliers in 2011, for both the reviewing of license application files and the inspections performed in these entities. With regard to users, it will pay particular attention to on-site utilisation of ionising radiation sources and to seeking out entities that are not in conformity with the regulations.

ASN will also continue its work to implement equivalent regulations for the suppliers of electrical devices emitting ionising radiation.

Following the incidents related to gamma radiography sources, ASN initiated specific, targeted monitoring actions on high-level sources. It will continue these actions, placing emphasis on the security-related aspects, in anticipation of its new duties.

The 2010 initiative to publish the follow-up letters to the inspections ASN conducted in the non-medical sector will be continued in 2011.

ASN endeavours to constantly improve its knowledge of the players and organisations in the industry and in research, with the aim - among other things - of stepping up the verification of the justification for using radioactivity when reviewing license applications, and to encourage integration of the principle of optimisation from the equipment design stage. In the specific domain of gamma radiography, these objectives concern as much the gamma radiography contractors as the ordering companies, which are often directly involved in the choice of non-destructive testing techniques used on their site.

TRANSPORT OF RADIOACTIVE MATERIALS

CHAPTER 11

Since 1997, the French nuclear safety authority (ASN) has been responsible for monitoring and regulating the safety of packages used for transporting radioactive and fissile materials for civil applications. To guarantee a high level of transport safety, strict rules must be applied. They are based on the implementation of a "Defence in Depth" approach, where the design robustness of the packages is essential. The regulatory requirements relating to the safety functions - namely, containment of the radioactivity, protection from ionising radiation and prevention of criticality risks - must be ensured by the package under both normal transport conditions and accident conditions. The regulatory provisions incorporate the recommendations of the International Atomic Energy Agency (IAEA) to ensure consistency and reliability in the international transport context.

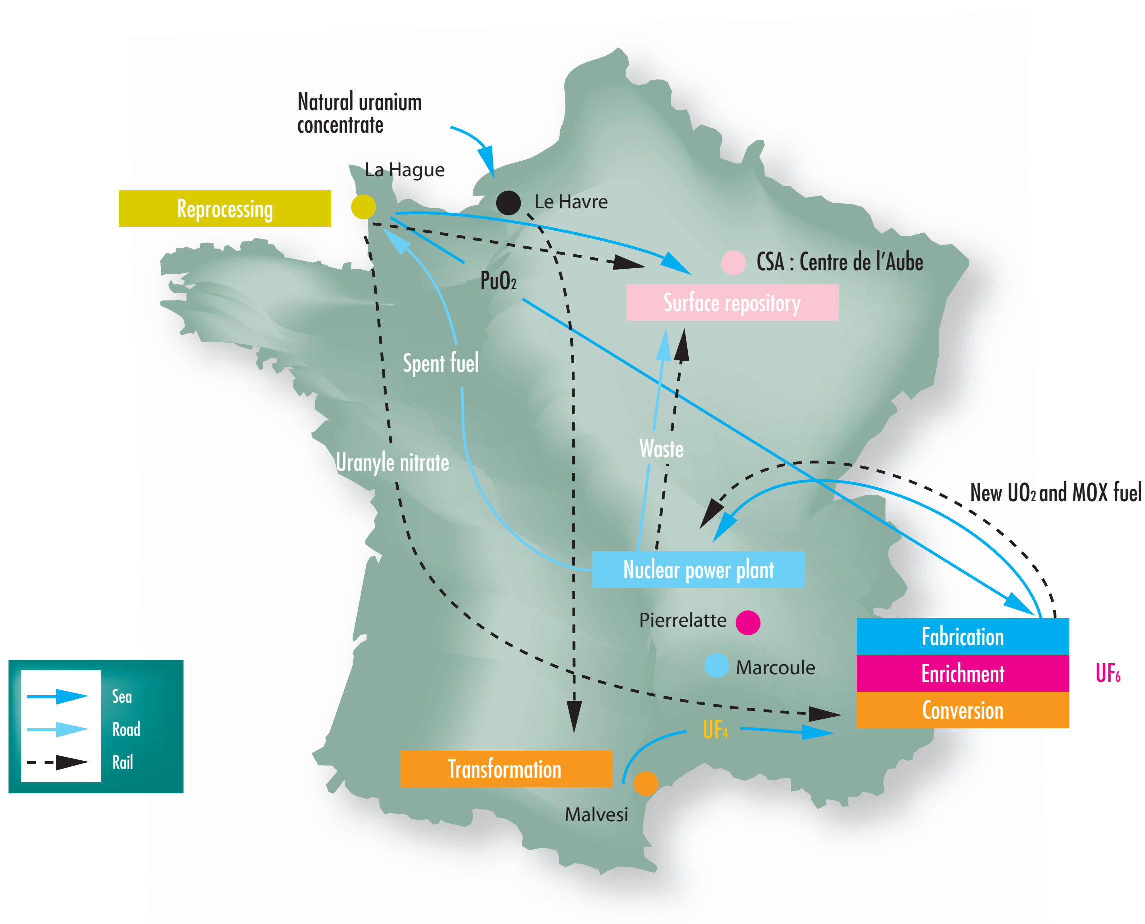
1 GENERAL INTRODUCTION

1|1 The diversity of the radioactive material traffic

Each year, approximately 15 million packages of materials considered as dangerous due to their chemical, explosive or toxic nature, are transported in France. About 900,000 packages of radioactive materials are transported each year, representing a few percent of the dangerous goods traffic. The majority (two-thirds) consists of packages for medical or industrial uses (lead analysers, gamma ray projectors, etc.). Radioactive material packages can be various. Their radioactivity can range over more than twelve orders of magnitude, that is to say from a few thousand becquerels (pharmaceutical packages) to millions of billions of becquerels (irradiated fuels) and their weight can range from a few kilograms to about one hundred tonnes.

The nuclear power cycle industry generates the transport of many sorts of radioactive materials: uranium concentrates, uranium tetrafluoride, depleted, natural or enriched uranium hexafluoride, fresh or spent fuel assemblies containing

Transports related to the fuel cycle in France



Classification of ships carrying an INF cargo

For the purpose of this Code, ships carrying INF cargo (irradiated nuclear fuel, plutonium, or highly radioactive waste) are assigned to the following three classes, depending on the total activity of INF cargo which is carried on board:

Class INF 1 - Ships which are certified to carry INF cargo with an aggregate activity less than 4,000 TBq.

Class INF 2 – Ships which are certified to carry irradiated nuclear fuel or high-level radioactive wastes with an aggregate activity less than 2 x 106 TBq and ships which are certified to carry plutonium with an aggregate activity less than 2 x 105 TBq.

Class INF 3 – Ships which are certified to carry irradiated nuclear fuel or high-level radioactive wastes and ships which are certified to carry plutonium with no restriction on the maximum aggregate activity of the materials.

A sliding scale of requirements applies to each of these ship classes in terms of stability, fire extinguishing capability, temperature control in the cargo hold, stowage and securing of packages in the holds, backup electrical power, radiation protection, and the shipboard emergency and personnel training plan.

uranium oxide or mixed uranium and plutonium oxide (MOX), plutonium oxide, waste from power plants, reprocessing plants, CEA research centres, etc. The largest consignments concern about 300 shipments per year for fresh fuel, 250 for spent fuel, about 30 for MOX fuel and about 60 for plutonium oxide powder.

Transport can be international, and France is a transit country for some of those transports.

A large number of international shipments are also due to the presence in the country of plants enriching uranium, fabricating or reprocessing nuclear fuels, along with manufacturers of radioisotopes for medical purposes, all of whom have commercial links with foreign organisations.

1|2 Modes of transport

Rail

Rail transport represents 3% of radioactive material transport operations. This mode of transport is chosen as a priority for heavy or large packages, provided that a rail link is available. For example, almost all the spent fuel intended for reprocessing is sent by train to the rail terminal at Valognes, and then by road for the remaining 20 km to the La Hague plant.

Road

Road transport represents about 90% of all radioactive material transport operations. The transport of radioactive materials by road, in the same way as any other hazardous goods, is subject to general or local specific traffic and parking regulations, to avoid congestion of the road network, especially when traffic is heavy and in residential areas. Most packages of pharmaceutical products and medical sources are delivered to hospitals by road.

Sea

Sea transport represents 4% of all radioactive material transports. The ships used for carrying spent nuclear fuel, plutonium and high-level waste must comply with the requirements of the "International Code for the Safe Carriage of Packaged Irradiated Nuclear Fuel, Plutonium and High-Level Radioactive Wastes on Board Ships" (INF Code). This code divides the ships transporting this type of radioactive material into three classes. These ships are approved by the public authorities.

Air

Air transport, which represents 3% of the traffic, is frequently used for transporting small urgent packages over long distances, such as short-lived radiopharmaceutical products.

ASN inspection of maritime transport – Le Havre Port – 2009

2 THE VARIOUS ROLES IN THE TRANSPORT ORGANISATION

2|1 Fields of competence of the various authorities

Regulation of transport safety and radiation protection

Since 12 June 1997, ASN has been responsible for the regulations relating to the safe transport of radioactive and fissile materials for civil use and for monitoring their application. Its responsibilities in this area were confirmed by Act 2006-686 of 13 June 2006 on Transparency and Security in the Nuclear Field (TSN Act). ASN is also responsible for advising the Government with regard to regulations on this subject.

Ensuring nuclear safety and radiation protection in the transport sector involves managing the risks of irradiation, contamination and criticality and preventing damage caused by the heat of the packages containing radioactive and fissile materials, so that man and the environment do not suffer any prejudicial consequences.

These requirements are met, firstly by modulating the package content limitations and the means of transport, along with the performance standards applied to the package models, according to the risk inherent in to radioactive contents; secondly by setting requirements for the design and operation of the packages and for container maintenance, taking into account the nature of the radioactive contents. In this regard, ASN delivers the approvals for package models and transports that require such approvals. Compliance with these requirements is verified by inspections carried out in both normal and emergency situations.

The responsibility for regulation of the transport of radioactive and fissile materials for national security purposes lies with the Defence Nuclear Safety and Radiation Protection Delegate (DSND).

A distinction must also be made between safety (prevention of accidents), which is the responsibility of ASN and DSND, and security, or physical protection, which consists in preventing the loss, disappearance, theft and misappropriation of nuclear materials (those used for weapons). It is the Defence and Security Executive Officer (HFDS) of the Ministry of Ecology, Sustainable Development, Transport and Housing (MEDTL) who is the competent authority. Further information is provided in chapter 3 of this report.

Finally, a number of other administrations intervene in areas other than safety that interface with it. For the transport of materials displaying a high activity level (more than 3000 times the value of the A2 reference threshold for the radionuclide in question – see point 2|4), the Ministry of the Interior is the competent authority for developing emergency plans. ASN works regularly with these ministries to ensure that inspections are as consistent as possible. The breakdown of the various responsibilities is summarised in table 1.

Table 1: 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 (MEDTL). ASN assists with the monitoring of 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 (MEDTL).	The General Directorate for Risk Prevention (DGPR) is responsible for regulating packages of hazardous 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 (MEDTL).	The DGAC is competent to regulate packages of dangerous goods in general and in close coordination with ASN for packages of radioactive materials.

2|2 Industrial participants

The main participants in transport arrangements are the consignor and the carrier. The consignor is responsible for package safety and accepts his responsibility by way of the dispatch note accompanying the package remitted to the carrier. 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 good safety conditions, a stringent chain of responsibility has to be set up. So, for major transport operations:

– the consignor must be fully aware of the characteristics of the material to be transported, so that it can select the type of container to be used and specify transport conditions accordingly;
– the corresponding packaging must be designed and sized in accordance with use conditions and current regulations. In most cases, a prototype is needed to carry out the tests prescribed by the regulations. As soon as this phase is completed, the safety analysis report is prepared and submitted to the competent authority to complete the authorisation application;
– in cases where existing containers are used, their conformity with approved models has to be confirmed. In this context, the container owner must set up a maintenance system in conformity with that described in the safety documents and the authorisation certificate;
– the container is sent to the consignor's site, where it will be loaded with the material for transportation. The consignor must carry out the inspections for which it is responsible (leaktightness, dose rate, temperature, contamination) on the loaded container prior to entry on a public road or railway track;
– the transport operation itself is organised by the carriage commission agent, who is responsible for obtaining the requisite permits and complying with advance notice requirements on behalf of the consignor. He also selects the means of transport, the carrier and the itinerary, in compliance with the above-listed requirements;
– the actual transportation is entrusted to specialised firms, having the necessary permits and vehicles. The drivers of road vehicles in particular must be in possession of the training certificate required by the regulations.

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. 1,739 notifications were sent to ASN in 2010.

2|3 Regulations - drafting and objectives

The international nature of radioactive material transport gave rise to regulations, drafted under the supervision of IAEA, ensuring that a very high level of safety is guaranteed.

The international regulations include the following texts:

– the European agreement concerning the international transport of dangerous goods by road (ADR) drafted by the United Nations Economic Commission for Europe (UNECE);
– the Regulations concerning the International Carriage of Dangerous goods by rail (RID) drafted by the Intergovernmental Organisation for International Carriage by Rail (OTIF);
– the International Maritime Dangerous Goods Code (IMDG Code) drafted by the International Maritime Organisation (IMO);
– the Technical Instructions for the Safe Transport of Dangerous Goods by Air, drafted by the International Civil Aviation Organisation (ICAO).

These modal regulations were then entirely transposed into French law and made applicable by government orders, and in particular the amended "TMD" order of 29 May 2009 relative to the transport of dangerous goods by road or rail.

Transit storage

The regulations for the transport of radioactive materials apply to all modes of transport, whether by land, sea, air or inland waterway. For information, transport comprises all operations and conditions associated with the movement of radioactive materials, including transit storage. In 2009, ASN inventoried these transit storage facilities and placed them on the list of topics for inspection in 2010.

Transparency in the transport of radioactive materials

Article 19 of the TSN Act stipulates that the requirements for transparency, introduced by that same Act, from persons responsible for transporting radioactive materials, applies when the quantities transported are higher than thresholds laid down by decree. ASN and the other concerned government departments are currently drafting this decree, which will extend the obligations for transparency incumbent on nuclear licensees to those responsible for transporting radioactive materials and the holders of these materials. An initial draft was submitted to the various stakeholders in 2010.

2|4 Specific intervention for the different package types

Although the regulations apply to all radioactive material packages they define thresholds above which these packages require approval by the public authorities before they can be used. These thresholds are determined so that in the event of an accident, the effective dose received by the public or the parties involved cannot exceed 50 mSv. They are specific to each radionuclide. They are calculated using a model called Q-system.

For a given radionuclide, these thresholds (which are called A2 or A1 depending on whether or not the source presents a risk of dispersion) are taken as the activity which, in the event of an accident, would lead to an effective dose of 50 mSv in 30 minutes at 1 metre, considering all five modes of exposure (external due to photons, external due to beta emitters, internal for exposure by inhalation, immersion or ingestion).

The Q-system thus defines a reference activity level which is inversely proportional to the harmfulness of the product. For example, for Pu 239, A1 is equal to 10 TBq and A2 is equal to 10^{-3} TBq.

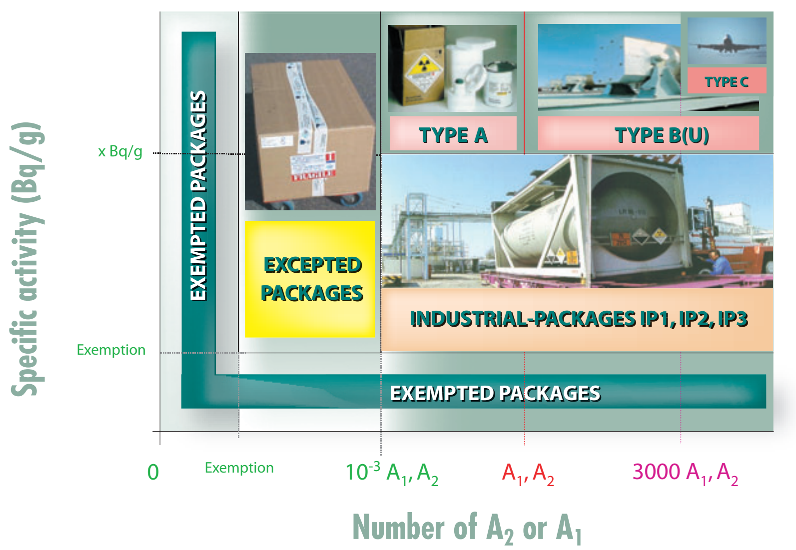
These calculations thus allow the scope of intervention by the public authorities and the acceptable level of transport risk to be defined. They lead to the definition of different types of packages – presented in the following diagram – some of which must be approved by the administration before they can be used. This is the case for:

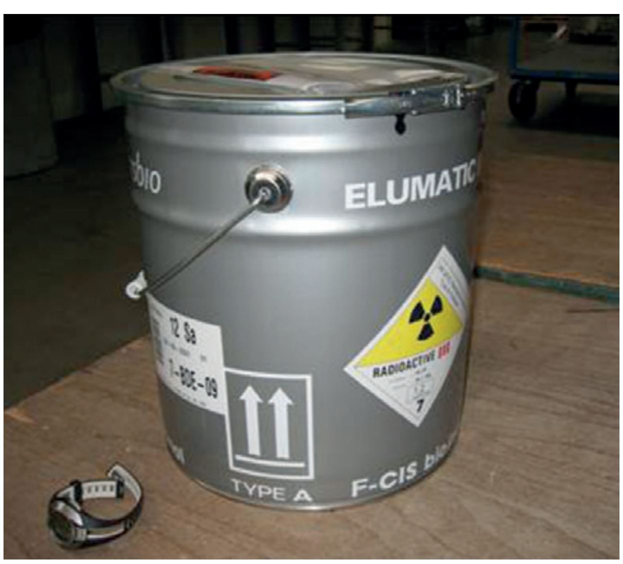
– radioactive materials in special forms;
– low dispersible radioactive materials;
– Type B and C packages and all fissile material packages;
– special arrangement shipments (the package fails to comply with all the requisite criteria, but compensatory transport measures have been taken to ensure that transport safety is not below that of a transport operation involving an approved package).

Furthermore, each type of package undergoes a number of resistance tests representative of the risks to which the shipment can be exposed, taking into account the risk inherent in the material being transported.

Finally, over and above these design rules, the regulations define rules for the operations concerning the container and those concerning its contents.

Types of package depending on total and specific activity





Example of a Type A package – technetium 99m generator

Example of a Type B packaging – Gammagraph containing an iridium source

Characteristics of the various types of package

Excepted packages are not subjected to qualification tests. They must however comply with a number of general specifications, such as a maximum dose rate at the surface of below 0.005 mSv/h.

Non-fissile industrial or Type A packages are not designed to withstand accident situations. However, they must withstand some kind of incidents which could occur during handling or storage operations. They must consequently withstand the following tests:

– exposure to a severe storm (rainfall reaching 5 cm/h for at least 1 hour);

– drop test onto an unyielding surface from a height varying according to the weight 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.

These tests should not lead to loss of material and radiation shielding deterioration must remain below 20%.

Fissile or Type B packages must be designed so that they continue to fulfil their containment, sub-criticality and radiation shielding functions under accidental conditions. These accidents are represented by the following tests:

– a series of 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 water at a depth of 15 m (200 m depth for spent fuel) for 8 hours.

Type C packages must be designed so that they continue to fulfil their containment, sub-criticality and radiation shielding functions under representative air transport accident conditions. These accidents are represented by the following tests:

– a series of three consecutive tests:

- *a 9 m drop test onto an unyielding surface,*
- *a 3 m drop onto a spike,*
- *encircling fire of at least 800 °C for 60 minutes;*

– 90 m/s impact on an unyielding surface;

– immersion in water at a depth of 200 m for 1 hour;

– burial test.

2|5 ASN responsibilities regarding regulation of the safe transport of radioactive materials

In the context of the regulation of the safe transport of radioactive and fissile materials, ASN is responsible for:

– proposing technical regulations to the government and monitoring their implementation. It can therefore propose supplements to the rules defined by IAEA;

– completing authorisation procedures (approval of packages and organisations);

– organising and coordinating inspection of packages and materials and their means of transport;

– taking enforcement measures (formal notice, provision of financial guarantees, automatic performance of work, suspension of transport, etc.) and imposing the necessary penalties;

– proposing and organising public information.

In addition, ASN acts within the context of emergency plans defined by the authorities to deal with an accident.

Public information

In 2010, ASN organised several information seminars for the various entities involved in the transport of radioactive materials.

These seminars were held:
- *on 1 February on the premises of the DGAC (General Directorate of Civil Aviation): seminar for the various concerned airport staff;*
- *on 4 February in Lyons, organised by the Lyons division;*
- *on 7 June in Lille, organised by the Douai division for users of gamma ray projectors and gamma density meters;*
- *on 29 September in Aix-en-Provence, organised by the Marseilles division.*

The main purpose of these seminars was to present the important points of the regulations and its evolution, to underline the importance of notifying events that could have affected the safety of the packages, and to answer the participants' questions.

More seminars of this type will be organised in other regions in 2011.

TO BE NOTED IN 2010

2|6 Administrative authorisations

ASN conducts a critical analysis of the safety analysis reports proposed by the applicants to obtain approval of the package models which so require.

After technical review of the documents by IRSN (French Institute for Radiation Protection and Nuclear Safety), ASN delivers the approvals of the package models stipulated in the regulations and validates approvals issued by the competent authorities in other countries for shipments transiting in France.

These approval certificates are usually issued for a period of a few years. At present, about one hundred applications for approval are submitted annually to ASN by the manufacturers (new package model, approval renewal, validation of a certificate issued by a foreign authority, special arrangement, extension to contents other than those initially defined in the approval certificate).

Generally speaking, approval is given for a package model, and not package by package. The approval certificate nevertheless specifies the manufacturing, operating and maintenance conditions.

The approval certificate is often issued 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).

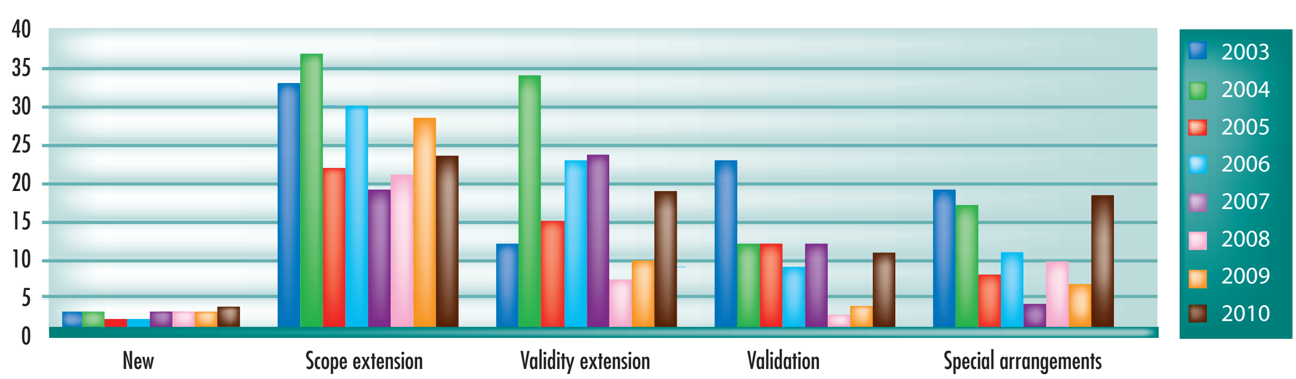
A decision of 1 December 1998 set up an Advisory Committee of Experts (GPE) for radioactive material transport, similar to the other GPEs already in existence for other sectors. The expertise carried out by IRSN at the request of ASN can thus be supplemented by an Advisory Committee examination. This procedure is used for new package concepts, for example.

This GPE thus met in 2010 for the R73 package designed by ROBATEL Industrie for transporting waste from the decommissioning of first-generation reactors of EDF.

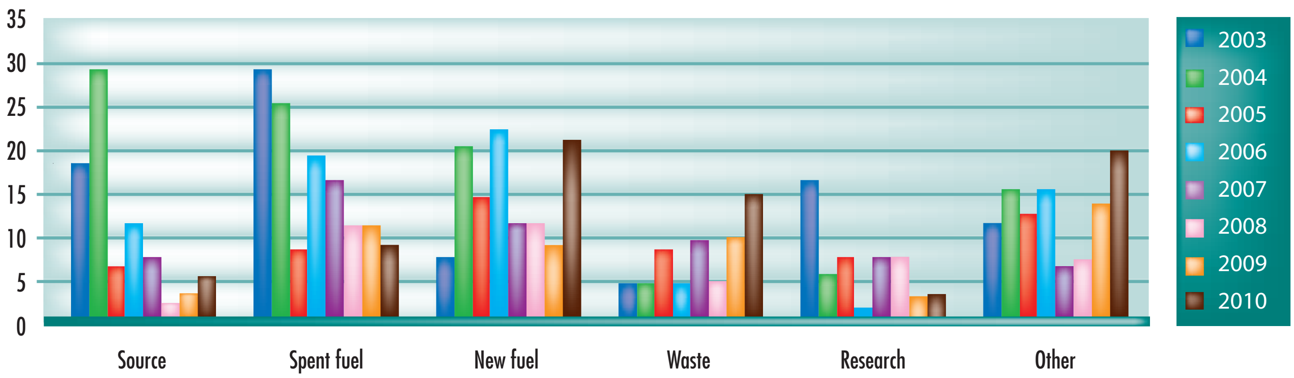
In 2011, packages TN833 and TN843 will be presented to the GPE by the company TN International for the transport of bituminous and compacted wastes coming from the reprocessing of irradiated fuel at La Hague.

ASN delivered 75 certificates in 2010, for which the breakdown by type is shown in graph 1.

Graph 1: Breakdown of the number of approvals according to type



Graph 2: Breakdown of the number of approvals according to their content



The breakdown and nature of the transport operations concerned by these certificates in 2010 are shown in graph 2.

Finally, in May 2009, ASN published an applicant's guide for approval of shipments and package models 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 analysis reports are to be transmitted to ASN and to IRSN, their structure, the contents of the draft approval certificate, the minimum processing times, the experience feedback from previous reviews and the requirements to be met if a package model 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.

3 REGULATING THE TRANSPORT OF RADIOACTIVE MATERIALS

3|1 Regulation by ASN

As part of its responsibilities, ASN carries out checks on the various parties involved in the transport of radioactive materials. The consignors and carriers are the focus of constant attention, but the inspections also concern peripheral activities associated with transport, such as the manufacture and maintenance of the packaging containers.

From both the regulatory and practical standpoints, it is important to ensure good cohesion with other supervisory authorities responsible, notably, for the inspection of transport vehicles, for conventional safety inspection in the transport sector or for the protection of nuclear materials. For this purpose, ASN has already signed - or will soon signing - protocols with the General Directorate for Infrastructures, Transports and Maritime Affairs (DGITM), the General Directorate for the Prevention of Risks (DGPR) and the General Directorate for Civil Aviation (DGAC). The TSN Act also reinforced the powers of ASN inspectors, in particular with regard to ascertaining violations and imposing penalties.

In 2010, a total of 92 inspections were carried out in the field of radioactive material transport.

In 2010, the radioactive material transport inspection duties performed by ASN inspectors revolved around various priority topics:

– airport handling of radioactive packages;
– BNI field inspections;
– design, manufacture, testing and maintenance of containers;
– manufacture and testing of packages that do not require approval by the competent authority.

Among the observations or findings formulated further to the inspections, the most frequent are about quality assurance, documentation, the responsibilities of the various parties involved, or compliance with procedures and established practices as indicated in the approval certificates, safety cases or, more generally, regulatory texts.

In particular for packages that do not require approval by the competent authority, ASN considers the situation to be unsatisfactory. Whether demonstrations of conformity with the regulations or pre-shipping checks, the inspections revealed a large number of shortcomings. This situation is all the more worrying as these packages are the source of a large proportion of the incidents that occurred in 2010.

On the other hand, the inspections performed in 2009 and 2010 reveal progress in the development of the radiation protection programs, which have been compulsory since 2001.

ASN carried out inspections during the manufacture of the R73 and TN117 containers, and during the regulatory testing of the

DE25 container. The deviations identified mainly concern quality assurance deficiencies that can be divided into the following three types:
- problems with the traceability of correspondence and official validations (nonconformities, hold points) between the packaging designer and manufacturer;
- insufficient traceability of document revisions;
- incomplete application of the internal quality reference system (performance of internal audits, supplier monitoring, verification of device calibration).

3|2 On-site transport rules

In 2008, ASN decided jointly with ASND (Defence Nuclear Safety Authority) to tighten the regulatory framework for dangerous goods transport on nuclear sites.

At the request of ASN, some sites defined technical rules applicable for this type of transport as early as 2003. This is for example the case with the CEA centres or Areva's La Hague or Tricastin sites. On-site transport on the AREVA La Hague site, for example, was optimized in 2010 by adopting protected transport lanes that are preferentially dedicated to the transport of radioactive materials.

These on-site transport rules are a set of operational and organisational rules largely inspired by the current road and rail transport regulations ("TMD" order) while taking into account certain aspects specific to on-site transport.

ASN together with ASND monitored the progress made by the working group which should lead to an overhaul of these on-site transport rules, taking account of initial operating experience feedback.

Measuring radioactivity at Cadarache before a spent fuel convoy departs for the Greifswald centre in Germany – December 2010

Package not requiring approval by the competent authority

Industrial or Type A packages do not require approval, thus ASN does not deliver an approval certificate.

These packages are nevertheless subject to regulations and must, among others, withstand certain tests (see point 2|2).

Through the inspection of various container manufacturers, ASN checks that the packages comply with the regulations: tests performed in accordance with regulations, presence of a complete conformity file and a certificate of conformity for all the package models.

UNDERSTAND

4 INCIDENTS AND ACCIDENTS

The criteria for ASN notification of transport incidents or accidents are defined by a guide. The currently applicable version of this guide was sent out by ASN in a letter dated 24 October 2005 to all consignors and carriers (see chapter 4). This guide also reuses the incident report template proposed in the "TMD" order.

All transport deviations are thus to be declared to ASN. Apart from this notification, a detailed incident report must be sent to ASN within two months. Events concerning regulatory nonconformities but which do not impair the safety functions are not concerned by this report. In case of contamination, an analysis report is to be sent to ASN within two months.

The main events arisen this year are detailed below according to the following categories:

– package handling events;

– incidents and accidents during actual transport;

– nonconformity with the regulatory requirements of the official orders relative to each mode of transport and with the requirements of the package model approval certificates, and notably the pre-shipping verifications (difference concerning marking, labelling and placarding, transport documentation and exceeding of the contamination and dose rates thresholds).

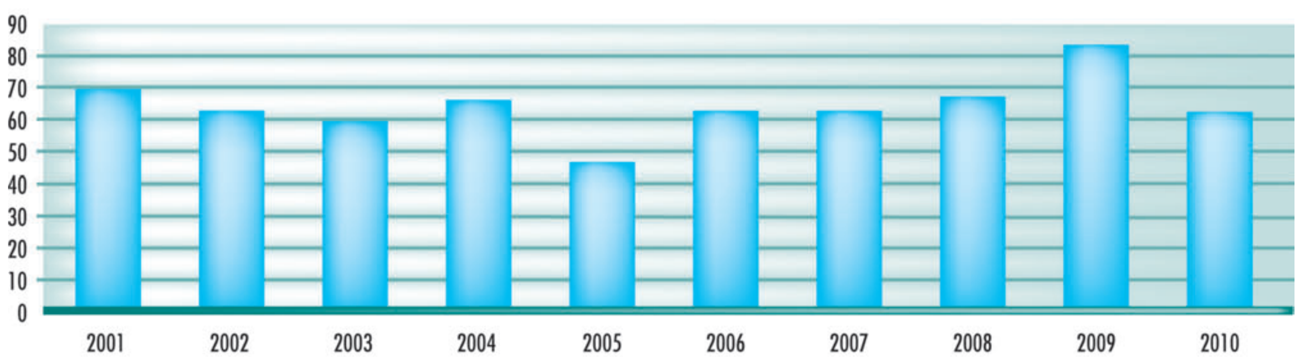
In 2010, 53 incidents were classified as level 0, and 9 as level 1. Graph 4 shows the trends since 2001.

The medical, conventional industry and research sectors account for about 46% of the transport-related events. However, this number must be treated with caution. It is in fact striking that most of the deviations notified to ASN in the medical, conventional industry or research sectors are events that cannot be hidden, such as package damage, theft or loss, or even road accidents. However, those concerning violations of the regulations or for which the direct safety consequences are minor represent a far smaller share than in the nuclear sector. This is without any doubt due to professionals in the small-scale nuclear activities failing to submit notifications.

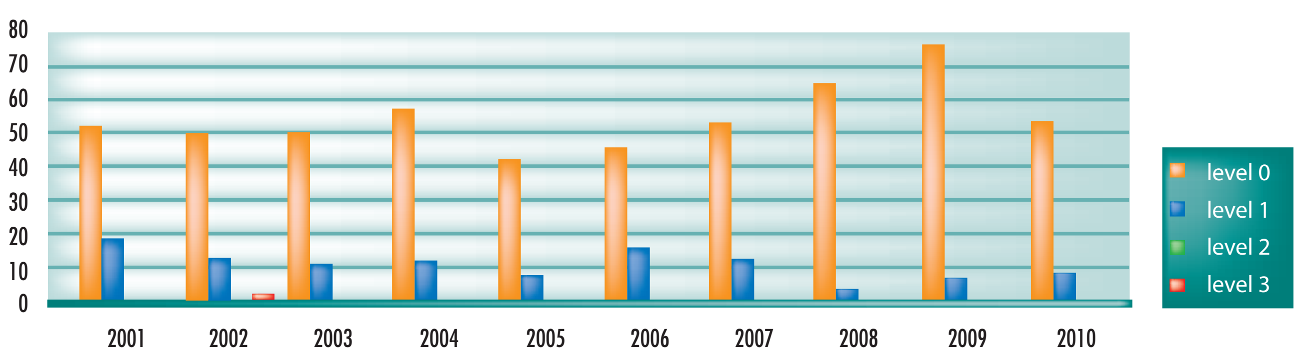
ASN considers this situation to be unsatisfactory, because poor design or incorrect use of these packages can lead workers or the public to receive doses higher than the regulation limits, especially in the event of content leakage.

The obligation and the method of notifying transport events were underlined at the various information seminars (see point 2 | 3).

Graph 3: Trend for the number of radioactive material transport incidents or accidents declared between 2001 and 2010



Graph 4: Trend for the number of events classified on the INES scale since 2001



4|1 Package handling events

Events causing damage during package handling are considered to be transport-related incidents. In the eyes of the regulations, handling is part of transport because transport is defined as including all operations and conditions associated with the movement of radioactive materials, such as container design, manufacture, maintenance and repair, preparation, dispatch, loading, routing (including interim storage in transit), unloading and reception at the final destination of the radioactive material shipments.

These events are among those that ASN follows most closely, because their potential impact on workers, whether radiological or not, requires an extreme vigilance. Among the events that are of the greatest concern to ASN are those occurring in airports.

Events in airports

Events in airports are generally handling incidents where radioactive material packages suffer impacts.

In 2010, twenty-three incidents of this type were recorded at the airports of Roissy-Charles-de-Gaulle, Orly and Marignane (Marseilles). These incidents concerned damages to type A or excepted type packages (damages ranging from simple impacts to package crushing). Two of these incidents led to a slight loss of containment (container torn), but no contamination. These two incidents were classified as level 1 on the INES scale.

In addition, a Type A package was lost in 2010. It contained Iodine 131 intended for medical uses and did not reach its destination. The package was to be sent from Charles-de-Gaulle airport to Denmark, but trace of it was lost at Charles-de-Gaulle airport. This significant event was classified as level 1 on the INES scale.

In cooperation with the DGAC and the air transport police, ASN performed several inspections in the air freight zone of Charles-de-Gaulle airport. The carriers were reminded of the need to implement a radiation protection program appropriate to the transport activities, to correctly secure the packages and to make the personnel aware of the ionising radiation risks.

4|2 Incidents and accidents during actual transport

Transport-related events are generally caused by ordinary road accidents. For this kind of event, ASN examines very closely not only the consequences for workers, but also for the public and the environment.

4|3 Nonconformity of container or content

These events are often rooted in non-compliance with the package approval certificate or the package user's guide. These events include the exceeding of radiation intensity limits or a deviation from the content described in the package approval certificate (presence of cover or omission of a seal in the container). There are usually no consequences for the workers, the public or the environment, however ASN examines them meticulously given that they can affect the public.

4|4 Transport infrastructure hazards assessments

ASN and IRSN were invited to participate in the working group organised by the Minister in charge of the Environment, aiming to publish a guide about the method to carry out hazard assessments relative to transport infrastructures. The primary goal is to standardize the content study, and then to assist infrastructure managers in this task. Decree 2007-700 dated 3 May 2007 effectively compels the largest infrastructure managers to submit a hazard study of their facility to the *préfet*[1] of the *département*[2] by May 2010.

ASN was part of the Hazardous Materials delegation at the ministry, on the one hand to propose radiological dose thresholds equivalent to those used by the other classes of hazardous materials, and on the other to propose a guide for the production of safety reports specific to radioactive materials.

The hazard thresholds used for the other hazardous materials are:
– significant lethal effects threshold (LET 5% LC);
– first lethal effects threshold (LET 1% LC);
– irreversible effects threshold (IET).

ASN considered the production of dose rate thresholds equivalent to the effect thresholds of other hazardous materials to be unwise. In consequence, ASN proposed adopting a single threshold of 50 mSv. This is consistent with the thresholds (health thresholds) in on-site emergency plans ("PUI") and with the transport regulations.

The purpose of the guide, which is not legally binding and of a which ASN issued a draft in 2010, is to provide infrastructure managers with the methodological information and the data required to evaluate the specific risks associated with the transport of radioactive materials that must be handled in their safety reports. The ASN guide is intended for the managers of the following infrastructures, which are specified in the decree of 3 May 2007 on the safety reports of infrastructures for the storage, loading or unloading of hazardous materials, implementing article L. 551-2 of the Environment Code:
– highway parking areas with a capacity exceeding 150 heavy goods vehicles;
– railway marshalling or classification yards where on average more than 50 hazardous materials wagons are present simultaneously;
– sea and river port, beyond a total annual goods traffic volume (hazardous or not) of 4 million metric tonnes per year for the sea port infrastructure and 1 million metric tonnes for the river port;
– the multimodal facilities used by hazardous goods vehicles and means of transport, including radioactive materials.

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

4|5 Radioactive material transport emergency plan

In 2008, jointly with ASND, ASN decided to organize a working group to define and harmonize emergency plans applicable to the transport of radioactive materials (PU-TMR) on the public highway or in trans shipment centres. The PU-TMR is an operational document which must describe the response of the consignor, jointly with the other concerned parties (carriers, shipping agents, designers, etc.).

In 2010, the working group agreed on a framework structure that will be issued in 2011 for application for national transport of radioactive materials in packages whose model is approved by the competent authority (ASN or ASND).

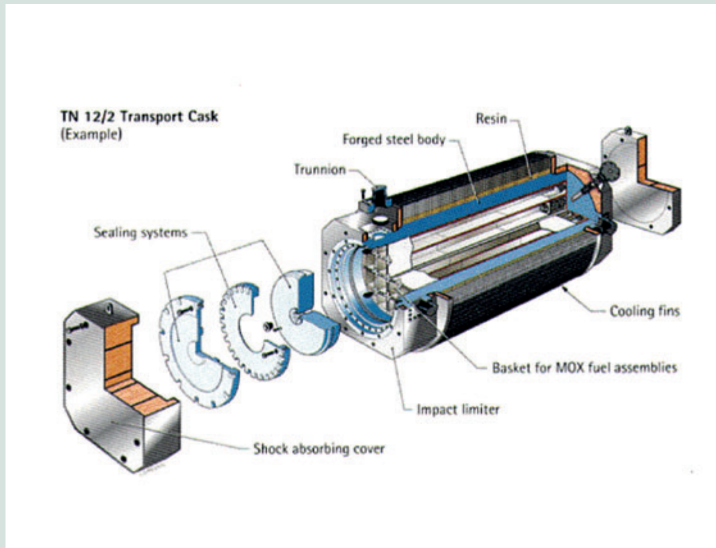
UNDERSTAND

Presence of foreign objects in containers

During the maintenance of package models TN12/2, TN13/2 and MX8, foreign objects were found inside the containers. The objects included seals, screws, and pieces of emery cloth used to clean the container. These objects are not authorized by the package approval certificate. Were they to be found in large quantities, the absence of impact of their presence on the safety of the package, particularly in terms of radiolysis would have to be demonstrated.

TN International has implemented several procedures to prevent this type of incident:
- *closing the pockets of maintenance staff with adhesive tape,*
- *checking that seals are in place before shipping.*

Particular attention shall be focused on compliance with these procedures during inspections in 2011.



Example of an irradiated fuel transport package in which seals were found

5 INTERNATIONAL ACTION

The international nature of radioactive material transport has given rise to regulations, drafted under the supervision of IAEA, ensuring that a very high level of safety is guaranteed. The drafting and implementation of these regulations give rise to fruitful exchanges between the countries. ASN considers these exchanges to be a contributing factor in the constant improvement in the safety of radioactive material transport.

Regulations

ASN is a member of 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. ASN took part in the corresponding meetings held from 14 to 18 June and from 29 November to 3 December 2010 in Vienna.

Working groups will be set up in 2011 in preparation for the forthcoming revision of the radioactive material transport regulations (future 2014/2015 edition). They will concern, for example, the acceleration forces to take into account for the securing of packages.

ASN hosted a working group on the foundations of the radioactive materials transport regulations from 11 to 15 October 2010. Organised and supervised by the International Atomic Energy Agency (IAEA), the meeting was attended by 25 participants from eight countries (France, Germany, Argentina, Belgium, Canada, Japan, the Netherlands and Sweden) and international organisations (ISO - International Standards Organisation, and WNTI - World Nuclear Transport Institute) and involved plenary sessions and workshops. It resulted in the development of methods that will be used to identify and assess the bases of the technical requirements of the radioactive material transport regulations (safety standard referenced TS-R-1).

Creation of a club of European authorities with competence for the inspection of radioactive material transport

A club of European authorities with competence for radioactive material transport was created in December 2008. ASN is a member. Within this framework, it works achieve more harmonious implementation of the regulations concerning radioactive materials and exchange operating experience feedback with the various member countries. ASN took part in the fourth and fifth plenary meetings held respectively in Stockholm in May 2010 and London in October 2010. The countries are working on an inspection guide which should be finalised in 2011.

Bilateral relations

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 in particular include Belgium, the United Kingdom and Germany. Relations with the competent authorities in these two countries are both frequent and fruitful.

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 Belgian authority (Belgian Federal Nuclear Regulating Agency – AFCN) regularly exchange know-how and experience feedback.

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 models validated in Belgium. The meeting of 28 May 2010 reviewed the various package models used in France and Belgium. A joint inspection was carried out on 16 September 2010 in the Ateliers de La Meuse after a series of manufacturing defects was found on the TN24 family of packaging containers.

The United Kingdom

France and the United Kingdom use radioactive materials for similar civil applications, such as nuclear generation of electricity, reprocessing and use of radioactive substances for medical purposes, and consequently the two authorities 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.

A bilateral Memorandum of Understanding (MoU) enables ASN to acknowledge the approval certificates issued by the competent UK authority (DfT, Department for Transport) in accordance with the applicable rules, and vice-versa. This MoU eases the procedural burden between the two countries and enables the two authorities to devote more time to important issues. ASN and the DfT also collaborate in the following areas:
- licensing procedures;
- inspections;
- emergency procedures;
- guides for domestic and international transport of radioactive materials;
- radioactive material transport standards;
- quality assurance systems.

Two discussion meetings are organised annually between ASN and the DfT, to enable them to work more closely together, particularly in reviewing the safety analysis reports for the package models used in the UK and France. A consultation meeting was held on 13 April 2010.

Germany

The French and German nuclear authorities have decided to regularly meet to discuss certain technical files. It is true, there is no shortage of subjects of joint interest. 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. A consultation meeting was held on 21 May 2010.

United States

The American nuclear regulators (NRC and DOT) and ASN have greatly increased their collaborations on subjects of joint interest (discussions on container approvals, for example). Two consultation meetings were held in London in March and October 2010.

PATRAM symposium

ASN/IRSN made two joint presentations at the PATRAM (Packaging and Transport of Radioactive Materials) symposium held from 3 to 8 October 2010. One was on operating experience feedback (REX) from events in France over the last ten years, emphasising the importance of organisational and human factors, while the other addressed the transport infrastructure safety reports.

6 OUTLOOK

In 2011, ASN will continue its inspections of the designers, manufacturers, users, carriers and consignors of radioactive material packages.

Inspecting the manufacture of the containers remains a strong priority for ASN, to ensure that they are well made, in accordance with the requirements specified in their safety analysis report.

ASN will also continue to monitor packages that are not subject to approval, particularly in the medical, conventional industry and research sectors, taking advantage of the radiation protection inspections it already carries out in these fields.

ASN will in 2011 continue to test its response organisation designed to deal with an accident involving the transport of radioactive materials. It considers that emergency exercises in the transport field are of particular importance. Given that an accident can happen anywhere, the local response organisation could be inadequately prepared to deal with it, especially if it occurs in a *département* in which there are no basic nuclear installations. These national exercises, combined with local exercises, contribute to the training of the protagonists. In 2011, ASN will continue its efforts to harmonise and strengthen the emergency plans for dealing with transport accidents through the working group which it set up in 2008, involving representatives from the industrial nuclear world.

ASN is also looking to improve the regulation of the transport of dangerous goods within nuclear sites. To achieve this, in the next two years it will be producing supplements to the regulations applicable to nuclear installations in this respect.

ASN will be continuing the technical background work prior to issue of approval certificates: periodic safety reviews of existing package models and the approval of new models incorporating innovative design features contribute to the overall upgrading of transport safety.

ASN intends to intervene as early as possible in the drafting of IAEA's recommendations. Harmonising safety and radiation protection practices in the transport field also remains a strong priority for ASN.

NUCLEAR POWER PLANTS

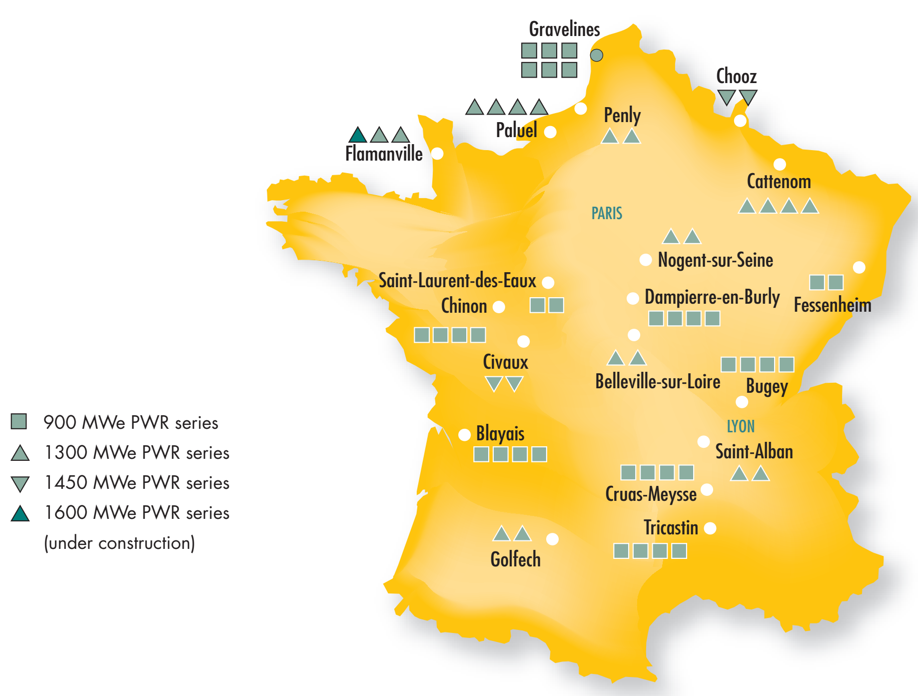
CHAPTER 12

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. One particularity in France is the standardisation of plants, with a large number of technically similar reactors, justifying a 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 decide on its position each year with regard to the current status of nuclear safety and radiation protection in NPPs.

In ASN's opinion, 2010 was a satisfactory year regarding safety and radiation protection in NPPs. However, ASN remains concerned about the impact of subcontracting of maintenance activities. Formal expression of the organisation of recourse to subcontracting for maintenance activities is satisfactory, as is the positive development observed in the area of radiation protection. Conversely, implementation of the subcontracting policy has some chronic shortcomings, relating especially to supervision of subcontracted activities and application of safety rules in a context of increasing requirements being placed on contracting companies. ASN has also pinpointed a lack of foresight in maintenance and equipment replacement programmes, especially where steam generators are concerned.

1 OVERVIEW OF NUCLEAR POWER PLANTS



Power reactor locations 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.

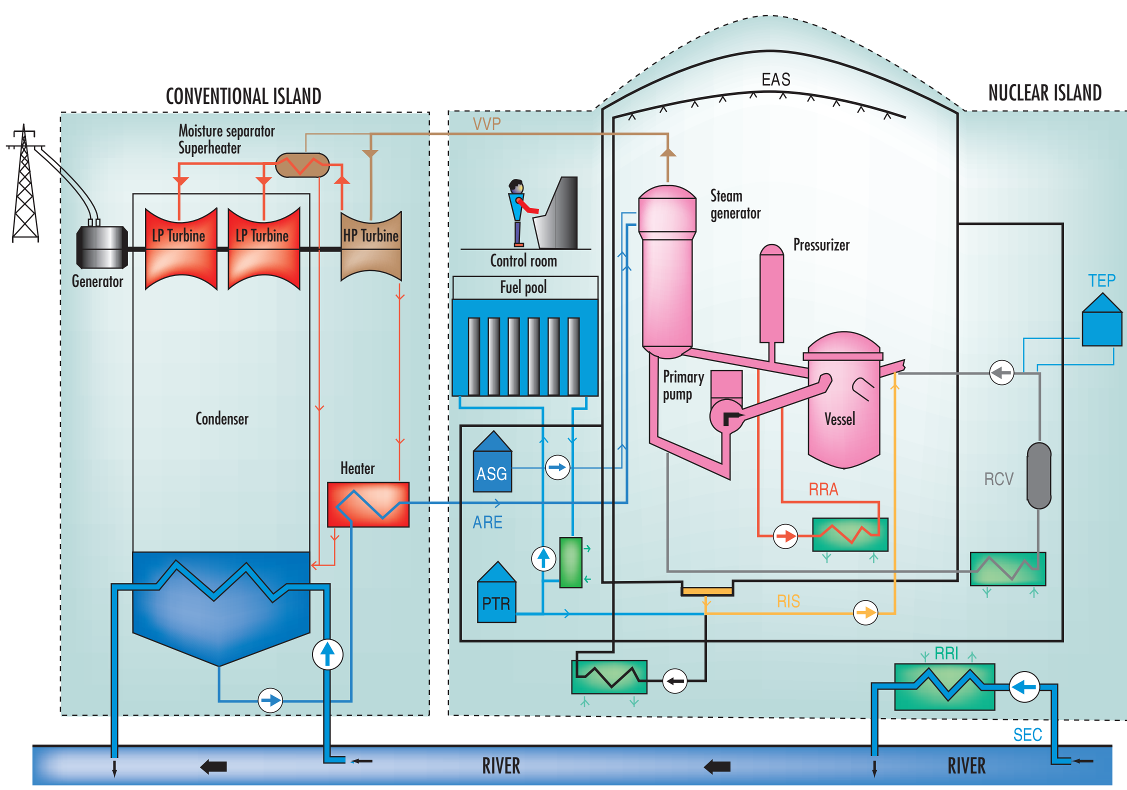
The CPY reactors differ from the Bugey and Fessenheim reactors (CP0) in building design and the addition of an intermediate cooling system between that used for containment spraying in the event of an accident and that containing heat sink water, along with more flexible operation.

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 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, and 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 as well as the building housing the fuel storage pit.

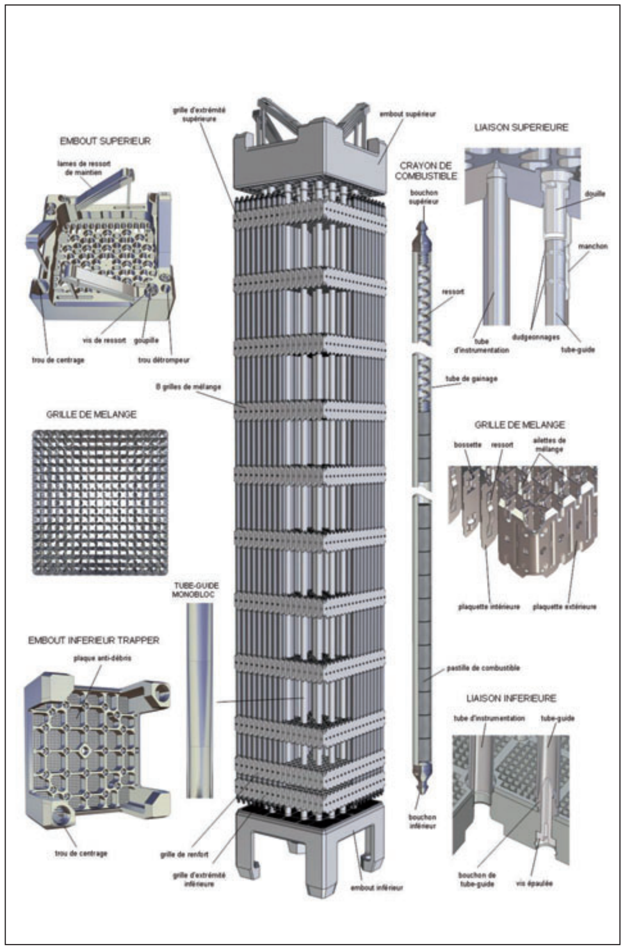
The conventional island equipment includes the turbine, the AC generator and the condenser. Some components of this equipment contribute to reactor safety.

The secondary systems belong partly to the nuclear island and partly to the conventional island.

The safety of pressurised water reactors is guaranteed by a series of strong, independent, leaktight barriers, for which the safety analysis must demonstrate their effectiveness in normal and accident operating situations. There are generally three of these barriers, 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.

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.



Fuel assembly for a pressurised water reactor

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 (absorbing 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 (UO2) 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 UO2 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 superheater separators 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.

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).

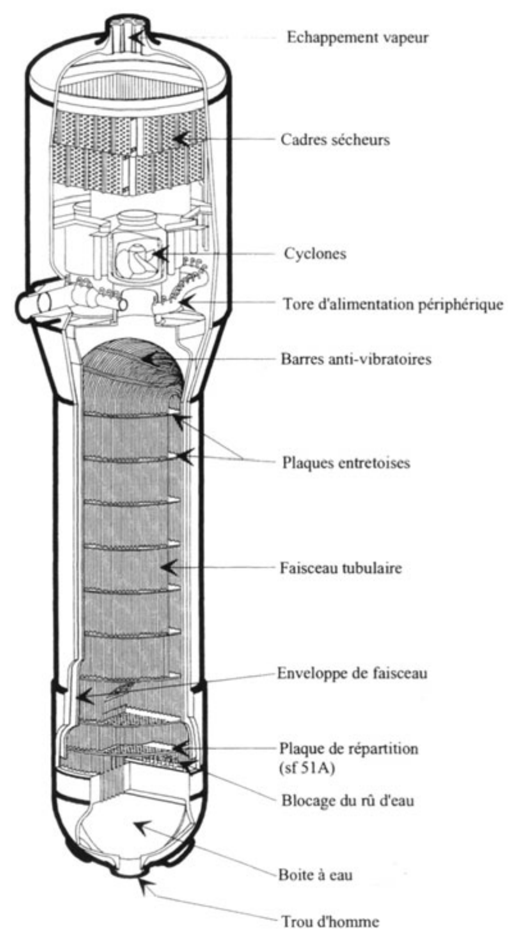
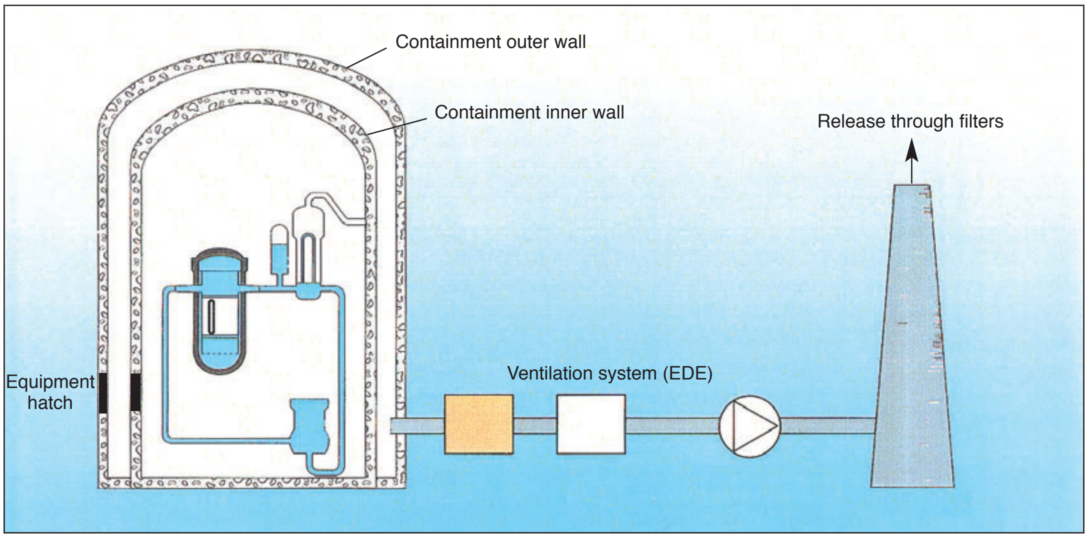


Diagram of a steam generator

Depending on the source of the cold water circulating in the condenser, the condensers are 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 releases of copper and zinc). However, unlike brass condensers, the renovated units do not constitute 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.).



Containment of a 1,300 MWe reactor

1|1|5 Reactor containment building

The PWR containment building has two functions:
– protection of the reactor against external hazards;
– containment, thereby protecting the public and the environment against radioactive products likely to be dispersed outside the primary system in the event of an accident. The containments are therefore designed to withstand the pressures and temperatures that could be reached in an accident situation, and offer sufficient leaktightness in such 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;
– 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.

View of the concrete hull of a reactor building

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 systems important for safety

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 the engineering centres (for a detailed presentation, see *http://energie.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

As part of its national regulatory role, ASN maintains relations mainly with the DPN concerning the power plants in operation and with the DIN for new reactors. ASN's contacts are the DPN head office departments with regard to handling of generic matters, that is those concerning several if not all of the reactors in service. ASN deals directly with the management of each power plant for issues specifically concerning the safety of the reactors in it. As regards equipment design and study documents, they are discussed in the first place with the DIN. Those concerning fuels and fuel management are also discussed with a third division responsible for these questions: the Nuclear Fuels Division (DCN).

1 | 2 | 2 Close examination 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.

These first of all comprise the general operating rules (GORs) applicable to reactors in service. They supplement the safety analysis report, which mainly deals with the measures taken at the design phase of the reactor, and translate the initial scenarios and findings of the various studies into operating rules.

The GORs comprise several chapters, among 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 equipment and systems that are important for safety, 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 restarting 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 the knowledge of the potential failures of the equipment.

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.

Documentation conformity review by ASN inspectors during the in-depth inspection of Chooz – July 2010

1 | 2 | 3 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:

Hydro-testing of reactor number 3 at Chinon – June 2009

– during the outage preparation phase, conformity with the applicable reactor outage safety requirements. ASN adopts a stance on this aspect;
– at the regular information meetings and inspections during the outage, how the various problems encountered are dealt with;
– at the end of outage, when the licensee presents its reactor outage report on the condition of the reactor and its readiness for restart. It is after this inspection that ASN will authorise restarting of the reactor;
– after criticality, the results of all tests carried out during the outage and after restart.

2 THE MAJOR NUCLEAR SAFETY AND RADIATION PROTECTION ISSUES

2 | 1 People, organisations, safety and competitiveness

Human and organisational factors make a determining contribution to the management of safety in nuclear installations that are operating, as well as to their design, construction and decommissioning. Ensuring that this contribution works constantly to improve safety is all the more important given that safety is always faced with other considerations, such as competitiveness.

2 | 1 | 1 Workers

Between 800 and 2,000 men and women work to operate an NPP (the actual number varies depending on the number of reactors in the plant). This workforce is made up of EDF staff and permanent service providers breaking down into categories as shown below:
– plant operation: 50%;
– maintenance: 20%;
– administration and support staff: 30%.

In addition, large numbers of service providers and subcontractors participate in the maintenance and in specific operations scheduled during outages. The numbers of additional people involved during an outage can be from 300 to 2,700, depending on the type of outage.

These workers are exposed to the “conventional” risks that are common to all industries (working at height, ground level risks, etc.) as well as to the risks arising from use of ionising radiation.

In the case of a nuclear reactor, the exposure to ionising radiation is primarily due to activation products and, to a lesser degree, from fission products present in the fuel. All types of radiations are present (neutrons, α, β and γ) and the risk of exposure can be either external or internal. In practice, over 90% of the doses are from external exposure to β and γ radiation. Erosion and corrosion are the phenomena at the origin of this exposure, as they release materials or chemical species that are activated or that may be activated by a neutron flux and that are carried by the primary system.


Use of a self-checks during a training session on a training worksite


ASN inspection of the control room during the ten-yearly inspection of the Tricastin NPP – May 2009

These mechanisms notably account for the presence in the primary system of radio-isotopes of cobalt such as ^{58}Co and ^{60}Co, responsible for 80% of the doses received from external exposure.

Eighty per cent of the doses received by workers are related to maintenance operations performed during reactor outages. In 2010, the doses were distributed over a workforce of around 45,000 people, including EDF staff, service providers and subcontractors, as shown in graphics 4, 5 and 6, below (see point 6 | 1 | 2).

Monitoring of application of labour related legislation in NPPs is addressed in point 3 | 8.

2 | 1 | 2 Regulating human and organisational factors

For ASN, everything in the working situation and the organisation that has an influence on the actual activity of the individuals working in an installation such as a nuclear power plant constitutes what are called human and organisational factors (HOF). These factors are particularly concerned with anything that has to do with the organisation of work, the people involved (workforce, skills, motivation, etc.), the procedures, technical organisation and the working environment.

Whatever the level at which the activities to be carried out are specified, the situations actually encountered by individuals in the field vary constantly (equipment which does not react as expected, night-work, an inexperienced colleague, varying levels of urgency, labour disputes, etc.), obliging them to adapt how they work to attain the expected outcome at a cost (in terms of fatigue, stress, health, and so on) that is acceptable to them.

It is the licensee's responsibility to ensure that personnel are placed in satisfactory working conditions and have adequate means to adapt their procedures to the variability encountered in the working situations. Personnel must be able to carry out their duties correctly (safety, security, efficiency, quality) at an acceptable health cost, while deriving adequate benefit from it (feeling of a job well done, recognition of their peers and their hierarchy, development of new skills, and so on).

Inappropriate resources – for instance inadequate tools, cramped or poorly lit working environment, insufficient training or practice, poor design of man-machine interfaces, shortage of spare parts, professional teams destabilised by organisational change, under-manning or insufficient time allocated for tasks – can lead to risks. An operating situation in which performance is satisfactory but in which this was obtained at very high human cost to those involved is, therefore, a source of risk: only a slight variation in the context or change of a member of personnel can be enough to prevent the required performance level from being reached.

ASN regulation

ASN asks licensees to develop an explicit policy to address HOF, and to acquire the necessary resources for effective action and to take steps according to appropriate approaches and methodologies.

ASN regulation of HOF is based, mainly, on the inspections performed in the NPPs. These inspections are an opportunity to review the licensee's HOF policy and organisation, the means and resources committed, particularly in terms of specific skills, the steps taken to improve how HOF are incorporated into operations and to assess actual implementation and results in the field. ASN also relies on the assessments carried out at its request by IRSN and the Advisory Committee for nuclear reactors (GPR).

Incorporating HOF

L'ASN considers that licensees must systematically implement an approach incorporating HOF into the following areas 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 establishing feedback on reactors during their design, building and operation, and particularly analysis of causes of HOF and the lessons to be learned.

Implementation of the approach must be appropriate to the safety issues identified by the licensee. Adequate and appropriate resources and skills must be committed by the licensee at both national and local levels to allow implementation of the HOF approach.

2|1|3 Regulating the management of employment, skills, training and qualifications within EDF

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 (see point 3|2|1 in Chapter 3) states categorically 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 qualification must be based on justification of the skills acquired through training and professional experience and the skills demonstrated in performance of the professional discipline concerned.

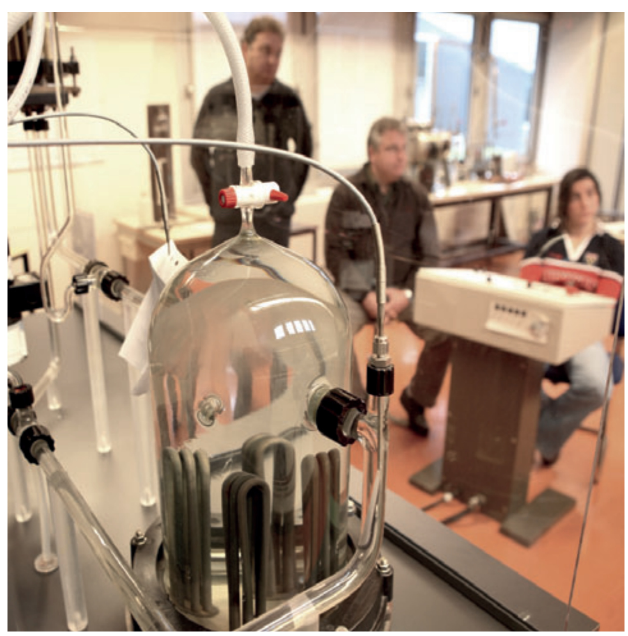
ASN regulation

Pursuant to the above-mentioned Article 7 of the order of 10 August 1984, ASN monitors the quality of the employment, skills, training and qualifications management system and its implementation in the EDF NPPs. This monitoring relies in particular on the inspections carried out in the plants. They are an opportunity to analyse the results obtained and the quality and the adequacy of the organisational and human arrangements actually made with regard to these issues. ASN also uses the assessments made at its request by IRSN and the GPR.

2|1|4 Incorporating safety management into the general management system

In its INSAG 13 document *"Management of Operational Safety in Nuclear Power Plants"* published in 1999, IAEA gives the following definition: *"The safety management system comprises those arrangements made by the organisation for the management of safety in order to promote a strong safety culture and achieve good safety performance"*.

Safety management concerns the steps a licensee must take to establish its safety policy and to develop and implement a system allowing the safety of its installation to be maintained and constantly improved. It is based on a process of continual safety improvement, incorporating:



Training session in the training site laboratory in the Paluel NPP

– definition of requirements, of an organisation, or roles and responsibilities, of means and resources, particularly with regard to skills;
– preparation and implementation of arrangements for guaranteeing or enhancing safety;
– monitoring and evaluation of the implementation of these arrangements;
– improvement of the system on the basis of the lessons learned from the inspections and assessments carried out.

For ASN, the safety management system must provide a framework and support for the decisions and actions which either directly or indirectly concern safety issues. The safety management steps taken by the licensee must lead to decisions and actions that promote safety. They must also convey a message that enables the stakeholders to give safety the importance it deserves in their daily activities. Finally, it must be possible to compare them with the results achieved, to allow continual improvement and to ensure that safety progresses.

ASN regulation

The order of 10 August 1984 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. The requirements are mainly concerned with the organisation that the licensee, who has primary responsibility for safety in its installation, must put in place to ensure control of the activities affected by quality.

ASN considers that safety management must be a part of the general management system, to ensure that safety is given consideration in the same way as the other interests protected by the TSN Act, such as radiation protection, environmental protection, but also the security of the electricity grid, the guaranteed supply of electricity to the country, as well as the cost control, NPP availability or corporate competitiveness objectives.

Improving safety must be a permanent aim for management. During its inspections, ASN was able to assess the progress monitoring initiated by the sites, which is on the whole satisfactory. Improvements are needed in the traceability of this progress monitoring. It is also important for these measures to be clearly formulated and carried out at clearly defined intervals.

2|1|5 Monitoring the quality of subcontracted operations

A large proportion of reactor maintenance operations in France's NPPs is subcontracted by EDF to outside companies. This activity involves about 20,000 contractors and subcontractors.

Implementing an industrial policy such as this is left to the initiative of the licensee. Pursuant to the order of 10 August 1984, ASN's role is to ensure that EDF exercises its responsibility for the safety of its installations, by implementing a quality approach, and in particular by monitoring the conditions under which subcontracting takes place. This approach is officially laid out in the "Progress and sustainable development charter" signed by EDF and its main service providers.

Selection and monitoring of the activities performed by the contractors

EDF has set up a contractor qualification system based on an assessment of their technical know-how and their organisation. As a complement to this, EDF must ensure the quality of preparation of operations and monitor or arrange for monitoring of the activities performed by its contractors. It must also make use of feedback to continuously monitor contractors' capacity to retain their qualification.

ASN carries out inspections on the implementation of and compliance with EDF contractor monitoring requirements in the NPPs. As part of its oversight of the construction of the FA3 reactor, ASN also carries out inspections on this aspect within the various engineering departments in charge of the design studies (see point 2|4|2).

2|1|6 Safety and competitiveness

Act 2000-108 of 10 February 2000, on modernisation and development of public electricity service introduced in-depth change into the electricity market in France. The act stipulates EDF's public service obligation but also transposes a European directive on the internal electricity market into legislation, notably placing EDF in competition for generating and supply of electricity to industrial and private customers. Competition will increase under reform of the electricity market (Act 2010 -1 488 of 7 December 2010 on new organisation of the electricity market). EDF has opened its capital, with the French state retaining 84% of the shares.

The concern with cost control is today stressed more by the operator in its dealings with the ASN. Technical discussions with EDF clearly reflect a harder line with regard to economic feasibility, justification of certain demands and deadlines, and on the very short-term handling of some files during unit outages.

ASN regulation

To develop control and regulation in this context, ASN has developed tools for early identification of possible drift: developments in spending, purchases relating to improving of safety (maintenance and R&D), personnel management, development of safety and radiation protection indicators and changes in the licensee's organisation are the object of increased vigilance. Developments in spending indicate that EDF is continuing to invest in the maintenance of its assets and that the R&D effort remains satisfactory. In general, ASN's examination found no drift that was cause for concern. However, ASN will, in the future, continue to be attentive to the possible consequences of changes to EDF's organisation introduced by the company in order to achieve its economic targets.

ASN will also develop exchanges with its counterparts in other countries to work towards a harmonisation of requirements in the face of the increased international nature of licensees and of the coming competitive electricity market. Work by the Western European Nuclear Regulators' Association (WENRA) and the OECD's Nuclear Energy Agency, (NEA) and by the International Atomic Energy Agency (IAEA), in which ASN takes an active part, is contributing to this harmonisation (see Chapter 7).

Work meeting on a civil engineering worksite involving a team of contractors

2|1|7 Submitting certain operations to a system of internal authorisations

ASN has requested that EDF submit certain operations relating to operating of installations and considered as sensitive from the nuclear safety and radiation protection standpoint, to a system of stricter internal checks as planned in ASN decision 2008-DC-0106 of 11 July 2008 concerning the procedures for implementation of the internal authorisation system in BNIs. Internal authorisations systems were approved by ASN for the following operations:
– lowering the primary system water level to the "low operating range" of the RRA system with core loaded (transient commonly called "mid-loop operation");
– reactor restart after outages without significant maintenance.

Authorisations in these two areas can only be issued by EDF management or the management of the NPP concerned, following a review by an independent internal body comprising the safety and quality managers. EDF also checks the working of these processes and reports on them to ASN.

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 is cultivating 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, degradation due to ageing, etc. ASN considers that regular inspections and searches for anomalies carried out continuously by licensees contribute to 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 conformity anomalies (INES scale level 1 and higher) by means of ASN's website. An upstream system was created to ensure that ASN is specifically informed of any conformity anomalies 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 nonconformity 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 nonconformity. 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 conformity anomaly which significantly impairs safety must be corrected rapidly, even if the remedial measures entail a large volume of work. 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 anomaly. 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 anomaly is present is considered to be unacceptable and if there is no appropriate remedial measure. Conversely, the lead-time allowed for correction of a less severe anomaly 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 lead-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 2010 figures in 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. In 2011, the GPR met to examine the important events of the 2006–2008

TO BE NOTED IN 2010

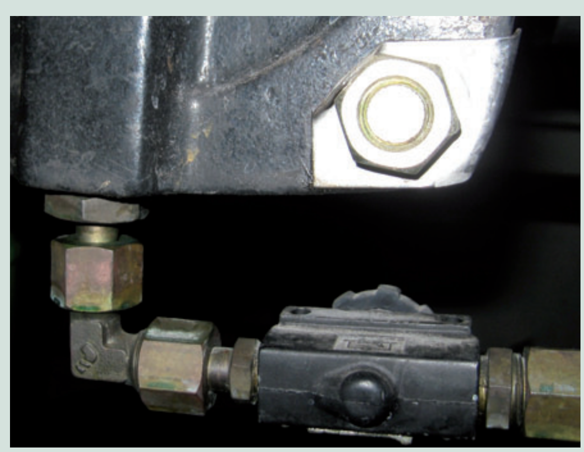
Incorrect tightening of threaded fasteners on seismically qualified valves

On 7 September, EDF notified ASN of an event relating to incorrect tightening of the threaded fasteners of seismically qualified valves in the Chooz and Civaux 1,450 MWe NPPs. The fault found was the absence of any tightening device or the presence of inappropriate devices on the fasteners of seismically qualified valves. Errors made during initial installation or during maintenance operations were the cause of these anomalies, which compromise the qualification of the valves.

Following this event, in 2009, EDF took action to perform checks and to re-establish compliance for the anomaly situations found on the Chooz and Civaux reactors. In February 2010, ASN asked EDF to introduce additional measures to prevent recurrence of these errors on the 1,450 MWe reactors and also on the 900 and 1,300 MWe reactors.

On 28 June 2010, EDF updated its incident reporting and established an inspection programme covering all of the reactors operated by EDF, to be applied from September 2010. EDF established the inspection programme on the basis of ranking of equipment to be checked as indicated by a safety analysis. EDF committed to return any fault observed to a state of compliance after these checks.

The anomaly was rated at level 1 on the INES.



Threaded fastener clamping devices: locking plate bent down on bolt period with a focus on events that were significant for radiation protection and for the environment, specific devices or means, post-maintenance testing operations, administrative sanctions, or anomalies encountered on steam generators.

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 for an in-depth examination of the condition of the NPPs, to check that they comply with all the safety requirements and the applicable safety provisions. Its objective is also to improve the level of safety of the installations, particularly by comparing the applicable requirements with those applied to more recent NPPs. The periodic safety review ends with transmission of the report required in III of article 29 of the TSN Act.

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 NPP 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 to the applicable safety requirements and regulations including, notably, the creation of authorisation 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.

Possibly after consulting the GPR, ASN may rule on the study topics envisaged by the licensee before the launch of the safety reassessment studies, during the phase known as the periodic safety review orientation phase.

3) Submission of a review report: subsequent to the above-mentioned steps, the licensee sends a review conclusions report to ASN. In this the licensee states its position on the regulatory conformity of its installation, and on the benefits of implementing or not implementing envisaged modifications intended to improve the installation's safety. The review report contains information provided for in Article 24 of Decree 2007-1557 of 2 November 2007, amended.

Implementation of the improvements emerging from the safety review

The ten-yearly outage is an ideal opportunity to make the modifications identified in the periodic safety review. 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. As an example, the third ten-yearly outages for 900 MWe reactors (reactors 1 in the Tricastin and Fessenheim plants) began in 2009, whereas the last 1,300 MWe reactors will undergo their second ten-yearly outage in 2011. The third ten-yearly outages for 1,300 MWe reactors will begin in 2015, with reactor 2 at the Paluel plant.

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.

Decree of 2 November 2007 clarified the requirements concerning implementation of changes by EDF and their review by ASN. In 2010, the equipment change notifications received by ASN were primarily aimed at improving reactor safety and correcting conformity anomalies.

Documentary modifications are also subject to prior notification to ASN, under the terms of 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 covered are presented in points 3|1|1, 3|1|2 and 3|2|4.

2|3 Taking account of nuclear power plant (NPP) ageing

NPPs, like all industrial installations, are subject to ageing. ASN ensures that, in line with its general operating and maintenance strategy, EDF takes account of ageing-related phenomena in order to maintain a satisfactory level of safety throughout installations' lives.

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 2010, 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 degraded 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.

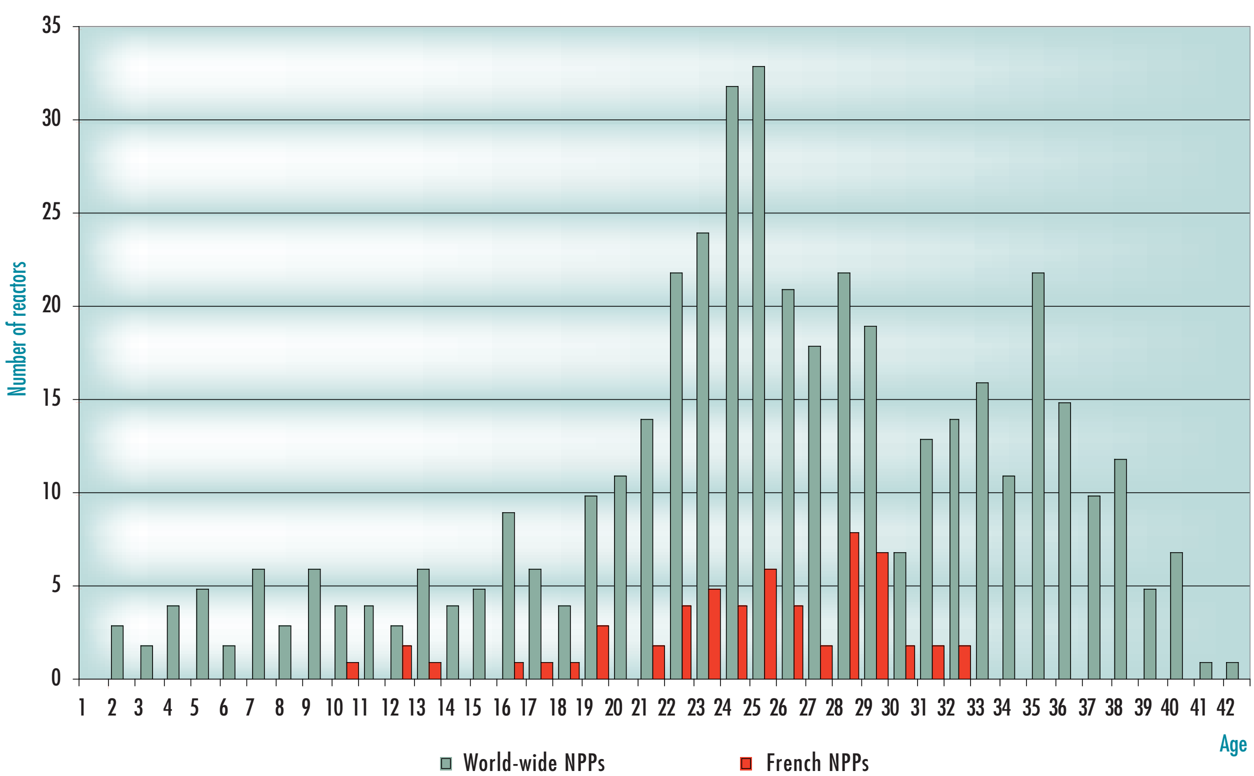
Equipment or component obsolescence

Equipment that is important for safety is "qualified" for installation in NPPs. 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 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.

Graph 1: Breakdown by age of reactors in service worldwide (sources: IAEA, March 2009 and CEA, Elecnuc edition 2008)



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 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. Review – of which the primary purpose is to increase the level of safety of the installations – also provides the opportunity for in-depth examination of ageing of equipment (see point 2|2|3).

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. However, this generic assessment does not take account of any specific features of individual reactors. ASN will therefore rule at a later date 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. On 4 November 2010, ASN pronounced on the conformity of reactor 1 in the Tricastin NPP with regard to the applicable safety requirements, and on the conditions for its continued operation for a period of up to 40 years, after the third ten-yearly outage. As an example, EDF has implemented modifications to the design of this reactor in order to reduce radiocative releases to the environment in the case of rapid draining of the spent fuel pit where the spent fuel assemblies are stored before their removal from the plant. Modification was focused on the system measuring the water level in the spent fuel pit and on the PLC controlling the cooling water pumps.

The periodic safety review concerning the second ten-yearly outages for the 1,300 MWe reactors

In 2006, subsequent to the safety review, ASN declared itself to be in favour of continued operation of the 1,300 MWe reactors up to their third ten-yearly outage. The changes arising from this safety review will be implemented by 2014. In 2010, the Belleville 1 and Nogent 2 reactors incorporated the changes following their second ten-yearly outage safety review.

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. Reactor 2 in the Paluel NPP will be the first to be subject to a third ten-yearly outage, in 2015. 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 orientation 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. In 2010, the modifications resulting from the safety review concerning its first ten-yearly outage were implemented on the Chooz B1 reactor.

Issues surrounding continued reactor operation

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. Two objectives are therefore imperative. First, a re-evaluation of the safety level in the light of that required of EPR type reactors or their equivalent is necessary, with proposals to bring about significant and relevant improvements to the reactors. R&D work in France and elsewhere is already indicating orientations that could lead to answers, and improvements that would provide significant reductions in radioactive releases in case of severe accident are being studied. Second, strict compliance of the reactors with the applicable regulations must be demonstrated. At the same time, ageing and obsolescence of the equipment will have to be managed. Where these two points are concerned, ASN expects far-reaching proposals from the licensee. With a view to a request for continued operation beyond 40 years, ASN has referred the matter to the GPR which will meet at the end of 2011 to establish the safety requirements for reactors at their fourth ten-yearly outage.

2 | 4 The Flamanville 3 EPR reactor

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 1,600 MWe EPR type reactor on the Flamanville NPP, which already houses two 1,300 MWe 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. 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. The civil engineering work has since continued. Installation of the first components (tanks, pipes, , electrical cables and cabinets, etc) began in 2010. In parallel with the construction work on the Flamanville site, manufacture of the pressure equipment, in particular that of the primary system (vessel, pressuriser, pumps, valves, pipes, etc.) and secondary system (steam generators, valves, pipes, etc.) is in progress in the manufacturers' facilities. In the summer of 2010, EDF announced that it was planning commissioning of Flamanville 3 in 2013.

2 | 4 | 1 The steps up to commissioning

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, send ASN a file comprising the safety analysis report, the general operating rules, a study of NPP waste management, the on-site emergency plan and the NPP decommissioning plan.

In anticipation of the sending of the complete commissioning request file, ASN, with IRSN, has undertaken an advance review of:
– the technical references necessary for demonstration of safety and for finalising of the detailed reactor design;

ASN inspection of the EPR site at Flamanville

– the detailed design of some systems that are important for safety presented in the safety report;
– certain elements forming part of or guiding compilation of the commissioning request file.

This advance review is intended to help prepare examination of the commissioning request file. At the same time as this advance technical review, to prepare for the commissioning authorisation, ASN also checks the construction of the NPP in order to rule on its quality and its ability to comply with the defined requirements.

Advance review of required documents

In 2010, ASN and IRSN continued with reviews started in 2009, essentially of the future general operating rules. To date review has concerned the doctrines for drafting of technical and operating specifications and for periodic testing, the operating rules in case of incident or accident, and the principles of organisation and human and technical resources planned by EDF for operation of the Flamanville 3 reactor. Reviews have also been undertaken on radiation protection for workers and on the internal emergency response plan.

2 | 4 | 2 Construction oversight in 2010

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;
– controlling the quality of performance of the NPP construction activities in a manner proportionate to the safety, radiation protection and environmental protection issues;
– 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 and erection of structures, systems and components, either on the NPP 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 2010 is described in point 5 | 1.

Oversight of nuclear pressure equipment manufacture

Nuclear pressure equipment comprises the components of a nuclear installation subjected to pressure, which can give rise to

View of the concrete formwork of the EPR spent fuel pools – August 2010

Overview of the EPR construction site – August 2010

radioactive releases if they fail (vessel, piping, steam generators, etc.), or to accidents. 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). ASN considers that the quality of nuclear pressure equipment has to be exemplary, because it determines the safety of nuclear installations. Within this framework, ASN or inspecting organisations accredited by it, evaluate compliance with regulatory requirements for each item of pressure equipment for the EPR reactor.

Oversight by ASN and its accredited organisations comes into play at different stages of 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. The manufacturer must also demonstrate its ability to control possible risks of variation in quality of materials arising from, for example, the complexity of manufacturing operations.

2 | 4 | 3 Cooperation with foreign nuclear regulators

Installation of a steam generator supply tank on the EPR site – December 2010

At a time when nuclear programmes are enjoying renewed interest worldwide, and so as to share experience with other regulators, ASN is increasing its technical exchanges with its foreign counterparts on the 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 2010, ASN and IRSN participated in bilateral meetings on these subjects with a number of foreign nuclear safety regulators: Finland, US, Switzerland, China.

Given the EPR reactor construction projects at Olkiluoto, in Finland and Flamanville, in France, ASN and IRSN have maintained enhanced cooperation with the Finnish nuclear regulator (STUK) since 2004. In 2010, this enhanced cooperation took the form of a technical meeting and visit to the Olkiluoto 3 construction site, with an agenda focusing on civil engineering and mechanical assembly.

Regular discussions between STUK and ASN also take place in order to share experience of nuclear pressure equipment manufacturing.

As nuclear installations are also be constructed in the US, exchanges with the American regulator, NRC, also took place in 2010, on the subject of oversight of construction of nuclear installations. For example, NRC's construction inspectors were able to observe an ASN inspection of the Flamanville 3 construction site.

Towards multinational cooperation

Some international bodies such as the NEA and WENRA also provide opportunities for exchanges on practices and lessons drawn from overseeing reactor construction.

In this context, ASN participated in the work outlined below, as a member of working groups set up to foster international cooperation in the area of evaluation of reactor design (Multinational Design Evaluation Programme, [MDEP], see Chapter 7 point 2 | 4):
– five themed meetings were held in 2010 with member countries of the MDEP group, focusing on the evaluation of the detailed design of the EPR. IRSN also took part. The meetings addressed radiation protection, severe accidents, instrumentation and

ASN participation in the IRRS (Integrated Regulatory Review Service) at the United States NRC (Nuclear Regulatory Commission)

ASN participation at the IAEA Consultancy Meeting held in Vienna (Austria) from 29 June to 2 July 2010

control, probabilistic safety studies, accident and transient condition monitoring. The plenary group also met twice, in May and November. The latest of these meetings was held in China;
– two meetings of the MDEP group on technical codes and standards were held in 2010;
– two meetings of the MDEP group on inspection practices and suppliers were held in 2010.

At the end of September, ASN also participated in a meeting of the WENRA working group on inspection practices and in working meetings on 9–10 November 2010, after which the WENRA members established their position on the safety objectives for new nuclear reactors (see Chapter 7, point 2 | 1 | 5).

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. For ASN, these international exchanges are one of the driving forces behind the harmonisation of safety requirements and regulatory practices.

TO BE NOTED IN 2010

Outcomes of enhanced cooperation between ASN and STUK

Finland was the first country to undertake the construction of an EPR. It was therefore natural for ASN and STUK to initiate enhanced cooperation. This enhanced bilateral cooperation is intended to strengthen the conclusions of the technical reviews conducted in each country on identical subjects and to share information on the difficulties encountered in overseeing detailed design, construction or manufacture. While there are sometimes differences in the ways in which the two countries address the subjects and oversee construction, the fact remains that the difficulties encountered are the same, in terms of design, construction and manufacture.

Accordingly, a meeting is organised between STUK and ASN every sixth months, with the participation of IRSN. Held by turns in France and in Finland, the meetings are organised in two stages: after technical discussions, the "visitors" act as observers to an inspection carried out on the construction site by their counterparts.

The meetings also provide the opportunity to benefit from the experience gained by each of the countries. For instance, the technical inspection of the containment metal liner welds appeared relevant to ASN which subsequently asked EDF to establish a new weld inspection programme on the basis of the Finnish practice.

Additional occasional meetings are also held as a complement to these events. Organised on a case-by-case basis, they focus on a particular technical theme. This was the case in 2010 for discussion of containment and of the quality of manufacture of some items of pressure equipment. It was these exchanges that led the two regulators to conduct a joint inspection of AREVA NP at one of the supplier's facilities (the FIVES NORDON company, Nancy, France (see point 5|1).

Lastly, it should be emphasised that the enhanced cooperation between ASN and STUK has led licensees and manufacturers to institute the organisation necessary for exchanges in order to share their operating feedback and to attempt to anticipate possible difficulties.

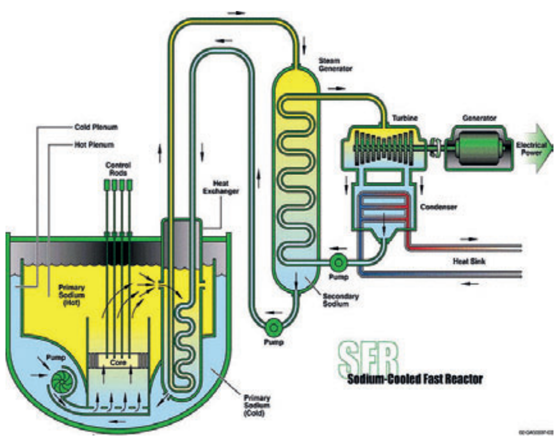
2 | 5 The reactors of the future: initiating discussions on generation IV safety

The French Alternative Energies and Atomic Energy Commission (CEA), in partnership with EDF has, since 2000, been involved in looking at the development of the fourth generation of nuclear reactors[1] ("GEN IV"), notably 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. Industrial development of fourth generation reactors in France is envisaged for the 2040–2060 period. 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.

In 2010, CEA undertook studies for a prototype SFR, under the ASTRID project. For CEA, this project forms part of the preparation of fourth generation reactors. CEA also informed ASN that its was maintaining its R&D activities on gas cooled fast reactors with a view to the development in a European context of a low-power experimental reactor (50–100 MWth) that will not generate electricity (the ALLEGRO project). The commissioning of this experimental reactor may be envisaged for 2025-2030.



Schematic of a sodium-cooled fast reactor

With this both medium- and long-term view, ASN wishes, at a stage well upstream of the regulatory procedure, to track the development of fourth generation reactors by French industrial concerns and the associated safety concerns – as was the case for the EPR – so as to be in a position, at the appropriate time, to establish the safety objectives for these future reactors. During meetings in 2010, ASN also indicated to the French stakeholders in the project its expectations regarding the framework to be established for exchanges for examination concerning the safety aspects of this project, and regarding the first documents required to begin technical discussions. These documents, forwarded at the end of 2009 and in 2010 by the French project stakeholders, relate to:

- the justification of the choice of technology selected for development in France;
- national and international operating experience feedback on the SFR reactors.

In 2011, ASN plans to obtain the GPR's opinion on these documents. In particular, the feedback must allow identification of the areas of research and development that warrant follow up or the improvements that would need to be made to installations if SFR reactors were to be operated again in France.

While it is perfectly legitimate to expect improved safety of fourth generation reactors in comparison with current ones, ASN nonetheless feels that it is premature to attempt now to fix safety objectives for reactors that will become commercially viable in several decades. Although the initial considerations within this framework are on the safety outlook for those SFR reactors highlighted by the CEA for its industrial prototype project, ASN wishes, in parallel, to maintain a watching brief on safety for the other types of reactors so as to, at this stage, maintain an open debate, especially with its foreign counterparts, on the safety objectives for the next generation of industrially produced reactors.

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 the phenomenon of sump clogging, or studies into

1. "4th generation" reactors in opposition to the reactors currently available to renew the installed base of so-called "3rd generation" reactors (this name itself being in opposition to the present installed base of second generation reactors, e.g. in France, the pressurised water reactors (PWR) that succeeded the gas-graphite reactors of the first generation).

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.

Furthermore, if this knowledge of the latest research findings is important during international discussions between safety regulators, when comparing their nuclear safety and radiation protection actions, then it is essential to the ASN and IRSN contribution to the drafting of recommendations for the IAEA guides.

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;
– the reactor lifetime issue: EDF's wish to continue operation of the existing plants has initiated research into the ageing of materials and the evolution of structures and components, particularly the performance of the concrete containments and the properties of steel under the effects of irradiation;
– benefiting from feedback on events: research into the risks of flooding or modelling of movements of oil slicks that could affect NPP operation are worthy of note in this regard.

ASN is aware of the high stakes involved in being familiar with the latest research findings and has set up an organisation to more precisely identify its requirements. ASN thus identified the main subjects of interest, which would require greater investment.

3 NPP SAFETY

3 | 1 Operation and control

3 | 1 | 1 Operation under normal conditions: ensuring compliance with general operating rules and authorising changes to documents

Changing technical operating specifications (STE)

Chapter III of the general operating rules (GOR) contains technical reactor 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. Moreover, 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 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 procedure or sequence to be applied. These operating documents are drafted on the basis of incident and accident operating rules, as presented in chapter VI of the GOR. Implementation or modification of these documents must be notified to ASN.

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 GOR, 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 guide (GIAG).

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.

Furthermore, taking advantage of nuclear reactor standardisation, EDF is deploying the "pilot equipment" maintenance concept. This maintenance is based on the definition of uniform technical families of similar equipment, operated in the same way in all the NPPs in operation. EDF considers that the selection and close monitoring of a limited number of these equipment items – which then act as pilot items within these families – could, if no failure is detected, spare systematic monitoring of all the equipment in the family.

In this context of widely changing methods and in the light of nuclear reactor ageing, ASN asked the GPR for its opinion on EDF's maintenance policy and its implementation in NPPs. The GPR held a meeting on this subject on 27 March 2008. On the basis of this review, ASN considers that the methods for optimisation of programmes for maintenance of equipment important for safety 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 failure to detect a new or unforeseen fault, and has therefore asked EDF to underpin their dissemination by maintaining 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 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, the AP913. This methodology was developed in 2001 by the Institute of Nuclear Power Operations (INPO) working with American licensees. ASN will follow the introduction of this new doctrine closely.

3 | 2 | 2 Examining the qualification of scientific applications

The scientific applications contributing to 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 the application can be used in complete confidence within a specific field.

In 2010, ASN continued to review applications which will be used for EPR reactor studies. Furthermore, ASN is continuing its work aimed at defining the principles and methods to be used for the qualification review of the computer codes 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, undergo qualification by an entity of proven competence and independence. This entity, the Qualification Commission, has been accredited by the COFRAC since 2001; it is to request renewal of its accreditation before May 2011. The role of the commission is to assess the

Ultrasonic inspection of a weld joint

representativeness both of the mock-ups used for the demonstration and 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 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 in progress to meet new needs, especially for the Flamanville 3 reactor for which 41 applications are to be qualified. In order to reduce dosimetry, ultrasound applications are preferred to radiography.

3|2|4 Authorising periodic test programmes

In order to check the correct operation of equipment important for safety 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 GOR.

ASN is called on regularly to decide on declarations of modification of periodic test programmes and carries out review of design of periodic tests for the EPR.

3|3 Fuel

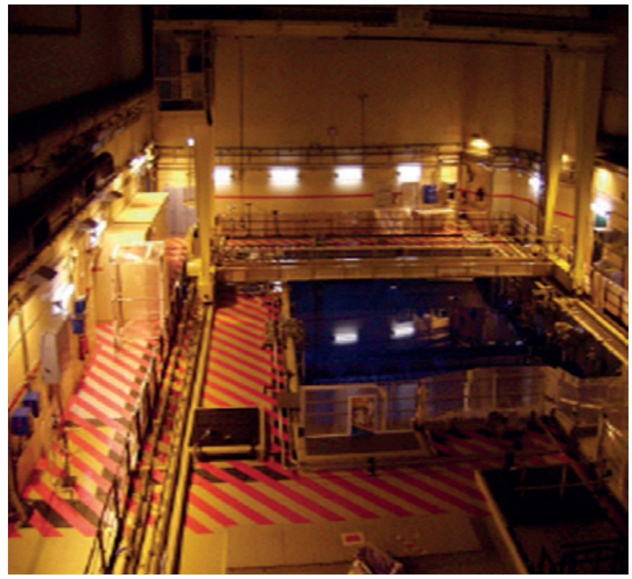
3|3|1 Controlling in-pile fuel management changes

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).

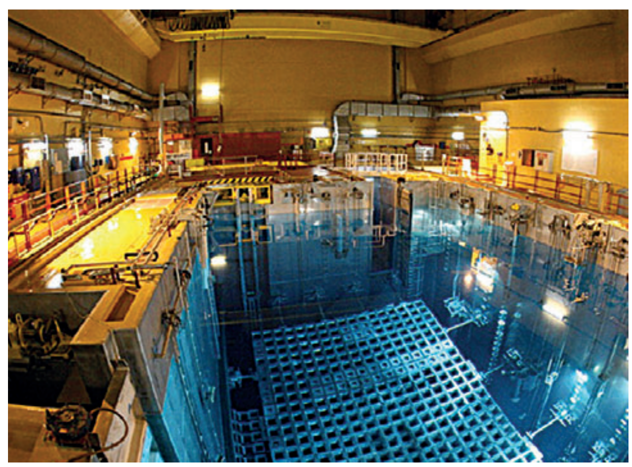
ASN ensures that each new mode of fuel management is the subject of a specific safety case for the reactors concerned, based on the specific characteristics of the new fuel management. When a change in the fuel or its management model leads to EDF revising an accident study method, this requires prior review and cannot be implemented without ASN approval. Since 2007, the adoption of new fuel management requires a decision from ASN containing implementation requirements.

3|3|2 Monitoring fuel integrity 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. Increase in activity beyond pre-determined threshold levels is an indication of loss of leaktightness of the fuel assemblies. Such faults appeared, notably, in fuel assemblies made from M5 alloy (see box). If the activity level becomes too high, application of the GOR leads to reactor shutdown before the end of the normal cycle. ASN has required of EDF that it search for and identify the assemblies containing leaking rods when unloading the core, and that EDF forbid their reloading. These assemblies may be repaired by replacement of the leaking rods before being re-used.



Marking out of a foreign body exclusion zone around the spent fuel assembly storage pool in Paluel



Spent fuel pool

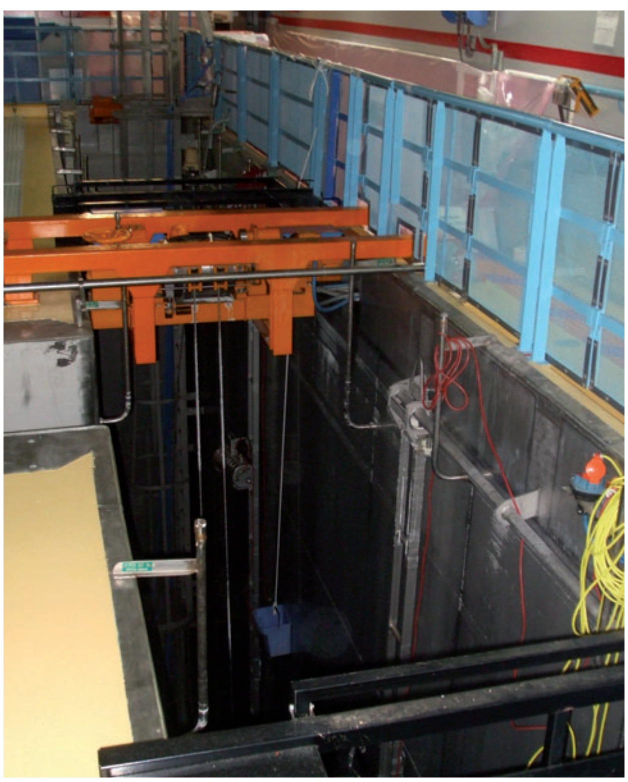
ASN also ensures that EDF analyse the causes of leaks and that it, notably, should implement examinations of leaking rods to determine the cause of the failure and to remedy this as soon as possible. Failure may be due to an inadequacy in design in relation to the loads actually sustained or to the presence of foreign bodies in the primary system damaging the cladding. Preventive and remedial actions 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 for information drawn 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. Supervision of the operation of these systems is regulated by the order of 10 November 1999, mentioned in chapter 3, point 3 | 6.

3 | 4 | 1 Monitoring and inspection of 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. In 2010, six main primary systems underwent periodic post-maintenance testing: on the Belleville 1, Chinon B4, Nogent 2, Tricastin 2, Bugey 2 and Chooz B1 reactors.



View of a fuel assembly handling device

3 | 4 | 2 Monitoring of nickel-based alloy zones

Several parts of pressurised water reactors are made from nickel-based alloy, for example the steam generator (SG) tubes and partition plates as well as vessel penetration tubes. However, in reactor operating conditions, one of the alloys used, Inconel 600, has proved to be susceptible to stress corrosion. This 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 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. To date, the volumetric examination of the vessel penetration tubes in 600 alloy has not shown any signs of stress corrosion.

Piping verification by the ASN inspector during hydro-testing of the reactor coolant system (Cattenom)

TO BE NOTED IN 2010

M5 alloy fuel assemblies

The reactors currently using fuel with M5 alloy cladding are the four 1,450 MWe reactors, the 900 MWe reactors used for Parité MOX fuel management (for MOX fuel assemblies only) and three 1,300 MWe reactors.

Acquisition of operating experience feedback and characterisation of tightness defects that appeared on some of these assemblies, led EDF to take steps to improve the welding process for the fuel rods making up the assemblies loaded as of 2007, in order to reduce the incidence of cladding tightness defects. The fuel assemblies loaded have since showed no signs of tightness defects at the welds concerned by these improvements. However, other losses of tightness along cladding have been attributed to the abnormal presence of small chips of M5 produced under the fuel assembly springs. Initial remedial measures have been taken to limit the creation of these chips; other actions are being developed or are in the process of implementation. Tightness defects were again detected in some reactors containing M5 fuel assemblies. ASN has asked EDF to no longer employ assemblies with M5 cladding in its reactors.

Inspections of the SG partition plates in 2010, initiated after detection in 2004 of cracks thought to be caused by stress corrosion, yielded no new indication of cracking and showed no significant variation in the indications monitored. In addition the SGs are the subject of a major replacement programme (see point 3|4|4).

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, 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.

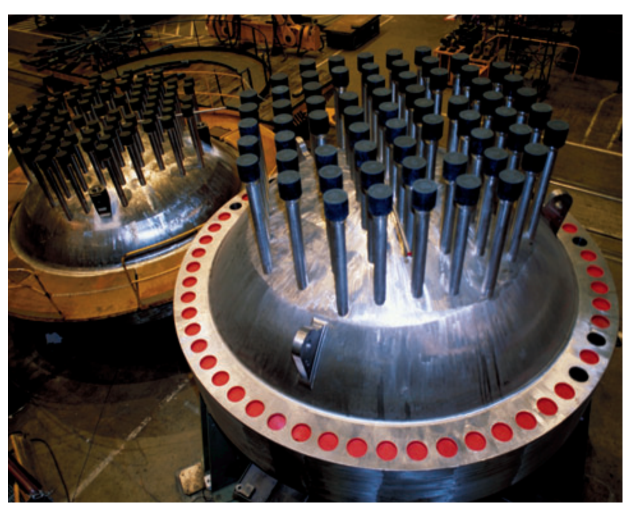
In normal operation, the vessel deteriorates slowly, under the effect of the neutrons resulting from the core fission reaction, which embrittles the metal. This embrittlement makes the vessel particularly sensitive to pressurised thermal shocks or to sudden pressure surges when cold. This sensitivity 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 removed regularly 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.

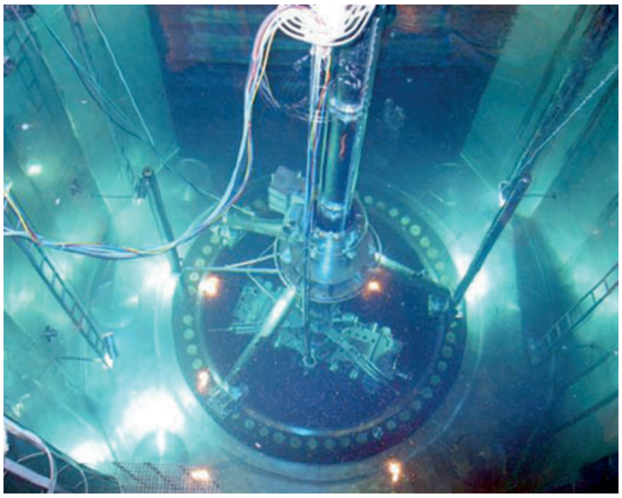
ASN carries out regular examination of the documents on the vessels' in-service behaviour forwarded to it by EDF, so as to ensure that the demonstration provided by EDF regarding vessel in-service behaviour is sufficiently conservative and that it complies with regulations. This file was presented to the advisory committee for nuclear pressure equipment in June 2010, and allowed ASN to establish its position on the conditions of operation of vessels beyond 30 years.

3|4|4 Monitoring steam generator maintenance and replacement

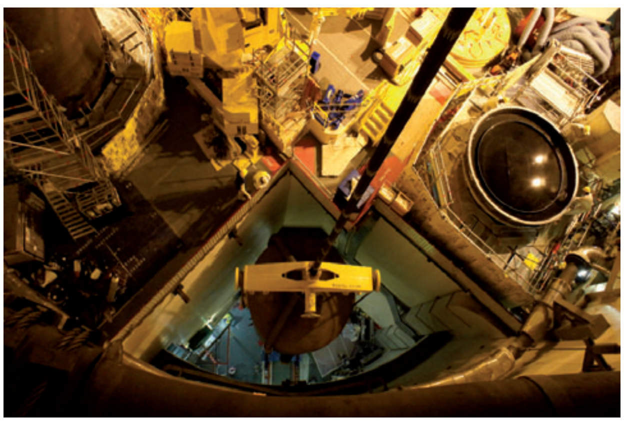
The steam generators are exchangers of heat between the water of the primary system and that of the secondary system. The exchange surface consists of a tube bundle comprising from 3,500 to 5,600 tubes, depending on the model. These tubes contain the primary system water and exchange heat while preventing any contact between the primary and secondary fluids.



Vessel closure head during manufacture (AREVA)



Vessel in-service inspection machine during an inspection



Replacement of a steam generator at the Blayais NPP in 2009

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.

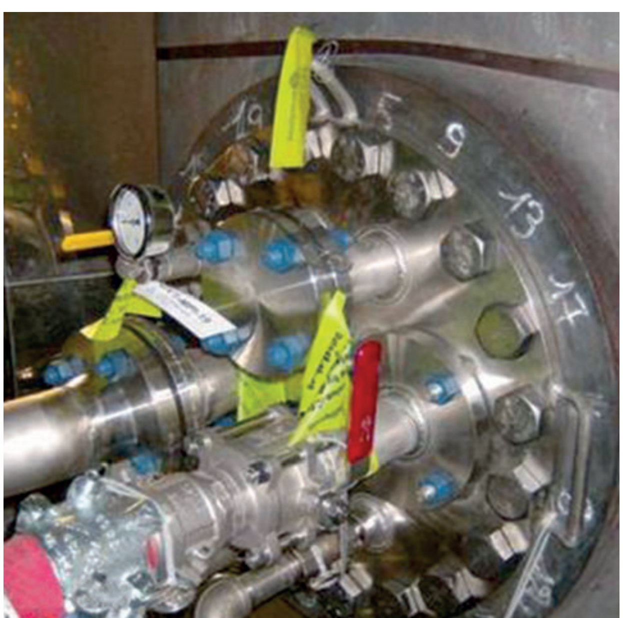
The steam generators are the subject of a special in-service monitoring programme, established by EDF, reviewed periodically and examined by ASN. After inspection, tubes that are too badly damaged are plugged to remove them from service.

Since the early 1990s, EDF has been conducting a replacement programme for steam generators with the most heavily damaged tube bundles. This programme will continue at the rate of one reactor a year. At the end of 2010, six of the thirty-four 900 MWe reactors will still be equipped with steam generators containing tube bundles made of non-heat-treated Inconel 600 type nickel-based alloy (600 MA), which are the most affected by stress corrosion (see point 3 | 4 | 2).

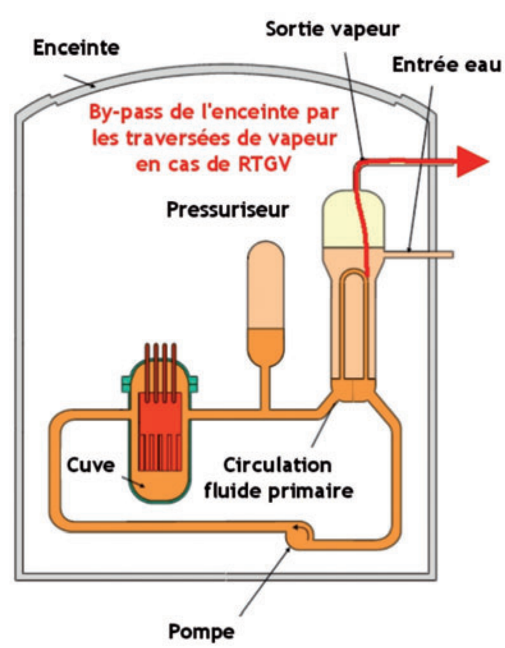
3 | 5 Checking containment conformity

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



Installation of equipment during chemical cleaning of a steam generator



Bypassing of the concrete containment in the event of an SG tube rupture accident

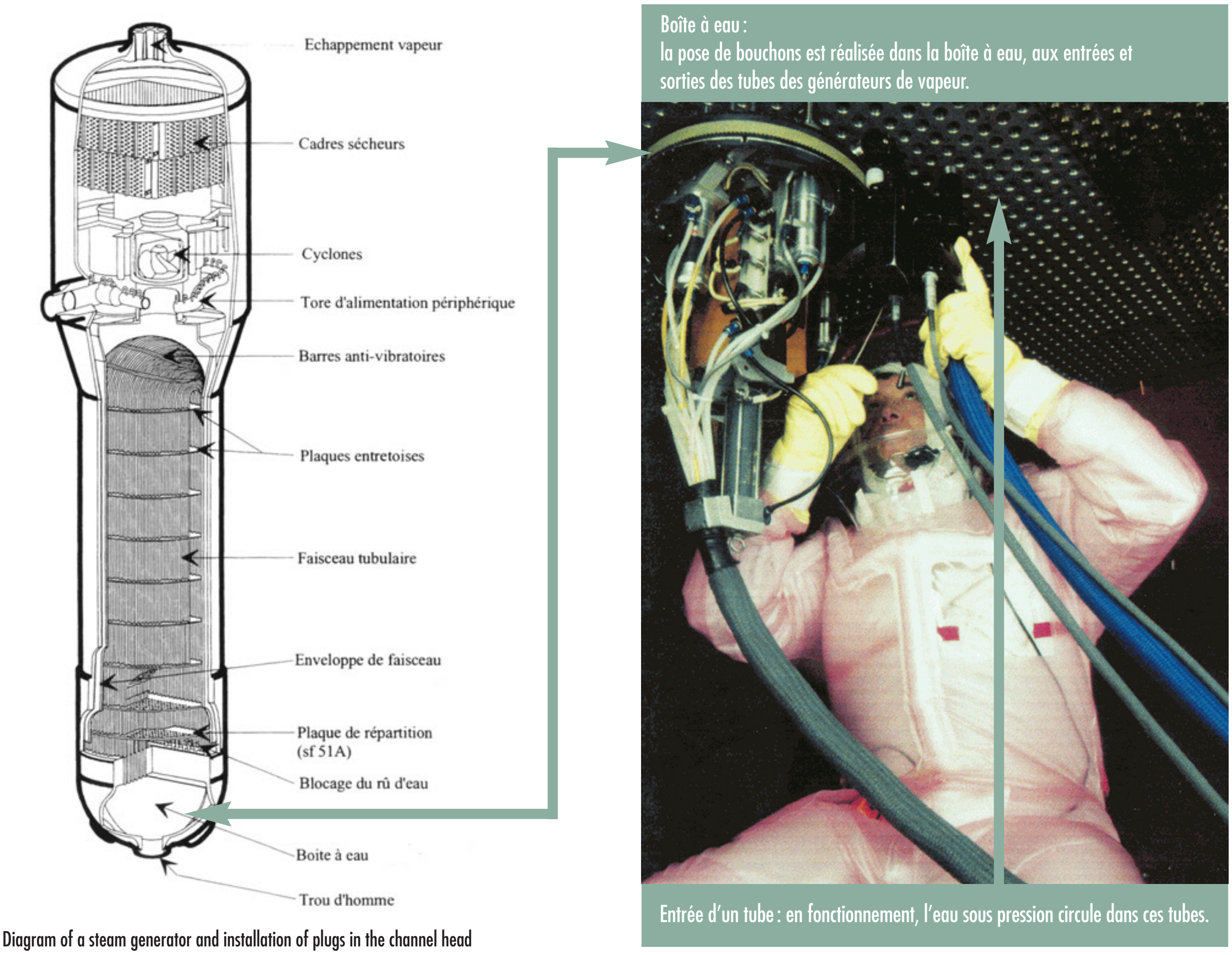
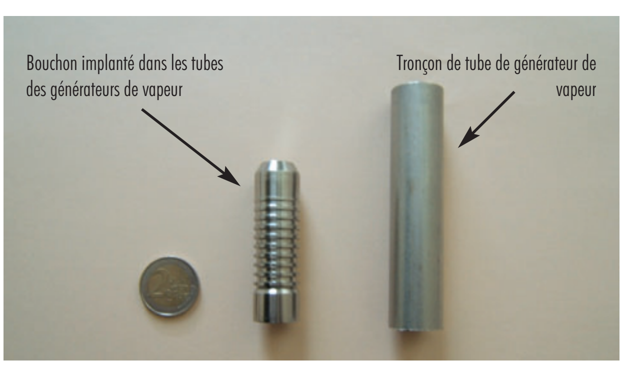
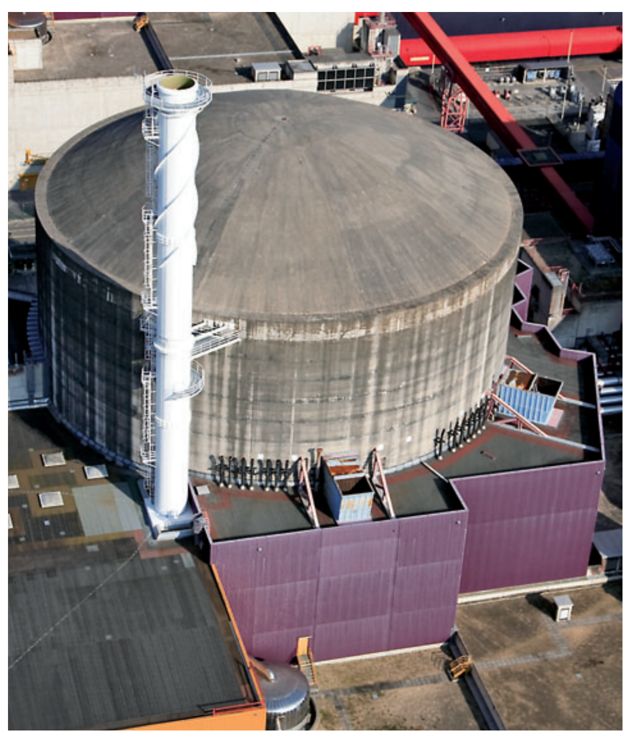


Diagram of a steam generator and installation of plugs in the channel head

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.



Mechanical plug installed in steam generator tube bundle



Reactor containment in a reactor building at the Chooz NPP

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 combat this phenomenon, EDF has implemented a preventive repair programme aimed at restoring the tightness of the most heavily affected areas. This work is done at each ten-yearly outage. At the end of 2010, work had been carried out on 22 reactors out of 24. All the reactors concerned will have undergone the necessary maintenance work by 2012.

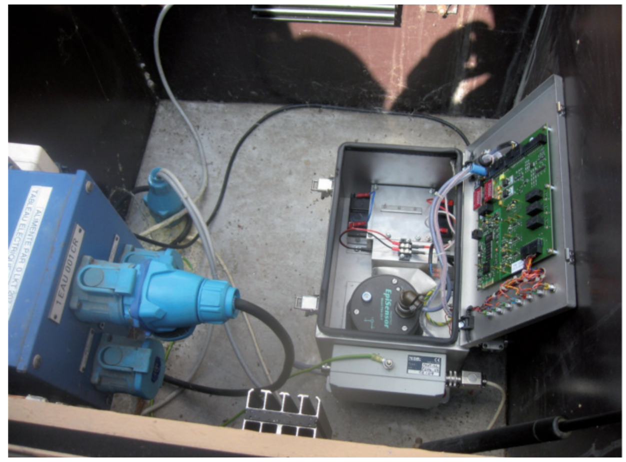
3 | 6 Application of pressure equipment rules and regulations

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.

Such equipment (tanks, heat exchangers, pipes, etc.) is not specific to the nuclear industry. It is found in many sectors of activity such as the chemical and oil industries, in paper making and in the refrigeration industry. It is therefore subject to regulation set by the Ministry for Industry, which imposes the requirements with a view to guaranteeing its safe manufacture and operation.

The equipment in this category liable to allow radioactive releases in the event of failure is called nuclear pressure equipment and is regulated by the order of 12 December 2005. In addition to the requirements applicable to conventional pressure equipment and contained in existing texts covering reactor primary and secondary systems, the order imposes additional safety requirements on nuclear pressure equipment that will come into force on 22 January 2011. In readiness for this deadline, EDF has begun the drafting of the documents required under the order and their examination by ASN began in 2010. Specifically, the procedures for classification of this equipment was the subject of a presentation to the advisory committee on nuclear pressure equipment.

ASN is also tasked with monitoring application of the regulations on the operation of non-nuclear pressure equipment in NPPs. This consists, especially through on-site checks, in ensuring that EDF is implementing the measures required of it. ASN actions in 2010 included audits and surveillance visits of the NPP inspection departments. These departments, under the responsibility of the licensees, are responsible for carrying out inspections to ensure equipment safety. Their competence, limited at present to non-nuclear pressure equipment, could be extended to nuclear pressure equipment once the requirements associated with it, especially those corresponding to its safety roles, are fully established. In 2010, ASN carried out six certification renewal audits for these inspection departments and an initial certification audit for the Flamanville NPP inspection department.



View of a seismic monitoring device (accelerometer) in an NPP

Events in 2010 concerning pressure equipment, other than the main primary and secondary systems dealt with in point 3|4, include damage linked to corrosion and erosion mechanisms detected on the moisture separator-reheaters (GSS). These units, which dry and super-heat the steam from the steam generators, are items of pressure equipment consisting of a confinement with a diameter of more than four metres, a length of twenty metres and operate at a pressure of 17 bar and a temperature of 300 °C. Given the amount of energy they contain, they can, in the event of failure, represent a risk for the safety of personnel.

Although a complete inspection and repair programme was carried out and is still ongoing for these items of equipment for 1,300 We reactors, subsequent to events in 2008, other deterioration appeared in 2010 on equivalent units for 900 MWe reactors. The licensee has undertaken a programme of inspection and is developing repair solutions for the damaged zones. The deterioration observed in 2010 in several zones of the secondary system also led ASN to be particularly vigilant regarding compliance with the procedures for pilot equipment monitoring developed by EDF.

3 | 7 Ensuring hazard protection

3 | 7 | 1 Prevention of seismic risks

Buildings and equipment of importance 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. 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 no particularly strong seismic risk in France, this topic is the subject of considerable efforts 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 n° 2/01 of 26 May 2006) on inclusion of 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 anti-seismic engineering field. For surface BNIs and based on NPP data, this text defines the anti-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.

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 closure 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 guaranteed the resistance of these reactors to the earthquakes reassessed according to RFS 2001-01, provided that additional justification data was provided concerning protection of the electrical building civil engineering structures and safeguard auxiliaries of P'4 reactors from the risk presented by the turbine hall.

In preparation of the next seismic reviews (review at forty years for 900 MWe reactors and at thirty years for the 1,300 MWe reactors), ASN has set up a working group bringing together EDF, IRSN and ASN. The aim of this working group is to determine the reference earthquakes to be considered for these forthcoming reviews. The discussions concerning the 1,300 MWe reactors ended in June 2009. EDF therefore sent ASN a technical report proposing updated seismic levels to be taken into account during the safety review associated with the third ten-yearly outages of the 1,300 MWe reactors. ASN sets the safety objectives applicable to nuclear installations and, accordingly, established its position on these proposals in 2010. ASN also takes part in a working group comprising the General Directorate for the Prevention of Risks (DGPR) as well as 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.

3|7|2 Drafting flood prevention rules

Following the flooding of the Le Blayais NPP in December 1999, EDF began to reassess the external 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, dam failure 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 the 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.

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 the recommendations of the GPR and GPU 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 NPP. 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 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.

ASN considers that the progress of studies and work is as expected. For the particular case of the Tricastin NPP, EDF carried out additional studies into the risk of dam failure, a subject on which ASN asked IRSN for its opinion. At the same time, a working group of experts from IRSN, licensees' delegates and ASN undertook review of the RFS1.1 on integration of the flooding risk. The new BNI flooding risk protection guide will cover the choice of unexpected events likely to lead to flooding of the NPP, and the methods used to characterise such events. This draft guide from the working group was the subject of consultation in 2010. The GPR and GPU will meet in 2011. ASN should publish this new guide in 2012. ASN is also taking part in updating the IAEA guide concerning the off-site flooding risk for nuclear sites. There are a number of objectives:

– to incorporate operating experience feedback;
– to include climate change studies;
– to obtain a single guide (replacing the various IAEA guides on the subject);
– to take account of new phenomena;
– to take account of all NPPs.

Overall aerial view of the Blayais NPP on the Gironde estuary

2010 was also marked by triggering of the on-site flooding emergency plan (PUI) on two occasions at Le Blayais NPP in anticipation of the violent winds of 28 January. ASN's crisis centre was activated for this event. The PUI was lifted in both cases as the situation improved with regard both to the water level in the Gironde river and the wind speeds. The Blayais site was not flooded.

3|7|3 Preventing heatwave and drought risks

The heatwave in the summer of 2003 had significant consequences for the environment of NPPs: some water courses experienced reduced flows and significant rises in the temperature of waters some of which are used for cooling in NPPs. The heatwave also resulted in increased air temperatures, causing a temperature increase within the NPPs. During this period of heatwave and drought some physical limits that had hitherto been applied to NPP design or imposed by the GOR were reached. EDF accordingly proposed a set of "intense heatwave" references examining and reassessing the operation of installations under more severe conditions than those envisaged for design, applying higher hypothetical air and water temperatures. EDF proposed a version of these references for the 900 MWe reactors and a version for the 1,300 MWe reactors. The references for the 1,300 MWe reactors will be forwarded for the safety review associated with the reactors' third ten-yearly outages. ASN established its position on the 900 MWe and 1,450 MWe reactor references in 2009. At the same time, EDF introduced modifications improving the cooling capacity and reinforcing the withstand capacity of equipment sensitive to high temperatures.

Managing the risk of fire or explosion

At the same time, EDF introduced an in-house heatwave watch in order to anticipate any climate changes that could compromise the scenarios used in the "intense heatwave" references. As part of the safety review associated with the third ten-yearly outages of 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 reference documents.

ASN is taking part in the national heatwave watch. With regard to this issue, ASN has instituted a decision-making process in case of heatwave.

3|7|4 Taking account of the fire risk

The fire risk in EDF NPPs is handled using the principle of defence in depth, based on three levels: NPP 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 designing sectoring;
– 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.

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.

In 2005, ASN asked EDF to take greater account of the risk of internal explosion. It then asked EDF to review the associated provisions for protection of the 900 MWe, 1,300 MWe and 1,450 MWe reactors.

ASN also looks at the preventive and monitoring measures implemented regarding the risk of explosion, thereby ensuring that:
– EDF includes this risk in its reference documents with regard to all gases (and not only hydrogen), for all of the buildings on its sites (and not only the reactor building) and for all operating and maintenance phases;
– dissemination of these references is effective for all sites as soon as possible.

ASN also ensures compliance with explosive atmosphere (ATEX) regulations and has thus requested that EDF introduce organisation that will allow identification of the areas at risk as well as classification by zone and the associated modifications. ASN inspectors verify the effectiveness and appropriateness of this organisation during their site inspections.

3 | 8 Oversight of application of labour legislation in NPPs

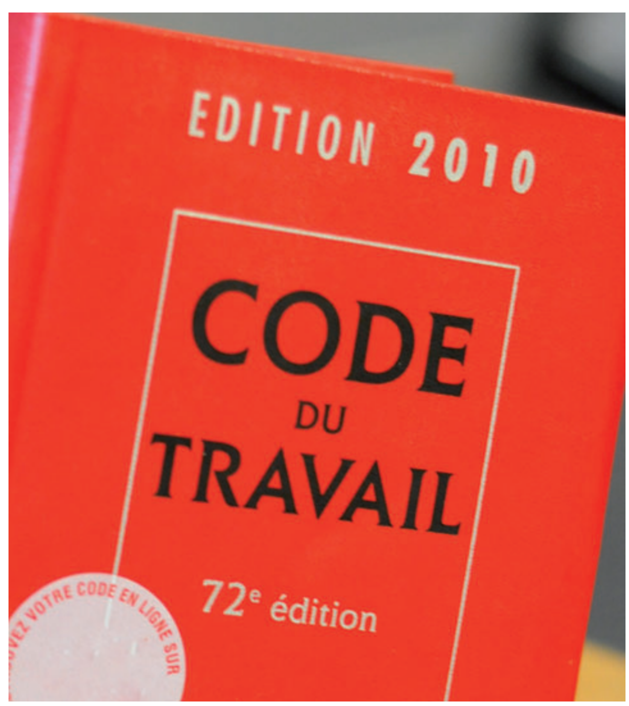
Pursuant to Article 57 of the TSN Act and the Labour Code (Article R 8111-11), ASN is responsible for monitoring safety and for occupational health and safety inspection duties in the NPPs. The health, safety, working conditions and quality of employment of the employees of EDF, its contractors and their subcontractors, along with the safety of the NPPs, are now regulated on a coordinated basis by ASN. These duties concern the construction, operation and decommissioning phases of NPPs.

The main duties of the ASN officers in charge of occupational health and safety inspections 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 employees, their representatives and employers and to take part in occupational health and safety committee (CHSCT) meetings;
– to inform ASN of any shortcomings or abuses not covered by labour legislation and of the situation in the establishments inspected.

This means that some 20,000 EDF employees and as many employees of service providers, either permanent or on temporary work sites, are covered by ASN's occupational health and safety inspection duties in the 19 operating NPPs, working on the 9 reactors being decommissioned and on building of the Flamanville reactor.

As of 31 December 2010, in order to fulfil its duties, ASN had 13 inspectors and a health and a central safety manager tasked with leading and coordinating the health and safety inspectors' network. The coordination duties are strengthened, the methods harmonised and the documentary resources and the results of documentary watch distributed. Finally, the links with the other NPP regulating activities are being consolidated in order to contribute to achieving the integrated vision of regulation that is being sought by ASN.

Coordination with the Ministry of Labour's General Directorate for Labour was strengthened in 2009 and was the subject of an agreement signed at the start of 2011.



Verification of application of the occupational health and safety regulations was ASN's main activity relating to conventional safety inspection in 2010

4 RADIATION PROTECTION AND ENVIRONMENTAL PROTECTION

4 | 1 Oversight of occupational radiation protection

As part of ASN's duties to regulate BNI's, as set out in Article 4 of the TSN Act, NPPs are subject to verification of their compliance with regulations on the protection of workers who may be exposed to ionising radiation. In this context, ASN's duty of care extends to all workers in 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:
- 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 radiation protection of workers. This may be examination of:
- events notified as significant where radiation protection is concerned;
- maintenance or modification files with national scope, with support from IRSN.

In addition, ASN provides EDF with an annual presentation of ASN's evaluation of the status of radiation protection in the operating NPPs. This annual report allows comparison of the ASN's assessment with that of the licensee, in order to identify possible pathways to progress. Meetings are also convened periodically to consider the progress of technical or organisational projects to be studied 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 draw lessons from the operating nuclear installations in France and from similar 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, has examined 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.

4 | 2 Controlling the environmental and health impacts of NPPs

4 | 2 | 1 Reviewing discharge requirements

The TSN Act, and in particular its Article 29, task ASN with establishing the requirements on abstraction of water intake for BNIs and on discharge of radioactive substances from those installations (see Chapter 4, point 3 | 3 | 1). 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 establishes the requirements for procedures for discharge and for intake and consumption of water.

ASN applies the following principles when requests for discharge authorisation or modification are received:
- for radioactive discharges, ASN tends to lower the regulatory limits on the basis of operating feedback on actual discharges, while taking account of the contingencies of day-to-day reactor operation;
- for non-radioactive substances, ASN has decided to establish requirements on discharges of substances that were not formerly 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.

Aerial view of the Dampierre-en-Burly NPP with its four production units

River Loire water take-off and discharge structures of the Dampierre-en-Burly NPP

Radioactive release values

The licensee sends ASN its discharge results every month. These data are regularly cross-checked against reactor operation during the period considered. Anomalies detected give rise to requests for additional information from the licensee.

The 2010 results concerning radioactive effluent discharges are presented in graphs 2 and 3. Graph 2, "Liquid radioactive discharges", presents the 2010 discharges of liquid tritium and liquid non-tritium (carbon 14, iodine 131, nickel 63 and other beta and gamma emitting radionuclides) per pair of reactors. Graph 3, "Gaseous radioactive discharges", presents the 2010 discharges of gases (carbon 14, tritium and noble gases) and halogens and aerosols (iodine and other beta and gamma emitting radionuclides) per pair of reactors. Evaluation of the radiological impact of these discharges is presented in Chapter 4.

4|2|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 coherence 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 reference 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, various other points such as the handling of anomalies, and visit areas where waste is stored temporarily or treated.

4|2|3 Increasing protection against other risks and forms of pollution

NPPs are covered by general technical regulations on BNIs as outlined in Chapter 3. However, they are also faced with highly specific problems with potentially serious consequences, such as legionella bacteria or the discharge of cooling fluids, discussed in more detail below.

Controlling the bacteriological risk

Management of the bacteriological risk in NPPs is a health issue, owing to the severity of the potential infections, but also an environmental one, given the impacts of the effluents from biocidal treatment.

To strengthen prevention of the risk of legionella arising from cooling tower operation (point 1|1|7), in 2005 ASN, together with the General Directorate for Health (DGS), required 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 an opinion given by AFSSET, ASN requested that EDF develop and implement preventive or

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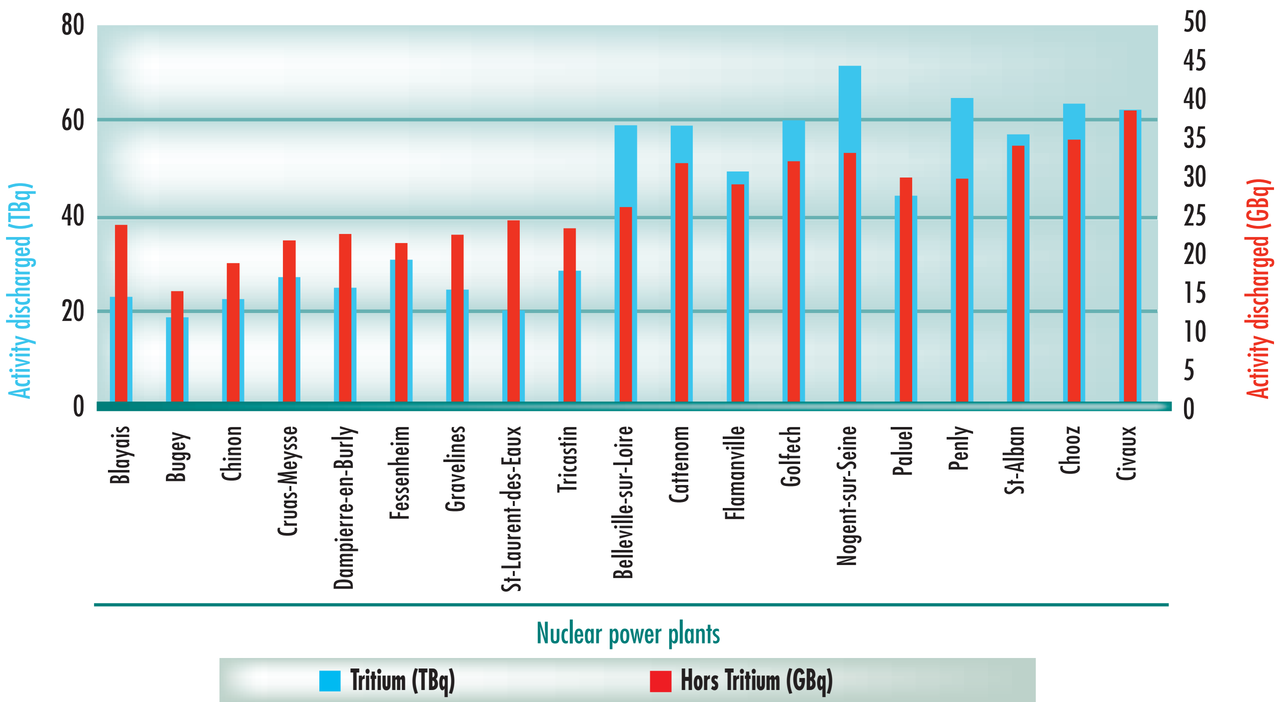
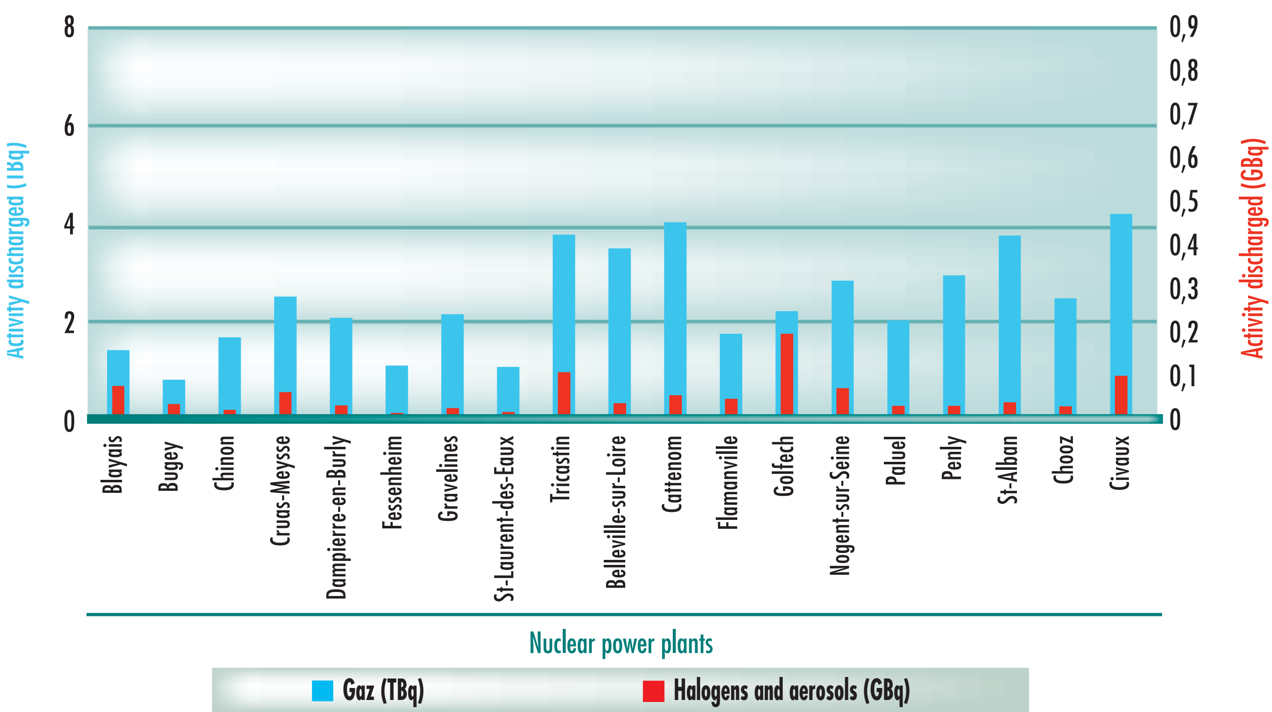
Legionella concentration levels in the large NPP cooling towers

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.

Graph 2: liquid radioactive discharges



Graph 3: gaseous radioactive discharges



remedial means to reduce the risk arising from micro-organisms, whilst also seeking to minimise the discharges of chemicals resulting from treatments. Given the health implications of this issue – as some sites still have legionella "colonies" exceeding 10^5 CFU/l – ASN is monitoring progress of action plans closely while requiring EDF to investigate all alternative solutions to regular chemical treatments and all of the technical methods attenuating the impact of such treatments when they have to be used. By examining files and carrying out field inspections, ASN verifies the progress and the results of actions to combat legionella.

Reducing emissions of ozone depleting substances

In order to meet both industrial and service requirements, NPPs operate chillers. The technology used in these units involves a refrigerant fluid which is vaporised and condensed to allow heat transfer. Use of these refrigerants is regulated by a number of texts including European Regulation 1005/2009 which came into force on 1 January 2010. The regulation limits the production, placing on the market and use of substances that deplete the ozone layer. In addition, Decree 2007-737 of 7 May 2007 on certain refrigerant fluids introduces requirements on notification of state officials when a leak is detected or degassing is performed.

In 2009, ASN first requested that EDF produce an annual report and analysis of refrigerant losses. ASN also keeps a close watch on the progress of replacement of chiller units which must comply with a phase-out schedule set by European regulation[2].

5 CURRENT STATUS OF NUCLEAR SAFETY AND RADIATION PROTECTION

5 | 1 Oversight of the construction of the EPR in 2010

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 2010, ASN and IRSN continued their examination of the installation's control and instrumentation system and civil engineering, and initiated examination of the detailed design of some systems that are important for reactor safety, focusing on the innovative systems and those involved in reactor protection and safeguarding or in maintaining the three safety functions (see point 1).

In addition to the detailed design technical review carried out with the support of IRSN, ASN in 2010 conducted nine inspections in the engineering departments in charge of carrying them out and of monitoring manufacturing at the suppliers. ASN thus checked implementation of the requirements of the order of 10 August 1984 in the project management system, in particular the requirements concerning management and oversight of contractors, including by inspections carried out directly in manufacturers' facilities; identification and management of quality-related activities; management of anomalies; management of operating experience feedback; and the consideration given to human and organisational factors on the construction site. Implementation of these requirements was checked both in the engineering departments and on the FA3 construction site.

Oversight of construction activities on the FA3 NPP

With IRSN's support, ASN performed 24 inspections on the construction site in 2010. These in particular concerned the following technical topics:
– civil engineering, including installation of the steel liner on the reactor building inner containment wall;
– mechanical assembly activities;
– electrical system assembly activities;

Conventional safety inspection by ASN inspectors on the EPR site

2. Regulation n°2037/2000 (amended) established, as of 1 January 2010, the banning and placing on the market of HCFCs and of 1 January 2015 banning of the use of recycled HCFCs for maintenance and servicing of refrigerating and air-conditioning equipment. The latter date is included in European regulation 1005/2009 which recast Regulation 2037/2000.

TO BE NOTED IN 2010

Joint inspection of AREVA NP by ASN and Finnish regulator STUK

On 29–30 March ASN, with the Finnish regulator STUK, carried out a joint inspection of the manufacturer AREVA NP in a facility belonging to FIVES NORDON, one of AREVA NP's suppliers, located in Nancy (France). The follow-up letter to this inspection is published on ASN's website. The purpose of the inspection was to examine the actions taken after the discovery of unrecorded discrepancies in production of primary system pipes for the Olkiluoto EPR reactor (EPR OL3). The inspectors formulated requests to AREVA NP for remedial action regarding the quality of this supplier's risk analysis, the setting up of an internal inspection system, and formalising of quality habits and implementation of requirements relative to the quality system and to the manufacturing reference documents. Once AREVA NP had responded satisfactorily to these requests, manufacture of equipment for the Flamanville 3 EPR reactor was resumed in the supplier's facility, under condition of temporary heightened surveillance by AREVA NP and EDF. ASN also asked AREVA NP and EDF to draw all possible lessons from the shortcomings observed and to improve the efficiency of their systems for oversight of suppliers by introducing measures to detect early signs of a lowering of quality in production.

– non-destructive testing and radiation protection;
– organisation and management of safety on the construction site;
– 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 2010, ASN paid particular attention to the following subjects:

– installation of a pre-stressing system for the reactor inner housing wall. On request from ASN, EDF provided justification demonstrating the absence of impact on reactor safety of the non-conformity in positioning of pre-stressing conduits that occurred in 2009. In June 2010, EDF notified ASN as to the presence in the poured concrete of a deformed pre-stressing conduit preventing passage of the pre-stressing cables as designed– repair was necessary;
– installation of a metal liner in the reactor building inner housing. ASN has been monitoring the building of this part of the structure closely since the end of 2008. At the start of 2009, ASN requested that EDF put in place an action plan to improve the quality of welding and, in the interim, to introduce 100% X-ray weld inspection. 2010 saw temporary deterioration of weld quality on two occasions, until EDF was able to bring in remedial and preventive measures. ASN carried out an inspection in July 2010 on this subject and asked EDF to improve the integration of lessons learned from the anomalies detected in 2009 for all of the welding activities on the site;
– method for dealing with construction joints to comply with the construction reference documents for civil engineering structures. Over the course of several inspections in 2009, ASN observed that construction joints were of inadequate quality and that the treatment methods used for these construction joints were not those given in the applicable construction reference documents. ASN asked EDF for justification of methods different from those in the reference documents. EDF then performed tests to justify the behaviour of the construction joints made using alternative methods. The results were presented to ASN and IRSN at the end of 2010. ASN will make known its position regarding these issues in 2011;
– event with significance for safety on the Flamanville 2 reactor relating to construction activities for Flamanville 3. In June 2010, a worker on the Flamanville 3 construction site carried out partial penetration of a concrete block containing one the 400 kV cables supplying the Flamanville 2 reactor: EDF's monitoring played its role in that the penetration was stopped before damage occurred to the cable. This event serves as a reminder of the importance of controlling risks on the reactors operating on the Flamanville 3 site. ASN carries out periodic inspections of the Flamanville 3 site and of the operating Flamanville NPP to check that the measures introduced by EDF concerning these risks comply with ASN's requirements.

Occupational health and safety inspection on the FA3 reactor construction site

Occupational health and safety inspections have been carried out by ASN since signing of the DAC. The action taken in 2010 consisted in:

– participation in meetings of the joint companies commission for safety, health and working conditions (CIESSCT) and the operational committee for the prevention of illegal labour (COLTI);
– performance of safety inspections on the NPP;
– performance of investigation of accidents occurring on the NPP;
– response to direct requests from employees;
– response to requests concerning risk prevention plans on construction sites with a large number of contractors.

In 2010, ASN's occupational health and safety inspectors in particular verified that the contractors working on the site complied with the requirements of the Labour Code concerning the declaration of foreign workers, working hours, the risks involved in simultaneous work and the incorporation of operating experience feedback from the others reactors in operation into the design of this reactor.

Regulation of nuclear pressure equipment manufacture

In 2010, ASN and the accredited organisations continued examination of the files relative to the design and manufacture of primary and secondary equipment for the EPR, most of which is currently being manufactured (vessel, primary coolant pumps, control rod drive mechanism, pressuriser, steam generator as well as some of the piping and valves). ASN and the accredited organisations performed 776 inspections to monitor manufacture of this equipment, corresponding to 1,000 days of presence in the facilities of the manufacturer AREVA NP and those of its suppliers and

Management of an electric transformer fire at the Paluel NPP – April 2010

subcontractors. At the end of 2010, ASN and the approved organisations also oversaw the carrying out of the pressure testing marking completion of manufacture of the first items of nuclear pressure equipment or their components to be used for the Flamanville 3 EPR reactor (vessel body, valves, pipes).

5 | 2 ASN review of safety options for new ATMEA reactor

Several countries around the world are considering the construction of new NPPs. In this context, the ATMEA company, a joint venture formed between AREVA (France) and the Mitsubishi Heavy Industries (MHI, Japan), has called on ASN to review the safety options 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 has responded favourably to ATMEA's request and signed an agreement specifying this review. The purpose of the safety options review, carried out with IRSN's support, is to ascertain whether or not ATMEA 1's safety options comply with French regulations. Initiated in the summer of 2010, this examination is conducted under the same conditions as for a BNI that would be built in France. During the technical examination, ASN will call on the advisory committee for nuclear reactors (GPR). ASN will publish the conclusions of the examination at the end of 2011. The review will also allow ASN to assist the regulators in countries building reactors, if necessary.

*The **safety options 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.*

5 | 3 Notable findings relating to fire and explosion risks

Transformer fires

Two transformer fires occurred in NPPs in 2010. The transformers are located outside of the nuclear area and serve to place the energy produced by the reactor on the electricity grid. In both cases the licensee activated the internal emergency plan (PUI) to mobilise all of the resources needed to manage the events.

The first fire broke out on 8 April 2010 on the line transformer of reactor 3 in the Paluel NPP. The second occurred on 25 July 2010 on one the terminals of the reactor 2 line transformer in the Tricastin plant.

These two events were the subject of inspections by ASN. In particular, the inspectors looked at how the event progressed, the actions taken to shut down the reactor and the progress of the firefighting response, provided jointly with the response team of the *Départmental*[3] fire and rescue service (SDIS).

Fire risk studies

As of 31 December 2009, ASN had received fire risk studies from 19 sites, in compliance with the timelines set in Article 11 of the government order of 31 January 2006 amending the order of 31 December 1999 establishing the general technical regulations intended to prevent and limit external nuisances and risks from the operation of BNIs. In 2010, ASN undertook examination of these studies, distinguishing between the parts specific to a particular site and those that are more generic and applicable to the installed base of NPPs. ASN has already asked EDF for further information on the requirements envisaged for some areas such as turbine halls and tunnels.

3. *Département*, in France an administrative region headed by a *préfet*.

Positioning reinforcing bars on the EPR site – October 2009

5 | 4 Notable findings relating to occupational health and safety inspections

Closer monitoring of occupational health and safety regulations

ASN's main occupational health and safety inspectorate activity in 2010 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 2010, occupational health and safety inspection activities covered the following areas:
- risk of falls on site: limitation of rope access work (mountaineering techniques);
- systematic investigations following serious industrial accidents. In several cases, health and safety inspectors observed failure to comply with regulations relating to work equipment and in terms of organisation of subcontracted activities (prevention plan); in addition, one fatal accident case was the subject of an inquiry concerning the victim's working hours; no notable discrepancy was found;
- compliance with the requirements of the Labour Code by the companies working on the construction sites, in particular with regard to simultaneous work by more than one contractor required for operation or maintenance of the NPPs;
- activities involving the use of carcinogenic, mutagenic or reprotoxic chemical products; EDF and its service providers were encouraged to take steps in line with the principles of prevention: eliminate the risk or limit exposure of workers to these substances, or find less hazardous alternatives;
- work close to the reactor while it is operating at full power, in terms of exposure to ionising radiation and heat, but also of the psycho-social risk factors.

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 informed regularly about relevant subjects, notably concerning occupational accidents and psycho-social risk factors.

Monitoring working hours travail

ASN's occupational health and safety inspectors carried out inspections of compliance with regulations on working hours as well as on daily and weekly rest periods specifically during reactor shutdown for maintenance. In 2010, they once again detected anomalies concerning the maximum daily and weekly working hours and rest periods. The infringements observed relate to periods of high activity (maintenance during reactor shut down).

Other areas

The occupational health and safety inspectors were called on to examine subjects raised by the workers' representative bodies, in particular:
- arbitration concerning implementation of the right to warning of serious and imminent hazard by the CHSCTs;
- the quality of services provided and, in particular, services provided by foreign companies, while monitoring correct application of collective agreements and the notion of service provider autonomy.

The inspectors also participated in joint work within the operational committee for the prevention of illegal labour (COLTI) led by the *Procureur de la République*[4], especially where the EPR site is concerned.

Penal procedures

ASN's occupational health and safety inspectorate issued five violation notifications to the relevant jurisdictions. Four of these related to violations that led to occupational accidents.

4. Public prosecutor.

On-site work conditions and risk of falling – October 2009

Surveillance of a spent fuel pool by ASN inspectors – November 2010

5 | 5 Notable findings relating to radiation protection of personnel

Zinc injection

ASN authorised EDF to inject zinc into the primary system of 16 reactors. This practice is in line with the overall approach to reduce the collective dose based on modification of the primary coolant chemistry. This operation was identified by EDF, notably in practice in other countries, as a means of reducing contamination of the primary system by the radioactive isotope of cobalt deposited in the system walls.

Two events with significance for radiation protection at the Chinon NPP

On 23 April 2010, during a check on cleanness at the bottom of the spent fuel pit, an operative's hand was irradiated while picking up and then handling an activated metal part (see box point 6|1|5).

On 4 August 2010, during a cleanness check on the steam generator water box, an object generating high levels of radiation was picked up by an operative then handled by three other operatives in succession before being removed from the zone.

These events were classified, respectively, at levels 1 and 2 on the INES.

ASN carried out a site inspection after each of these events: the inspectors observed that these incidences of accidental irradiation were, notably, due to inadequate analysis of the risks and to a lack of knowledge of how to act in the presence of undesirable objects detected during cleanness checks.

ASN inspectors equipped to check the Legionella risk

Examination of the EPR file

ASN is also continuing to examine the situation prior to commissioning of the EPR, 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 is presented in point 2|4 of this chapter.

5 | 6 Notable findings relating to the environmental impacts of NPPs and discharges

Review of discharge requirements

In 2010, ASN completed its review of the effluent discharge and water intake files for the Saint-Laurent-des-Eaux and Flamanville NPPs.

– effluent discharges and water intake at Saint-Laurent-des-Eaux are now regulated by the ASN decisions of 18 May 2010, 2010-DC-0182 and 2010-DC-0183, published in the ASN Official Bulletin on its website;
– effluent discharges and water intake at the Flamanville site (two operating reactors and the EPR type reactor) are regulated by decisions 2010-DC-0188 and 2010-DC-0189 of 7 July 2010 published in the ASN Official Bulletin on its website.

Furthermore, in its White Paper on Tritium of July 2010 *(http://livre-blanc-tritium.asn.fr/)*, ASN asked EDF to provide a critical study of the radiological impact of radioactive discharges at the Flamanville site, taking account of a weighting factor (wR) for tritium equal to two (see Chapter 4). Increase in the dosimetric impact linked to a weighting factor of two does not affect the magnitude of the annual effective doses due to discharges from the Flamanville site, which remains less than 2% of the regulation limit set at 1 mSv/yr for a member of the public by the public health code.

ASN reminded EDF of its request to include this critical study in the impact studies in the effluent discharge and water intake files submitted in July 2010.

Experience feedback from SOCATRI

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 retention systems that could contain toxic, radioactive, flammable, corrosive or explosive 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. The programme concluded with the drafting of a summary for the sites and of a national summary, currently undergoing examination by ASN.

From the site reports and inspections, ASN was able to observe that EDF's inspection work for these installations had been significant and that its central departments had been driving forces in terms of use and pooling of feedback. Examination of the summaries nonetheless highlighted the importance of the need for checks to be exhaustive, especially when systems are not easily accessible (underground pipes, etc.).

Replacement of a steam generator at the Blayais NPP in 2009

Actions to combat legionella

In 2010, EDF presented ASN with a report on actions undertaken to combat legionella since 2008. These indicated progress in terms of piloting of installations (control of legionella risk and of the impacts of biocidal treatments used) as well as improvements in the quality of the associated monitoring. However, ASN is also of the opinion that the efforts made by EDF to develop an alternative industrial scale solution to the current biocidal treatments should be pursued and that the situation on some sites not having biocidal treatments remains delicate from the health point of view, with legionella colonies sometimes exceeding 10^5 CFU/l. It is therefore pursuing its dialogue with EDF in order to further investigate the different possibilities for improvement.

5 | 7 Notable findings relating to oversight of pressure equipment

ASN is of the opinion that the safety case for prolonging vessel service life until fourth ten-yearly outages is acceptable

The safety case for keeping reactor vessels in service (see point 3 | 4 | 3) is covered by a special file that is regularly updated and examined by ASN. In provision for the establishment of a position on operation of each 900 MWe reactor until the fourth ten-yearly outage (VD4), EDF has submitted a justification file that is the subject of technical examination by ASN and IRSN. After consultation with the advisory committee for nuclear pressure equipment in June 2010, ASN established its position regarding the adequacy of this demonstration which completes the steps taken by EDF with regard to monitoring of ageing and in-service oversight of reactor vessels.

ASN and IRSN examined the safety case for keeping reactor vessels in service to ensure its compliance with regulations and to verify the validity of the calculations and of the assumptions made. The purpose of analysis was to ensure that the results provided at each calculation step were conservative, and that the safety margins required by regulations were respected.

EDF's calculations indicated compliance with regulatory criteria during the decade following the third ten-yearly outages (VD3). ASN also noted that EDF is able, if necessary, to rapidly provide technical solutions, such as heating of the safety injection, that guarantee that faults are not harmful if new elements arise that could compromise the content of the current file. ASN considers that all of the 900 MWe reactor vessels are fit for service during the decade after the third ten-yearly reactor outages. ASN will verify that the inspections performed during the ten-yearly outages are such that they ensure that no new faults will appear and that faults already detected will not worsen.

ASN did, however, formulate some requests intended to further improve the methods employed, to continue studies to confirm current data and to correct certain elements for which EDF had not given sufficient guarantees as to their conservative nature.

Shutdown of Bugey 3 reactor awaiting replacement of its steam generators

During a shutdown for maintenance of reactor 3 at Bugey, in April 2009, EDF's inspections revealed a new type of damage of the steam generator. Following this discovery, EDF introduced a programme of checks and expert examination of which the results are the subject of a major examination by ASN and IRSN.

In order to characterise the condition of the Bugey 3 steam generators, EDF has set up a programme of checks of all of the steam generator tubes appropriate to the type and number of incidences of damage detected. The checks were carried out with means specially developed for the purpose and processes used in other countries that had not yet been used in French NPPs. They continued until September 2009.

Inspection of the tubes was competed by extraction of several of them for expert laboratory examination, to determine the precise nature of the faults encountered and to guarantee the ability of the checking procedures to detect them.

The damage revealed by expert examination indicated corrosion phenomena, locally deep and associated with cracking. This damage was located on the tubes at the circular section support plates and only concerned Inconel 600 MA alloy tubes.

Before establishing a position on the risk of steam generator tube rupture and the absence of risk of a significant leak between the primary and secondary systems during the Bugey 3 reactor's next operating cycle, ASN, with IRSN, has examined the results of the checks and studies performed by EDF and obtained the opinion of the advisory committee for nuclear pressure equipment, which met on 19 April 2010.

On the basis of these elements, ASN considered that the means for checking and for expert examination introduced by EDF were appropriate for the characterisation of this type of damage. However, ASN was also of the opinion that the measures proposed by EDF initially, prior to possible restarting of the reactor before replacement of the steam generators, were inadequate and should be completed, notably with regard to conducting of a complete pressure test on steam generator 1. The hydraulic pressure test at a pressure of 207 bar, greater than the maximum pressure occurring in an accident situation, was considered to be the only means that could guarantee leaktightness of tubes.

Taking account of the constraints relating to the carrying out of such an operation, EDF chose to bring forward replacement of the steam generators, initially scheduled for September 2010, to July 2010. ASN acknowledged this decision which is beneficial to reactor safety, but pointed out that it could have been foreseen given the extent of corrosion of the tubes on steam generator 1 at Bugey 3.

Amongst the other reactors that may be affected by this type of damage, Fessenheim 2 has also shown signs of atypical damage and been the subject of additional checks and expert examination intended to provide understanding of the phenomenon and for characterisation of the condition of the steam generator tube bundles. The other sites concerned, Le Blayais 2, 3, 4, Gravelines 3 and Chinon B2, were found to be less affected by corrosion.

ASN asked EDF to carry out preventive plugging on Fessenheim 2, in order to offer sufficient guarantees concerning the serviceability of the steam generators of this reactor for the forthcoming cycles. The inspection and maintenance programmes for the other reactors have been amended accordingly.

The steam generators concerned by these phenomena will be replaced between 2011 and 2014, in accordance with EDF's schedule.

The steam generator replacement programme

2010 was marked by the replacement of the steam generators on the Bugey 2 and 3 reactors, in accordance with EDF's decision to replace the steam generators with 600 MA alloy tube bundles. The design of the building of the CP0 plant series (Fessenheim and Bugey) requires introduction of the steam generator into the reactor building in two parts and final joining of the two parts on site.

EDF also plans to replace the steam generators equipped with 600 TT alloy tube bundles that have been proven to be sensitive to corrosion damage, but to a lesser extent than those in 600 MA alloy. The 1,300 MWe reactors are also concerned by these operations, with the first replacement scheduled at Paluel for 2015, because of a high level of cracking in the dudgeonning transition zone. This will be followed by replacement on the Flamanville reactors in 2017 and 2018, the others being programmed between the third and fourth ten-yearly outages.

6 ASSESSMENT

Operating reactors

6 | 1 Evaluating the head offices 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 2010, 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 2010, ASN conducted 491 inspections in the nuclear power plants in service and in EDF head offices.

The general assessment represents ASN's view of the year 2010 and acts as a guideline for ASN regulation and inspection actions for 2011.

6 | 1 | 1 Evaluating nuclear safety

Reactor operations

The documents required for operation are, on the whole, well managed, cover the different operating phases and provide an accurate picture of the actual status of the installations. Anomalies in application of the rules for periodic testing are less numerous than in previous years.

Management of training and operating personnel authorisations is satisfactory.

Improved operational stringency remains a key priority for the NPPs and head office departments. ASN considers that the efforts made on this subject in recent years must be continued.

Efforts were made in 2010 to identify, manage and absorb a backlog of 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 managers of operating staff do not have the time needed to correctly fulfil their duties, especially during reactor outage. Similarly, oversight of the control room needs to be improved, to be able to detect any malfunctioning as early as possible.

The interfaces between operating and maintenance or testing personnel are often the source of anomalies, resulting from communication or misunderstanding. Actions to improve this situation must be identified and implemented.

In spite of the limited progress noted by ASN in the management of equipment lock out, numerous anomalies were once again recorded in this area in 2010, as well as in the area of circuit alignment. There is a lack of rigour and oversight where these operations are concerned.

Lastly, the stringent application of operating reference documents and temporary operating instructions still needs to be improved.

Emergency situations

ASN considers that EDF's management of emergency situations is highly satisfactory. Relations between ASN and EDF at national level have been strengthened in recent years, notably via meetings on the reference documents for EDF's internal emergency plans (PUI). However, ASN needs to be better informed about documents introduced to the sites by EDF's head office departments, such as the reference for emergency telecommunications (RMTC).

In 2010, EDF forwarded the new PUI reference documents to the different sites for comment. The comments were incorporated by EDF at the national level. ASN also forwarded its comments to EDF's head office departments; these are being incorporated by EDF.

ASN still considers that the emergency response organisation in case of ammonia release, introduced for sites with a monochloramine treatment facility, is not satisfactory, and it is still not operational on most of the sites concerned. This risk should be included in the "Toxic" PUI planned in the new reference documents.

Based on its inspections in 2010, ASN noted progress in the area of firefighting although there is still room for improvement, especially where performance of duties and the actions of response teams are concerned.

The different sites have made efforts to implement an organisation that complies with the requirements of the order of 31 December 1999 relative to the organisation of firefighting.

Further efforts are required in the area of sectorisation management and of prevention, especially regarding fire permits and fire loads.

Maintenance activities

In the area of maintenance, ASN observes that, in the past, EDF has failed to anticipate certain problems sufficiently far in advance and has not taken sufficient account of international feedback, with the result that it is now having to carry out delicate, large-scale corrective maintenance, notably on the steam generators, in order to guarantee safety. This lack of foresight in maintenance and equipment replacement programmes, with particular reference to the steam generators, has also resulted in recent years in very extensive inspection and expert examination programmes. However, ASN notes that EDF is now taking onboard the lessons of these observations by, for example, already planning a programme for replacement of these items of equipment for the 1,300 MWe reactors. 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 references 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.

Managing of contracting

Most maintenance activities on NPPs are entrusted to contractors selected on the basis of a qualification and evaluation system implemented by EDF. ASN is of the opinion that EDF has not made progress in its monitoring of these contractors since 2009. In particular, ASN sees no improvement in monitoring of the activities carried out by contractors in the field and considers that this needs to be rapidly improved and strengthened. ASN observes that monitoring of cascade subcontracting is either non-existent or too light. EDF must therefore check the adequacy of the quantity and quality of the resources allocated to monitoring of the activities subcontracted, given their implications for safety, radiation protection and protection of the environment. Furthermore, as in previous years, ASN has noted that the material resources provided for contractors are often inadequate or inappropriate, leading in some cases to degraded working conditions in terms of safety and radiation protection. ASN believes that it is necessary to ask EDF to reassess its industrial maintenance policy and its use of contractors to implement it.

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 its management of qualification of equipment for accident conditions, whether during preventive maintenance operations or when replacing equipment.

Pressure equipment

ASN considers that EDF has made progress in the management of pressure equipment. All of the NPP inspection departments are now recognised. ASN notes that the situation is satisfactory or is progressing on an increasing number of sites. ASN also notes that the recognised inspection departments (SIR) have acquired a certain degree of maturity and believes that EDF should continue its efforts to create such departments to allow them to carry out their duties on the basis of exhaustive inspection plans.

The first barrier

In ASN's view, in 2010, the situation regarding the first barrier was satisfactory on the whole but there are a few points where there is room for improvement, notably in the area of prevention of deterioration during operation. The long-term actions undertaken by EDF do not yet permit a return to an optimum status for the first barrier and, in 2010, ASN once again observed leaks in fuel assemblies, damaged support grids and the presence of numerous foreign bodies in the primary system.

Where grid damage and blocking of fuel assemblies during handling are concerned, ASN noted the general deployment of "improved grids", for which feedback in 2009 and 2010 was favourable, on the 1,300 MWe and 1,450 MWe reactors.

ASN also took a positive view of actions to prevent fuel grid blocking incidents such as those that occurred in 2008 and 2009 at Tricastin and Gravelines. The measures adopted improved the reliability of handling of the vessel upper internals and provided better detection of foreign bodies in the systems and fuel assemblies.

In 2010, 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. Modification of the design of these assemblies means that this source of loss of leaktightness can be expected to disappear progressively within an acceptable period. Conversely, ASN considers that EDF should pursue the actions undertaken in relation to leaktightness of M5 fuel assemblies.

ASN also believes that EDF should make progress regarding preventing and dealing with foreign bodies in systems. The actions undertaken by EDF since 2008 are judged satisfactory, but they still appear to be only partially implemented and there should be more uptake of these actions by the different sites.

Finally, EDF should also make progress with the application of maintenance programmes for fuel handing equipment as this can, in the event of its malfunctioning, be the cause of damage to the fuel assemblies placed in the reactor core.

The second barrier

ASN considers that there is still room for improvement to EDF's situation regarding maintaining integrity of the second barrier. The particular case of the Bugey 3 steam generators – where the more in-depth inspections and associated expert examination led finally, before the equipment resumed operation, to early replacement of the steam generators – is an illustration of the possibility for improvement. However, ASN notes that the situation is improving with the implementation this year of EDF's strategy to maintain cleanness of the steam generator secondary system (chemical cleaning, conditioning at high pH, monitoring of chemical parameters and carrying out of preventive cleaning operations).

Chemical cleaning of steam generators was carried out in 2010 on the Cattenom 4 and Belleville 2 reactors. In the latter case the presence of hardened sludge on the tube plate and at the tube ends (formation of gangue) was detected. An additional high temperature de-oxidation phase was applied for the first time to remove the hardened sludge.

Preventive steam generator cleaning was used for the first time on Gravelines 5. To date, it is difficult to reach a conclusion as to the effectiveness of the process where fouling is concerned due to unforeseen circumstances that occurred during this operation.

Two satisfactory steam generator replacement operations were carried out in 2010, on the Bugey 2 and Bugey 3 reactors.

EDF continued to address the anomalies encountered during installation of mechanical plugs on steam generator tubes. The main cause of these anomalies is a lack of lubrication. EDF has accordingly undertaken the amendment of the plug manufacturing requirements.

The third barrier

Although it was felt in 2010 that the third barrier and its components could still be improved, ASN noted a reduction in the number of containment related events in relation to 2009. The trend observed in 2010 will, nonetheless, have to be confirmed in 2011.

The results of ten-year testing of the 1,300 and 1,450 MWe reactor containments conducted in 2010 complied with the criteria established in the operating rules. However, EDF will present ASN with technical solutions that will guarantee the leak-tightness of the containments over time, in spite of their ageing. Analysis of these proposals, which will begin in 2011, will be presented to the advisory committee for nuclear reactors in 2012.

6|1|2 Evaluating radiation protection

EIn 2010, ASN carried out 24 specific inspections in the area of radiation protection on sites and two inspections in EDF's head office departments. The inspections allowed ASN to observe that EDF had reacted to the observations of 2009 by revitalising the "as low as reasonably achievable" (ALARA) approach. While the collective dose in the NPPs had been on the rise for two years, EDF attained its collective dose objective for 2010 (see graphs 4, 5 and 6).

In view of these results, ASN considers it essential for EDF to sustain its renewed efforts regarding the ALARA approach during future reactor outages, and to ensure the long-term viability of improvements in the area of collective and individual doses.

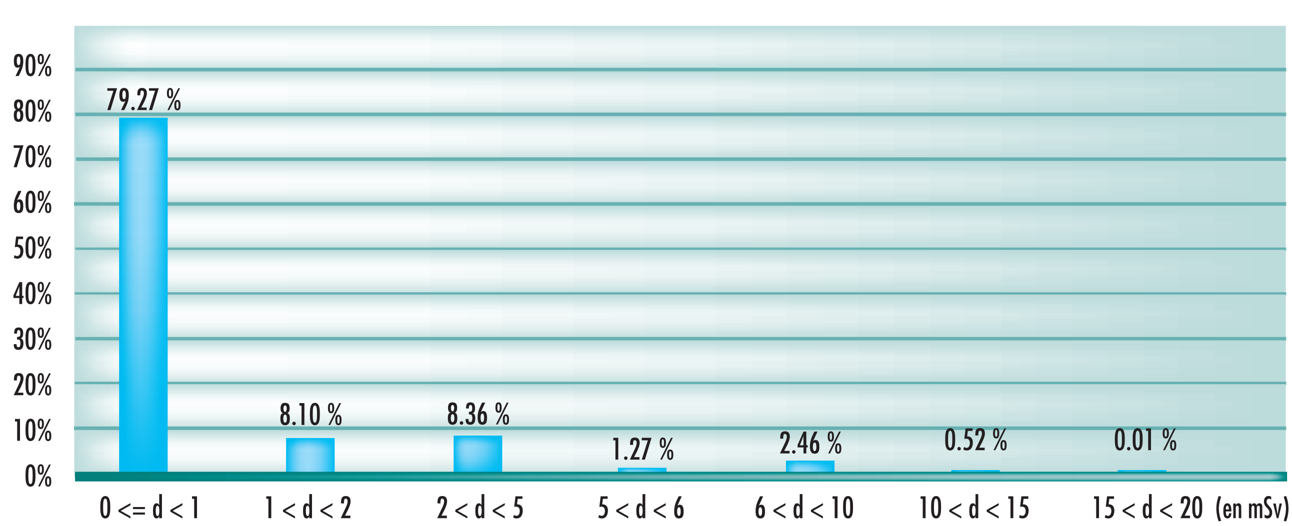
ASN also observed that the action plan implemented by EDF to improve radiation protection for workers during industrial radiographic exposure continued to produce positive results.

However, ASN observed wide variations across the installed base of NPPs where radiation protection is concerned and considers that EDF must be vigilant with regard to improvement on all sites. In addition, the different observations by the ASN inspectors, especially those made during inspections following the events in April and August 2010 on the Chinon site, serve as a reminder that the quality and integration of risk analyses and of dose optimisation studies are fundamental elements of the preventive approach and that EDF must still improve its performance with regard to these aspects.

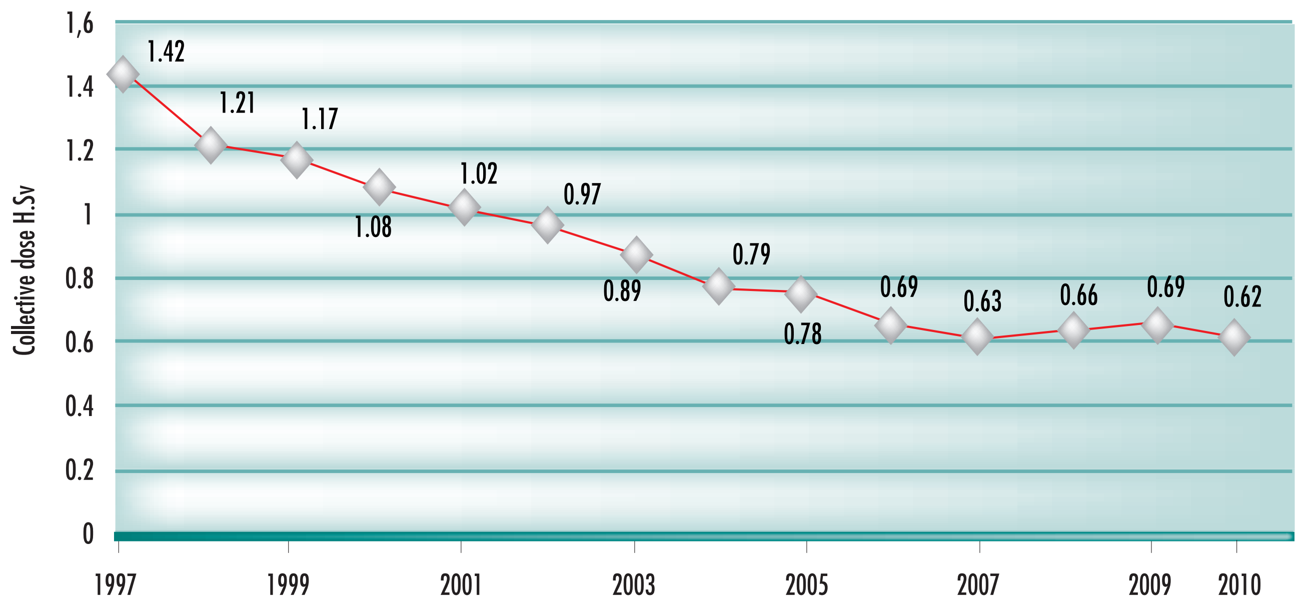
ASN also considers that EDF should make improvements regarding the time required to integrate changes in regulations into its radiation protection framework.

Lastly, ASN believes that EDF should look again at the quality and breakdown of the radiation protection duties of people involved in the preparation of sites and in carrying out work on them, especially in the light of the conclusions of the studies of

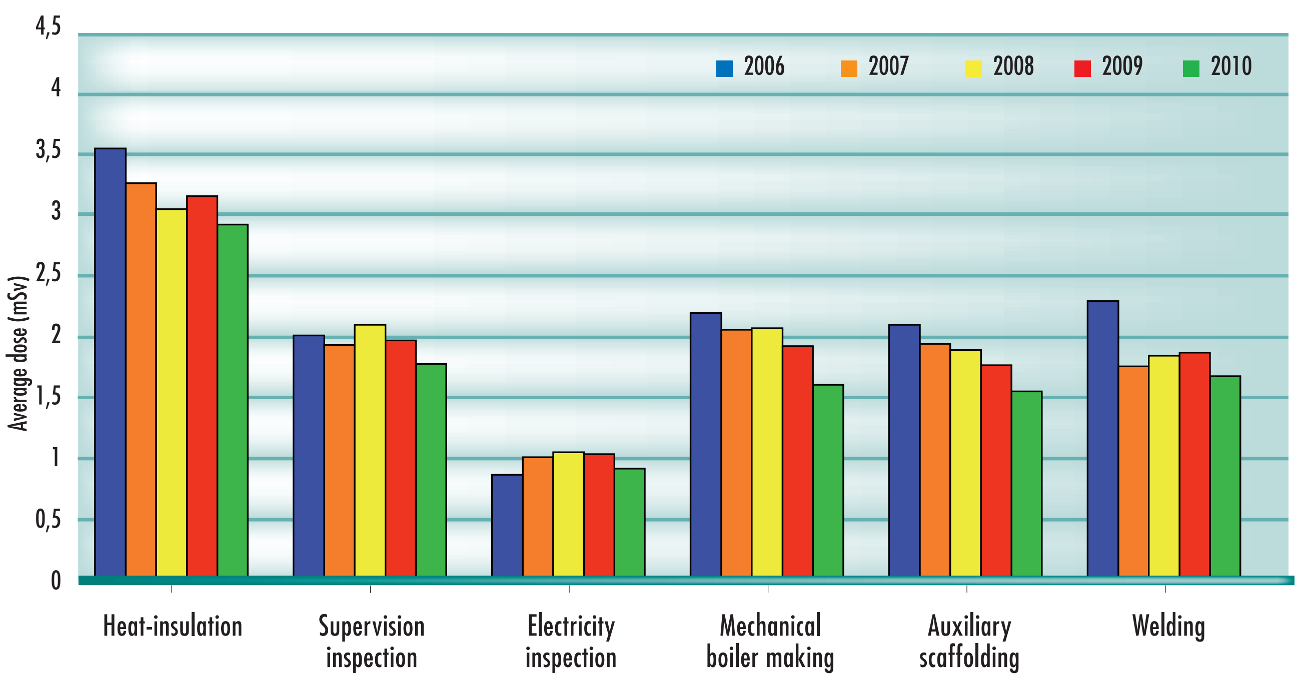
Graph 4: breakdown of the population per dose range for the year 2010 (EDF data)



Graph 5: mean collective dose per reactor



Graph 6: changes in mean individual dose according to categories of workers involved in reactor maintenance



human and organisational factors (HOF). These considerations should feed into the policy for improvement and into EDF's objectives for controlling contamination at source, sharing feedback, monitoring application of site radiation protection rules and, more generally, for radiation protection culture.

6|1|3 Evaluating environmental protection measures

At the end of 2009, ASN warned EDF that it had observed a worsening of the situation regarding environmental protection. In 2010, ASN considered that EDF had taken a more dynamic approach to the issue but that this had not yet allowed the different sites to return to a satisfactory situation.

Therefore, although the environmental situation is satisfactory for most sites, ASN still observe numerous anomalies in the different NPPs. In fact, anomalies in compliance of installations, in implementation of corrective actions and in monitoring of contractors' activities were all highlighted in 2010. Furthermore, ASN inspectors observed several discrepancies in the application of the government order on discharges and the amended order of 31 December 1999, as well as anomalies in the management of conventional waste.

Some of these anomalies are the subject of modification of discharge requirement files that are being examined.

In addition, ASN yet again pinpoints flaws in the management of chillers, leading to releases of refrigerants to the atmosphere.

Lastly, ASN regrets that, in certain declarations of equipment modifications made under Article 26 of order 2007-1557, EDF did not adequately encompass all of the elements protected by the TSN Act.

In conclusion, ASN considers that EDF must consolidate and pursue its efforts to attain satisfactory environmental performance. Its efforts should result in a coherent industrial policy encompassing all of the elements protected by the TSN Act.

6|1|4 Analysing staff and organisational measures

Organisation of sites and staff

ASN is of the opinion that EDF's organisation for dealing with matters of nuclear safety and radiation protection is satisfactory, but that anomalies in application by the different sites persist, in particular regarding maintenance but also regarding operating departments.

In the area of nuclear safety, the plans for a rigorous approach to operation create a dynamic that is favourable to achieving the objectives that the sites with the lowest safety performance set for themselves. Conversely, other objectives, and notably those relating to reactor operation (monitoring in control room, excursions from the operating range, alignment and lock out anomalies) are more difficult to attain.

In the area of environment, ASN considers the objectives set by some sites to be far-reaching.

The roles and responsibilities within the departments are generally defined in organisation circulars but are not always actually applied in carrying out of activities. Anomalies observed, some of which lead to significant events, reveal a lack of clear perception of duties and difficulties in the distribution of roles between departments, notably between the operating department and the others. Lack of time means that management personnel cannot be as involved as they need to be, even though EDF has made considerable efforts at the national level.

Welding operation on a work site

Manning levels are generally speaking appropriate but ASN nonetheless observed shortcomings in this area during reactor outages. Conversely, the situation regarding oversight of contractors' activities is not satisfactory. The lack of human resources leads to inadequate oversight in the field, difficulties in overseeing un-scheduled operations or oversight being entrusted to "support" personnel, to contractors or to staff members who do not have the necessary authorisation.

Incorporating HOF in operating activities

ASN is still observing shortcomings in the organisation and resources employed on the different sites to incorporate human factors: obsolete organisation circulars, human factor consultants without prescribed duties, absence of local network of correspondents in the specific discipline departments, etc. ASN observed that human factor correspondents had no basic training. Lastly, the simultaneous presence on a site of a local human factors network with other local networks such as human resources performance, weak signal approach or change management can lead to confusion and requires strengthened leadership either on the sites or at national level.

ASN notes the considerable efforts made by EDF to develop implementation of practices to improve reliability of operations within the framework of the national "human resources performance" project. Training sessions are provided in simulator and on training sites under the training or retraining programmes, and some sessions on the training sites are open to contractors. However, ASN still observes shortcomings in the use of these good practices. ASN considers that the effort made by EDF should be pursued.

In general, managers are reinforcing their presence in the field. However, field visits are sometimes organised more with a view to monitoring the condition of installations under the "obtaining an exemplary condition for installations" (OEEI) project than with the intention of observing work situations under the "human resources performance" project. ASN has noted with interest that some sites associate or are planning to associate contractors with the field visits organised during reactor outages.

ASN also noted that on one site the weak signals detection approach is open to all staff. Overall, however, contractors are still only slightly involved in the issuing and characterisation of observations from the field. Furthermore, organisation of the weak signal approach relies heavily on department heads, who do not always have the time needed to develop it. Lastly, ASN notes that the observations made by managers in the field are sometimes insufficiently critical: licensees should make efforts to maintain more balanced proportions of positive and negative observations.

Ergonomics – resources and working conditions

ASN notes that ergonomic studies were conducted on sites in 2010 with the intention of either proposing solutions for improvement subsequent to events or to contribute to design and installation of new equipment or new premises such as, for example, the fitting out of the unit outage steering committee (COPAT) room.

In 2010, ASN was still finding numerous shortcomings relating to ergonomic problems concerning operating documents, equipment, work spaces and man-machine interfaces: equipment unsuited to tasks to be performed; restricted work spaces; inappropriate, incomplete or inaccessible documents; unsatisfactory identification; or indications that are difficult to read, sometimes leading to significant events.

For instance, an alignment error led to notification of a significant event when indication of the direction of rotation of a valve operating in the opposite direction to other valves was painted over. In addition, although the OEEI project contributes to an overall improvement in labelling and identification of equipment, ASN noted in 2010 that some work undertaken for the project had led to removal of labelling and indications and that these had not been replaced.

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.

Analysis of HOF causes in operating experience feedback from reactors in operation

Overall, human factor consultants are integrated into the feedback analysis process, but the situation varies from site to site. They sometimes support the various disciplines, usually at their request, to help them analyse an event from the human factors standpoint. It would be desirable for the human factors consultants to be consulted more systematically by site management. When they exist, human factor correspondent networks in specific discipline departments are involved in event analysis, but in some cases their professionalisation warrants closer monitoring.

Skills and authorisations

The organisation of skills and authorisation management in place on the sites appears to be satisfactory and the management processes well documented and coherent. Shortcomings are observed by ASN during inspections: annual interviews not taking place; managers who do not systematically carry out the observation in the work situation that is necessary for evaluation of skills and renewal of authorisations; an IT application allowing tracking of "unusual actions" that is not up to date and is little used.

Provisional jobs and skills management (GPEC), which makes it possible to forecast and plan for future skills requirements, is satisfactory on the whole. However, ASN observed a case of failure to foresee a large proportion of operation planners taking retirement from the maintenance department of one of the sites.

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. However, anomalies are still frequently observed during inspections or following significant events, especially in the areas of radiation protection and environmental protection: contractors with no or little awareness of environmental issues; shortcomings in training of people responsible for overseeing contractors, arising from a skills deficit. In 2010, ASN found a shortage of simulator instructors on some sites. ASN estimated the proportion of instructors having significant experience of NPP operation to be less than 50%.

It is also important that "buddy system" pairing actions be fully recorded in documents such as paring logs, that the tutors be recognised and that this activity be allowed for in individuals' work programmes.

In general, ASN observed that staff professionalisation logs were well kept and found few errors in staff authorisations. However, ASN did find some anomalies during inspections (operations requiring authorisation carried out by a staff member not yet authorised, an authorisation renewed without obligatory training having been validated, etc.).

Incorporating HOF when modifying reactors in operation

Where modifications of existing installations are concerned, ASN, with IRSN's endorsement, highlights the efforts made by EDF to develop an approach that integrates human factors into the technical and documentary modifications in NPPs and to disseminate this approach to the relevant engineering centres and to the different sites. In the engineering centres, improvements need to be made to the practices used for file analysis and the specialist HOF skills must be strengthened. Furthermore, ASN observed during inspections that the HOF consultants on the sites are very little associated with the implementation of this approach. More generally, the involvement of the sites in the engineering processes should be enhanced.

6|1|5 Analysing operating experience feedback

Significant events in 2010

Under the rules on notification of significant events in the areas of safety, radiation protection and the environment, in 2010 EDF reported 622 significant safety event (ESS), 90 significant radiation protection events (ESR) and 100 significant environmental events (ESE) (involving neither nuclear safety nor radiation protection). 717 events were rated on the INES.

Graph 7 shows the trends in the number of significant events reported by EDF and rated on the INES scale since 2005.

Graph 8 shows the trends since 2005 in the number of significant events per area concerned by the notification (ESS, ESR and ESE).

The number of ESS declared reduced by around 11% in relation to 2009: reduction is due, mainly, to the studies conducted as part of the examination of compliance associated with the third 900 MWe ten-yearly outages, which revealed several generic compliance anomalies in 2009 that have now been dealt with. Progressive introduction by EDF of a plan to harmonise its operating practices made a visible contribution to reduction. The number of ESS in 2010 returned to its 2008 level.

The number of ESR has been reducing since 2007. This is mainly due to continuous improvement in the resources used for protection against ionising radiation. However, this year also saw an ESR rated at 2 on the INES. 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 was stable in relation to the preceding year but 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 2010, rated at levels 0 and 1 on the INES, 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 2010. The increased amount of maintenance and activity during the outage periods generally contributes to a rise in the number of events.

6|2 Evaluating each site

Belleville-sur-Loire

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Belleville-sur-Loire NPP is, on the whole, in line with ASN's general assessment of EDF's performance.

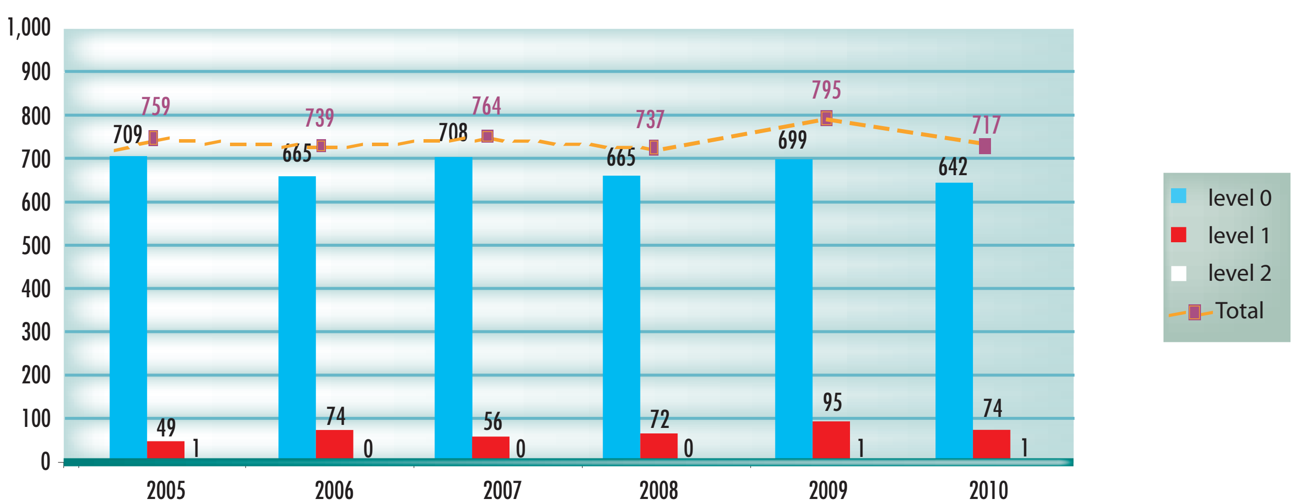
ASN notes a significant improvement on the site in the area of maintenance. Technical and documentary anomalies recorded are now handled correctly and the site draws benefit from feedback at each outage, so as to make progress in maintenance of its installations. However, system alignment errors recorded and significant events that still occur during restarting confirm the need to pursue efforts on stringency in operation.

In the area of environmental protection, the organisational improvements recorded are heavily outweighed by the numerous anomalies still observed. However, ASN notes that the actions under way help to significantly limit their gravity for and impact on the environment.

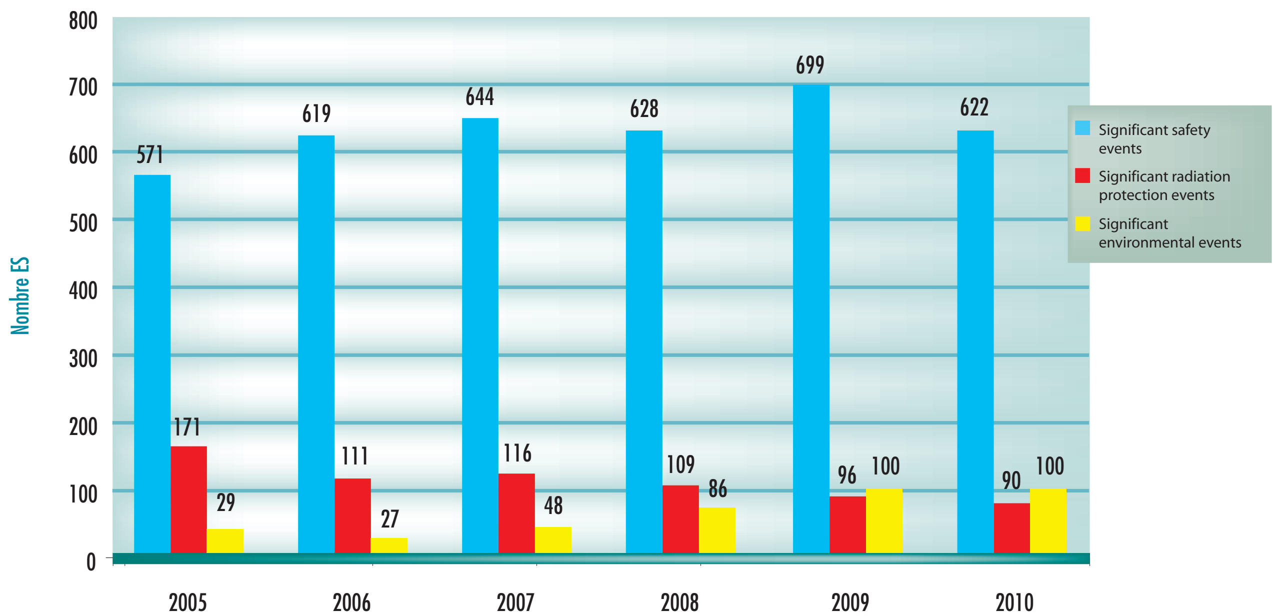
Le Blayais

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Le Blayais NPP is,

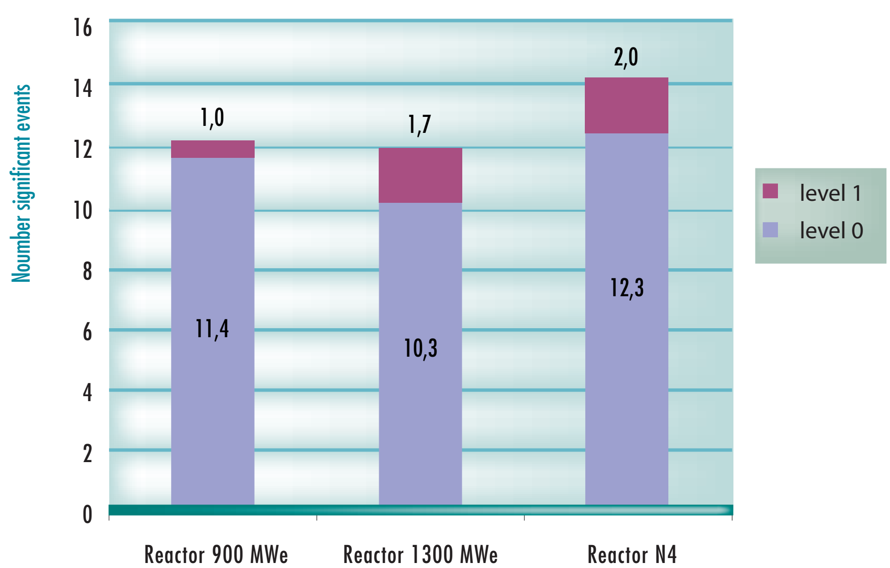
Graph 7: changes in the number of significant events rated on the INES scale in EDF nuclear power plants from 2005 to 2010



Graph 8: changes in the number of significant events per domain in EDF nuclear power plants from 2005 to 2010



Graph 9: average number of INES level 0 and 1 significant events in the EDF NPPs, per type of reactor, for 2010



on the whole, in line with ASN's general assessment of EDF's performance.

ASN has observed significant progress in the carrying out of maintenance operations and plant operation. However, the number of anomalies in application of operating technical specifications remains high and ASN considers that this site should further increase stringency regarding system alignment and preparation of operations, especially regarding the quality and exhaustiveness of risk analyses.

Significant radiation protection event that occurred on 23 April 2010 in the Chinon NPP reactor 4 fuel building

At about 11 a.m. on 23 April 2010, an employee of a contractor company working for EDF was performing a cleanliness inspection of the bottom of the transfer pool in the reactor 4 fuel building for foreign objects. This inspection is required before filling the transfer pool prior to any fuel handling operations. It serves to check that there are no foreign objects that could be entrained into the reactor core during refuelling.

The employee was wearing an impermeable protective garment and vinyl gloves. He was accompanied by another employee who was performing the technical inspection of the activity (and who was wearing the same personal protective equipment).

During the inspection, a metal object was found on the bottom of the pool. The employee performing the cleanliness inspection picked it up with one hand, then held it in his other hand to look at it. Alerted by the triggering of the audio alarm of his operational dosimeter, he threw the object into a bucket used to lower tools from the top of the pool. It was noted that the dosimeter alarm of the employee performing the technical inspection was not triggered.

The bucket was raised to the top of the pool by a third person whose dosimeter alarm was activated in turn. The work site was then evacuated and the workers left the controlled area. The employee who had touched the object with his hands was examined by the plant's occupational physician and to date displays a normal clinical profile.

A reactive inspection carried out in the Chinon NPP by ASN on 3 May revealed the plant's difficulties in establishing a precise record of the facts and a lack of coordination in the post-accident analysis. Several organisational malfunctions and three significant deviations were notified to the licensee.

ASN confirmed the classification of the event as level 2 on the 7-level International Nuclear Event Scale (INES), because a worker was irradiated on the hand, and the dose received exceeded the associated regulatory annual limit.

Lastly, ASN feels that the site must maintain vigilance in the area of radiation protection and strengthen support and oversight in the field, in order to return to the good results of 2009, especially regarding the control of orange zones and radiological cleanness.

Bugey

ASN considers that the Bugey site stands out positively with regard to its nuclear safety, performance in relation to ASN's general assessment of EDF's performance. In particular, the Bugey NPP has an independent safety structure that is strong and is well positioned within the site's organisation.

However, the quality of operation in 2010 showed signs of weakness in the area of system alignments, lock outs and compliance with the technical operating specifications.

In 2010, ASN noted deterioration in the conditions of occupational safety. ASN is expecting some real actions in this area in 2011, a year characterised by a large amount of maintenance activities.

In the areas of radiation protection and protection of the environment, ASN considers that the site's performance is in line with ASN's general assessment of EDF's performance. The efforts under way on the Bugey site for several years are beginning to produce results.

Cattenom

ASN considers that the performance of the Cattenom NPP in the area of nuclear safety, radiation protection and protection of the environment is satisfactory on the whole and is in line with ASN's general assessment of EDF's performance. In particular, ASN considers that the actions undertaken on the site in 2010 have led to progress in radiation protection of workers and should be pursued.

In the fight against legionella, ASN notes that the experimental treatment of make up water did not reach an industrial scale outcome and will ensure that the site continues its efforts in this area, by integrating all of the safety, environmental protection and public health issues.

In addition, ASN considers that the Cattenom site should be more rigorous in its management of transport of radioactive materials as several anomalies occurred in 2010, including the shipping of radioactive waste in unsuitable packaging, an event rated at level 1 on the INES.

Chinon

ASN considers that the Chinon NPP is under-performing in terms of nuclear safety and radiation protection and that the site's environmental performance is, on the whole, in line with ASN's general assessment of EDF's performance.

ASN considers that there is a lack of rigour in operation, characterised again in 2010 by a considerable number of significant events. Analysis of the anomalies reveals weaknesses in both reactor operation and system alignment. In ASN's view the site needs to make progress on knowledge of the general operating rules and compliance with procedures.

Where radiation protection is concerned, the two significant incidences of abnormal exposure of workers to ionising radiation that occurred in 2010 revealed important shortcomings in the preparation of operations. ASN considers that integration of the risk of handling irradiated objects and of the procedures for prior mapping needs to be greatly improved.

Chooz

ASN considers that the Chooz B NPP is under-performing in terms of environmental protection and that the site's performance regarding nuclear safety and radiation protection is, on the whole, in line with ASN's general assessment of EDF's performance.

The licensee at Chooz was confronted with a number of maintenance related incidents that often implicated the preparation of activities or even the competence of the maintenance teams. Where operation is concerned, ASN noted that alignment errors had been virtually eliminated in 2010. In addition, the year was also marked by distortion of assemblies, difficulty with fuel handling operations and jamming of control rods.

In the area of environmental protection, ASN considers that the licensee has not fully integrated the decisions made in 2009 regulating discharges. Several events involving failure to comply with these regulations were reported. The site will have to make progress in this area in 2011.

Civaux

ASN considers that the Civaux NPP's radiation protection performance stands out positively and that its nuclear safety and environmental protection results are, on the whole, in line with ASN's general assessment of EDF's performance.

ASN considers that the site should improve maintenance of its equipment as shortcomings here can have environmental impacts.

Where reactor operation is concerned, ASN notes that conducting of periodic tests is improving, but the Authority considers that the site needs to be more rigorous during the preparation of operations.

Civaux's radiation protection results are good, notably with a low collective dose. ASN emphasises that, for the first time, the EVEREST approach (entering limited access areas wearing ordinary overalls) was implemented in a reactor building throughout an outage.

Cruas-Meysse

ASN considers that the Cruas-Meysse NPP's nuclear safety, radiation protection and environmental performance is, on the whole, in line with ASN's general assessment of EDF's performance, notably because of the plan to improve safety that has been implemented since 2008. However, the site needs to be far more vigilant in order to ensure long-term improvements to the stringency of its operation of the plant.

In the area of radiation protection, the Cruas-Meysse site reported contrasting results in 2010. ASN considers that the results obtained in the area of gammagraphic inspections are satisfactory, but that results are not satisfactory where control of access to orange radiological zones is concerned.

Lastly, where environmental protection is concerned, in 2010 ASN observed weaknesses in the running of projects relative to the setting up of new installations with implications for the environment.

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, in 2010, ASN once again detected shortcomings in the overseeing of maintenance contractors. In addition, despite the actions that have been under way in this area for several years, problems arising from anomalies in system alignment persist. ASN considers that these two areas should be priorities for action in 2011.

Where radiation protection of workers is concerned, ASN once again observed an absence of improvement in the integration of requirements on the practices of people coming onto the site. As of 2011, the site should make progress concerning control of contamination and compliance with the essential radiation protection rules.

Fessenheim

ASN considers that the nuclear safety, environmental protection and radiation protection performance of the Fessenheim NPP is satisfactory and is, on the whole, in line with ASN's general assessment of EDF's performance.

However, ASN considers that the site must remain vigilant with regard to worker occupational exposure and must take adequate steps.

The ten-yearly outage of reactor 1, which took place from October 2009 to March 2010, showed that the condition of the installations, and in particular of the containment barriers, is satisfactory. At the time of writing ASN is examining the results of the inspections conducted during the outage and will forward its opinion on the extended operation of reactor 1 to the government in 2011. The ten-yearly outage of reactor 2 will also take place in 2011. The steam generators will be replaced on that occasion, making a further contribution to improving the condition of the installations.

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.

The site is continuing application of a programme intended to improve safety performance, recentred around clear and targeted objectives that correspond to the shortcomings identified by ASN for several years. The shortcomings relate more specifically to organisational problems, inadequate steering of actions to improve safety, a large maintenance backlog and failures in the area of safety culture.

ASN considers that there have been positive developments in several areas since the middle of 2010. These improvements remain fragile and the programmed periods of reactor outage should allow the site to consolidate its results in 2011.

Golfech

ASN considers that the Golfech NPP's radiation protection performance stands out positively and that its nuclear safety and environmental protection results are, on the whole, in line with ASN's general assessment of EDF's performance.

In spite of results that are satisfactory overall, in 2010 ASN observed some loss of stringency during some operations. There were also some shortcomings in the preparation and carrying out of some maintenance operations during two reactor outages.

ASN considers that the site crews should pay greater heed to events that could have environmental impacts.

In the area of radiation protection, the collective dose is satisfactory and the Golfech plant carries out fuel handling phases in ordinary overalls, without oversuits, a sign of good control of contamination at source.

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 should look for ways to improve rigour and reliability of some operations. In addition, several events that could have impacted nuclear safety or security were not handled appropriately by the site. In particular, ASN requested temporary shutdown of reactor 2 to remedy incorrect adjustment observed on a steam take-off line for which seismic resistance was no longer guaranteed.

As in 2009, ASN considered that the site should reinforce the means for dealing with environmental protection issues, given its size and location in a dense industrial environment.

Nogent-sur-Seine

ASN considers that the nuclear safety and radiation protection performance of the Nogent-sur-Seine NPP is, on the whole, in line with ASN's general assessment of EDF's performance but that it is under-performing in the area of environmental protection.

In 2010, reactor 2 was shut down for around 3 months as part of the ten-yearly outage and the determining inspections for safety were satisfactory. Conversely, several significant events were reported after excursions from the authorised operating range (reactor control) and following system alignment errors during reactor outage.

In addition, ASN considers that the site's results remain satisfactory in the areas of radiation protection, pressure equipment and transport of radioactive materials.

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.

The site confirmed its progress in the areas of quality of maintenance operations and post maintenance testing of equipment. A reduction in the number of maintenance quality faults was also observed. The site has also implemented a new maintenance strategy intended to improve equipment reliability. In addition, new major investments in the installations have had a positive impact in the areas of safety, radiation protection and environmental protection.

However, ASN considers that the stringency of control operations should be a priority for action and that the staff safety culture should be strengthened since, in spite of much work undertaken, anomalies with regard to operating requirements persist.

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.

However, ASN is of the opinion that organisation of the inspection department recognised as being in charge of implementation of pressure equipment inspection plans remains weak. This point is the subject of special attention on the part of ASN.

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 2010, the structural weaknesses already identified in 2009 were observed again, notably during the outage of reactor 2 for reloading.

Since mid 2009 the site has been implementing a plan for more rigorous operation. ASN has noted an upswing in the way safety requirements are affirmed.

In the areas of radiation protection and environment, the site's results remain fragile, these issues not being integrated with sufficient rigour.

ASN notes that where monitoring of pressure equipment is concerned, the recognised inspection department must establish its authority more firmly.

In addition, in 2011, ASN expects progress from the Saint-Alban NPP in terms of its responsiveness and communications with ASN.

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.

In the area of safety, the progress recorded on oversight of the control room has allowed the site to improve management of transient phases of reactor shutdown and restarting. However, ASN considers that the site must remain vigilant in order to ensure the long-term viability of the results and must strive to strengthen the preparation of operations.

ASN notes that the resources implemented by the site have made it possible to reduce the number of significant radiation protection events. Although the radiological cleanness indicators remain at a satisfactory level, the efforts on integration of issues relating to radiation protection by operatives must be maintained.

Tricastin

ASN considers that the nuclear safety performance of the Tricastin NPP stands out positively in relation to ASN's general assessment of EDF's performance. ASN notes that, even if there is still room for progress, in particular in the preparation of operations, plant operation was carried out with greater rigour in 2010, as a result, notably, of the greater involvement of management.

Where radiation protection and protection of the environment are concerned, ASN considers that the site's overall performance is in line with ASN's general assessment of EDF's performance. Specifically, in the area of radiation protection, ASN has observed an improvement in radiological cleanness, especially during reactor outages but also noted a lowering of the site's performance in the area of compliance with radiological zoning.

Lastly, ASN considers that the safety of workers deteriorated badly in 2010, notably with three serious occupational accidents.

Nouveaux réacteurs

6 | 3 Evaluating EPR construction

After inspections carried out in 2010 and examination of the anomalies reported by EDF, ASN considers that, where civil engineering is concerned, the organisation of EDF and the main contractor Bouygue is satisfactory overall and that, in relation to previous years, there has been progress with technical and documentary stringency. Conversely, for new activities such as mechanical or electrical assembly, ASN has noted that, in general, EDF has not adequately anticipated the difficulties of companies in adapting to the requirements associated with application of the government order of 10 August 1984, including prior identification of quality related activities and compliance with all of the associated requirements.

Management of quality associated with construction

During these inspections, ASN noted that the organisation put into place in the various EDF departments in charge of monitoring was on the whole satisfactory. Anomalies were nonetheless observed relating to identification of quality related activities and errors in the traceability of monitoring actions carried out by EDF. Regarding activities inspected in 2010, these errors are, essentially, concentrated around the design engineering practice to which EDF entrusted the monitoring of the detailed design studies for civil engineering and manufacture of systems and components not forming part of the nuclear steam supply system. ASN also considers that EDF should improve its control system for documents used for manufacture of systems, structures and components.

HOF in new reactor projects

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. This opinion was to be given in December 2010. However, the results of the first series of tests carried out on simulator in 2010 were not conclusive where certain essential elements of the safety case were concerned. They are therefore to be completed by another series planned for 2011, with the GPR's opinion being given in 2012.

In addition, in 2010, ASN also examined the integration of HOF on the Flamanville 3 EPR construction site. ASN considers that HOF specialists should be called on more systematically, for example to develop HOF monitoring guidelines intended for works supervisors and to help the supervisors put them into practice. ASN pinpoints as a positive step the ergonomic analyses conducted in different work situations by the main civil engineering contractor. Where interventions by foreign workers are concerned on the site, particular attention must be paid to there being enough interpreters and to their degree of fluency in French.

With a view to preparing the examination of the application for commissioning of the installation, ASN inspected the organisation of the first pre-operating phase. This is the phase of progressive takeover of the NPP prior to its commissioning. ASN has noted the desire on the part of the future operating team to put in place an organisation that is able to anticipate and which is in line with the "learning organisation" concept: this would take the form of integration of the weak signal detection approach, of the presence of human factor consultants and the setting up of a local network of human factor correspondents. ASN has, nonetheless, asked the licensee to, at the earliest opportunity, take the steps required to guarantee a level of quality that is in compliance with the order of August 1984 for carrying out of current or future actions and that relate to application of the order.

7 OUTLOOK

With regard to NPPs, ASN's regulatory and inspection duties in 2011 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. ASN intends to pursue its regulatory duties in the areas of prevention of occupational accidents, surveillance by EDF of the quality of work for both works on the construction site and manufacture carried out by its suppliers, notably by means of equipment testing. At present, EDF is planning to submit a commissioning application for its installation in 2012, for initial operation at nominal power in 2014. At the same time, ASN will also be continuing with an early review of certain aspects of the regulatory commissioning application file, in particular the accident study methods, the principles of control and general operating rules. In addition, in December 2010, EDF submitted an application for authorisation to create a reactor of the EPR type at Penly. In 2011, ASN, with IRSN's support, will undertake examination of the file submitted by EDF with the intention of stating its opinion on the authorisation for creation of this new reactor.

Other actions relating to new reactors

In 2011, ASN will, with support from IRSN and the advisory committee for reactors (GPR), examine the safety options for the ATMEA-1 reactor, and will state its opinion on the options. This examination will take place within the framework and according to the procedures of the three-party agreement signed mid-2010 between ASN, IRSN and the ATMEA company.

Furthermore, 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 Oversight of subcontracting

ASN will initiate a process of evaluation of the subcontracting policy, to verify that EDF maintains an adequate internal volume of skills to be able to meet its responsibilities. In addition, ASN will carry out a series of targeted inspections to check that regulations are complied with in subcontracted tasks and the link with conditions for awarding contracts, for both operating installations and on the Flamanville 3 EPR construction site.

7 | 3 Occupational health and safety inspection

Subsequent to the anomalies on sites observed in 2010 relating to exceeding of maximum working hours, ASN will maintain its monitoring in this area. It will see that EDF undertakes real actions in the area of working hours of management staff, the group most concerned. It will also make efforts to disseminate the measures established in the Ministry of Labour's action plan for occupational health and safety inspection, thereby placing the emphasis on health and safety at work, the quality of the work experience, labour relations and governance and combating illicit employment. Lastly, to foster an integral vision of safety, ASN's occupational health and safety inspectors will be associated with ASN's other regulatory activities, notably those concerning subcontractors. ASN will also make a detailed analysis of the conditions of access to the reactor buildings with the reactor in operation, which have caused site CHSCTs to be alerted to a "serious and immediate hazard" on several occasions. ASN will examine the risks inherent to these operations, including the risk of exposure to neutrons and the psycho-social risk. Analysis will be made jointly by ASN's radiation protection and occupational health and safety inspectors.

7 | 4 Radiation protection and protection of the environment

Radiation protection

ASN expects of EDF that it will strengthen its radiation protection policy with, notably, greater raising of awareness of safety culture amongst personnel and progress in controlling of contamination at source. The Authority will be attentive to compliance on these different aspects in the files it will examine, and during on-site inspections. In particular, ASN will carry out a major inspection on the four sites in the Val de Loire region (Belleville, Dampierre, Saint-Laurent-des-Eaux and Chinon), with the intention of producing an in-depth review of the radiation protection actions and to ensure that feedback on events at Chinon 2010 has been taken into account.

Environmental Protection

ASN will apply itself to checking in the field that the actions planned by EDF to fight against legionella, as well as actions to reduce refrigerant emissions, are actually implemented on the different sites. It will also continue its discussions with the licensee on optimisation of emissions, in line with the actions recommended by the GPR in 2009, when it met to examine the question of chemical effluents from operating French NPPs.

7 | 5 Hazard prevention

Preventing fires and explosions

After the transformer fires that occurred in the Paluel and Tricastin NPPs in 2010, ASN decided to carry out reinforced inspections to verify the adequacy of servicing and maintenance of these items of equipment.

Flood prevention

In 2011, ASN will submit the draft guidelines on protection of BNIs against external flooding to the advisory committees for reactors, laboratories and plants. The guidelines constitute the outcome from a working group that, between 2006 and 2009, brought together ASN, IRSN, nuclear industry operators and experts in hydrology.

7 | 6 Surveillance of equipment and maintenance

In 2010, EDF informed ASN of its intention to change in the near future to a new maintenance doctrine, known as AP913. This methodology was developed by the Institute of Nuclear Power Operations (INPO), with the American licensees in 2001. ASN will closely monitor the implementation of this new doctrine.

7 | 7 Review of safety associated with ten-yearly outage

In 2011, ASN will pursue attentively examination of the safety reviews of NPPs that are associated with the ten-yearly outages. ASN considers this to be a fundamental step in obtaining a precise picture of the condition of the reactors and in analysing EDF's ability to continue to operate them. The Authority will, one year after the end of each ten-yearly outage, make known its opinion on the compliance of each installation with the applicable safety requirements and, if necessary, will prescribe technical requirements to provide a framework for continued reactor operation. Accordingly, in 2011, ASN will state its position after the ten-yearly outages in 2010, notably for the Fessenheim 1 and Bugey 2 reactors which have completed their third ten-yearly outage.

7 | 8 Continuing operation beyond 40 years

As EDF has indicated its desire to extend the duration of operation of its reactors significantly beyond 40 years, ASN will pursue its examination of possible conditions for extension of their operation. To this end, in 2011, ASN, with IRSN's support, will ask the GPR to assess EDF's proposed study and work programme with a view to extending reactor operation. For ASN, extension of reactor operation 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.

NUCLEAR FUEL CYCLE INSTALLATIONS

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 oxide and plutonium, the plutonium having been generated when the fuel based on natural enriched uranium passes through the power reactors.

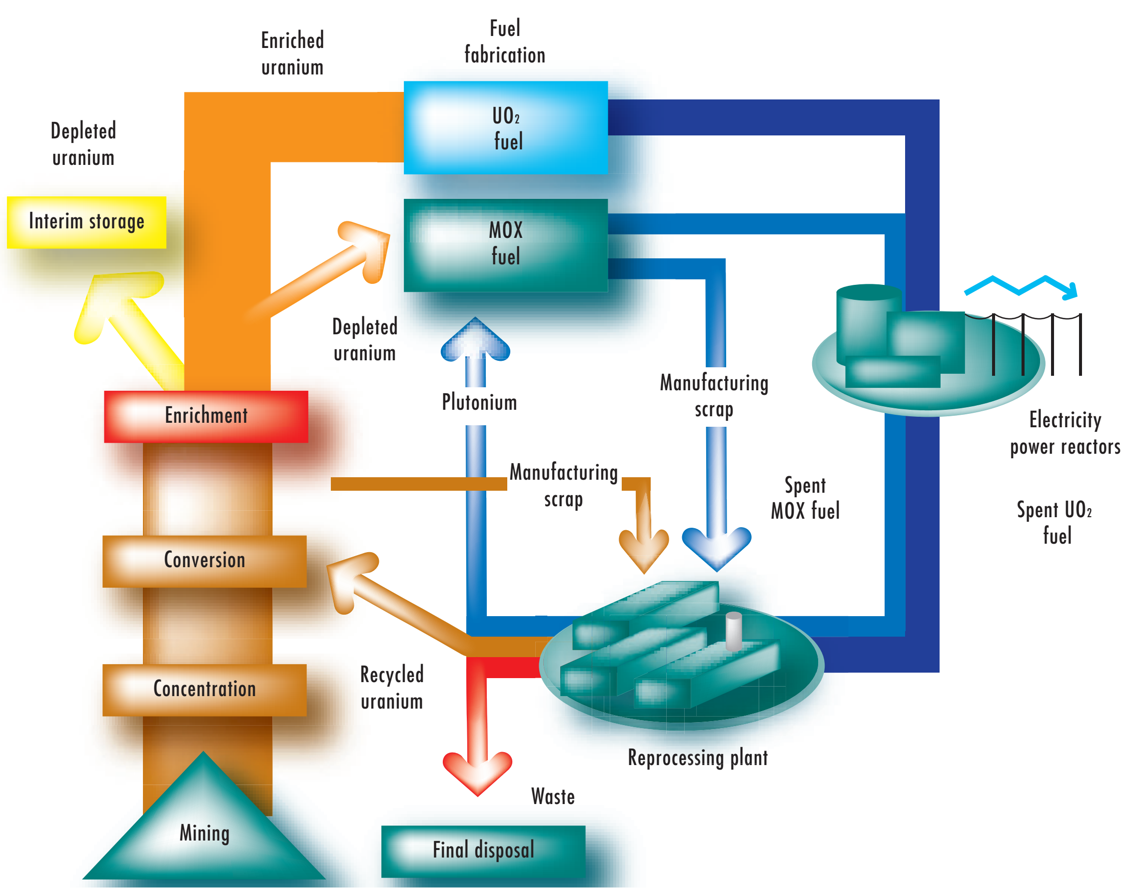
Historically, ASN has monitored these industrial facilities independently. Today its objective is to monitor a fleet of facilities having common basis in terms of safety and radiation protection. The creation of the AREVA Group was a determining factor in this respect, as was the desire to address these safety issues in international forum.

Today, ASN expects from AREVA a very high Level of safety and radiation protection management, corresponding to the ambitions stated by the Group; this must be based on an integrated vision of safety, shared by all the Group's stakeholders.

The fuel cycle comprises the fabrication of the fuel and its subsequent reprocessing after it has been used in the nuclear reactors (NPPs). 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 (UF6) in the conversion operation. The raw material for enrichment is fabricated by COMURHEX in Malvési (Aude *département*[1]) and Pierrelatte (Drôme *département*). The facilities in question – which are not regulated as basic nuclear installations (BNIs) but as classified installations – use natural uranium in which the uranium 235 content is around 0.7%.

The fuel cycle



1. Administrative region headed by a *préfet*.

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 from 0.7% to between 3 and 5% is the role of the EURODIF plant in Tricastin, which separates the UF6 by means of a twin-stream gaseous diffusion process, with one stream becoming enriched in uranium 235 while the other becomes depleted in the course of 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 pond, 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 to manufacture fuel for fast neutron reactors (as was done in the ATPu in Cadarache). Alternatively, in the Marcoule MÉLOX plant, it can be used to manufacture the MOX fuel (mixture of uranium and plutonium oxides) used in particular in the French 900 MWe PWR reactors.

The main plants of the fuel cycle – COMURHEX, AREVA NC Pierrelatte (TU5/W), EURODIF, GB II, FBFC, MÉLOX, AREVA NC La Hague – belong to the AREVA Group.

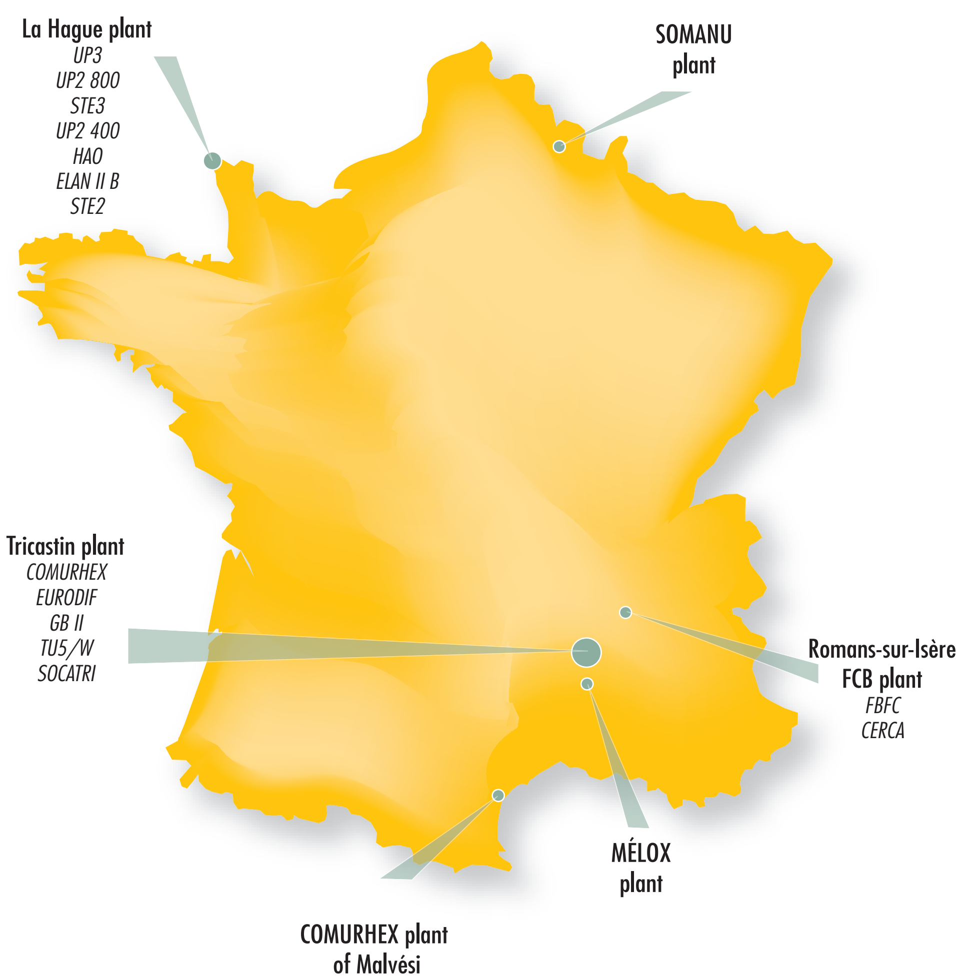


Table 1: Fuel cycle industry movements[1]

Installation	Origins	Material processed	Tonnage (unless otherwise specified)	Product obtained	Tonnage (unless otherwise specified)	Destination	Tonnage (unless otherwise specified)
COMURHEX Pierrelatte[2]		U02(N03)2 (derived from reprocessed uranium)		UF_4 UF_6 U_3O_8			
AREVA NC Pierrelatte TU5 facility	**AREVA NC** La Hague	$UO_2(NO_3)_2$ (derived from reprocessed uranium)	3949	U_3O_8	1163	Interim storage TU5	1163
AREVA NC Pierrelatte W plant	**URENCO** **EURODIF**	UF_6 (based on depleted uranium)	9070 8926	U_3O_8	7237 7065	Interim storage Plant W	7237 7065
EURODIF Pierrelatte	Converters and EURODIF Production	UF_6 (derived from natural and depleted uranium)	11896	UF_6 (depleted uranium)	10888	Defluorination and re-enrichment of tailings	11976
	Re-enrichment of tailings	UF_6 (based on enriched uranium)	1387	UF_6 (enriched uranium)	2430	Fuel manufacturers	1997
FBFC Romans	**EURODIF** **TENEX** **URENCO**	UF_6 (based on enriched natural uranium) (ML[3])	624.827	UO_2 (powder)	204.478	FBFC, Dessel (Belgium)	
				Fuel elements derived from enriched natural uranium	271.079 71.995 44.739	EDF, Tihange + Doel (Belgium), KOEBERG (South Africa)	
	AREVA NC	UF_6 (based on enriched natural uranium) (ML[3])	95.913	UO_2 (powder)			
				Fuel elements derived from enriched natural uranium	92.426	EDF	
MÉLOX Marcoule	**AREVA NC** Pierrelatte **AREVA NC** La Hague	UO_2 (based on depleted uranium) (ML[3]) PuO_2 (ML[3])	123.4 11.4	MOX fuel elements (ML[3])	124	CNPE EDF FBFC-Dessel AREVA NC La Hague (Japan)[9]	
AREVA NC La Hague	UOX and MOX: EDF, CAORSO	Reprocessed irradiated fuel elements: UP3 $(U+Pu)_{init}$	453.73	$UO_2(NO_3)_2$ (tonne of U)	997.71[8]		
	RTR: BR2 MOL	Reprocessed irradiated fuel elements: UP3 $(U+Pu)_{init}$	0.08	PuO_2 (tonne of PuO_2)	13.70[5]		
	UOX and MOX: EDF	Reprocessed irradiated fuel elements: UP2 800 UP3 $(U+Pu)_{init}$	595.11	Quantity of vitrified waste products in UP3	383 CSD-V	Interim storage La Hague	455 CSD-V
		Reprocessed irradiated fuel elements: UP2 400		Quantity of vitrified waste products in UP2 800	380 CSD-V		
				Quantity of compacted waste products	1472 CSD-C	Interim storage La Hague	1260 CSD-C[7]
	UOX: EDF and CAORSO UOX and CELESTINS for RTR					Irradiated fuel elements unloaded into a pool $(U+Pu)_{init}$	1120.99

(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 2010. Production ceased in January 2008.
(3) Heavy metal.
(4) Value which includes the production from 2008 but which was accepted in 2009.
(5) Production of PuO2 in 2010: 13.70 tonnes of PuO2 and 1.7 kg of samples. In 2010, AREVA NC shipped 12.17 tonnes to MELOX (the samples are not shipped to MELOX).
(6) In 2010, AREVA NC shipped 308 packages of waste produced between 2002 and 2006 to Germany.
(7) In 2010, AREVA NC shipped 212 packages of compacted waste to Switzerland, Belgium and the Netherlands.
(8) In 2010, AREVA NC shipped all the uranyl nitrate produced to the Pierrelatte TU5 plant.
(9) Products fabricated in the MELOX plant and leaving it as assemblies or rods.

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 (UF6), the form in which it is enriched. These operations are mainly carried out on the Tricastin site, also known as Pierrelatte.

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 UF6 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.

Storage of depleted uranium on the Tricastin site

1 | 1 | 2 The uranium isotopes gaseous diffusion separation 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 UF6 through porous barriers. These barriers allow preferential passage to the uranium 235 isotope containing the gas, thereby increasing the proportion of this fissile isotope in the UF6 at each passage. The UF6 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 has announced that plant operation will stop in 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 of the DGEC (General Directorate for Energy and Climate) on 23 April 2010. Given the masses involved – 150,000 tonnes of steel for the diffusers for example – it is important to anticipate the inventory and characteristics of the equipment in order to optimise processing, disassembly, transport and disposal. The licensee should thus shortly submit 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. A public inquiry will be held for these operations.

Following the PRISME operations, the licensee will submit a final shutdown and decommissioning decree application (MAD-DEM) for the installation, a procedure that also entails a public inquiry.

At the end of October 2008, the licensee had submitted an application for a modification to the EURODIF plant's creation authorisation decree. This application concerned an increase in the maximum quantity of UF6 present in the facility and a number of operations on behalf of the site licensees concerning the reception, shipment and monitoring of the UF6. This application also concerned sorting and packaging of non-radioactive waste. The perimeter of the facility was to be modified in order to include the chlorine trifluoride (ClF3) disposal facility, which is an installation classified on environmental protection grounds (ICPE). The licensee withdrew its application at the end of 2009 in order to include the PRISME operations in it; the licensee also indicated to ASN that the quantity of UF6 present in the facility would remain below the authorised limit (50,000 tonnes) in the coming years and that it would not maintain its request to increase the quantity. The other requests will be unchanged.

Lastly, and in order to make a decision on the continuation of operation of GBI for a limited period of time, ASN is examining the licensee's report on thirty years of operating experience feedback from the plant; it is also examining the current operational, management and human factor integration aspects that will give foresight on plant shutdown.

Aerial view of EURODIF, uranium isotopes gaseous diffusion separation plant on the Tricastin site

In 2009, an ASN inspection on waste management led to notification of an incident rated Level 1 on the INES scale. This event concerned significant deficiencies in criticality risk prevention during storage of fissile materials in waste areas not specifically designed for this purpose. The licensee rapidly took remedial action with respect to the criticality risk, which gave satisfactory results. However, ASN conducted an inspection of the subcontractor in 2010 that revealed deficiencies. The licensee has engaged a plan of action.

With regard to the plan of action engaged following the operating experience feedback from the Socatri incident of July 2008, although major work has been undertaken on the retention areas to bring them up to standard, ASN has found defects in the floor coverings beneath the overhead chlorinated solvent pipes. ASN has asked the licensee to establish a periodic inspection programme for the retention areas.

1|1|3 The Georges Besse II ultracentrifugation enrichment plant project

The ultracentrifugation process should eventually replace gaseous diffusion. This process, which will be operated by the Société d'Enrichissement du Tricastin (SET), consists in rotating a cylindrical bowl containing uranium hexafluoride (UF6) 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 mass of nuclear material present in the cascades and centrifuges is reduced, and is 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 support facilities, was authorised by a decree on 27 April 2007.

The review carried out by ASN, its technical support organisations IRSN, and the Advisory Committee for laboratories and plants, revealed that the low level of UF6 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 also considers that the licensee has adopted satisfactory measures to control the risks associated with maintenance work being performed alongside normal operations, owing to the modular design of the plant.

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 is dependent on a number of technical requirements, explaining the centrifugation plant's start-up and operating conditions. In March 2010, ASN supplemented this framework with a decision in which it prescribes a set of conditions relative to the safety tests prior to the first introduction of UF6 into the plant. The UF6 was introduced at the end of 2010 and the plant will start functioning in 2011.

Furthermore, in January 2008, SET submitted a modification application for the GBII basic nuclear installation (BNI) creation decree (168), more specifically to allow the use of reprocessed uranium (URT) in the REC II support shop. The public inquiry on this matter took place from 22 December 2008 to 30 January 2009 and the coordinating *préfet*[2] approved the modification. The amending decree is currently being drafted.

1|2 Nuclear fuel fabrication plants in Romans-sur-Isère and Marcoule

After 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. This powder is used to fabricate pellets which are made into fuel rods, which in turn are grouped to form fuel assemblies. As for experimental reactors, some of them use highly enriched uranium in metal form. These fuels are fabricated by FBFC in Romans-sur-Isère.

The MÉLOX plant in Marcoule is specialised in the fabrication of MOX (mixed oxide) fuels.

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

ASN commissioners visit the Georges Besse II plant – July 2010

1|2|1 The FBFC and CERCA uranium-based fuel fabrication plants

The two BNIs located on the Romans-sur-Isère site belong to the CERCA and FBFC companies respectively. These two companies are now an integral part of the AREVA Group. As far as the regulations are concerned, FBFC is the sole nuclear licensee for the site.

The CERCA plant comprises a series of facilities for the manufacture of highly enriched uranium based fuel for experimental reactors.

The FBFC plant production, consisting of uranium oxide powder or fuel assemblies, is intended solely for light water reactors (PWRs or BWRs).

During 2010, the licensee renovated the uraniferous (i.e. containing uranium) effluent networks further to the incident of 12 October 2009, in which part of the site's stormwater drainage network and one stormwater tank were found to be contaminated with uranium due to uncontrolled connections. The renovation work separated the uraniferous effluent networks from the stormwater drainage networks.

Robotic welding in the FBFC plant of Romans-sur-Isère

FBFC nuclear fuel fabrication facility

By a decree of 20 March 2006, FBFC was authorised to raise annual capacity to:
– 1,800 tons for the conversion unit;
– 1,400 tons for the pelletizing, rod fabrication and assembly lines.

However, pending the end of the work to renew and modernise the industrial plant, ASN restricted the capacity of the pelletizing lines to 1,000 tons per year. The industrial plant renewal and modernisation work continued in 2010. Adjustment of the new uranium pellet sintering[3] furnaces is finished.

CERCA fuel element fabrication plant

The CERCA plant, one of France's oldest nuclear installations, predates the BNI regulations. The Government was therefore simply notified of this installation in 1967.

In order to improve regulation of the activities carried out in the installation, work on drafting the requirements stipulated in act 2006-686 of 13 June 2006 has been started. These technical requirements will be finalised in the first quarter of 2011.

In this context and in accordance with the conclusions of the periodic safety review carried out on this installation in 2006, ASN is particularly vigilant to human factors being considered in the routine operation of the units and in handling of the waste produced by the site's activities.

1|2|2 The MÉLOX uranium and plutonium-based fuel fabrication plant

The MÉLOX plant is today the only French nuclear installation producing MOX fuel, consisting of a mixture of uranium and plutonium oxides.

In a decree of 20 March 2007, MÉLOX was authorised to raise the production capacity 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.

In 2008, pursuant to the requirements of article 29 of decree 2007-1557 of 2 November 2007, the CEO of the MÉLOX SA company submitted an application for the transfer of nuclear licensee status from AREVA NC to MÉLOX SA.

ASN reviewed this application in 2009; the decree was published in the Official Gazette 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. Through this decision, ASN confirms that the licensee has indeed complied

3. Sintering is a very high-temperature baking operation which transforms the compacted "raw" uranium pellets into pellets with a composition similar to that of a ceramic.

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 considered in the periodic safety review of the facility, as defined in article 29 of the TSN Act, continued in 2010: the review file is to be submitted to ASN in mid-2011.

2010 was marked by the event on 9 February 2009 which was classified as Level 1 on the INES scale (see point 3). During a maintenance operation using a glove box, the rotation of a mechanical wheel driven by a motor functioning intermittently caused a containment break by tearing the glove used by an operator, resulting in internal contamination of the operator's forearm.

Analysis of the causes of this event revealed a number of failings involving human and organisational factors in both the preparation and the performance of this intervention. The licensee decided to review the work authorisation procedure, analysing the human factor in greater depth. The conclusions of the working group responsible for this review will be applied to all the plant units.

Further to ASN's various findings (deficiencies in the computerised production management system, inconsistencies between the authorised requirements and practices on the ground) related 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 this topic within the facility in June 2010 (see point 3.3.4).

ASN notes that managers of the plant have now made a strong commitment to better managing organisational and human factors on the site. Modifications are in progress to increase the presence of engineers on the ground and to improve operating team responsiveness to unplanned situations. Nevertheless, although things are moving in the right direction, the means deployed today still fall short of the stated objectives of plant management.

Loading fuel assemblies in the MÉLOX plant

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 commissioned from 1986 (reception and storage of spent fuel) to 1994 (vitrification facility), with most of the process facilities becoming active 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).

Operations carried out in the plant

The main processing chain of these facilities comprises reception and interim storage installations for spent fuel, plus facilities for shearing and dissolving it, chemical separation of fission products, purification of the uranium and plutonium and effluent treatment.

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 pond, or dry in a leak-tight shielded cell. The fuel is then stored in the ponds.

After shearing the rods, the spent fuel is separated from its metal cladding by being dissolved 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_30_8) in the Pierrelatte TU5 installation.

After purification and concentration, the plutonium is precipitated by oxalic acid, dried, calcinated 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 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 ponds:	*Ponds 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 – EDS – D/E EDS ECC:	*Packaged technological and structure waste storage and recovery facilities*
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 pond*
C pond:	*Pond 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:**	*STE 3 facility: effluent recovery and treatment and storage of bituminised packages*

View of the spent fuel reprocessing plant in La Hague

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 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.

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. In 2009, the licensee thus shipped standard containers of compacted waste (CSD-C) back to the Netherlands and in 2010 to Germany.

1|3|2 Plant modifications

The plant authorised operating framework

The creation authorisation decrees 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.

ASN decisions now authorise broadening of the nature and origin of the materials and substances brought in for treatment from other installations, while remaining within the domain defined by the decrees.

Adaptation of the industrial plant

Environmental protection concerns and new market trends require the licensee to modify its industrial plant.

The cold crucible project

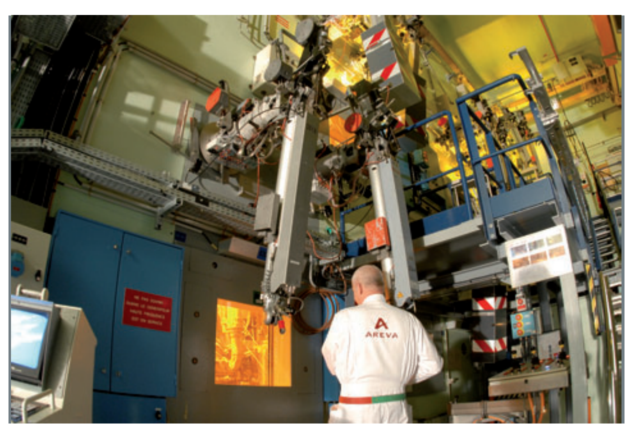
Between 1966 and 1985, the processing of UNGG (Uranium Naturel Graphite Gas) GCR (Gas Cooled Reactor) fuels of type UMo (alloy of uranium and molybdenum) and UMoSnAl (alloy of uranium, molybdenum, tin and aluminium) generated fission product concentrates with a high concentration of molybdenum and phosphorus, 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 (MoO3) 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. Authorisation to supply the cold crucible with solutions of fission products containing molybdenum originating from legacy waste is currently being examined by ASN.

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.



Cold crucible vitrification process in the AREVA plant in La Hague

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 elements important for safety.

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 for laboratories and plants from the end of 2011 to 2013. 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 will be 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 (CDAI).

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.

The new facilities planned

To face up the increases in plutonium recycling flows of the coming years, AREVA NC is envisaging putting a "plutoniferous material treatment" (TMP) unit into service in the T4 facility. The licensee submitted the corresponding safety options file to ASN in 2009, and this is currently being reviewed.

This addition will be subject to a modification of the BNI 116 creation authorisation decree, with a prior public inquiry.

AREVA NC has submitted to ASN a project for the complete renewal of the fleet of boilers that produce the heat necessary for operation of the La Hague plant. AREVA NC plans to replace them with one wood biomass boiler room and two new oil-burning boilers.

Construction of an extension to the fission product interim storage hall (CSD-V)

2 INSTALLATIONS IN CLOSURE PHASE

2 | 1 Older AREVA NC La Hague installations

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 due to 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 is not necessarily easy, as it involves major technical difficulties and high costs. But 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, disposal routes or new interim storage solutions must be decided upon, because their deployment represents long-term projects: pushing them further back would jeopardise compliance with the deadlines set by the act of 28 June 2006, learing on "radioactive waste and spent fuel management".

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 issues linked to the age of the waste, in particular its characterisation prior to any recovery and reprocessing, confirm ASN's approach to the licensees which is to require that for all projects, they 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 for laboratories and plants and for waste, ASN confirmed the need to undertake as rapidly as possible the recovery of the sludge stored in the STE2 silos, the wastes from the HAO silo and the silo of Building 130, and the drums of predominantly alpha waste stored in Building 118 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 these experiments and the December 2007 review of the proposed packaging process by the Advisory Committee for laboratories and plants, ASN issued a decision on 2 September 2008 prohibiting the bituminisation of STE2 sludge 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. Recovery of this sludge should be completed no later than 31 December 2030.

STE2 sludge storage silo

HAO silo

The HAO silo contains various wastes comprising hulls, end-pieces, fines (dust produced mainly by 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 SOC (optimised hull storage) 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 ACC facility. ASN continues to pay particular attention to the effective implementation times of the waste recovery and packaging operations.

Silo 130

Following the announced postponement in the setting up of a graphite waste disposal route, the licensee stated that its strategy would have to change, but that whatever the case, it still aimed to recover the waste from Silo 130. The operations will therefore require interim storage of the recovered waste.

The project submitted by the licensee to achieve this 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 water 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.

In 2008, ASN approved the preliminary preparatory work, in particular installation of the silo waste recovery and evacuation cells.

Unfortunately, the licensee announced in early 2009 that the start of the waste recovery operations was postponed to a later date. Considering the old design of this silo and the uncertainties as to the way its civil engineering structure would evolve over time, ASN enacted requirements on 29 June 2010 obliging the licensee to take compensatory safety measures and submit a detailed file on the waste recovery preparation and actual recovery operations. 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 French gas-cooled reactor fuel, in particular containing molybdenum, the licensee has opted for cold crucible vitrification (see point 1.3.2).

It is planned to put the cold crucible into service with these old solutions in 2011, with the aim of packaging the solutions between 2011 and 2017.

Removal from storage in Building 119 of BNI 38

An overall strategy was implemented by the licensee for priority treatment of the existing drums of alpha waste, which are currently stored in Building 119.

At the end of 2006, ASN thus authorised the licensee to receive, store and process in the D/E EB facility in BNI 118, the drums of alpha waste from the French MOX fuel manufacturing plants. This authorisation was supplemented in 2008 to allow the reception, storage and treatment in the D/E EB facility in BNI 118 of the drums of alpha waste from the plants on the La Hague site.

In 2009, and in 2010 but at a slower pace due to an incident that affected the installations, verification and transfer for processing to the alpha waste conditioning unit (UCD) in the R2 facility continued. This conditioning will enable said waste to be disposed via existing disposal routes.

The processing capacity of the UCD will be entirely devoted to Building 119, which will enable this facility to be closed down earlier, as it no longer meets current safety requirements.

A new compacting unit capable of handling a large volume of alpha waste is currently being studied.

2|1|2 Final shutdown of the UP2 400 plants, the STE2 facilities and the Elan IIB unit

On 1 January 1967, the UP2 400 plant for reprocessing the spent fuels from the GCR reactors entered into industrial operation jointly with the effluent treatment station STE2 for purifying the liquid effluents before their discharge into the sea. In 1974, UP2 400 was licensed to reprocess fuels from the light water reactors.

On 30 December 2003, the licensee notified its decision to stop processing spent fuel in the UP2 400 facility as of 1 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 integrated the ORCADE project, which is responsible for final shutdown of the UP2 400 units and the legacy waste recovery programmes, into 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 sharing of operating experience feedback between the various AREVA facilities (UP1 plant in Marcoule, ATPu in the CEA/Cadarache centre, SICN in Veurey - Voroise).

The year 2010 was marked by the reclassification to Level 2 on the INES scale of an incident involving plutonium contamination of a worker wearing a leak-tight suit during a dust removal operation in a cell of the MAU facility of the UP2 400 plant (see point 3.4.1).

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 MAD/DEM safety file of the HAO facility (high oxide activity: old facility for receiving, shearing and dissolving spent fuels in the UP2 400 plant) was subject to a public inquiry in November 2008 and received a favourable opinion. Final shutdown and decommissioning decree 2009-961 for BNI 80 was published on 31 July 2009 (see chapter 15).

The north section of the HAO facility will nevertheless continue to receive the fuels that cannot be received in the head workshops of the UP3 and UP2 800 plants.

2|2 COMURHEX uranium hexafluoride preparation 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 fluorinate products such as chlorine trifluoride (ClF3).

This production activity uses the excess fluorine resulting from the hydrolysis of hydrofluoric acid (HF).

Production of UF_6 uses natural uranium in the ICPE part of the plant, or reprocessed uranium in the BNI part of the plant. This latter part, BNI 105, chiefly consists of two facilities:
– the 2000 unit, which transforms reprocessed uranyl nitrate ($UO_2(NO_3)_2$) into uranium tetrafluoride (UF_4) or uranium sesquioxide (U_3O_8);
– the 2450 unit, which converts the UF_4 (whose uranium 235 content is between 1 and 2.5%) from the 2000 unit into UF_6. This UF_6 will be used to enrich the reprocessed uranium for recycling in the reactor.

During its inspections in 2008 and 2009, ASN observed irregularities affecting the means of prevention of chemical or radiological pollution risks. On 20 November 2009, the licensee had informed the authorities of a leak in which about 17 m^3 of liquid acid effluents had infiltrated the water table of the River Rhône. For operating reasons, the licensee had decided to drain the part of a tank containing acid effluents into its retention structure, but this structure was not leak-tight. The DREAL (Regional Directorate for the Environment, Planning and Housing), in collaboration with ASN, gave the COMURHEX site formal notice to bring the retention structure of its liquid effluent treatment facility into conformity.

At the request of ASN, the licensee implemented a plan of actions aiming to check the conformity of all the retention structures on the site (BNI and ICPE), and carry out the repair work where necessary. The Tricastin site underwent a tightened inspection on 9 June 2010 that confirmed the monitoring of this plan of action and the one put in place following the operating experience feedback from the SICATRI incident of July 2008. The inspectors observed that all the actions were in progress or completed.

On 13 October 2008, the licensee notified ASN of final shutdown of its 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 has postponed submission of the final shutdown and decommissioning decree application file, initially announced for mid-2010, to the first quarter 2011. ASN considers this postponement prejudicial because it will push back decommissioning operations that must be started as soon as possible. Furthermore, the safety baseline of the installation shut down under its operating baseline is still not satisfactory; ASN has asked the licensee to complete it. Pending application authorisation, the licensee, at the request of ASN, has communicated the list of operations it wants to carry out on the installation and which are compatible with the currently authorised baseline.

As regards the ICPE, at the end of 2008 COMURHEX submitted an application file for a license to operate a new installation, COMURHEX II. This project consists in replacing the existing conversion units 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 in operation and those in the course of construction.

Fluorine electrolysis cells. COMURHEX Pierrelatte plant for converting UF4 to UF6, Tricastin site

3 REGULATING THE NUCLEAR FUEL CYCLE FACILITIES

3|1 Regulating the main steps in the life of nuclear facilities

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 2010, change of licensee operating MÉLOX, commissioning of GBII, preparation for shutdown 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 were produced for the first time for the commissioning of GBII and the aim is ultimately to issue them for all the facilities of the AREVA Group. In 2010, ASN produced drafts for the La Hague and CERCA facilities.

ASN reviews insofar as necessary the safety files 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 uniformly to all these facilities and that they are regularly updated, particularly on the occasion of the ten-year safety reviews.

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 DOR of SOMANU is practically finalised. The subjects of discussion concerned the organisation of the reviews as an activity directly affecting safety and its regulation and inspection, the consideration of ageing of the facilities, the identification and application of elements important for safety. All these files will be presented to the Advisory Committee for laboratories and plants between 2011 and 2013. In 2010, the SOCATRI file underwent an admissibility review by ASN and IRSN. The content of the periodic safety review file was considered insufficient and it must be supplemented, particularly regarding the facility's ten-year development prospects, in accordance with the requirements of the TSN Act.

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 gave ASN the opportunity to clarify its expectations on this subject.

An operating experience feedback unit within ASN, specialised in laboratories and plants, examines all the incidents occurring in these facilities. It analyses their causes to detect deviations or events that could occur in other facilities. Where applicable, ASN informs the licensees of the lessons learned, or modifies the regulations (see section 3.4.1).

ASN inspection of EURODIF plant on the Tricastin site - March 2010

ASN's regulatory actions also cover 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 2010, the main subjects were the production of internal authorisation systems and the more widespread consideration given to human and organisational factors (HOF), in particular through production of the "safety management in AREVA facilities" file. ASN also alerted the AREVA head office departments about the standardisation of practices relating to incident notifications and the drawing up of significant event reports. Defining the elements important for the safety of the group's facilities was also a key subject in 2010.

Finally, because ASN will be taking over responsibility for regulation and inspection of the Pierrelatte site in the medium term, ASN and the Defence Nuclear Safety Authority (ASND) are focusing on ensuring completely coherent application on the Tricastin site of the safety and radiation protection requirements for which each of them is responsible. Most of the facilities under the responsibility of ASND have been shutdown 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.

ASN and ASND set up a working group to clarify the steps involved in ASN's taking over responsibility for regulating the safety of the activities performed on this site. This working group was opened up to the licensees in 2010 to establish the precise procedures involved in the change in regulatory body. It was decided that this would take place gradually as and when the regulatory situation of each facility is clarified (after periodic safety review, decommissioning under way or planned). The end of this process is scheduled for about 2018. The working group reported its conclusions to the two regulatory bodies at the end of 2010.

3|2 Ensuring the consistency of the cycle

ASN regulates the overall safety-related and regulatory consistency of the industrial choices made with regard to fuel management. 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 term, ASN particularly aims to anticipate and prevent saturation of the storage capacity of the NPPs, as has been seen in other countries, and to prevent the licensees from using former installations, for which the regulatory and technical licensing requirements are less strict, as an interim storage solution. ASN is assisted in this approach by the ministry in charge of energy, consulted to obtain information concerning 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 by EDF and reviewed to date provide significant clarification of how the fuel cycle operates and the safety issues involved, and how changes to fuel management policies may result in changes to the technical and regulatory limits, subject to adequate justification.

In order to maintain an overview of the fuel cycle, the data will have to be periodically updated. For any new fuel management policy, 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 file was submitted in 2008. This file was reviewed on 30 June 2010 by the Advisory Committees for laboratories and plants, and for wastes, on the basis of a report presented by IRSN. The DGEC (General Directorate for Energy and Climate) and members of the Advisory Committees for nuclear reactors and for transport took part in the discussion.

On completion of this review, ASN enhances the monitoring of the cycle and its modifications through biennial updating reports, and requires that EDF communicate an updated “cycle” file by 2016. This monitoring system integrates more specific technical requests: they concern the management of new fuels, the way certain types of fuel evolve, and the spent fuel storage strategy.

3|3 Overseeing licensee organisation

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 findings in this context concern the under-staffing of certain departments that play a key role in safety, or the balance between duties and available resources in other departments. This is liable to make it hard for them to perform the duties entrusted to them, with production demands often taking precedence over the other constraints.

ASN therefore initiated a safety management review within the AREVA Group, for the BNIs operated by the Group. The file on which this review is based was submitted by AREVA in January 2010; it is currently being examined and should be presented to the Advisory Committee for laboratories and plants in autumn 2011.

3|4 Promoting operating experience feedback

3|4|1 Dealing with incidents

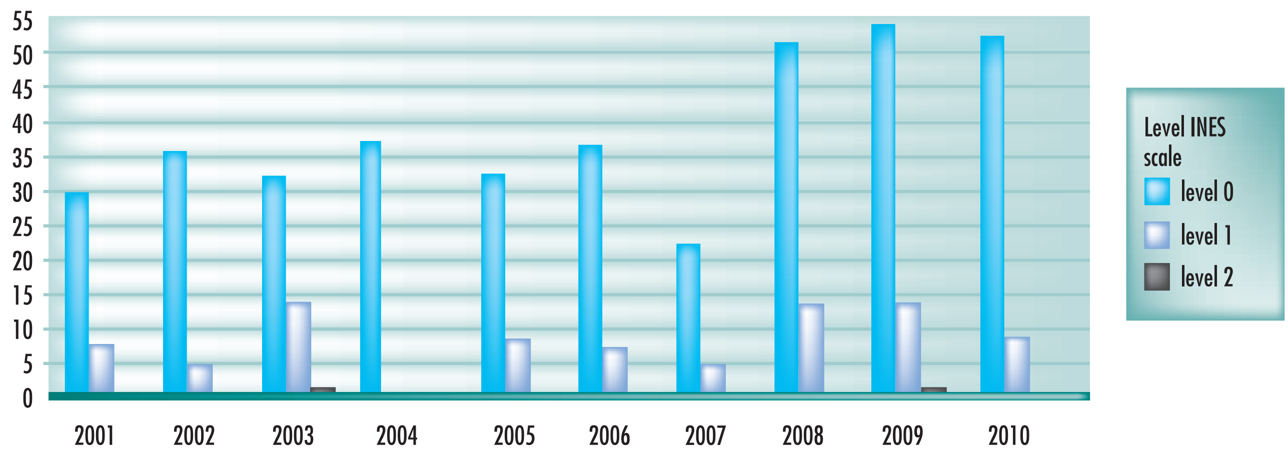
The detection and processing of significant events that have occurred during operation of the installations play a fundamental safety role. The lessons learned from these events lead to new requirements applicable to elements important for safety (EIS) and to new operating rules. Licensees must therefore set up reliable systems for detecting, correcting and learning lessons from all safety-related events.

The following graph shows the trend in the number of significant events notified in fuel cycle installations.

Examination these events by ASN and their management by the licensees serve notably to identify:
– events recurring on the same installation;
– events requiring operating experience feedback to other installations to confirm or invalidate their generic nature, in other words, affecting or likely to affect several installations belonging to one or more licensees.

The number of notified significant events has dropped, after having risen markedly for two years in succession. The drop is observed more particularly in the installations upstream of the cycle, namely the research laboratories and the installations undergoing decommissioning. These trends will be analysed in depth by ASN in 2011.

Graph 1: Trend in the number of significant events in fuel cycle installations since 2001



The year 2010 was marked by the reclassification to Level 2 on the INES scale of a personnel contamination incident that occurred at the end of 2009 in the MAU (medium uranium activity) facility of the UP2 400 plant on the La Hague site.

2010 was also marked by the consequences of the significant event that occurred within the ATPu (Plutonium Technology facility) on the Cadarache site, declared on 6 October 2009 (see point 3.4.4). This event led ASN to send out generic requests to the licensees with the prime aim of getting them to verify the quantities of fissile materials[4] actually present in their facilities. The results of the first verifications were presented to the High Committee for nuclear safety transparency and information at the end of April 2010. As these verifications were incomplete, ASN asked the licensees for additional information in May 2010, chiefly relating to verifications to be carried out in poorly accessible systems, such as ventilation ducts or liquid effluent discharge networks. The results of these additional verifications are still to be communicated.

The inspections carried out in the AREVA Group's facilities in 2010 showed that, when they are detected, events are still not sufficiently analysed. ASN observed that even if abnormal situations are correctly detected, their analysis does not always provide the licensees with a common view of the safety issues at stake in the different facilities, enabling them to draw the relevant lessons from them. ASN expects continuing improvement in operating experience feedback based on significant events.

The facilities involved in the fuel cycle progressed in their assimilation of operating experience feedback in 2010: on the whole, they showed greater rigour in compliance with the notification criteria and event report submission times. Several incidents do however show that weaknesses persist in the organisation of safety and radiation protection in the AREVA Group's facilities, even if their overall number has decreased. ASN will remain vigilant on the licensees' implementation of measures to prevent their renewal.

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

TO BE NOTED

Internal contamination of an employee of a subcontractor

On 19 November 2009, an employee of a subcontractor company was contaminated, more specifically by plutonium, when removing dust from a cell in the MAU (medium uranium activity) facility. In the course of the operation, the right hand of the employee, who was wearing a leak-tight ventilated suit, hit a metal wire attaching an identification label to a pipe in the cell. The metal wire pierced the employee's protective gloves and pricked him, causing internal contamination. The licensee carried out a detailed analysis of the incident, which was examined by ASN. The licensee temporarily suspended this type of clean-out operation in the facility in order to redefine the working conditions and improve the conditions of use of personal protective equipment.

The results of the periodic complementary examinations of the contaminated employee led to the 50-year committed dose being estimated at between 20 mSv and 100 mSv. This dose was calculated by the occupational physicians and confirmed by IRSN. No disease has been observed to date as a consequence of this level of exposure.

4. A fissile material is a material that can sustain a nuclear reaction, like that used in nuclear reactors to produce electricity.

within 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 in 2008, when the Group's head office departments employed a HOF specialist. Since then, a central policy has been drafted and is being gradually deployed among the Group's licensees. This approach will still take some time to bear full fruit.

The various licensees within the AREVA Group are now staffed with persons competent in HOF. Nonetheless, ASN wonders whether the resources of certain licensees are sufficient in this area.

The analysis of significant event reports or the review of the technical files would seem to indicate that assimilation of the HOF approach is still in progress. The specialists on the subject are not yet systematically consulted with regard to issues with high stakes in terms of human reliability or workstation ergonomics.

3|4|3 Maintenance

The elements important for safety (EIS) in a facility undergo maintenance with the aim of guaranteeing their long-term operation and their availability. Maintenance is said to be corrective when it is carried out at the initiative of the licensee after a failure. Preventive maintenance leads to maintenance programmes, usually annual, determined under the responsibility of the licensee. These programmes include the periodic checks and tests.

In the industrial environment, maintenance operations are to a very large extent subcontracted, with the licensee keeping its own personnel for the smaller-scale operations and those relating to the core activity.

ASN considers that, being responsible for the safety of the facility, the licensee must guarantee the quality of preventive maintenance operations, be familiar with its results and conduct in-depth analysis of the causes of any deviations and drift observed.

ASN thus attaches particular importance to the choice of contractors, to the way the licensee accomplishes its duty in monitoring them, to the quality of the analysis of their work, to the results of the second-level checks that the licensee must perform, and to any improvements it might have to make.

ASN calls a number of inspections on this topic every year. The campaign of inspections carried out in 2010 revealed inadequate monitoring of the contractors working for first-tier subcontractors.

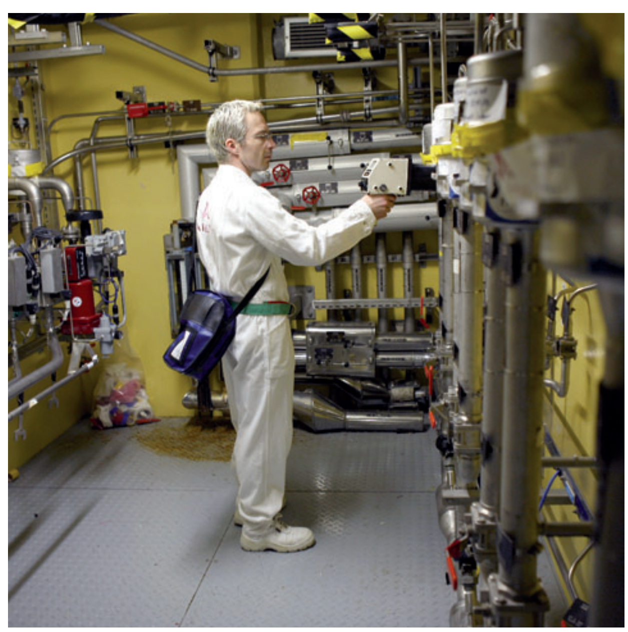
3|4|4 Controlling sub-criticality

In 2009, events had revealed significant deficiencies in prevention of the criticality risk[5] in several nuclear facilities of the AREVA Group.

Moreover, two events in the laboratories and plants had been classified as Level 2 on the INES scale and concerned the limitation of the mass of fissile materials:
– 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;

5. Criticality: capacity of fissile materials to be able to trigger and sustain, under certain conditions, a nuclear reaction. Crticality 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).

Maintenance intervention by AREVA on the core instrumentation of a nuclear power plant



Inspection in the radiation protection department of the spent fuel reprocessing plant in La Hague

– an incorrect estimation of the ATPu (see chapter 16) of the residual masses of fissile materials in some workstations (undetected accumulation of deposits during operation), that could have led to the maximum authorised mass being exceeded in several workstations. (see point 3.4.1).

Moreover, with regard to the MÉLOX facility, in June 2010 ASN carried out a review inspection on the theme "assimilation of the criticality risk and human and organisational factors". The inspectors noted improvements in awareness of the importance of current and future implications in terms of safety, criticality and human and organisational factors within the facility. Certain technical or organisational provisions for preventing the criticality risk, such as the procedure for managing inconsistencies of masses in material monitoring within the facility, must be subject to clarification and improvement. Lastly, the inspections and internal audits on the topic of criticality were still considered insufficient, even if they are developing within the MÉLOX facility.

It is therefore essential to check the arrangements taken, ensuring that they are appropriate for all plausible situations, that safety-criticality requirements are met and that the operators have been trained. 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 this series of events, ASN decided that the fundamental safety rule in relation to criticality dating from 1984 would be revised in order to introduce 25 years of national and international operating experience feedback from the installations, the changes in the dedicated calculation codes, and the principle of "Defence in Depth" into the approach to this risk. A working group bringing together ASN, IRSN, licencees' criticality engineers and a number of experts (IAEA) will be tasked with revising this text. The revision will be presented to the Advisory Committee for the laboratories and plants and to the safety-criticality commission of ASND.

4 INTERNATIONAL ACTION

In June 2009, ASN 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 population's 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 operating 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.

In March 2010, NRC visited the centrifuging plants to learn about France's operating experience feedback from the start-up of the GBII plant, given that NRC is responsible for the licensing process of two new plants in the U.S.

The NRC also met ASN and the licensees of the La Hague and MÉLOX plants in September 2010 to discuss topics associated with recycling. The question of research dedicated to recycling and waste was addressed at a meeting with the CEA (French Alternative Energies and Atomic Energy Commission). Over and beyond research topics, CEA gave a presentation – at the request of ASN – on the safety of the installations that carry out this research in France and which are BNIs (particularly ATALANTE in CEA's Marcoule centre).

In June 2010, ASN also took part in the annual public meeting to share experience about the fuel cycle which for the past 4 years has brought together licensees and associations at the NRC premises in Washington. These seminars, entitled FCIX "fuel cycle exchange information meetings" attract up to 300 people. ASN presented France's operating experience feedback concerning regulation of the nuclear fuel cycle and the main areas in which progress is expected.

Lastly, ASN took part in two seminars of the OECD /NEA in Vienna: firstly that of the WGFCF (Working Group for Fuel Cycle Facilities) on 9 October 2010 on the integration of operating experience feedback from fuel cycle facilities, and secondly the FINAS (Fuel Incident Notification and Analysis System) conference of 7 and 8 October 2010 (organised jointly by IAEA/NEA) during which it presented its appraisal of the incidents that occurred in the French laboratories and plants in the last year.

5 OUTLOOK

Cross-disciplinary aspects

In 2011, ASN will continue the actions undertaken in 2010 to better supervise the ongoing and future license applications and the planned periodic safety reviews.

ASN also initiated in September 2010 the overall review of the safety and radiation protection management process within the AREVA Group. ASN is closely monitoring this file, which should be presented to the Advisory Committees of Experts in November 2011.

The way the AREVA Group licensees integrate operating experience feedback will receive particular attention in 2011, as will the implementation of internal authorisation systems.

Tricastin site

Pollution prevention and progress with the projects concerning the effluent and waste treatment stations remain the major issues for this site in 2011.

ASN will ensure that all the projects planned by AREVA, whether to prepare for the EURODIF and COMURHEX plant shutdown operations or for the major changes in the existing plants (SOCATRI, GBII), are conducted in compliance with the TSN Act, particularly as regards informing the public.

Romans-sur-Isère site

In 2011 on the Romans-sur-Isère site, ASN will in 2011 closely monitor confirmation of the progress already achieved in terms of safety. It in particular expects improved management of the waste areas. It will also be focusing on the actions taken following the safety reassessment of the facilities belonging to the CERCA company.

MÉLOX plant

As regards the MÉLOX plant in Marcoule, ASN will remain vigilant on the organisation and means implemented to increase the production capacity of the industrial plant and accompany the change in the nature of the materials used with respect to the expected requirements in term of safety and radiation protection. Consequently, verification of dosimetry control and the capacity to prevent the risks associated with human and organisational factors and the criticality risk, will remain a priority.

The periodic safety review of the MÉLOX plant is scheduled in 2011. It will constitute a key step in the life of the facility, as it provides the opportunity to assess its conformity with the regulations and with its safety requirements, while at the same time establishing the safety improvement work programme for the next ten years. This review will also allow the fundamental questions concerning the choice of computerised production management system to be addressed. Today this system manages both criticality risk prevention and nuclear materials accounting.

La Hague site

ASN considers that efforts must be continued in the La Hague plants, particular in the integration of operating experience feedback and the notification of significant events. In the framework of the periodic safety reviews of the facilities, 2011 should see the completion of the identification of elements important for safety 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 has already taken measures to this end for Silo 130 in 2010, and will oversee the programme as a whole more closely in 2011.

Lastly, ASN will closely monitor the implementation of the system of internal authorisations at the La Hague plant.

NUCLEAR RESEARCH FACILITIES AND VARIOUS NUCLEAR INSTALLATIONS

CHAPTER 14

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, those belonging to the civil part of the French Alternative Energies and Atomic Energy Commission, the CEA, (research reactors, material testing reactors, laboratories, nuclear material storage facilities, waste and effluent treatment plants, etc.), basic nuclear installations (BNIs) belonging to other research establishments (the Institut Laue-Langevin reactor) and some other BNIs (facilities producing radio-pharmaceuticals, particle accelerators, etc.) that are neither power reactors nor facilities involved in the nuclear fuel cycle (fuel production 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 lists the generic subjects which marked the year 2010. Point 1|2 describes topical events in the various CEA installations currently operating. The installations currently undergoing clean-out or decommissioning are dealt with in chapter 15 and those devoted specifically to the interim storage of waste and spent fuel 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 2010 were:
– management of nuclear safety and radiation protection;
– management of civil engineering works in installations under construction or being renovated;
– updating of internal authorisations system;
– progress on CEA's "major commitments" 1|1|2) and especially regarding commissioning of the MAGENTA installation which will replace the MCMF, the nuclear materials store at Cadarache.

On 5 November 2010, the ASN Commission gave a hearing to the CEA General Administrator, as in previous years. CEA took this opportunity to present the content of its "risk management" report published in June 2009, which highlighted reporting of information in case of a nuclear incident and management and monitoring of services. It also presented its new three-year plan for improving safety and security, with a strong focus on the prevention of occupational risks and the safety and radiation protection culture of CEA staff as well as of its partner organisations and service providers. ASN gave a detailed appreciation of safety at CEA and CEA presented an update on its major commitments in the area of nuclear safety, made official in 2007 after a request from ASN.

1|1|1 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 2010, ASN examined CEA's nuclear safety and radiation protection management file, which was subject to evaluation by the Advisory Committees.

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|2 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 nuclear regulator, in particular with regard to the decision-making process. CEA therefore presented ASN in 2007 with a list of twenty major safety and radiation protection commitments.

These commitments in particular include:

For the Cadarache site:
– inclusion of specific site effects in the seismic risk.

For experimental reactors:
– upgrading of CABRI and construction of its new water loop, which should be completed in 2011;
– the MASURCA safety review, including major seismic conformity and fire protection work.

For the laboratories:
– the renovation work and in particular the seismic reinforcement work on the LEFCA subsequent to its periodic safety review; this work, with the exception of the drain to prevent soil liquefaction, is now mostly completed;
– compliance with the deadline for commissioning of MAGENTA, designed to replace the MCMF.

For waste storage and processing installations:
– removal from storage of certain wastes and effluents and ensuring of their safe condition in other installations (PEGASE, ZGEL, STEDS) ;
– commissioning of the installations scheduled to replace the older ones, in particular STELLA and AGATE.

CEA reports to ASN on compliance with these commitments, on a formal, regular basis during meetings. During the hearing of the CEA Administrator, ASN restated that it considers the major commitments approach to be worth pursuing.

1|1|3 Internal authorisations

An internal authorisation system has been in place at CEA since 2002. Its authorisation was renewed by decision 2010-DC-0178 of 16 March 2010. Thereby, ASN allows the CEA centre directors – with the assistance of the centre safety units and, where applicable, safety commissions – to apply this "internal authorisations system" to certain operations that are sensitive from the safety and radiation protection viewpoints, but which do not compromise an installation's safety case. ASN has monitored the system regularly since its introduction and has found it to be globally 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, it has been subject to modification on several occasions, sometimes without any overall review of its 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 contained in the 13 June 2006 Act on transparency and security in the nuclear field (TSN Act). 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.

In 2005, ASN also detailed its expectations with regard to the safety reviews of CEA installations, in terms of responsibility, content and schedule, in the form of an ASN guide (SD3-CEA-05). These measures will be integrated into an ASN decision concerning all BNIs. This decision is currently in the advisory review stages.

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. Finally, after the periodic safety reviews, ASN can define requirements pursuant to the TSN Act of 13 June 2006 on transparency and nuclear safety.

In 2010, ASN examined the conclusions of the safety review of the ORPHÉE installation, on which the Advisory Committee for reactors had already expressed its opinion. ASN will pronounce on its continued operation in the near future.

In 2010, CEA also submitted its safety review of the EOLE and MINERVE installations; this will be examined in 2011 and submitted for an opinion from the Advisory Committee for reactors.

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.

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 files per centre, to extend the sealed source utilisation period beyond the regulation 10 years. Under the terms of the Government Order of 23 October 2009 on approval of ASN's decision establishing the technical criteria underlying the extension of the utilisation period of sealed sources, ASN requested CEA to provide additional information in support of its files. This information was supplied at the end of 2010 for some of the sources for which the situation is to be brought into compliance. CEA will have to proceed with administrative regularisation of all of the sources requiring extension of utilisation in 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 process to revise the CEA Saclay water intake and effluent discharge licenses, which began in July 2006 under decree 95-540 of 4 May 1995, was completed in 2009 with the publication of the decisions of 15 September 2009 and their approval by orders of 4 January 2010. A correction appeared in France's Official Journal of 24 April 2010 (correction to tritium limit).

The water intake and effluent discharge on the Cadarache site were covered by three government orders of 25 April 2006 and orders of the *préfet* dated 12 August and 12 September 2005, allowing consistent regulation of all radioactive and chemical discharges from the centre. In 2009, CEA asked for a number of changes to be made to these orders, relating in particular to the new facilities in the centre. Although the changes concerned were not significant, the corresponding impact assessment was nonetheless the subject of a local debate organised by the licensee over a one-month period. This approach, implemented for the first time on an experimental basis, reflects the desire for transparency on the part of ASN and the licensee. It supplements the administrative consultations required by law. The approved decision, setting limits for liquid and gaseous effluent discharges from CEA's Cadarache installations, was signed on 5 January 2010, approved 9 March 2010 and appeared in the Official Journal of 2 April 2010.

With regard to the Marcoule site, the file modifying the BNIs' discharge licenses (which currently cover all the liquid discharges from the site) was submitted at the beginning of 2009 to ASND. The purpose of the modification is the reduction of discharges. The same applies for the ATALANTE facility. These files were completed in September 2010 by an overall impact assessment of the discharges from the CEA sites and from the CENTRACO and MÉLOX installations, for which the authorisations have been or soon will be amended.

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 of changes in the design rules.

In 2003, ASN asked CEA to improve its knowledge of the seismic risk for the Cadarache centre, by initiating a programme to study any particular site effects. In response, CEA presented a study program run jointly with the Laue Langevin Institute of Grenoble, with the collaboration of several international partners and experts. The results of this research were transmitted to ASN in 2009 and are currently being examined in order to determine the operational applications. In 2010, together with IRSN and the licensees concerned, ASN also completed an overall study of how the seismic risk is addressed on the Cadarache nuclear site. The same exercise is under way for the Marcoule site. In parallel with this, ASN also organised two one-day meetings on seismic risks in nuclear installations in the south of France, the first on 4 February 2010 in Marseille, the second on 7 December 2010 in Avignon. The aim of the meetings was to present the approach adopted to knowledge of and consideration given to seismic risks in nuclear installations. These events, open to the public, to people from the voluntary sector and to professionals, brought together 200 participants from widely differing backgrounds.

In addition, a study at the Cadarache nuclear site of the general resources that would come into play in case of seismic disturbance, established by CEA at ASN's request, is currently the object of examination initiated in the latter part of 2009, in order to determine whether the resources are adequate and appropriate.

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 2010, in particular at the Cadarache centre. To monitor progress on the construction of the installations in question, 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 monitoring, by survey, during inspections.

The inspections carried out by ASN in 2010 focused on taking account of the requests and comments made after the review inspection conducted jointly with ASND in May 2010 or the subject of construction/civil engineering in the AGATE, CABRI, LEFCA, MAGENTA and RJH installations.

These inspections confirmed the motivation of the teams involved, the introduction of project management dedicated to site control and the frequent recourse to technical inspection companies in certain phases of operations.

Furthermore, the internal checks made by CEA on project management and in relation to outside companies were the subject of new requests from ASN in 2010 (formalising or stipulation of approach adopted for second level checks and internal hold points).

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.

The design, performance and irradiation licensing conditions for the experimental equipment have in recent years been extensively discussed by ASN and CEA. This led to the creation of a technical guide defining a number of requirements (in January 2007).

In 2011, ASN intends to analyse application of the approach developed in the guide, based on the case of an experimental device for the OSIRIS reactor recently the subject of a safety review, to a device from amongst those that will be irradiated in the future Jules Horowitz reactor at Cadarache and that is currently in the design stages.

1 | 2 Topical events in CEA research facilities

In addition to the generic subjects presented above, the main subjects relating to CEA installations in operation that were the focus of ASN's attention in 2010 were the following:
– conducting of end-of-life tests on PHÉNIX reactor;
– safety reviews for ORPHÉE and OSIRIS installations;
– completion of renovation work on the CABRI installation and continued construction of the Jules Horowitz reactor;
– commissioning of the MAGENTA installation;
– prevention of soil liquefaction at LEFCA;
– start of operations to remove radioactive effluent contained in the HA4 vessel at Saclay.

1 | 2 | 1 CEA centres

a) Cadarache centre

The Cadarache Centre is located at Saint-Paul-lez-Durance, in the Bouches-du-Rhone *département*. It employs about 4,500 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 building was published in 2009. The international ITER installation – scheduled to be commissioned in 2018, on the proviso that its request for authorisation (DAC) is accepted – will be built close by.

In recent years, ASN has noted progress in safety management at the Cadarache centre. Although these efforts need to be continued, ASN observed that the safety unit has adopted a more critical view of the safety of the site's installations and of the necessary priorities. ASN also observed that the Administrator General's "major commitments" were being implemented in the centre and satisfactorily assimilated by the staff, despite the difficulties sometimes encountered. Particular vigilance will however be required with regard to supervision of service providers, especially given the increasing use being made of subcontracting. ASN observed the vulnerability of the centre's electrical installations. Their renovation is under way and sufficient efforts will be needed if this is not to fall behind schedule.

The construction of new facilities and the renovation of older installations, 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.

b) 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. In 2006, 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 radioactive marking of molecules, manufacturing of products used in nuclear medicine for therapy and imaging and in vitro medical diagnosis and molecular screening (see point 3.2).

The ASN decision of 15 September 2009 on the authorisations for discharge of gaseous effluents, whether radioactive or not, was approved in 2010 by the ministers responsible for ecology and industry (Government Order of 4 January 2010).

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 (point 1 | 2 | 6: liquid effluents management zone and STELLA project;
– waste storage facilities (chapter 16): solid waste management zone;
– installations undergoing final shutdown or decommissioning (chapter 15): LHA.

In line with this, in 2010, ASN conducted a review inspection on the theme of safety management. Seven ASN nuclear safety inspectors, accompanied by IRSN experts, inspected six BNIs and examined the steps taken by the BNI safety and nuclear material inspection unit (CCSIMN); the logistics, technical and IT support units; the projects, security and safety support department; the centre's management; and the delegated management for nuclear activities at Saclay. More specifically, this inspection allowed verification of the organisation of safety control at the centre and in the BNIs, compliance with regulations and with commitments and authorisations, inclusion of human and organisational factors, and aspects relating to control of services procured externally. Inspection gave rise to a follow-up letter, available on the ASN website, presenting the main observations made by the inspectors and the requests for corrective action addressed to CEA.

The outcome was that ASN observed the utilisation of control tools that are appropriate for management of the priorities and imperatives relating to nuclear safety on the Saclay site.

However, ASN also observed that the strategy for development of "internal diagnosis" of the safety of installations – in which the installations and nuclear materials security unit plays an important part – remained to be specified and that there appeared to be room for improvement.

As part of this inspection, the inspectors also observed the necessity for tighter control over the process of making commitments to ASN and the associated follow-up.

The inspectors were also of the opinion that the deviation management methodology should be made uniform and that, to achieve this, CEA should establish criteria for identification of safety-related events[1].

Finally, where monitoring of services provided is concerned, ASN noted inconsistent application of procedures issued by the centre regarding assessment of suppliers, but noted that CEA was addressing the matter.

c) The Marcoule centre

The Marcoule centre is the 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. It houses both civil and defence-related nuclear installations. CEA's two civil installations in Marcoule, ATALANTE (research laboratory) and PHÉNIX (reactor) were called on to make a particularly significant contribution in this field.

The site also houses two other civil BNIs: MELOX (see chapter 13) and CENTRACO (see point 3.6 of this chapter). A third installation, the GAMMATEC irradiator, is planned (see point 3.1).

The move undertaken to develop a closer working relationship between ASN and the authority for defence-related nuclear safety (ASND), with the aim of obtaining a clearer overview of the site, continued in 2010 with the organisation of joint inspections.

It should also be noted that the overall impact assessment for the Marcoule site is under review.

d) 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.

e) Grenoble centre

All the 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 and implemented. In this respect, a more generic approach to the safety of installations has developed in recent years, driven by the rules applying to power reactors, especially through the inclusion of operating conditions and classification of associated equipment. This has led to considerable progress on safety. This approach is now used for the periodic safety reviews on 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.

a) Critical mock-ups

• MASURCA reactor (Cadarache)

The MASURCA reactor is intended for neutronic studies, primarily on fast neutron reactor cores, and for developing neutron measurement techniques. This installation, for which the last periodic safety review was discussed at a meeting of the Advisory Committee for nuclear reactors in March 2006, has been shut down for conformity work since 2007. However, the work has not yet started, as the licensee hopes to bring down its cost and reassess the lifetime strategy for its reactors. The reactor core was completely defuelled and the installation is being maintained in a safe condition. A certain number of technical solutions selected for reactor renovation after this review have already been the subject of development proposals on which ASN established its position in 2010. In parallel, the operator has decided to continue the service life of this reactor and to build a new storage and handling building. This latter development constitutes a significant modification under the terms of Article 31 of Decree 2007-1557 of November 2007. The request for authorisation for modification of the installation will therefore be the subject of a public inquiry. Restarting will then be subject to authorisation by ASN. This will be on the basis of a review of the safety analysis report and after consultation with the Advisory Committee for reactors.

• ÉOLE and MINERVE reactors (Cadarache)

The ÉOLE reactor is intended for neutronic 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, located in the same hall as the ÉOLE reactor, is devoted to measuring cross-sections through the oscillation

1. The guide of 21 October 2005 concerning the conditions for notifying and codifying criteria relative to significant events involving safety, radiation protection or the environment, applicable to BNIs and the transport of radioactive materials, requires the defining of the criteria for identifying events relating to nuclear safety.

of samples in order to measure reactivity variations. CEA has expressed its intention to continue with long-term operation of the ÉOLE and MINERVE installations and, in 2007, ASN reviewed the guidelines file of the periodic safety review. The final review file was transferred in February 2010. The meeting of the Advisory Committee for reactors that will consider this review is scheduled for mid-2011.

Based on the conclusions of CEA's consideration of strategic planning regarding the continued operation of these installations, CEA would relinquish operation of these two reactors within 10 years and would retain certain items of equipment to be used in the PHÉBUS installation (BNI 92) as part of the research into "Generation IV" reactors.

b) Irradiation reactors

• The OSIRIS reactor and its ISIS critical mock-up (Saclay)

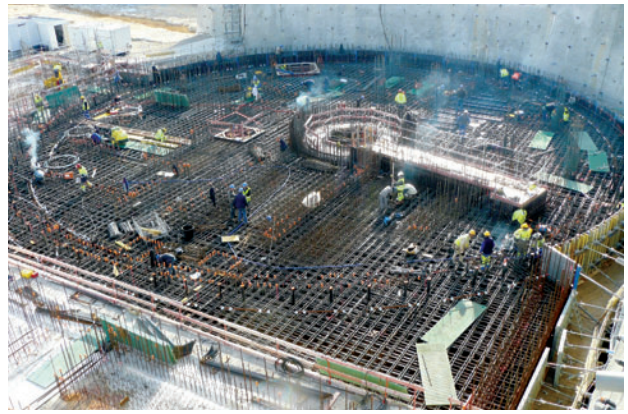
The OSIRIS pool-type reactor has an authorised power of 70 MWth. It is primarily intended for technological irradiation of structural and fuel materials for various power reactor technologies. It is also used for a few industrial applications, in particular the production of radionuclides for medical uses. Its critical mock-up, the ISIS reactor, is today mainly used for training.

CEA, in compliance with the ASN decision of 16 September 2008, will completely shut down operation of the OSIRIS reactor by 2015 at the latest. To continue with operation until that time, it has proposed a programme of renovation and safety improvement works for the installation, implemented by the end of 2010. ASN will rule in the near future on the continued operation of the installation until 2015. This decision will take account of the conclusions of the ongoing analysis of the BNI's safety review file forwarded by the licensee to ASN in 2009.

Since the OSIRIS reactor is part of the chain producing artificial radionuclides for medical uses, in particular technetium 99, ASN felt that the potential repercussions of its shutdown in 2015 needed to be anticipated as early as possible. This is proving to be essential as the events which, in 2008 and 2009, led to the shutdown of other reactors abroad (such as HFR in Petten, Netherlands and NRU in Chalk River, Canada) revealed the vulnerability of the complex production chain for these radionuclides and the risk of problems with supplies to the medical sector. ASN organised a seminar on this subject in January 2009, attended by safety authorities from abroad concerned by the issue and with the participation of health authorities. The seminar led to recommendations addressed to stakeholders (governments, health authorities, the medical sector, industrial operators, etc.) and decisions were made by the safety authorities aimed at improving sharing of information, including feedback on existing or planned installations. ASN is continuing to play an active role in the international initiatives concerning the production of radionuclides for medical uses and ageing of the irradiation reactors.

• The RJH (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.



Installing the reinforcing bars for the upper raft of the Jules Horowitz reactor at Cadarache - October 2010

The RJH 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.

Subsequent to the favourable outcome of the public inquiry conducted in 2006 and of the analysis of the initial safety report for the planned installation, the decree authorising creation was signed on 12 October 2009 (gazetted 14 October 2009). After initial earthworks, site preparation and pouring of the first concrete in 2009, civil engineering works continued in 2010 with installation of the paraseismic bearing pads and reinforcement bars and pouring of concrete for the bunker lower bed in May, reinforcement bars and pouring of the upper bed for the auxiliary building in June. Installation of the reinforcement bars and pouring of the upper bed for the reactor building is scheduled for early 2011. The civil engineering work on the site was inspected four times in 2010. No major discrepancies were found. 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.

In 2010 as a complement to the requests and commitments formulated after review of the preliminary safety report for the planned installation, ASN produced draft technical specifications about which the licensee was consulted, in line with the requirements of Decree 2007-1557 of 2 November 2007. These set the requirements for the detailed design and construction phase, thereby stipulating the requirements of the decree authorising the installation's creation.

The concrete-pouring operations for the reactor building upper raft were suspended temporarily in 2010, at CEA's initiative, pending certain elements relative to the design and construction requirements in the pool-raft interface area. The pouring operations for the raft were finally carried out on 14 December 2010.

c) Neutron source reactors

• ORPHÉE reactor (Saclay)

The ORPHÉE reactor, with an authorised power of 14 MWth, is a pool-type research reactor. It is equipped with nine horizontal channels, tangential to the core, enabling 20 neutron beams to be used. These beams are used as "material probes" to conduct experiments in fields such as physics, biology and physical chemistry. The reactor also has nine 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 went critical for the first time in 1980.

In April 2009, the licensee submitted the file corresponding to the second safety review. The file was examined in 2009 and 2010. ASN will decide shortly on continued operation of the reactor, subsequent to the meeting of the Advisory Committee for reactors held in September 2010.

d) Test reactors

• CABRI reactor (Cadarache)

The CABRI reactor 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 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.).

For the new research programmes, the reactor's sodium loop was replaced by a water loop. The CABRI reactor will be used to conduct tests to determine the behaviour of high-burn-up fuels in accident situations representative of those which could be encountered in a pressurised water reactor. In parallel with this modification, CEA conducted a safety review of the installation with a view to continued operation for a further twenty years. 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 case. The licensee must therefore have responded satisfactorily to any requests made subsequent to the review of the safety analysis report. In 2009 and 2010, ASN reminded CEA that it must make efforts to transmit the required files early enough so that they can be examined within a time-frame compatible with its scheduling objectives. Most of this work is now completed and examination of the corresponding files was finalised in 2010 with regard to reloading, requalification of the equipment required for reloading and maintaining the installation's safety state after reloading, as well as the associated safety reference. For criticality, examination of the corresponding file is ongoing.

• PHÉBUS reactor (Cadarache)

The PHÉBUS reactor is one of the tools used by CEA to study severe accidents that could affect pressurised water reactors (PWRs) by means of tests designed and financed by IRSN. CEA has announced that it wishes to cease any new programmes with this reactor. Clean-out and decommissioning of the experimental systems used in the last experiment have been continuing since 2004. In July 2010, ASN gave its express agreement to the creation and use of a temporary access in the reactor vessel to facilitate access for this work.

Cutting operation on an item of equipment of the PHEBUS experimental reactor at Cadarache

ASN asked CEA to inform it rapidly of its strategy concerning the future of this BNI, so that the regulation and safety procedures with regard to either decommissioning or a modification of the installation to allow new activities could be initiated. ASN remains attentive to the operations carried out in this installation which may receive some items of equipment from the Eole Minerve installation for research on the "Generation IV" reactors.

e) Teaching reactors

• 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 application for the facility, submitted in the summer of 2009, is being examined by ASN.

f) Prototype reactors

• PHÉNIX reactor (Marcoule)

The PHÉNIX reactor, built and operated by CEA jointly with EDF, is a fast neutron demonstration reactor. It is located in Marcoule (Gard *département*). Its construction began in 1968 and first criticality occurred on 31 August 1973. Its initial nominal power of 563 MWth was reduced to 350 Mth in 2002.

On 6 March 2009, the plant was finally disconnected from the grid, mainly as a result of behaviour in the event of seismic disturbance and difficulties in explaining the cause of the negative reactivity trips (AURN) observed in 1989 and 1990. Since then only tests corresponding to end of operation, known as end-of-life tests, have been carried out. The purpose of these tests is to enhance understanding of sodium-cooled fast neutron reactors, with a view to developing "Generation IV" power generating reactors. These tests, subject to ASN authorisation in accordance with decision 2009-DC-0131 of 17 February 2009, also come within the scope of the prototype studies mentioned in article 3 of Act 2006-739 of 28 June 2006 on management of radioactive materials and waste. The request for authorisation of decommissioning is to be addressed to ASN in the second half of 2011. The decommissioning programme will include, in particular, implementation of a sodium treatment facility. However, prior to the decommissioning decree, preparatory work will be needed in compliance with the current safety requirements.

In 2009 and 2010, ASN attracted the licensee's attention to compliance with safety requirements and, in particular, to performance of periodic checks. The licensee should also be attentive to ventilation management as, notably, the neutronography installation was shut down in 2009 after malfunctioning of its ventilation system. Modification of the neutronography, which was a condition for restarting of the installation, was authorised in July 2010, on condition that the licensee modify certain monitoring parameters. Declassification of areas with regard to waste zoning is also a point requiring vigilance. Lastly, human and organisational factors (HOF) remain an important consideration in the performance of the future reactor decommissioning operations.

1|2|3 Laboratories

a) 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)

LECA 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.

Following its periodic safety review in 2001, an extensive upgrade programme comprising in particular operations to improve the seismic resistance of the civil engineering works, was carried out at LECA. It was to be completed by the end of 2009 with the dismantling of the "U02" building, thus reducing interactions between buildings. However, technical difficulties have led CEA to push back the deadline to the end of 2011.

Given the scale of the renovation work undertaken and the progress made, ASN has indicated that it has no objection to continued operation of the installation nor to implementation of the new safety requirements. CEA has also indicated its intention to extend the duration of LECA operation of the by further increasing the ability to withstand seismic disturbance. This option will be examined during the next periodic safety review in 2013.

• LECA's treatment, clean-out and reconditioning station (STAR) (Cadarache)

The STAR installation, designed to stabilise and recondition GCR spent fuel, also carries out destructive and non-destructive testing of PWR-type spent fuel.

The installation's safety review file was examined in June 2009. ASN indicated that it had no objection to continued operation of the installation and authorised extension of the operating range, allowing CEA to recondition new types of fuels. In addition, ASN is examining the requests for modification of the installation within the scope of CEA' s programmes and notably the VERDON laboratory (study of releases and early deposits of fission products of new fuels).

• 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, and the manufacture of irradiation test capsules or experimental assemblies.

Continued operation of LEFCA was authorised after a safety review of the installation in 2003.

CEA completed the work to improve the building's seismic resistance in 2010. Regarding the system to prevent the risk of soil liquefaction, the technical investigation of the latest elements provided by CEA does not bring into question the necessity for this work. ASN has made a decision on the technical requirements and requiring implementation of the system before 29 June 2012 (Decision 2010-DC-0186 of 29 June 2010).

• Spent fuel testing laboratory (LECI) (Saclay)

LECI is an installation designed to analyse the various components of spent fuel from nuclear reactors (components of the radioactive material, components of the assembly cladding, etc.), in order to determine how they behave under irradiation.

In June 2004, ASN authorised implementation of the extension of LECI on condition that there is compliance with certain requirements identified after examination of the extension project by the Advisory Committee meeting in April 2004. In 2005, ASN authorised partial commissioning of the LECI extension with full commissioning in 2006. In July 2008, in response to requests and commitments to ASN, the licensee provided the update to the installation's safety report. ASN has issued its judgement on this document. The safety review for BNI 50 is scheduled for 2013. In 2010, ASN carried out four inspections at LECI, covering radiation protection, fire hazard, criticality, periodic checks and testing, and maintenance. ASN did not observe any significant discrepancy.

b) Research and development laboratories

• Alpha facility and laboratory for transuranian elements analysis and reprocessing studies (ATALANTE) (Marcoule)

ATALANTE primarily contains CEA's R&D facilities for high-level radioactive waste and reprocessing. These activities were previously distributed over three sites: Fontenay-aux-Roses, Grenoble and the Rhone Valley.

Final commissioning and the safety review were examined by the Advisory Committee for plants (GPU) in 2007. ASN authorised the installation's final commissioning, accompanying this with certain requirements (decision 2007-DC-0050 of 22 June 2007). As the installation reinforcement work had been carried out, the activity restrictions applied in 2007 were lifted (decision 2009-DC-142 of 16 June 2009).

• The CHICADE installation (Cadarache)

The CHICADE (chemistry, waste characterisation) installation carries out research and development work on low and intermediate level nuclear waste, primarily concerning:
– aqueous liquid waste treatment processes;
– decontamination processes;
– solid waste packaging methods;
– assessment and monitoring of waste packaged by the waste producers.

In March 2007, CEA provided the BNI safety review file. ASN will adopt a stance with regard to this review in 2011.

1|2|4 Fissile material stores

• The central fissile material warehouse (MCMF) (Cadarache)

The MCMF is a warehouse for storing 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 temporarily without any specific purpose.

CEA also informed ASN that it was considering withdrawing all stored material from the installation by 2017. ASN will make known its position as to the acceptability of this proposal in the near future.

• The MAGENTA project (Cadarache)

The creation authorisation decree for the MAGENTA installation, which is intended to replace the MCMF by 2010, was signed on 25 September 2008. Construction of the installation was completed in 2010. ASN will announce its decision regarding commissioning of the installation by a decision in the early part of 2011.

1|2|5 The POSEIDON irradiator (Saclay)

The operating principles of irradiators are explained in part 3.1 of this chapter. The POSÉIDON installation is primarily dedicated to studying the strength of the materials used in nuclear power plants and fuel cycle plants. This installation, which was originally owned by CIS bio international, was incorporated into the CEA BNI inventory at the beginning of 2007. A current issue for this installation is the establishment and implementation of waste zoning, given the specific experiments conducted (long-term irradiation of samples in the source storage pool). Moreover, an event which occurred 20 January 2010 (failure to comply with operating instructions for opening of an irradiation chamber) highlighted a problem in management of access to the irradiation chambers. New measures taken, notably regarding management of the access keys, are such that re-occurrence of such an incident will be avoided. These steps were the subject of in-depth examination during inspection.

1|2|6 Effluent and waste treatment installations

The CEA's effluent and waste treatment and packaging facilities are spread over the Fontenay-aux-Roses, Grenoble, Cadarache and Saclay sites. They are generally equipped with characterisation facilities to enable measurement-based checks to be made on 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 facilities devoted specifically to storage of waste and spent fuels are dealt with in chapter 16 (point 2).

a) Cadarache centre

The effluent and waste treatment station (STED) processes and packages liquid and solid radioactive waste from the Cadarache centre. Following the periodic safety review of this installation in 1998, ASN authorised continued operation for a limited period. CEA then proposed creating three new installations with a view to carrying out the duties performed by the STED: the Rotonde, for sorting of solid waste, CEDRA, for treatment of a part of the solid waste and AGATE for treatment of liquid effluents. The Rotonde sorting installation has been operational since September 2007 and primarily interfaces between the solid waste producers and the treatment, storage and disposal installations. Since shutdown of the STED's 250-ton compacting press at the end of 2004, some of the solid waste is being sent directly to ANDRA's Aube waste repository, where it is compacted and packaged. At the beginning of 2007, CEA sent ASN a file proposing to provide seismic reinforcement of the part of the installation that houses a 500-ton press (ARCCAD project). The technical details of this project are expected in early 2011. They will be the subject of examination by the relevant Advisory Committee in order to verify that the steps adopted by CEA are adequate.

Processing of liquid effluents contaminated with intermediate-level alpha emitters, referred to as "special" effluents, ceased on 1 July 2005. CEA is transferring these effluents to the liquid effluent treatment station on the Marcoule site (STEL).

In May 2009, CEA submitted to ASN a further application for authorisation to continue operation of the STE until AGATE was able to take over completely in about 2011. The ASN Commission has authorised extension of operation to the end of 2011.

The AGATE installation will provide evaporation treatment of radioactive effluents mainly from the CEA/Cadarache nuclear installations, mostly contaminated with beta and gamma emitters. 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 requirements adopted by CEA are satisfactory. However, it asked CEA to present and justify the strategy adopted for treatment of the concentrates produced by the AGATE installation, taking account of possible difficulties in handling these wastes that may be encountered by the liquid effluent treatment plant (STEL) at Marcoule (the installation currently targeted for treatment of the first concentrates produced by bituminisation). Justifications are required, in particular regarding control of the process of bituminisation of these wastes. Prior to commissioning, CEA will therefore have to demonstrate that it has a route for disposal of these concentrates with time-lines that are compatible with the installation's capacity to store the concentrates.

b) Saclay centre

The solid waste management zone handles treatment and storage of solid radioactive residues produced in the centre by the reactors, laboratories and workshops. This installation provides the interface between the waste producers on the Saclay site and the treatment, storage and disposal installations for this waste. It also recovers waste from small producers (scintillation liquid sources, ion exchange resins) and provides storage of radioactive sources.

In 2009, CEA continued the programme to recover from the fuel assembly blocks the spent fuel elements stored in the solid waste management zone. This programme consists in characterising old containers so that they can be taken to the STAR installation in Cadarache for reconditioning before storage in CASCAD, pending a final solution (reprocessing or disposal).

CEA's current strategy is to reduce the source term present in the installation and primarily maintain the functions to provide the interface between the producers of solid waste and the appropriate disposal channels. At the beginning of 2009, the GPU examined the 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 timeframe, to remove the fuel stored in the pool and the fuel stored in the blocks. ASN holds yearly meetings to ensure that the commitments made by the licensee have been honoured. Discrepancies were observed in the planning for implementation of certain commitments. ASN will maintain its monitoring action.

Implementation of the action plan following the incident on 10 September 2007 (a staff member entered a zone classified as "prohibited" for radiation protection reasons, although with no radiological consequences) was finalised during the course of 2009.

The radioactive liquid effluent management zone (STE) collects, stores and reprocesses the low-level aqueous effluents and stores aqueous and organic effluents. The radioactive aqueous effluents are evaporated and then stored in the tanks of the RESERVOIR facility pending treatment. By a decree of 8 January 2004, CEA was authorised to modify the STE by adding the STELLA extension. The progress of the operations, first of all to recover stored legacy effluents awaiting treatment, and secondly to clean out the old installation buildings, are among CEA's priorities, along with pre-commissioning of STELLA. The first operations were performed to recover the organic radioactive wastes stored in tank HA4 and a part of the effluent was removed to the ATALANTE treatment facility. Other operations allowing final draining should take place in the coming two years. In all cases, the decree of 8 January 2004 requires that the tank HA4 and other radioactive effluents contained in the building known as 393 be recovered before the end of 2013.

In 2007, the safety review file for the "former plant" part of the effluent management area and for commissioning of the STELLA extension were presented to the Advisory Committee. The inactive tests (i.e. tests without radioactive materials) were performed for the evaporation process. In 2010, faced with difficulties in qualifying the 12H packages that will result from cementation of concentrates in STELLA, CEA asked ASN for staged commissioning of the STELLA facility. Initially, only the evaporation part will be commissioned. The cementation part will be commissioned when CEA has obtained ANDRA's agreement for package production. ASN has, by ASN decision 2010-DC-0198 of 9 November 2010, authorised staged commissioning of STELLA, under certain conditions.

Partially commissioned STELLA facility at Saclay – November 2010

c) Fontenay-aux-Roses centre

The main function of the radioactive effluent and solid waste treatment station (STED) is storage of solid and liquid waste prior to removal to the appropriate routes. As part of the site clean-out process, in addition to removal of the waste from storage, the STED will act as the support installation for managing the waste generated by decommissioning.

d) Grenoble centre

The effluent and waste treatment station (STED) is continuing with removal from storage and recovery of legacy waste, prior to complete decommissioning of the BNIs on the CEA site by 2012.

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 2010 were:
– undertaking of the administrative process linked to amendment of the decree for creation of GANIL with, notably, holding of the public inquiry in June-July 2010;
– signing of a new agreement governing safety of the CERN installations;
– start of examination of the request for authorisation of the ITER installation.

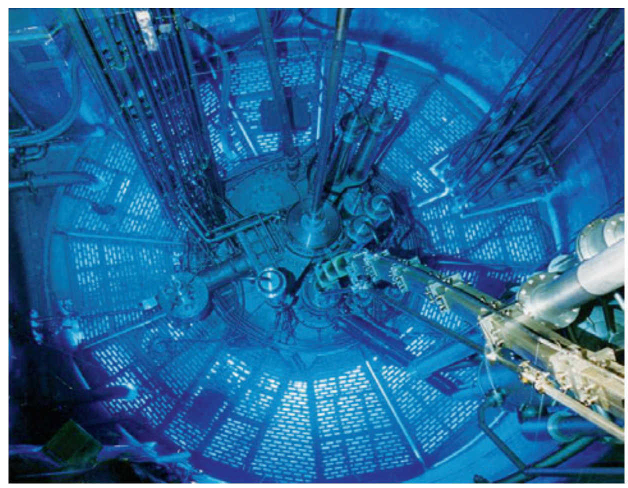
2|1 Large national heavy ion accelerator (GANIL)

The GANIL, located in Caen (Calvados *département*) is designed to accelerate all heavy ions (from carbon to uranium) with maximum energy of 100 MeV per nucleon.

In order to adapt to the requirements of international research, GANIL issued a safety option file in May 2004 for a new project, called SPIRAL 2 (creation of new experimentation equipment and rooms with a more powerful beam). In July 2005, ASN approved the safety options proposed by the GANIL, provided that a certain number of requests were taken into account. At the same time, ASN asked the GANIL to proceed with the periodic safety review of the installation. In order to monitor the progress of these two files (SPIRAL 2 project and safety review), periodic meetings have been held since 2007 between ASN and the GANIL. The preliminary safety report was submitted by the licensee in June 2009; it was updated in October-November 2009 to contain measures concerning the civil engineering. The corresponding public inquiry took place in June-July 2010. The Inquiry Chair's conclusions were given in September 2010. The file on the GANIL safety review will be submitted in the first quarter of 2011, concomitant with the preliminary safety report for SPIRAL 2, phase 2 (utilisation of new radioactive beams).

2|2 The high flux reactor at the Laue-Langevin institute

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 authorised power for this reactor is 58.3 MWth. The reactor core, cooled and moderated by heavy water, is placed at the centre of a reflector tank, itself immersed in a light water pool.



View of the core of the high-flux reactor at the Laue-Langevin Institute in Grenoble

In 2002, ASN requested major seismic reinforcement work on the installation. Most of this very extensive work was completed by the end of 2007 and was the subject of examination by the Advisory Committee for reactors. In 2010, an initial part of seismic reinforcement work was carried out for the handling crane. In the area of control of radioactive gaseous effluents, ILL introduced a delayed discharge buffer device but additional information is required for the study of the gaseous effluent filtration system which will have to withstand seismic disturbance. The licensee is also planning to install a system to reflood the reactor pool in case of serious accident. The RHF safety report will have to be updated in 2012. A new "operating conditions" method of analysis will be used for this. Finally, with a view to achieving complete delicensing of the CEA Grenoble centre, located in the immediate vicinity of the RHF, ASN asked ILL to examine the long-term future of the RHF on the existing site during the course of the installation's forthcoming periodic safety review, scheduled to take place in 2017.

2|3 The European Organization for Nuclear Research (CERN) installations

The European Organization for Nuclear Research (CERN) is an intergovernmental organisation established on the basis of a treaty between States for the purpose of carrying out purely scientific and fundamental research concerning high energy particles. The CERN site is located near Geneva, on the Franco-Swiss border.

The safety of these installations is regulated by a convention binding the French Government and CERN. The convention previously in force, which dates from July 2000, stated that certain provisions of French legislation applicable to BNIs apply to the LHC and to the SPS, two rings which make up part of the CERN's installations. It also designated ASN as the French Government representative to deal with technical matters concerning the treaty. ASN also has a seat on the CERN's radiation protection committee, in charge of all radiation protection problems on the site. However, ASN considers that its position with regard to CERN needs to be made clear. Discussions took place in 2009 to update the 2000 convention, after which a new convention was proposed. The new tripartite convention (CERN/ASN/Office Fédéral de la Santé Publique suisse) was signed on 15 November 2010. It covers safety and radiation protection for all CERN installations, both present and future.

The Large Hadron Collider (LHC), helping to push forward research in particle physics (search for the "Higgs boson"), was restarted in November 2009, following shutdown after an incident that occurred within days of its entry into service in September 2008 (helium leak from superconductor magnets). The LHC's power has been increased gradually with the aim of producing proton-proton collisions with a beam energy of 7 TeV.

In 2010, ASN conducted three monitoring visits to CERN, on the subjects of radiation protection, transport and LHC maintenance.

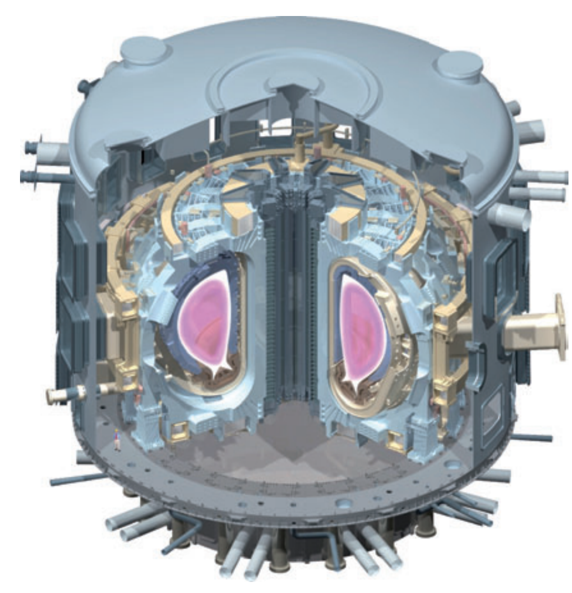
2 | 4 The ITER (international thermonuclear experimental reactor) project

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. Cadarache was chosen at the end of June 2005 to host the facility. The international treaty creating the ILE (ITER Legal Entity) was initialled in May 2006 and ratified by all the Parties in September 2007. The Headquarters Agreement between ITER and the French Government, signed on 7 November 2007, was published in the Official Gazette of the French Republic by decree on 11 April 2008.

At the request of ASN – which had noted that the international organisation status of the ITER installation, and in particular the prerogatives linked to the corresponding privileges and immunities, was liable to create problems with respect to the responsibility of the nuclear licensee – it was made clear that, as for other BNIs located in France, there could be no immunity for individuals nor inviolability of premises where nuclear safety and radiation protection inspections are concerned (article 16 of the Headquarters Agreement).

A first version of the creation authorisation application file for the ITER BNI was submitted at the end of January 2008. However, ASN informed the ITER Organization (IO) that its file was unacceptable in its current form and needed to be clarified on a number of points before the creation authorisation procedure and, in particular, before the public inquiry could be initiated. The revised file was submitted to ASN in April 2010 and was examined by ASN. ASN paid particular attention to the inclusion in this file of all of the conditions for satisfactory provision of information to the public, ensuring that only data of a sensitive nature were excluded. Examination of acceptability was started. It is already apparent that IO will have to complete its impact assessment before the public inquiry. The local information committee (CLI), set up in 2009, will be consulted regarding this application file. ASN will convene the Advisory Committees concerned to review this file and will establish its position on the ITER draft creation authorisation decree.

IO aims to obtain the first hydrogen plasma in 2019 and the first deuterium-tritium plasma in 2026. The preparatory site work is underway. The civil engineering works for construction of the BNI buildings are programmed for 2012.



Schematic diagram of the ITER Tokamak

3 IRRADIATION FACILITIES, MAINTENANCE FACILITIES AND OTHER NUCLEAR INSTALLATIONS

The main subjects of interest for ASN in 2010 were:
– safety review of the CIS bio international installation. This examination should continue in 2011. However, it already appears necessary to reduce the radioactive iodine inventory of this installation in order to reduce the potential consequences of a serious accident;
– follow-up to the incident of 22 June 2009 on the IONISOS installation which highlighted failings in access management.

3 | 1 Industrial ionisation installations

Industrial irradiation facilities provide gamma-ray (mainly cobalt 60 sources) treatment for medical equipment (sterilisation) or foodstuffs. An irradiation facility consists of a concrete bunker inside which the irradiation processes take place.

The sealed sources are placed in a pool inside the bunker. They are remotely and automatically extracted from the pool during an irradiation operation. They are lowered into the pool after the operation and prior to any intervention by the operators in the bunker. There is thus no risk of irradiation inside the bunker. The facilities currently operated are the IONISOS Group's installations situated in Pouzauges (Vendée *département*), Sablé-sur-Sarthe (Sarthe *département*) and Dagneux (Ain *département*) and the ISOTRON Group's installation in Marseilles (Bouches-du-Rhône *département*).

The safety problems mainly concern access management, a point to which ASN is extremely attentive, in particular on the basis of the experience feedback from the operation of similar installations in Europe.

With regard to follow-up on the event that occurred on 22 June 2009 (untimely opening of the access door to an irradiation cell on the IONISOS installation at Pouzauges in the Vendée region), ASN verified, over several inspections in 2010, that the licensee had implemented the immediate measures requested at the end of December 2009, as well as long-term measures such as modification of the locking system of the access door involved.

In June 2006, the ISOTRON France company submitted to ASN a licence application file for the creation of a BNI called GAMMATEC, on the Marcoule site. The decree authorising the creation of this facility was published in the Official Gazette on 27 September 2008. This new facility would be the ISOTRON Group's second in France. At the time of writing, the decision to start construction work on the new installation had not been taken by the licensee.

CLIs were set up in places around the Sablé and Pouzauges sites in 2009 and meet at least once a year. The CLI for the ISOTRON site in Marseille is to merge with that for Cadarache. The CLI for the Dagneux site has not yet been created by the *Conseil Général*[2] for the Ain *département*.

2. *Conseil Général: département*-level elected council

3 | 2 The radio-pharmaceuticals 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 authorising CIS bio international to replace CEA in operating BNI 29 was signed on 15 December 2008.

Extensive works for renovation, improvement and adaptation to increasing production needs have been carried out in the installation since 2004. They should be completed in 2011.

The licensee submitted the safety review file at the end of June 2008. However, ASN considered that numerous points in the file needed to be completed and decided accordingly (decision 2009-DC-137 of 7 April 2009). At the end of 2009, the licensee provided the documents requested by the above-mentioned decision in order to consolidate the safety review file. Examination of the file then began. At the start of 2010 it appeared that the content of these documents was not such that ASN could make a pronouncement as to the long-term viability of operation of the installation, notably in the absence of a full and completed examination of compliance. It was therefore decided that the Advisory Committee for plant (GPU) should convene an initial meeting, held on 7 July 2010, to assess the status of knowledge of the installation's safety and to identify priority areas for improvement. A second meeting was also scheduled to conclude on the review file. However, in order to avoid any delay in reducing the radiological consequences that could result from a potential accident, the installation's iodine 131 inventory will be significantly reduced from 2011 onwards.

Furthermore, despite progress in certain areas, ASN considered that the safety management system at CIS bio international still needed to be improved and that the resources dedicated to nuclear safety and radiation protection in BNI 29 were inadequate. It therefore issued decision 2009-DC-145 of 16 July 2009 requiring CIS bio international to remedy this situation. The licensee provided a first version of the file intended to respond to these requirements at the end of November 2009. However, the request for expert examination issued by the committee for hygiene, health and labour conditions (CHSCT) and recent organisational changes have led to amendment of this document. A new version of the file is pending. This subject is covered in the installation's safety review file.

Finally, new requirements on discharges specific to BNI 29 came into force in January 2010.

It should be noted that the public interest group (GIP) for sealed high-activity radioactive sources was the subject of a founding agreement contained in a Government Order of 4 June 2009.

3 | 3 Maintenance facilities

Three BNIs specifically handle nuclear maintenance activities in France:
– the SOMANU (*Société de maintenance nucléaire*) facility in

Maubeuge (Nord *département*), which specialises in the repair, maintenance and evaluation of equipment taken mainly from PWR main primary systems and their auxiliaries, with the exception of fuel elements. 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 review of the safety of the licensee's installation;

– the clean-out and uranium recovery installation of the *Société auxiliaire du Tricastin* (SOCATRI) in Bollène (Vaucluse *département*) which handles maintenance, storage and clean-out of equipment from the nuclear industry and storage of waste on behalf of ANDRA. Following an uncontrolled discharge on 7 July 2008, the former effluent treatment station was finally shut down, the tanks were drained and closed and the collection tank in question was repaired. On 14 October 2010, the tribunal court of the city of Carpentras declared SARL SOCATRI not guilty of causing water pollution damaging to health or flora and fauna but found it guilty of failing to make a timely declaration of an incident that had occurred in its premises, as required under articles 48 and 54 of the Act of 13 June 2006. The prosecution lodged an appeal against the tribunal's decision and the case will be re-tried. With regard to the consequences of the event on the environment, the broader monitoring programme set up has enabled the following conclusions to be drawn:
– at present there would seem to be no environmental contamination as a result of this incident; however, SOCATRI is required to continue monitoring the groundwater below 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. About thirty private wells are monitored by AREVA NC.

A study of this contamination conducted by IRSN provided a clearer view of the extent of this phenomenon. The study was monitored by the local information committee for major energy installations (CLIGEET), the departmental directorate for health and social affairs (DDASS) for Vaucluse and by AREVA NC.

The study gave rise to a public meeting on 22 September 2010 in which ASN participated.

This study and the methods and means of providing information that accompany it should take over from the monitoring of private wells currently organised by AREVA NC.

During 2009, the SOCATRI licensee undertook a review of the safety of its installation. It provided ASN with the files in 2010. ASN then began its examination.

In addition, SOCATRI undertook major works to be able to handle effluents generated by preparatory operations for the final shutdown of the EURODIF plant and of the maintenance units for some GBII equipment.

– the Tricastin operational hot unit (BCOT), also in Bollène, which carries out maintenance and storage of contaminated PWR equipment, except for fuel elements. In 2010, the BCOT licensee initiated a periodic safety review of its installation.

3 | 4 Chinon irradiated material facility (AMI)

This installation, located on the Chinon nuclear site (Indre-et-Loire *département*), is operated by EDF. It now primarily carries out examinations and appraisals of activated or contaminated materials from the PWRs.

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, in particular including final shutdown of the installation no later than 2015. In 2008, EDF indicated its aim of commissioning this new laboratory for 2011. Preparatory work began in 2009. If the schedule presented is complied with, the AMI's expert examination and appraisal work will wind down in 2012, and the preparatory operations for decommissioning of the installation will begin.

In 2007, EDF also presented ASN with the measures contemplated to guarantee the safety of the installation until final shutdown. ASN declared itself favourable to implementation of these measures, which included, notably, upgrading of the installation with regard to fire risk (improved sectorisation and fire detection). The corresponding work was completed at the start 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.

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*. EDF uses them to store nuclear fuel assemblies (only those made of uranium oxide) pending loading into the reactor. After reconsideration of the organisation of its supply chain, EDF decided against final shutdown of the Chinon warehouse. The licensee is considering dedicating one of the warehouses to transit of imported fuel assemblies. ASN has asked the licensee consider review of the safety of its installation rapidly.

3 | 6 CENTRACO waste incineration and melting facility

The CENTRACO low-level waste processing and packaging centre, located in Codolet near the Marcoule site (Gard *département*), is operated by SOCODEI.

SOCODEI aims to become a major player in waste processing. It has therefore begun to look at ways of expanding its scope of operations, given the need to reposition itself in the low-level waste management sector, particularly since ANDRA's very low-level waste repository opened. This strategy required amendment of the creation authorisation decree (DAC) and a revision of the discharge and water intake licence (ARPE). Examination of the applications in 2008 led to the signing of an amending decree and then, in 2009, to the publication of decisions concerning effluent discharge and water intake.

In addition, CENTRACO, which was having its effluents treated at the Marcoule centre, wished to create its own effluent treatment plant. As part of the commissioning process for this installation, ASN focused on examination of the performance of this installation with regard to the installation's discharge authorisations.

For its industrial development, the installation is having to handle increasing quantities of effluents from cleaning of EDF steam generators. These effluents have limited radiological activity but significant chemical loading. ASN is particularly attentive to this point and has asked the licensee to introduce specific monitoring of its installation over six months in order to confirm that handling of these new discharges is without impact on the environment.

Other potential changes in the waste accepted and the use of replacement products, allowing reduced consumption of uncontaminated products, are currently being examined.

Concerned by the shortcomings observed in 2008, the ASN's Director-General summoned the CENTRACO Director General in November 2008 to ask him to implement an action plan to remedy the situation. Application of this plan shows an improvement in the management system, which was the subject of enhanced monitoring, notably in the form of ASN inspections. At a second meeting between ASN and CENTRACO's Director General, towards the end of 2010, ASN noted that the licensee had fully assimilated the safety improvement action plan and that management was committed to its implementation.

4 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.

ASN is of the opinion that the "major commitments" initiative should be pursued and should be subject to formal six-monthly monitoring by CEA. It is felt that the commitments, by cordoning a limited number of high-stake projects, help to avoid postponement of meeting of commitments for reasons other than those of justifiably unforeseen technical problems. It is important that CEA devote the budgetary and human resources to fulfilling its "major commitments". ASN has, accordingly, asked CEA to pursue this approach, which should lead to improved project management.

In 2011, ASN will continue to focus on management of the civil engineering operations on the construction sites for new installations and on renovation work for existing installations. It will also be attentive to meeting deadlines for transfer of nuclear materials stored in the MCMF or in MASURCA to the new MAGENTA installation.

In 2011, ASN will also continue its monitoring in the field of measures introduced within the framework of CEA's internal authorisations system. Monitoring will cover: the process as a whole; the justification of compliance with the criteria for implementation of the decision; and verification of independence, within CEA, between the applicants, the support services and first and second level inspectors.

Furthermore, ASN will examine the conclusions of the safety review for the ÉOLE and MINERVE installations, programmed by CEA for shutdown within 10 years. The Authority will also examine the safety of the GANIL installation, at the same time as examination of the request for amendment to the decree for the installation, with a view to setting up of a new accelerator. It will complete examination of the safety review file for the CIS bio international radiopharmaceuticals production installation, in order to pronounce on the acceptability of its continued operation in the medium long terms.

ASN will also examine the request for authorisation file for the ITER installation project, which will be the subject of a meeting of members of the Advisory Committee for plants and members of the Advisory Committee for reactors.

ASN will continue its actions relative to commissioning of installations such as STELLA (Saclay centre's effluent treatment plant) or RJH (a research reactor for production of artificial radioelements).

Moreover, in 2011, ASN will examine – via examination of the ASTRID prototype project and work on fourth-generation reactors ("Generation IV") – the operating feedback on experience with fast neutron reactors (PHÉNIX, SUPERPHÉNIX and RAPSODIE, now shutdown), as well as elements requested from the CEA/EDF/AREVA consortium for comparison, in terms of safety, of the different systems.

Finally, in 2011, ASN will continue its actions to foster international harmonisation in the area of safety of research reactors, within the framework of the IAEA's fifth meeting on the Convention on Nuclear Safety, scheduled for 2011 (see chapter 7), as well as in Europe, within the framework of WENRA and the work of the NEA. It will also continue to be an active contributor to consideration, on the international level, of the ageing of installations and the safety of supply of radioelements for medical use.

SAFE DECOMMISSIONING OF BASIC NUCLEAR INSTALLATIONS

CHAPTER 15

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 disassembly, 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 2010, 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. These were clarified and supplemented in 2006 by the TSN Act. ASN continues to develop the regulatory framework and the applicable doctrine for this phase in the life of basic nuclear installations. 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 High Committee for Transparency and Information on Nuclear Security (HCTISN) in 2009 and was officially published in 2010.

1 TECHNICAL AND LEGAL REQUIREMENTS APPLICABLE TO DECOMMISSIONING

1 | 1 Decommissioning strategies

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). 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 contaminated waste or waste that is liable to 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 Legal requirements

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 followed by 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 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.

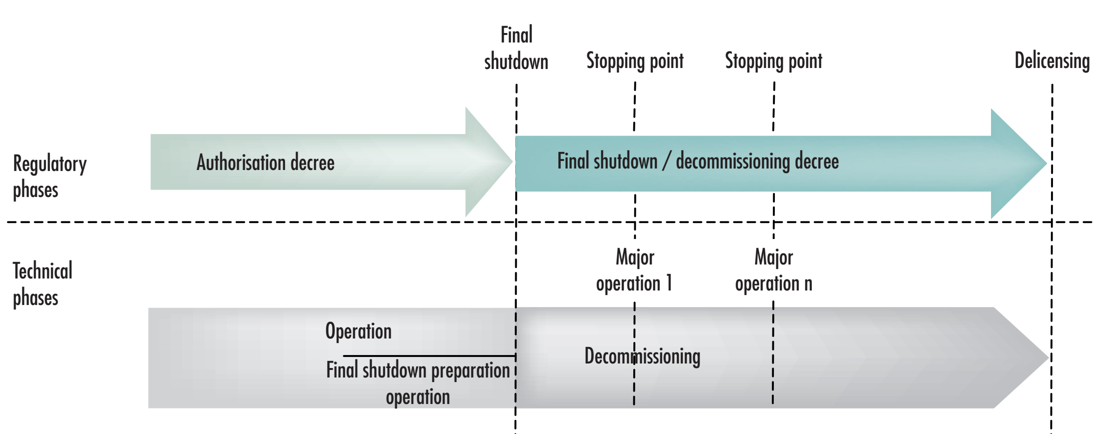
The TSN Act requires that the safety of an installation in the decommissioning phase be periodically reviewed. The frequency of these reviews is normally 10 years. When such safety reviews are performed, ASN's goal is to ensure that the installation's level of safety remains acceptable until it is delicensed. Compensatory measures proportional to the risks presented by the installation during decommissioning will be taken if necessary.

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.). Public protection restrictions 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 restrictions.

A 2003 ASN guide specified the regulations 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, designed to incorporate the regulatory changes brought about by the TSN Act and decree 2007-1557 of 2 November 2007, as well as the work done by the WENRA association, was finalised in 2008 and published at the beginning of 2009.

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).

Diagram 1: phases in the life of a BNI



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 creates a system for securing the nuclear expenses involved in the decommissioning of nuclear installations and management of radioactive waste. This article is clarified by decree no. 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 recovering and packaging legacy waste (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 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 then sent the Government its opinion with regard to the consistency of the strategies for decommissioning and management of spent fuel and radioactive waste, presented by the licensees, in terms of nuclear safety (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, with regard to:
- technical changes (perimeter, strategy, scenario, unforeseen event, etc.);
- ASN opinion 2007-AV-0037 of 20 November 2007.

The points it reviewed include those on which additional information is required in the annual update memos. Although the licensees have made a significant effort, further actions must still be undertaken. Paragraph II of article 2 of decree no. 2007-243 of 23 February 2007 concerning the securing of financing of nuclear costs requires the licensee to evaluate the costs of BNI decommissioning, based on analysis of the various options that can be reasonably envisaged for the operation and a conservative choice of reference strategy. In the reports submitted for the first exercise (2007), not one licensee put forward technical, radiation protection or economic criteria to demonstrate optimisation of the chosen scenario.

On several occasions in 2010, ASN and 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. In view of the experience acquired in this first exercise, ASN has started to draft a guide intended for the licensees, to clarify what is expected in application of the regulatory provisions, particularly regarding the description of technical scenarios and the evaluation of the corresponding costs.

The second three-yearly reports submitted by the licensees on account of article 20 of the Act of 28 June 2010 were examined by ASN in 2010. ASN will give its opinion in early 2011.

1 | 4 Decommissioning risks

Diagram 2 presents the main risks associated with the decommissioning of a nuclear installation and the periods during which these risks are highest.

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.

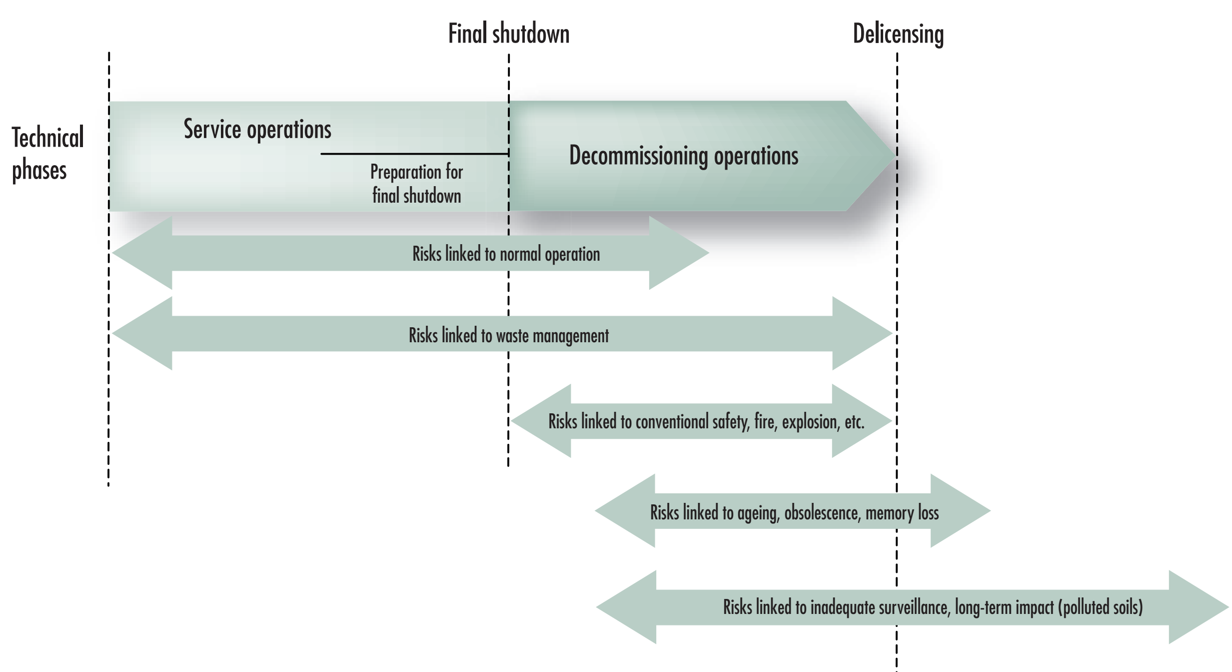
The risks presented by the nuclear installation when in operation change as decommissioning progresses. Even if certain risks, such as criticality, quickly disappear, others, such as those related to radiation protection (gradual removal of containment barriers) or general working safety (numerous contractors working together, falling loads, work at height, and so on) gradually become predominant. The same applies to the risk of fire or explosion ("hot work" technique used in cutting up the structures), as well as, for example, to the risks related to human and organisational factors (organisational changes in relation to the operating phase, frequent reliance on outside contractors).

For complex nuclear installations such as nuclear power plant reactors, decommissioning work often lasts for more than a decade. This follows on from an operating period that often lasts several decades. Consequently, there is a very real risk of loss of the design and operational memory of the nuclear installations. It is therefore vitally important to meticulously gather and record the knowledge of the persons involved in the operating phase, especially since measures to ensure the traceability of the design and operation of old installations are not always implemented. The length of the decommissioning operations also involves taking account of the risks inherent in the obsolescence of certain equipment (electrical or monitoring networks for example). Depending on the stage reached in the operations, risks linked to the potential instability of partially dismantled structures must also be taken into account.

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, either temporarily or permanently, to replace the centralised operational monitoring and surveillance systems with other more appropriate resources, such as "field" radiation monitoring or fire detection devices, located as close as possible to the potential sources of risks. Given these rapid and significant changes in the installation status, it is difficult to permanently check the adequacy of surveillance, and there is a very real risk of failing to detect the onset of a hazardous situation.

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 with a long-term impact, areas for which clean-out is technically impossible, etc. In this case, prior to delicensing of the installation, the licensee must present and justify the envisaged procedures for continued surveillance of the installation or site. Restrictions on the use of the site may also be imposed.

Diagram 2: principal risks encountered during decommissioning



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 then be delicensed on completion of any necessary "conventional" clean-out operations (cleaning of 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. This analysis showed that despite certain technical difficulties, the complete clean-out of civil engineering structures has proven itself and led to a large number of areas in nuclear installations undergoing decommissioning being delicensed to "conventional waste zone" status.

Having listened attentively to the arguments of the various stakeholders, ASN published a new version of the 2006 guide (draft guide no.14) which aims to specify the requirements in terms of modelling, delicensing of very large structures, using innovative decontamination techniques, adopting 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 2010

2 | 1 EDF nuclear power plants

In 1996, EDF's strategy was deferred decommissioning of its shutdown nuclear installations, namely the six gas-cooled nuclear power 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 decommissioning programme and identifies the forthcoming major milestones. Current thinking on the decommissioning strategy for the PWR reactors in operation is presented. EDF also specifies its intended orientations in the event of any delay in the availability of the graphite waste disposal route. ASN will adopt a stance in early 2011 on the file forwarded by EDF.

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 internal authorisation system is now regulated by decree 2007-1557 of 2 November 2007 concerning basic nuclear installations and the supervision of the transport of radioactive materials with respect to nuclear safety and by ASN decision 2008-DC-106 of 11 July 2008 which specifies ASN requirements for implementation of the provisions of this decree in the internal authorisation context. Pursuant to article 3 of this decision, EDF submitted a complete file to ASN in October 2009 presenting an update of its internal authorisation system, with a view to having it approved by the ASN Commission. This file is being examined by the ASN.

2 | 1 | 1 The Brennilis power plant

The Brennilis power plant is an industrial prototype of a heavy water-moderated, carbon dioxide-cooled nuclear power plant, 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 electromechanical components, demolition of non-nuclear buildings, etc.).

Decree 2006-147 of 9 February 2006 authorising EDF to proceed with the complete decommissioning of the installation was cancelled by the *Conseil d'État*[1] on 6 June 2007. The operations that could be carried out, notably repackaging and disposal 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 did nevertheless consider that EDF should be authorized to immediately complete the inventory of the initial radiological and chemical status of the site, complete the STE (effluent processing station) decommissioning operations, clean-out and fill in the effluent discharge channel in the River Ellez, clean out areas of diffuse pollution, and lastly, start decommissioning the heat exchangers following their radiological characterization.

In the opinion it submitted to the Government, ASN recommended authorising EDF to perform the operations to complete phase II of decommissioning - remaining consistent with the opinion of the investigation commission - and that EDF should initiate a new application for complete decommissioning. 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.

The draft decisions aiming to regulate water draw-offs and effluent discharges were presented by ASN at the CLI meeting of 16 November 2010 and should be presented at the Departmental Council for the Environment and for Health and Technological Risks (CODERST) in early 2011.

The draft decree for partial decommissioning, which only authorises phase II of the decommissioning described above, will be presented to the members of the ASN Commission in the first quarter of 2011.

Lastly, in its decision of 22 December 2009, ASN required that the waste awaiting waivers be removed by 30 June 2010 and that progress reports on the treatment of legacy waste requiring additional analyses be sent periodically to ASN. Since then, EDF has removed all the waste that was waiting for concessions, and now sends ASN a half-yearly on the treatment of legacy waste progress report (characterisation, sorting, repackaging) whose removal in the existing disposal routes requires complementary investigations, such as additional radiological characterisations.

2|1|2 Gas cooled reactors (GCR)

During the investigation of the file submitted by EDF in June 2009 concerning updating of the strategy for nuclear power plant decommissioning, ASN reaffirmed its strong support for an immediate decommissioning strategy. It nevertheless notes that where gas cooled Reactors (GCR) are concerned, the question of the disposal route for graphite waste can complicate 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 interim storage site for graphite waste in order to continue the decommissioning of the GCRs.

Bugey 1 reactor

The end of final shutdown and site preparation work continued until the end of 2008, when the installation complete decommissioning decree afetr 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. No significant events relating to safety, security or radiation protection were notified further to these investigations. The compartment was found to be in good overall condition with relatively low dust loading. Experience feedback from this intervention will be turned to good account in the similar investigations to be performed in the near future on the Saint-Laurent A and Chinon A3 reactors.

The year 2010 was essentially marked by the successful completion of the preparatory work necessary for installation decommissioning. Repackaging of legacy waste is continuing with a view to its disposal and the decommissioning operations - reactor compartment excluded - are in progress.

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.

Complete decommissioning of the Chinon A3 reactor compartment was authorised by decree 2010-511 of 18 May 2010, and will be carried out after decommissioning of the Bugey 1 and Saint-Laurent A2 reactor compartments, benefiting from the experience acquired in these latter operations.

Work is in progress to prepare for decommissioning of the heat exchangers (the first stage of installation decommissioning), which is currently planned for late 2011. This work, which will continue in 2011, consists more particularly in providing an installation that can ensure the dynamic containment of the premises that is necessary for heat exchanger decommissioning.

1. France's highest administrative court

The roads around Chinon A3 and A2 are also undergoing repair, with the prospect of decommissioning the Chinon A3 heat exchangers.

Furthermore, the graphite stack of the Chinon A1 reactor compartment is currently being core drilled to provide further input to the radiological inventory. These operations were carried out on Chinon A2 in 2010.

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. Decommissioning of the Saint-Laurent A2 reactor compartment will follow on from that of Bugey 1, while decommissioning of the Saint-Laurent A1 reactor compartment will come after Bugey 1, Saint-Laurent A2 and Chinon A3.

The works carried out in 2010 consisted in continuing and completing the removal and cutting of the water-steam pipes and the associated equipment (valves, supports and ventilation ducts) situated in the area beneath the reactor compartments of Saint-Laurent A1 and A2. Certain effluent tanks were also decommissioned in 2010.

The work to renovate the instrumentation of the discharge stacks and reorganise the waste interim storage areas, which began in 2010, will be completed in 2011.

Decommissioning of the electromechanical installations situated around the Saint-Laurent A2 reactor compartment to allow installation of the equipment necessary for the subsequent stages of compartment decommissioning will be the main work focus in 2011. For Saint-Laurent A1, the pre-clean-out work on the pool and its structural reconstitution will be carried out in 2011 with a view to using the pool for the decommissioning of the reactor compartments.

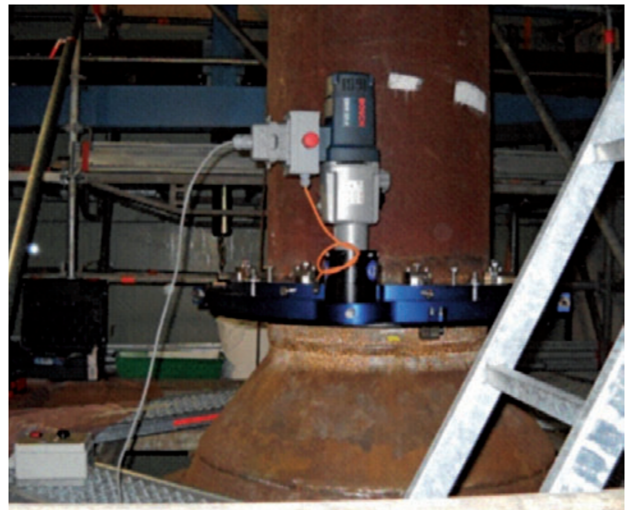
2|1|3 Chooz A reactor

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 29 September 2007.

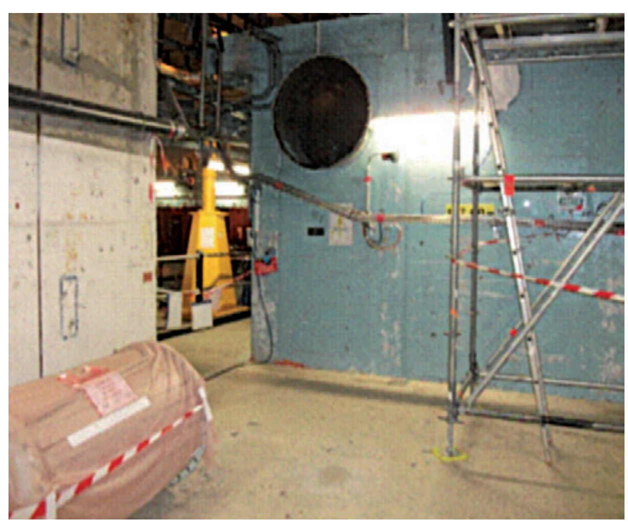
The main operations carried out in 2010 concern the decommissioning of the electromechanical equipment of the vault housing the auxiliaries and the preparatory work for decommissioning of the primary cooling system, excluding decommissioning of the reactor vessel in the reactor vault.

EDF submitted an authorisation application to the ASN to proceed with the actual decommissioning of the primary cooling system, excluding the reactor vessel. The application file was accompanied by an update of the safety report and the general surveillance and maintenance rules (RGSE) for the installation.



Preparation for the extraction of a steam generator at Chooz A – 2010

Site of the HK vault at Chooz A: before work – 2010



Site of the HK vault at Chooz A: after work – 2010

The primary cooling system decommissioning operations constitute a holding point mentioned in paragraph III of article 2 of the Chooz A decommissioning authorisation decree; engaging these operations is therefore subject to prior approval by ASN.

The file was reviewed between March and October 2010, and the examination revealed no technical grounds for refusing authorisation to carry out these works. ASN thus authorized commencement of the works, subject to compliance with a number of technical requirements, by its decision 2010-DC-0202 of 7 December 2010.

ASN also asked EDF to furnish an update of the RGSEs for the installation, incorporating a number of details provided by EDF itself during the technical review.

The significant events of 2011 will thus be the decommissioning of the primary cooling system, of which the main operations comprise the cutting and isolation of the main primary system and the steam generators (SG), the decontamination of the SGs by chemical and mechanical treatment, the decontamination of the pressuriser and the primary system pipes by chemical treatment before removing them from the site as very low-level waste (VLLW); and lastly the cutting without decontamination of the remaining equipment and systems.

Furthermore, after an examination of the corresponding file that lasted a little more than three years, the ministerial order approving ASN decision 2009-DC-0165 of 17 November 2009 setting the environmental discharge limits for the Chooz installations was published in the Official Gazette of the French Republic on 9 December 2009. ASN decision 2009-DC-0164 of 17 November 2009 sets the requirements relating to the conditions of water take-off and consumption and of discharges into the environment.

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. Complete decommissioning of the installation was authorised by decree 2006-321 of 20 March 2006, article 4 of which requires ASN authorisation for the commissioning of the sodium treatment installation, called TNA, and all the systems required for it to operate. The sodium treatment process using hydrolysis consists in injecting liquid sodium into an aqueous soda flow in order to produce 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 disposal.

The TNA installation commissioning review was carried out in compliance with article 20 of the decree of 2 November 2007, that is to say, on the basis of the examination of an update of the safety report, of the general surveillance and maintenance rules (RGSE), of the waste study and of the on-site emergency plan for the installation.

In parallel with this, the TNA installation operating tests, which were completed in 2010, were reviewed and inspected by the ASN services.

The various reviews revealed no technical points preventing industrial start-up of the TNA or storage of the soda concrete blocks produced by the sodium treatment. Consequently, ASN authorised EDF to put these two installations into service by decision 2010-DC-0187 of 6 July 2010.

After treating the secondary sodium for almost five months, EDF began treating the primary sodium in the TNA in late November 2010. These operations are still in progress.

Treatment of the secondary pumps in the MDG facility dedicated to decommissioning of the large removable components of the reactor vessel was completed in September 2009, and treatment of the primary pumps - authorised by ASN letter of 15 January 2010 - was completed in October 2010. Treatment of the intermediate heat exchangers, authorised by ASN letter of 3 August 2010, is in progress.

Furthermore, all the lateral neutron protections in the vessel have been removed and transferred to the APEC storage pool.

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 installation now accommodates the TNA that treats the sodium contained in the Superphénix reactor, and the storage area for the soda concrete packages produced by the TNA, the siting of which was authorised by decree 2006-319 of 20 March 2006 and the commissioning by decision 2010-DC-0187 of 6 July 2010.

2|2 CEA installations

In December 2006, the Advisory Committees 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.

2|2|1 Fontenay-aux-Roses centre

CEA's first research centre, 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. Since January 2008, the laboratories clean-out and installations decommissioning programme has been built around a project called Aladin. This project will use the experience feedback from the Grenoble Passage project. Initially forecast to last some ten years, the CEA has already informed ASN that it will be unable to meet this schedule due to the presumed presence of radioactive contamination underneath Building 18. ASN has asked the licensee to reassess the duration of the operations and produce a new schedule. Decommissioning of the two installations present on the site, the Process BNI (BNI 165) and the Support BNI (BNI 166), was authorised by decrees published in the Official Gazette of 2 July 2006. ASN considers that the BNI clean-out operations carried to date have run in accordance with their decommissioning decree. Before administrative delicensing of the centre's BNIs, ASN will be required to adopt a stance on the radiation status of the site as a whole, for which the licensee has undertaken major work to identify areas displaying radiological activity resulting from past experimentation and to rehabilitate the soil.

The Process installation (BNI 165)

Of the two BNIs, this will be the first to be decommissioned. Operations to raise tank B on the "Pétrus" line, which contained high-activity effluents, began in March 2007 and ended in September 2009.

The clean-out operations on the shielded lines are continuing: CEA submitted a file for the decommissioning and clean-out of one of the largest shielded lines in Building 18, which 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 BNI, before being decommissioned in turn.

This BNI is used for storage and evacuation of radioactive effluents from the site as well as the treatment of solid waste, storage in a decay pit of irradiated drums pending evacuation and storage of drums of low and very low level waste pending shipment to a repository.

Raising of the Circe container of high-level effluents should have begun in September 2008 but finally did not start until June 2009 due to containment problems.

With a view to improving the organisation of its activities and hence the safety of its installation, the CEA has installed a new waste drum characterisation line. In July 2010, it submitted a file for its entry into service.

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 its research activities were gradually transferred to other centres, the Grenoble centre turned its focus to fundamental and technological research into the field of non-greenhouse gas emitting energies (solar, fuel cell), health (biotechnologies) and communications (micro and nanotechnologies).

CEA Grenoble then launched its site denuclearisation project "Passage", which aims at ending nuclear activities in 2012.

The site housed six nuclear installations which since then have been gradually phased out, moving to the decommissioning phase with the ultimate aim of delicensing. After delicensing of the Siloette reactor (BNI 21) in 2007, decommissioning and clean-out of the CEA Grenoble nuclear installations continued in 2010.

ASN considers that clean-out and decommissioning of the installations in the Grenoble centre are proceeding correctly, with good control over the risks inherent to decommissioning worksites.

During its inspections, ASN noted that CEA Grenoble was making increasing use of outside companies, whether for operation of the installations, the engineering studies linked to the decommissioning work, or the work itself. In spite of the gradual reduction in the risks in terms of worker safety and radiation protection, ASN asked CEA Grenoble to maintain a level of resources enabling it to ensure complete control of its installations.

Radioactive effluent and solid waste treatment station and decay storage (BNI 36 and 79)

Decommissioning of the radioactive effluent and solid waste treatment station (STEDS - BNI 36) was authorised by decree 2008-980 of 18 September 2008 published in the Official Gazette. The decommissioning operations should continue until 2012. A part of the installation is now dismantled and its North zone is used for characterisation and collection of the decommissioning waste pending shipment for disposal.

BNI 79 (STED), which is within the boundary of BNI 36, is a decay storage facility for high level (HL) waste. Despite the problems encountered with disposal route availability, removal of the HL waste from storage was completed in June 2010, thereby meeting the completion commitment given to ASN (deadline of 31 December 2010). There is now no HL waste stored on the site. Decommissioning of this BNI was authorised by the same decree as that which authorised decommissioning of BNI 36.

Active material analysis laboratory (LAMA - BNI 61)

This laboratory ended its scientific research duties in 2002. It was used to receive experimental fuels with no further purpose, taken from the Siloé and Mélusine reactors following their shutdown. It takes part in the clean-out operations of BNI 36 and 79.

The source term was mainly situated in the very high level (VHL) containments.

Decommissioning of the LAMA was authorised by decree 2008-981 of 18 September 2008 and published in the Official Gazette of 21 September 2008. Two shielded cells remained to be dismantled in the third quarter of 2010. An inspection is planned in 2011 to verify the status of the premises before delicensing the installation.

Mélusine reactor (BNI 19)

Mélusine is a former pool type reactor operated by CEA. Final shutdown was declared in 1994. The decree authorising CEA to modify the Mélusine reactor prior to its decommissioning and

Installation of an internal lining for a decommissioning operation – STED Grenoble – February 2010

delicensing was published in the Official Gazette in January 2004. The clean-out work has been completed and in mid-2009, CEA submitted a file applying for BNI delicensing. ASN consulted the *préfet*[2] of the Isère *département*[3], the municipalities concerned, and the local information committee (CLI), which delivered a favourable opinion in summer 2010.

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 installation, operations are continuing but are behind schedule, given that activation of the pool block was greater than had been anticipated in the initial decommissioning scenario. CEA thus submitted an application pursuant to article 32 of the decree of 2 November 2007, requesting extension of the decommissioning work from 5 to 6 years. The corresponding decree was signed on 1 February 2010 and published in the Official Gazette on 2 February 2010. The reactor hall clean-out operations continued in 2010.

2|2|3 The Cadarache centre installations being decommissioned

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 in 2009, illustrates the feasibility of complete decommissioning. However, all relevant lessons must be learned from the incident that occurred in the plutonium technology facility (ATPu) and which was notified by 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 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.

Harmonie reactor

Operation of the Harmonie reactor ceased in 1996. It was a calibrated neutron source used primarily for calibrating detectors and studying the properties of certain materials. The decree authorising CEA to proceed with final shutdown and decommissioning was signed on 8 January 2004 and published in the Official Gazette on 9 January 2004. Following the operations to cut up the reactor block and take away the waste generated by decommissioning in 2005, the reactor slab, which had been activated by the neutron flux during operation, was subject to complete clean-out in 2006. 2007 and 2008 were mainly devoted to demolition of the building civil engineering works and operations that returned the site to its natural state.

The installation was delicensed on 10 June 2009 with publication in the Official Gazette of the ministerial order of 26 May 2009 implementing ASN decision 2009-DC-0133 of 31 March 2009.

Enriched uranium processing facilities (ATUE)

The ATUE provided conversion into sinterable oxide of the uranium hexafluoride from the isotopic enrichment plants. They

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

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 decree authorising final shutdown and decommissioning of the installation was published in February 2006. The year 2006 saw completion of the decommissioning phase for the process equipment.

The civil engineering structural dismantling and complete clean-out phases continued, in spite of a few stoppages due to technical and economic difficulties associated with clean-out of the structures. 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. This request is currently being reviewed. The licensee also implemented a programme to characterise the soil outside the buildings to detect any traces of pollution and determine appropriate depollution methods where necessary.

The plutonium technology facility (ATPu) and the chemical purification laboratory (LPC)

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. Since 1994, Areva NC has been the industrial licensee operating the ATPu and the LPC. From a regulatory standpoint, CEA nonetheless remains the nuclear licensee for these installations.

Given that it was impossible to demonstrate that these installations were immune to the seismic risk, Areva NC put an end to commercial activities within 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.

Following the cessation of commercial production in 2003, Areva NC initiated the recovery and packaging of the fabrication scrap and materials contained in the ATPu and LPC. This phase, which is necessary to reduce the risks inherent in these materials prior to decommissioning of the installations, was to end on 31 December 2006. As it became clear that it would be impossible to meet this deadline, CEA wished to postpone it to 31 December 2008. ASN considered that this was too long and that decommissioning needed to be completed as rapidly as possible and it issued decision 2007-DC-0036 of 21 March 2007, setting 30 June 2008 as the deadline for processing and evacuation of the materials and scrap from the ATPu and LPC. On 1 July 2008, ASN carried out an inspection in these installations, in order to check compliance with the above-mentioned decision. The inspectors were able to see that all the nuclear materials concerned by this decision had been repackaged and evacuated from the installations, mainly to the Areva NC facility at La Hague.

On 6 October 2009, CEA Cadarache informed ASN that the amounts of plutonium in the installation's glove boxes had been underestimated. They were evaluated at about 8 kg during the installation operating period, whereas the quantities recovered on that date stood at about 22 kg, and CEA estimated that the total quantity could reach 39 kg by the end of decommissioning. Following the ASN inspection of 9 October 2009, CEA was sent formal notice of non-compliance with the notification procedures stipulated in the regulations, as the licensee had been aware of this situation since June 2009. ASN also upgraded the incident from the licensee's initial Level 1 rating on the INES scale, to Level 2.

ASN also issued an initial decision 2009-DC-0160 on 14 October 2009 suspending the decommissioning operations in progress in the installation, and a second decision 2009-DC-0161 on 19 October 2009 defining the conditions for resumption of the work.

During 2010, ASN gradually authorised CEA to resume decommissioning activities on the basis of specific safety files examined by its technical support. ASN also decided to issue technical instructions ruling the decommissioning operations, through decisions 2010-DC-0196 and 2010-DC-0197 of 26 October 2010.

ASN will remain vigilant on aspects concerning the estimation of fissile materials and safety-criticality in 2011. It notes that, in 2010, CEA declared three significant events related to incorrect estimates in drums at the ATPu and the LPC, and in a heat exchanger at the ATPu.

2|2|4 The Saclay centre installations being decommissioned

ASN considers that the clean-out and decommissioning operations leading to delicensing of the two Saclay particle accelerators (ALS and Saturne) were carried out in compliance with satisfactory methodology and regulations, which should be extended to the other installations, particularly old installations or parts of installations, the decommissioning of which had been postponed for a considerable time.

High-activity laboratory (LHA)

The high-activity laboratory (LHA) comprises several units equipped for research and production assignments on various radionuclides. Following 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 will probably remain and will be covered by the ICPE system. Dismantling work has begun on the active effluent inter-cells tanks.

Celimene cell

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.

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. The decision to shut down this reactor was taken on 9 February 2007 and the final shutdown and decommissioning application was submitted to ASN in June 2009. The file is currently being reviewed.

2 | 3 Areva installations

2 | 3 | 1 UP2 400 spent fuel reprocessing plant and associated facilities

The situation in the 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. As the final shutdown preparatory work is already well-advanced, ASN had informed Areva NC that it wanted to see the decommissioning application files for the UP2 400 plant installations submitted rapidly. The first final shutdown and decommissioning application file for BNI 80 (HAO) was submitted at the beginning of 2008. This application was subject to a public inquiry in October 2008, and the final shutdown and decommissioning decree no.2009-961 of 31 July 2009 was published in the Official Gazette on 4 August 2010.

In October 2008, AREVA NC submitted three final shutdown and decommissioning authorisation applications for BNIs 33, 38 and 47. These files are currently being reviewed by ASN and were subject to a public inquiry in October 2010.

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, radiation 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 a final shutdown and decommissioning application for BNI 47 jointly with BNIs 33 and 38.

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 at the beginning of this century. 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 (see point 1.5), 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 therefore changed and entails the demolition 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 restrictions that will be put in place during administrative delicensing of the BNIs.

ASN considers that the decommissioning of the SICN site at Veurey-Voroize is proceeding satisfactorily and should allow delicensing of the waste zoning of the last buildings in early 2011. Nonetheless, the inspections carried out in 2010 revealed a lack of rigour in the monitoring of the decommissioning worksites.

Clean-out of a building gallery in the SICN plant – June 2007

2 | 4 Other 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 signed on 15 February 2006 and 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 local information committee (CLI) which was instituted in July 2010 by the *Conseil général*[4] of the Bas-Rhin *département*. ASN considers that the decommissioning work was satisfactory and that the clean-out goals were met.

2 | 4 | 2 Electromagnetic radiation laboratory (LURE)

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 began in 2004, the LURE licensee (CNRS) 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. This review resulted in a final shutdown and decommissioning decree 2009-405 dated 14 April 2009. The licensee removed the main constituents of the accelerator. The decommissioning operations should be completed in 2012 at the latest. After decommissioning of BNI 106, the final status will consist of cleaned-out empty premises returned to the Paris Sud XI University. The LURE has been attached to the local information committee of CEA Saclay.

4. *Département*-level elected council

3 OUTLOOK

In 2010, ASN published a guide to the final shutdown, decommissioning and delicensing of basic nuclear installations (guide no 6 of June 2010) and finalised the draft guide relating to complete clean-out methods acceptable in basic nuclear installations in France (draft guide no. 14 of June 2010).

The main actions ASN will carry out in 2011 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 methods.

In 2011, ASN will continue its inspections of installations undergoing decommissioning. It will focus in particular on:
– drafting a proposal decree for partial decommissioning of the Brennilis power plant and drawing up instructions relative to the waste from the installation;
– participating in the writing of drafts for the MAD DEM decree for the nuclear installations of the UP2 400 plant in La Hague;
– examining the safety of the decommissioning operations concerning the active solution treatment equipment and the associated circuits of the LPC;
– drawing up instructions concerning the waste from Chinon A3;
– reviewing the authorisation application submitted by the CEA for the decommissioning of the Pétrus equipment of BNI 165;
– reviewing the preparatory operations for final shutdown of the installations that will soon be shut down and decommissioned (Phénix, Comurhex, Eurodif).

In addition to this, ASN will finalise its review of EDF's decommissioning strategy. It will also review the elements submitted by the CEA for the updating of its decommissioning strategy, justifying the chosen time schedule and explaining the reasons, technical or otherwise, for the observed delays.

UNDERSTAND

Definitions

Decommissioning covers all the technical and administrative activities carried out following the shutdown of a nuclear installation, in order to achieve a final predefined 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, destruction 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 public protection restrictions imposing restrictions on use.

APPENDIX 1: LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2010

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Latest regulatory acts	Current status
NÉRÉIDE FAR*	(former BNI 10)	Reactor (500 kWth)	1960	1981	1987: Removed from BNI list	Decommissioned
TRITON FAR*	(former BNI 10)	Reactor (6.5 MWth)	1959	1982	1987: Removed from BNI list and classified in ICPE	Decommissioned
ZOÉ FAR*	(former BNI 11)	Reactor (250 kWth)	1948	1975	1978: Removed from BNI list and classified in ICPE	Confined (museum)
MINERVE FAR*	(former BNI 12)	Reactor (0.1 kWth)	1959	1976	1977: Removed from BNI list	Dismantled at FAR and reassembled at Cadarache
EL 2 SACLAY	(former BNI 13)	Reactor (2.8 MWth)	1952	1965	Removed from BNI list	Partielly decommissioned, remaining parts confined
EL 3 SACLAY	(former BNI 14)	Reactor (18 MWth)	1957	1979	1988: Removed from BNI list and classified in ICPE	Partielly decommissioned, remaining parts confined
PEGGY CADARACHE	(former BNI 23)	Reactor (1 kWth)	1961	1975	1976: Removed from BNI list	Decommissioned
CÉSAR CADARACHE	(former BNI 26)	Reactor (10 kWth)	1964	1974	1978: Removed from BNI list	Decommissioned
MARIUS CADARACHE	(former BNI 27)	Reactor (0.4 kWth)	1960 at Marcoule, 1964 at 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*	BNI 34	Processing of liquids and solid waste	Before 1964	2006	2006: Removed from BNI list	Integrated into BNIs 165 and 166
HARMONIE CADARACHE	(former BNI 41)	Reactor (1 kWth)	1965	1996	2009: Removed from BNI list	Decommissioned
ALS	(former BNI 43)	Accelerator	1958	1996	2006: Removed from BNI list	Cleaned-out – public protection restrictions***
SATURNE	(former BNI 48)	Accelerator	1966	1997	2005: Removed from BNI list	Cleaned-out – public protection restrictions***
ATTILA** FAR*	(former BNI 57)	Reprocessing pilot	1968	1975	2006: Removed from BNI list	Integrated into BNIs 165 and 166
LCPu FAR*	(former BNI 57)	Plutonium chemistry laboratory	1966	1995	2006: Removed from BNI list	Integrated into BNIs 165 and 166
BAT 19 FAR*	(former BNI 58)	Plutonium metallurgy	1968	1984	1984: Removed from BNI list	Decommissioned
RM2 FAR*	(former BNI 59)	Radio-metallurgy	1968	1982	2006: Removed from BNI list	Integrated into BNIs 165 and 166
LCAC GRENOBLE	(former BNI 60)	Fuels analysis	1975	1984	1997: Removed from BNI list	Decommissioned
STEDs FAR*	(former BNI 73)	Solid waste storage facilities	1989		2006: Removed from BNI list	Integrated into BNI 165 and 166

APPENDIX 1: LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2010 (continued)

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Latest regulatory acts	Current status
ARAC SACLAY	(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 – public protection restrictions***
FBFC PIERRELATTE	(former BNI 131)	Fuel fabrication	1990	1998	2003: Removed from BNI list	Cleaned-out – public protection restrictions***
SNCS OSMANVILLE	(former BNI 152)	Ioniser	1983	1995	2002: Removed from BNI list	Cleaned-out – public protection restrictions***
URANIUM WAREHOUSE MIRAMAS	(former BNI 134)	Uranium bearing materials warehouse	1964	2004	2007: Removed from BNI list	Cleaned-out – public protection restrictions***
SILOETTE GRENOBLE	(former BNI 21)	Reactor (100 kWth)	1964	2002	2007: Removed from BNI list	Cleaned-out – public protection restrictions***

(*) 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 FINALLY SHUT DOWN AS AT 31.12.2010

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Latest 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 licensing decree	Decommissioning in progress
MÉLUSINE GRENOBLE	19	Reactor (8 MWth)	1958	1988	2004: Final shutdown and decommissioning decree	Decommissioning in progress
SILOÉ GRENOBLE	20	Reactor (35 MWth)	1963	1997	2010: New final shutdown and decommissioning decree	Decommissioning in progress
RAPSODIE CADARACHE	25	Reactor (40 MWth)	1967	1983		Preparation for final shutdown
EL 4D (EX-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* cancelling the decree of 2006	Partially decommissioned, changed into a BNI for storing waste left in place
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 FINALLY SHUTDOWN AS AT 31.12.2010 (continued)

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Latest 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 progress
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	2009: Final shutdown and decommissioning decree	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	2006: 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* PROCEDE	165	Grouping of former process installations	2006		2006: Final shutdown and decommissioning decree	Decommissioning in progress
FAR* SUPPORT	166	Waste packaging and processing	2006		2006: Final shutdown and decommissioning decree	Decommissioning in progress

(*) FAR: Fontenay-aux-Roses: creation of BNIs 165 and 166, substituting for BNIs 34, 57, 59, and 73, followed by the shutdown and decommissioning of BNIs 165 and 166 further to the grouping of buildings as part of the Fontenay aux Roses site denuclearisation project.

RADIOACTIVE WASTE AND POLLUTED SITES

CHAPTER 16

This chapter covers the way in which radioactive waste and sites that are contaminated by radioactive materials are managed in order to guarantee protection of the environment and of the public.

Radioactive waste means radioactive materials for which no subsequent use is planned or envisaged. The waste may arise from nuclear activities or non-nuclear activities in which the radioactivity naturally contained in the materials, not used for their radioactive or fissile properties, may have become concentrated by the processes employed.

The management of radioactive waste is governed by the 28 June 2006 Act on the sustainable management of radioactive materials and waste. This act defines a roadmap for management of all radioactive waste, in particular by requiring the updating every 3 years of a French National Radioactive Material and Waste Management Plan (PNGMDR). The purpose of the PNGMDR, developed jointly by ASN and the ministry for energy, is to ensure the existence of safe disposal routes for each category of radioactive waste, to identify foreseeable needs for storage or disposal facilities and to establish the actions needed to bring about coherent and structured progress in the management of radioactive waste. The second edition of the PNGMDR was sent to Parliament at the start of 2010. The decree for its application, to be published in 2011, will stipulate the actions to be performed in compliance with the orientations indicated by the plan.

ASN dedicated issue 190 of its "*Contrôle*" magazine to the subject of radioactive waste management, in order to present the issues and points of view of the different stakeholders regarding management of radioactive waste in France.

Management of sites contaminated by radioactive substances consists in establishing and implementing rehabilitation of sites on which an activity has led to contamination of the environment or to radiological pollution (sometimes a legacy) after handling of radioactive materials or use, without the intention to make use of their radioactive properties, of naturally radioactive materials.

1 RADIOACTIVE WASTE MANAGEMENT PRINCIPLES

Like any human activity, nuclear activities generate waste. This waste is of two types, depending on whether or not it can be considered liable to have been contaminated by radionuclides.

Certain industrial waste, considered to be hazardous, must be managed in specific routes.

The basic principle enacted by current regulations is to optimise the quantity and nature of the waste produced by installations. Radioactive waste management begins with the design of installations using radioactive materials, and proceeds during the operating life of these installations through concern for limitation of the volume of waste produced, of its harmfulness and of the quantity of residual radioactive materials contained. It further continues through identification, sorting, processing, packaging, transport, interim storage and final disposal. All of the operations associated with the management of a given category of waste, from its production through to final disposal, form a "route" Each route must be appropriate to the nature of the waste handled.

The operations within each route are interlinked and all the routes are interdependent. These operations and routes form a system which has to be optimised in the context of an overall approach to radioactive waste management addressing safety, radiation protection, traceability and volume reduction issues. This management must also be completely transparent to the public.

Within the framework of the PNGMDR, the following are considered to be radioactive waste:
– waste from nuclear activities (activities regulated owing to the radioactivity they involve), which have been or are liable to have been contaminated by radioactivity or activated by a nuclear activity;
– waste from activities employing radioactivity, but formerly exempted from regulations, comprising sufficiently significant concentrations of radioactivity, or from items that exist in very large quantities and require specific measures (the case of smoke detectors, for example);
– waste containing NORM, possibly enhanced by a human activity (TENORM) although not necessarily using the radioactive properties of the materials, and in which the radioactivity concentration is such that it cannot be ignored as regard to radiation protection;
– uranium ore processing residues disposed of in classified installations.

The PNGMDR also defines the status of recoverable materials (uranium, thorium, plutonium) and requires that this status be periodically reviewed.

1|1 Radioactive waste management channels

Radioactive waste varies considerably by activity level, half-life, volume or even nature (scrap metal, rubble, oils, etc.) depending on the type. Each type of waste requires treatment and a long-term management solution that is appropriate, in order to overcome the risk involved, notably radiological risks.

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. A distinction is

Table 1: Existing or future disposal routes for the main radioactive solid wastes

Activity \ Half-life	Very short-lived	Short-lived	Long-lived
Very low level	Management by radioactive decay	Dedicated surface disposal Recycling routes	
Low level		Surface disposal (Aube repository)	Dedicated subsurface disposal under study
Intermediate level		except tritiated waste and certain sealed sources Article 3 of the act of 28 June 2006	Routes being examined under
High level		Routes being examined under article 3 of the act of 28 June 2006	

therefore made between very low, low, intermediate and high level wastes on the one hand, and between waste known as very short-lived, resulting mainly from medical activities (activity level halved in less than 100 days), short-lived (activity level halved in less than 30 years) and long-lived, containing a large quantity of long-lived radionuclides (activity level halved in more than 30 years).

Table 1 shows the stage reached in implementation of the different waste management routes: it shows that for certain wastes there is, at present, no final disposal solution.

Very short-lived waste

Medical uses of radioactivity, generally, involve very short-lived radioelements. The waste resulting from these diagnostic or care activities is collected and stored for a time, allowing the radioactivity to decay sufficiently (generally by about ten half-lives) before it is disposed of via the conventional hospital waste disposal systems.

Very low level waste

Apart from the waste originating from former operation of uranium mines in France, most very low level waste today comes from nuclear installation decommissioning, from conventional industrial or research sites which use low level radioactive materials, or from clean-out of sites polluted by radioactive materials. The quantity produced will grow considerably when the time comes for the large-scale complete decommissioning of the power reactors and plants currently in operation. The radioactivity level of this waste is about a few Becquerels (Bq) per gram. The management solution adopted for it is disposal in a very low level radioactive waste disposal facility (repository). This disposal route was created to apply the management strategy adopted for this very low level waste and which is specific to France. This represents a rejection of the concept of unconditional clearance of wastes, even the least radioactive.

Short-lived intermediate and low level waste

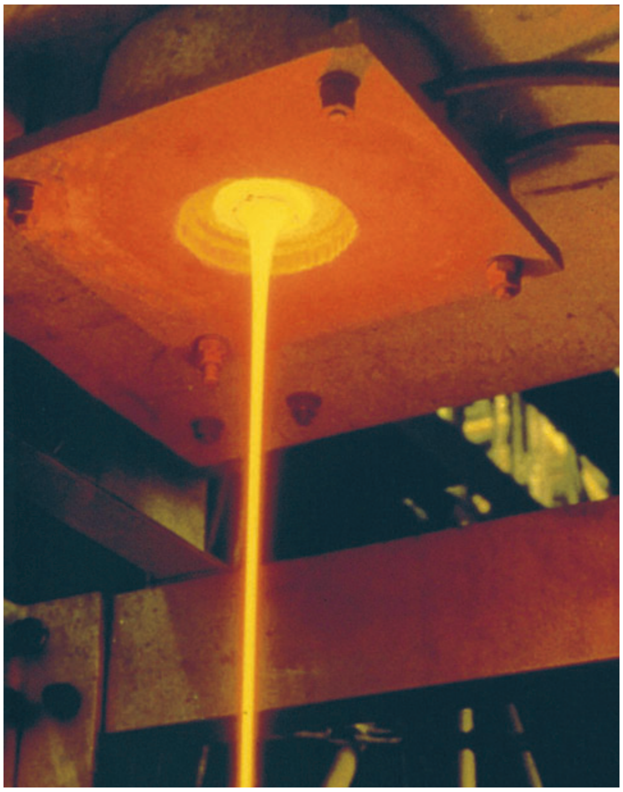
The activity of short-lived intermediate and low level waste is mainly due to radionuclides emitting beta or gamma radiation, with a half-life of less than 30 years. The activity of this waste is between a few hundred Bq per gram to 1 million Bq per gram. In this waste, long-lived radionuclides are strictly limited. This type of waste comes from nuclear reactors, fuel cycle facilities, research centres and university laboratories and hospitals. The technical solution generally adopted for this type of waste is its removal, either directly or after incineration or fusion, to a surface repository, where the waste packages are stored in concreted structures. This provides for containment of the radionuclides for a sufficient length of time to take full advantage of the radioactive decay phenomenon. This disposal route has been operational since 1969, when France was the first country to decide to cease its participation in the VLL waste immersion operations organised by the OECD. At that time, 14,300 m^3 of radioactive waste of French origin had already been immersed in the Atlantic Ocean.

Special case of short-lived intermediate and low level waste for which no disposal route is currently available

Short-lived intermediate and low level waste includes certain categories which have characteristics making them currently unsuitable for acceptance at the Aube repository in Soulaines without additional authorisation from ASN.

Most sealed sources fall into this category because the radioactivity they contain is often highly concentrated and in spite of the relatively short lives of the radioactive elements they contain, they cannot always be accepted in surface storage facilities. This is because, given their initial levels of activity, they may retain a significant level of radioactivity which must be taken into account in a scenario for the potential recovery of such objects from a repository after 300 years. Furthermore, their cladding is often made from inoxidisable metals that could be attractive to people digging in the repository.

However, since 2007, it has been possible to dispose of certain sources in low and intermediate level waste disposal facilities (CSFMA). These are short-lived sources with a half-life of 30 years or less, with activity levels below certain thresholds determined on the basis of the radionuclides concerned. For other sources, the French National Agency for Radioactive Waste Management (ANDRA) released a study on the sustainable management of used sealed sources establishing the different disposal solutions that could be envisaged and the associated criteria (notably activity and nature of radionuclides) for acceptance of the different categories of sources. In 2009, ASN



Vitrification of a solution of fission and activation products in the La Hague plant

approved the broad outlines of this strategy but issued a number of additional requests. In compliance with the recommendations issued by ASN, the 2010–2012 PNGMDR requires studies to be conducted to establish the processes that will allow appropriate packing of sources before their storage (with prior treatment if necessary).

In addition, some wastes contain significant quantities of tritium, a short-lived radioelement, that is difficult to contain owing to its mobility. In the light of the acceptance criteria for ANDRA's repositories, this waste cannot be accepted owing to its tritium content. The management routes chosen consist in storing it for a long enough period to allow radioactive decay (the half-life of tritium being nearly 12 years) before disposal. As required by decree 2008-357 of 16 April 2008 applying article L. 542-1-2 of the Environment Code and setting requirements relative to the PNGMDR, the French Alternative Energies and Atomic Energy Commission (CEA) produced a study inventorying the tritiated waste produced in France and proposing options for the design and sizing of future installations per family of waste (six in all) to allow storage for several decades. In particular, the PNGMDR incorporates the recommendations made by ASN in its report on these studies and its decree of application will stipulate both the need for creation of such storage facilities and the conducting by ANDRA of a study to specify the procedures for management of solid tritiated wastes from activities other than the nuclear industry.

Long-lived low level waste

This waste usually comes from industrial activities leading to concentration of naturally occurring radioactive materials (the former radium industry for example), or from the nuclear industry (such as the irradiated graphite contained in the structures of the former gas-cooled reactors (GCRs). The activity level of graphite waste is between ten thousand and one hundred thousand Bq per gram, primarily long-lived beta-emitter radionuclides. Radium-containing waste mainly consists of long-lived alpha-emitter radionuclides with an activity level of from a few tens of Bq per gram to several thousand Bq per gram.

Owing to its long life, this waste cannot be disposed of in a surface repository as it is impossible to take advantage of its radioactive decay within a time-frame compatible with permanent institutional monitoring. However, its low level of intrinsic hazardousness could lead to subsurface disposal being envisaged at a depth of at least fifteen metres. ANDRA is studying the disposal concepts for these wastes and is pursuing the search for a repository site on the basis of the safety orientations defined by ASN for search for a disposal site for waste with low specific activity and long life.

Intermediate level long-lived waste and high level waste

This waste contains long half-life radionuclides, notably alpha emitters. The vast bulk of it comes from the nuclear industry. It comprises both intermediate level and high level waste. The intermediate level waste is mainly process waste (spent fuel hulls and end-pieces, effluent treatment sludge) and in-service maintenance waste from spent fuel reprocessing facilities and research centres, or certain activated waste from the decommissioning of nuclear installations. The activity of this waste is about one million to one billion Bq per gram.

The high level waste generally originates from fission and activation products deriving from spent fuel processing. These wastes, which are vitrified, are characterised by the high levels of residual heat (as much as 4 kW per 150-litre container). This high level waste also includes fuel irradiated in CEA research reactors, together with EDF spent fuel which is not to be reprocessed. The activity level of this waste is of several billion Bq per gram.

For the time being, this waste is being stored in the nuclear installations. Research is being carried out into disposal in accordance with article 3 of the act of 28 June 2006 (see point 3.4).

1 | 2 The legal and regulatory requirements for radioactive waste management

Radioactive waste management falls within the general framework defined in chapter I of part IV of the Environment Code and its implementation decrees, concerning waste disposal and recovery of materials. The basic principles enacted by the Code are the prevention of waste production, the responsibility of the waste producers up until disposal, the traceability of this waste and the need to inform the general public. The Code was supplemented by act 91-1381 of 30 December 1991 on research into radioactive waste management, known as the “Bataille” Act, which established a framework for research into long-lived high level waste and by the act of 28 June 2006. It provides for the drafting of a National Plan for management of radioactive materials and waste, to be updated every 3 years. The act also sets the new schedule for

UNDERSTAND

Definitions

Among radioactive substances, some are considered to be recyclable while others are considered as waste. Thus, in the sense given in the Environment Code, "radioactive materials" are radioactive substances for which a subsequent use is planned or envisaged, after processing if applicable. In the nuclear electricity production process, for example, the spent fuel still contains materials that can be used. These materials are treated to extract uranium and plutonium in particular from them. "Radioactive wastes" are "radioactive substances for which no subsequent use is planned or envisaged".

research into long-lived high level and intermediate level waste. It reaffirms the ban on final disposal on French soil of foreign waste, by providing for the adoption of rules specifying the conditions for return of waste resulting from reprocessing in France of spent fuel or waste from abroad. The act of 28 June 2006 augments ANDRA's duties, in particular the public service requirement to rehabilitate sites contaminated by radioactive substances and to collect waste for which the responsible party has defaulted. Finally, the act of 28 June 2006 sets a clear legal framework for securing the funds necessary for decommissioning and for the management of radioactive waste (see chapter 15).

As part of the review of the regulatory regime applicable to BNIs, a number of technical measures concerning the production of waste in the installations, its packaging and the storage and disposal of radioactive waste will be clarified by ASN regulatory decisions.

Production of radioactive waste in basic nuclear installations

Management of radioactive waste from BNIs is established, notably by a ministerial order of 31 December 1999 establishing the general technical regulations intended to prevent and limit the detrimental effects and external hazards resulting from the operation of BNIs. This order reaffirms the need for the licensee to take all necessary steps in the design and operation of its installations to ensure optimum management of the waste produced, taking account of the subsequent management solutions. The order is currently under review. An ASN decision, placed on the ASN website for consultation in 2010, will complete the requirements relative to the modalities of management of wastes arising in BNIs.

Production of radioactive waste in other activities using radioactive materials

The provisions mentioned in decree 2002-460 of 4 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 materials 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. The ASN decision of 29 January 2008, approved by the ministers responsible for the Environment and Health, implementing the provisions of article R. 1333-12 of the Public Health Code, sets the technical rules applicable to the disposal of effluents and waste contaminated by radionuclides, or liable to have been contaminated owing to a nuclear activity.

Waste management route regulation

Regulation of the waste management routes requires on the one hand traceability of radioactive waste processing and disposal operations, and on the other detection of the presence of radioactive waste upstream from any processing in installations not authorised to receive them.

The systems for traceability of waste, whether or not radioactive (registers, periodic notification to the administration and waste monitoring statements) are defined by decree 2005-635 of 30 May 2005 concerning regulation of the waste processing circuits. The order of 30 October 2006 establishing the content of the registers mentioned in article 2 of decree 2005-635 of 30 May 2005 on monitoring of waste treatment circuits and radioactive waste monitoring statements mentioned in article 4 targets radioactive waste more specifically.

To avoid radioactive waste being introduced into waste treatment or disposal facilities that are not duly authorised, the steps taken by the authorities have led to the installation of radioactivity detection systems at site entrances (landfills, foundries, incinerators, etc.). These systems constitute an extra line of defence in the regulation of radioactive waste management routes.

1|3 Very low level radioactive waste management principles

Some European countries have implemented a policy establishing clearance thresholds for VLL waste on the basis of upper activity thresholds, an option that is allowed by Council Directive 96/29/Euratom of 13 May 1996 on radiation protection. French doctrine does not provide for unconditional clearance of VLL waste on the basis of universal threshold values, to avoid dissemination of radioactivity in manufactured products. This leads to specific management of this waste and disposal of it in a dedicated repository.

Waste management in the BNIs is, primarily, regulated by the order of 31 December 1999, amended. The order requires each BNI licensee to submit a study (known as the "waste study") to ASN stipulating the procedures for management of wastes produced in the BNIs and which addresses the risk of production of contaminated waste, activated or likely to become so. "Zoning" of the installation is therefore established, subject to approval by ASN. Two types of zone can be distinguished. The zones likely to lead to the production of radioactive waste are referred to as "nuclear waste zones". The waste originating from nuclear waste zones has to be managed via routes specific to radioactive waste. The waste from the other zones is, after checking that there is no radioactivity, sent to conventional waste routes (non-specific or special industrial waste). A guide for drafting of the BNI waste studies is available on the ASN website. Reuse of wastes from the nuclear waste zones is only possible in nuclear installations: for example, in the form of shielding inside waste packages.

1|4 European regulations harmonisation work within WENRA

The Western European Nuclear Regulators' Association (WENRA) was created in 1999.

One of the key WENRA missions is to develop a joint approach to nuclear safety and regulation. WENRA therefore implemented a procedure designed to draft reference safety levels for harmonising nuclear safety practices (see chapter 7).

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) is more specifically tasked with defining reference levels concerning the safe interim storage of radioactive waste and spent fuel and nuclear installation decommissioning operations. In 2010, it extended its work to include definition of the reference levels applicable to the disposal of radioactive waste in repositories.

Draft versions of the reference levels for the interim storage of radioactive waste and spent fuel and for the decommissioning of nuclear installations were published on the websites of the WENRA members at the beginning of 2006, in order to collect the opinions of the stakeholders before they were enshrined in national regulations. The comments received led the WGWD to revise these reference safety levels. A new version of the reference levels for storage of radioactive waste and spent fuels was thus made available for consultation in 2010. The main requirements concern the necessity of stipulating the responsibilities of owners of wastes or fuels and of storage facility licensees, ensuring that storage is reversible, and monitoring of the wastes and fuels to detect any degradation and take appropriate action.

The reference levels concerning the safety of decommissioning operations require that the nuclear licensees produce decommissioning strategies for their sites, draft decommissioning plans, that the more important decommissioning phases be submitted to the nuclear regulator and that decommissioning be designed into the nuclear installation in order to facilitate all the operations as and when the time comes. In 2010, the WGWD's efforts concentrated on updating of the reference level for decommissioning.

The new regulatory texts currently being prepared (order and ASN decisions) already include the WENRA reference levels whenever possible.

1|5 Stakeholders and responsibilities

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. Each producer is responsible for the waste until disposal in a duly authorised installation. However, other stakeholders are also involved in the waste processing, transport, storage or disposal process. Each party along the waste management chain is responsible for the safety of its installations and activities. This concerns:

– companies responsible for transporting waste between production and processing or storage sites (AREVA NC Logistics, BNFL SA, etc.);
– waste processing contractors (SOCODEI, AREVA NC) who sort and package the waste (for example by compacting and then vitrification) in order to make disposal or storage conditions safer. They can also use a variety of methods for recycling certain radioactive materials or eliminating certain waste (in particular by incineration);
– licensees of storage or disposal centres (CEA, EDF, AREVA NC, ANDRA). The act of 28 June 2006 tasked ANDRA with the long-term management of the repositories. ANDRA also has a public service obligation to store waste for which no disposal route is available and whose owners cannot safely store it, or for which the owner cannot be identified (see point 4);
– research and development organisations such as CEA or ANDRA, which also take part in technical optimisation of radioactive waste management, notably with regard to processes of characterisation, treatment and packaging of waste.

In this context, ASN drafts regulations governing radioactive waste management, regulates the safety of the BNIs which give rise to this waste or play a part in its disposal and conducts inspections in the facilities of the various waste producers (EDF, AREVA NC, CEA, hospitals, research centres, etc.) and of ANDRA. It regulates ANDRA's overall organisational provisions for acceptance of waste from the producers. It issues opinions on the waste policy and management practices of the radioactive waste producers.

ASN has three main concerns:

– safety at each stage in radioactive waste management (production, processing, packaging, interim storage, transport and disposal);
– safety of the overall radioactive waste management strategy, ensuring overall consistency;
– the setting up of routes adapted to each category of waste. Any delay in identifying waste disposal solutions increases the volume and size of the on-site interim storage facilities, and the inherent risks.

In the performance of its duties, ASN calls, in particular, on the services of IRSN.

Other parties are involved in evaluating the implementation of radioactive waste management policy, particularly the National Review Board (CNE), created by the act of 30 December 1991. This group of scientific personalities was initially tasked with reviewing the findings of research into the management of high level, long-lived radioactive waste. The act of 28 June 2006 confirmed that the second National Review Board (CNE2) had all of the duties of the first Board. The act also extended its duties by including in its evaluations the sustainable management of radioactive materials and wastes, in line with the orientations established by the PNGMDR. In addition, the COSRAC (Committee for the Monitoring of Research on the Cycle Back-End) comprising the various research and industrial parties involved (CEA, ANDRA, CNRS, AREVA, EDF) and the ministries concerned, is coordinating the research being done on radioactive waste.

1|6 ANDRA national inventory of radioactive waste and reusable materials

Article L.542-12 of the Environment Code, as amended by the act of 28 June 2006, 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 2009 national inventory, published in June 2009, presents the stocks of waste and materials as at the end of 2007, plus the forecasts for the end of 2020, the end of 2030 and at the end of the lifetime of the existing facilities. The inventory also lists the storage capacity for HLW, ILW-LL, LLW-LL, radium and tritiated waste, as well as the storage capacity needs for disposal of HLW and ILW-LL waste in deep underground repositories. Finally, the inventory presents the stocks of radioactive materials, information about sites polluted by radioactivity and mining residue disposal sites. ASN takes part in the steering committee of the national inventory of radioactive waste and recoverable materials. The national inventory is a source of information for drafting the PNGMDR.

1|7 The national plan for the management of radioactive materials and waste (PNGMDR)

The act of 28 June 2006 requires that the Government draw up a National Plan for the Management of Radioactive Materials and Waste every 3 years, the requirements concerning wich are established by decree.

In 2009, ASN, working with the General Directorate for Energy and Climate (DGEC), co-directed the drafting of a second PNGMDR for the 2010–2012 period; a summary was disseminated and published on the ASN's website, as recommended by the French Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPESCT). The new edition of the PNGMDR has been updated on the question of recoverable materials (see box in point 1.2) and regarding the overall coherence of the nuclear fuel cycle. A decree and application order will stipulate the actions to be taken in line with the orientations established in the 2010-2012 PNGMDR. Orientations are based mainly on the opinion communicated by ASN to the minister in charge of ecology on 25 August 2009 concerning the studies undertaken to respond to the recommendations of the first plan. In this context, ASN, in July 2009, sent the ministers in charge of health and ecology a round-up of the management solutions put in place for wastes containing enhanced naturally radioactive substances as well as proposals to improve waste management from the radiation protection point of view.

TO BE NOTED IN 2010

The European Commission adopts a draft directive on management of radioactive waste and spent fuel

On 3 November 2010, the European Commission officially adopted a draft directive on the management of radioactive waste and spent fuel. The document will now be submitted to the European Council and to the European Parliament which will study the terms of the proposal.

In line with the Commission, ASN is of the opinion that there is a need to establish a European regulatory framework devoted specifically to management of radioactive waste and spent fuel. It therefore supports the steps undertaken at the European Community level aimed at the adoption of a directive in this area.

The Authority considers that the directive proposed to the Commission constitutes real progress by defining a binding legal framework within the EU that is based on internationally recognised safety standards. In this regard, ASN has been closely involved in the preparatory work carried out within the European Nuclear Safety Regulators' Group (ENSREG) and which led to the proposal to the Commission of a draft directive on management of radioactive waste and spent fuel.

ASN feels particularly that the setting up in each Member State of a competent regulatory authority in the field of safe management of waste and spent fuel with sufficient financial and human resources to achieve its ends, would be an important step forward. Similarly, the conditions relating to transparency and peer review, and to the establishing of a national radioactive waste management plan would represent progress for the EU. On this latter point, ASN, which participates in the drafting of the national plan for radioactive waste and spent fuel management (PNGMDR), is of the opinion that the introduction of such a plan in each Member State would be a major development.

The 27 Member States and European Parliament are now beginning negotiations on the text in Brussels. ASN, whose competence in the area of safety of management of waste and spent fuels is recognised by the act of 28 June 2006 (known as the "Wastes" Act) will follow developments closely.

ASN views the PNGMDR as a veritable control tool and a roadmap for management of all radioactive wastes, regardless of their level of activity or their type. The PNGMDR also allows meaningful dialogue on these issues and contributes to transparency and availability of information. ASN thus notes with satisfaction that the draft European directive on radioactive waste management requires each Member State to develop such a plan.

Table 2: volumes of radioactive waste stored or disposed of as at end of 2007, in equivalent packaged m³

Waste categories	Volumes (m³)
Very low level	231,688 (including 89,331 disposed of)
Low and intermediate level - short-lived	792,695 (including 735,278 disposed of)
Low level – long-lived (LLW-LL)	82,536
Intermediate level– long-lived (ILW-VL)	41,757
High level waste (HLW)	2,293 (including 74 of spent fuel)
Management route to be defined	1,564
Total	1,152,533 (including 824,609 m³ disposed of)

Table 3: anticipated quantities of radioactive waste stocks as at end of 2020 and 2030, all sectors

(in equivalent packaged m³)	Existing volumes as at end of 2007	Existing volumes as at end of 2020	Existing volumes as at end of 2030	"Committed waste"[1]
HLW	2,293	3,679	5,060	7,910
ILW-LL	41,757	46,979	51,009	65,300
LLW-LL	82,536	114,592	151,876	164,700
LILW-SL	792,695	1,009,675	1,174,193	1,530,200
VLLW	231,688	629,217	869,311	1,560,200
TOTAL	**1,150,969**	**1,804,142**	**2,251,449**	**3,328,310**

Tables 2 and 3 are taken from the National Inventory of radioactive materials and waste published by ANDRA, 2009 edition.

1."Committed waste" is the waste that will be produced by all the current installations up to the end of their lives, assuming the continued production of nuclear generated electricity.

2 MANAGEMENT OF RADIOACTIVE WASTE BY THE PRODUCERS

2|1 Waste management in basic nuclear installations

Once produced and before final disposal, certain categories of radioactive waste undergo treatments to reduce the volume or harmfulness of the waste and, whenever possible, to recover exploitable materials. These treatments 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 waste repository.

ASN asks that in the design of new installations, the licensees meet a reduction target for the quantity of waste produced.

The following sections examine the situation of BNIs.

2|1|1 CEA waste management

CEA's waste management strategy

CEA has treatment, packaging and interim storage facilities for most of the waste its activities produce. In general, each CEA site has treatment and packaging installations for the waste and radioactive effluents it produces (see chapter 14). 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, repository, etc.). Long-lived intermediate and high level waste is generally stored by CEA in installations 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 and then taken away to the Morvilliers VLL waste repository. Liquid waste is treated, solidified and packaged in drums. 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 also possesses legacy solid and liquid waste for which there can be certain difficulties as regard to their treatment, or for which there is no operational disposal route. Nuclear fuel without further use from the civil sectors of CEA is placed in interim storage, either in dry storage or in a pool, pending definition of a management route (reprocessing or storage).

The two main issues for CEA with regard to radioactive waste management are:
– bringing new processing installations on-line 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.

As in previous years, ASN observes that CEA is experiencing persistent difficulties with managing these two issues.

For 2010, 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 (see chapter 14). ASN observed, for example, that action had been taken to recover waste from the BNI 56 at Cadarache but also noted that delays with these operations have nonetheless accumulated for technical reasons.

ASN also underscored the difficulties experienced by CEA in implementation of new installation projects or projects for upgrading of existing installations dedicated to radioactive waste management. For instance, commissioning of the Stella installation, is already delayed, will only be accomplished in stages owing to difficulties relating to production of waste packages; the request for authorisation to create the Diadem installation, dedicated to handling of irradiating or alpha-emitting waste and waste from decommissioning, was postponed by CEA. Commissioning of the installation will now take place by mid-2016 at the earliest. ASN has also noted delays in commissioning of the Agate installation at the Cadarache centre.

ASN is also concerned by the future of the Cadarache effluent and waste treatment plant (BIN 37 STED). CEA is considering extending operation of the BIN 37 STED by implementing a safety improvement programme (work to bring the facility into compliance, especially with regard to seismic risk, clean-out and decommissioning of parts not used for production). A part of the STED and STEL installations will be decommissioned. Given the central role of BIN 37 in CEA's radioactive waste management strategy, the proposed improvements to the installation's safety will be the object of particular attention on the part of ASN, as well as of examination by the Advisory Committee of Experts (GPE) in 2012.

CEA also informed ASN that there would probably be a delay in removal from storage of the drums containing plutonium in the PEGASE facility, owing to problems with manufacturing of the repackaging containers for this waste.

Interim storage hall of BNI 72 (Saclay)

Given the developments in CEA's waste management strategy, both in terms of organisation and projects for new or upgraded installations, ASN expressed the wish to re-examine all of CEA's activities relating to management of wastes from its BNIs and SBNIs, of spent fuels and used sealed sources. Accordingly, in March 2010, CEA forwarded its strategy for management of solid wastes, liquid effluents and spent fuel from civil CEA. ASN, jointly with the authority for defence-related nuclear safety (ASND), will decide, by the first quarter of 2012, on its position on management of CEA wastes and spent fuel, after examination of the file by the relevant Advisory Committees, paying particular attention to the orientations adopted for key waste management installations.

Storage of CEA waste

The waste treatment stations on the CEA sites at Saclay (BNI 72), Fontenay-aux-Roses (BNI 73) and Grenoble (BNI 79) (see chapters 14 and 15) also provide interim storage capacity for fuel elements or high level waste in pits and/or fuel blocks. The waste is packaged in containers and stored in radioactive decay pits. For BNIs 73 and 79, CEA has initiated a waste recovery program as part of the delicensing of the Grenoble and Fontenay-aux-Roses sites. In BNI 72, fuel is stored in concreted fuel blocks. Recovery of this fuel is currently being reviewed, for subsequent reconditioning in the STAR installation in Cadarache and then interim storage in the Cascad installation, also in Cadarache.

The main role of the radioactive waste storage yard (BNI 56) in Cadarache is to provide interim storage of radioactive solid waste (IL-LL waste) from the operation or decommissioning of CEA installations and which cannot be stored in the Aube waste repository. The waste is stored there in pits, in warehouses and, for the VLL waste, in a dedicated area. Operation of the CEDRA installation (radioactive waste packaging and interim storage unit), for which creation on the Cadarache site was authorised by decree[2] in 2004, will make it possible to empty the recent pits in BNI 56 and the warehouses, and to retrieve waste stored in older pits.

On 20 April 2006, the Ministers for Industry and the Environment authorised start-up of Cedra unit 1.

At Cadarache, CEA also operates the Pegase and Cascad installations, making up BNI 22.

Pegase is an installation mainly storing irradiated fuel elements and radioactive materials under water or dry. Drums of plutonium-containing by-products are stored in the PEGASE premises pending recovery for treatment.

Given the scale of the work needed to ensure compliance to allow continued operation of this installation, CEA, in December 2004, proposed final shutdown of the installation; this should take place in 2010.

Removal from storage began in January 2006 with Osiris type fuel being sent to the Cares store (INBS). Removal of the OSIRIS silicide elements from storage for transfer to La Hague then began. All the OSIRIS fuels have now been evacuated. The remaining fuels are currently the subject of requests to ASN for repackaging and then evacuation, particularly to Cascad.

2006 also saw the creation of a project for recovery of the drums of plutonium-bearing materials for storage in Cedra. On 28 January 2008, CEA notified ASN of installation of the recovery equipment. This project, which began in 2009, should allow CEA to finalise removal of the plutonium containing drums from the Pegase installation.

The Cascad installation is dedicated to dry storage of spent fuel. The fuel is placed in containers before being stored in sealed pits located in a concrete structure and cooled by natural air convection. In 2008, CEA launched a periodic safety review of the Cascad installation. This file was reviewed by IRSN. Further to this technical review, ASN established its position at the end of 2009 on continued operation of the installation, on condition of compliance with requirements, notably concerning acceptance in the installation of certain type of fuels.

In November 2007, CEA sent a safety option report to ASN concerning a new irradiating waste storage project for Marcoule, called DIADEM (a French acronym for decommissioning irradiating or alpha waste). ASN issued its position on this report on 1 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.

CEA informed ASN of a delay in submission of the request for authorisation file for DIADEM, which should take place at the end of 2011.

Recovery of CEA legacy waste

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.

CEA will resume the work to recover the waste from Trench T2 at the start of 2011, after interruption due to doubts about the stability of the mound's foundations and walls. To protect operations in trenches, CEA is to install a geotextile to protect against rock falls or localised slips.

Finishing of extraction of the legacy waste from Trench 2 is postponed until the end of 2011.

For the other trenches, CEA's approach is to reduce human intervention in the trenches and to favour a single, fixed packaging unit for the other four trenches. However, ASN notes that CEA's initial aim of completion of work in 2013 will probably not be achieved, as recovery from trenches T1, T3, T4 and T5 is planned after the work on T2, in order to benefit from the operating feedback from T2.

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.

Recovery of waste from older pits, some of which contain alpha-emitting radionuclides, is technically fairly complex. ASN

2. Decree n° 2004-1043 of 4 October 2004 authorising CEA to create a BNI known as CEDRA in the municipality of Saint-Paul-lez-Durance, France.

Interim storage hall of the vitrification facility R7, on the La Hague spent fuel reprocessing site

will pay particular attention to the quality of the technical solutions used on the site to recover the waste from pits F1, F2 and F4, for which it already appears evident that major technical resources will have to be used.

2|1|2 AREVA NC waste management

Description of waste produced by AREVA

The spent fuel reprocessing plant at La Hague produces most of AREVA's radioactive waste.

The waste produced at La Hague comprises on the one hand the waste resulting from reprocessing of spent fuel from the nuclear power plant licensees and on the other, the waste linked to operation of the installations. 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. The issue of recovering the legacy waste stored at La Hague is dealt with in chapter 13.

The waste generated by the spent fuels includes:

– Fission products and minor actinides (high level)
  The solutions of fission products and minor actinides resulting from spent fuel reprocessing are incinerated then vitrified in the R7 and T7 facilities. The vitrified waste is poured into stainless steel containers. After the glass has solidified, the containers are transferred to an interim storage installation pending availability of a long-term management solution or until they are shipped to AREVA's foreign customers.

– Long-lived intermediate level structural waste
  This chiefly consists of fuel metal cladding (called "hulls") and metal structures such as fuel assembly end-pieces. The packaging process consists in compacting the waste and placing it in a stainless steel container in the ACC facility. The final package can also contain metal technological waste. The packages are stored on the site or shipped to AREVA's foreign customers.

Waste linked to operation of the installations comprising:

– Waste from radioactive effluent treatment
  The La Hague site has two radioactive effluent treatment stations (an older one, STE2, and the more recent one, STE3). The effluents are treated there by chemical co-precipitation. The sludges produced in STE3 are evaporated and encapsulated in bitumen, with the final encapsulated product then being poured into stainless steel drums in this facility. The drums are then stored on the site. 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 to bituminising for sludge recovery. These sludges, representing 3,400 tons of salts, were produced between 1966 and the late 1990s in the UP2 400 plant and the CEA research centres. After technical studies, AREVA selected the C5 standard package as an alternative to the bituminisation process. This package should be able to meet the requirements of the act of 28 June 2006 requiring recovery of the IL-LL legacy waste by 2030. It should also enable the final volume of the waste to be reduced by comparison with the bituminisation protection. The package consists of compressed pellets placed in a container in which the remaining void is filled with an inert material (sand). Manufacture of this package will require ASN approval. ASN will first of all rule on whether or not any aspects disqualify the C5 package in terms of safe storage and disposal. This opinion will be required before detailed design studies can start on preparation of the facilities for the alternative process to bituminisation.

– Waste from organic effluents
  The La Hague plant has an installation for interim storage of organic effluents (MDSA). The effluents stored there are subsequently treated using a mineralisation process involving pyrolysis in the MDSB facility. This installation produces cemented packages that meet the criteria for the Aube repository. Production of the packages was suspended in 2007, after ANDRA found a fault in their quality. The appraisal carried out by AREVA showed a modification to the process was the reason for the anomalies detected. Changes were made, enabling production to resume. During suspension of production, effluents were stored in tanks provided for the purpose, their capacity and safety conditions having been judged satisfactory by ASN. 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.

– Ion exchanger resins
  The water in the fuel unloading and interim storage pools is continually purified by means of ion exchanger resins. Once used, these resins constitute waste that is treated using a cementation process.

– Technological waste in the ACC (hulls and end-pieces)
  On 27 November 2001, ASN authorised the production of CSD-C packages. This authorisation carried a restriction banning the introduction of organic technological waste and dissolver bottom debris into the primary drum. At the end of 2007, AREVA forwarded a safety analysis file to obtain lifting of the restriction on the introduction of organic technological waste. Analysis of the data transmitted did not permit this

restriction to be lifted. AREVA sent ASN a further authorisation application for introduction of dissolver bottom debris into CSD-C packages, together with the justification file. ASN should establish its position on this file in the first half of 2011.

– Other technological waste
The technological waste is sorted, compacted and encapsulated or immobilised in cement in the AD2 facility. The packages complying with ANDRA technical specifications for surface disposal are sent to the Aube repository. Those that do not are temporarily stored on the site. With regard to the waste stored in Building 119, and the waste from the Mélox plant, AREVA NC proposes introduction of a compacting process and creation of an installation in addition to the existing one. This strategy also includes the use of STE3 disposal cells for this type of drum, pending the availability of the new installation. In early 2009, AREVA sent a draft specification for the S5 package for packaging in compressed form of technological wastes coming mainly from the La Hague and Mélox plants. In its decision 2010-DC-0176 of 23 February 2010, ASN considered that the S5 package did not offer a sufficient guarantee for long-term storage and for deep geological formation disposal. ASN has asked AREVA to carry out studies that should lead to a physical-chemical form and resistance to leaching that comply with repositories' safety requirements.

ASN also noted recurring delays in recovery of older wastes from La Hague and the lack of an integrated view for the ranking of projects for recovery of these wastes in light of the safety issues surrounding storage. At the end of 2010, the Authority therefore asked AREVA to draw up and present to ASN a consolidated and binding schedule for recovery of these wastes that encompasses both compliance with storage safety requirements and the necessity for recovery of ILW-LL by the end of 2030 at the latest.

Cold crucible technology

In partnership with CEA, AREVA has completed the development of cold crucible direct induction furnace technology. This technique offers advantages over the existing hot crucible method for producing glass. First of all, the cooling of the melting furnace allows the formation of a fine layer of solid glass, which protects the crucible and prevents it from being corroded by the molten glass. Then, direct induction heating allows far higher production temperatures and therefore the design of new matrices.

AREVA therefore sent new specifications to ASN for the production launch authorisation.

AREVA sent ASN Specification 300 AQ 59 Rev. 0A, applying to the vitrified packages referred to as CSD-U. This is a package used to contain fission product solutions from processing on the La Hague site between 1966 and 1985 of GCR fuels of the UMo (molybdenum alloy) and MoSnAl (molybdenum, tin and aluminium alloy) types. In order to minimise the number of packages that need to be produced, the composition of the CSD-U must maximise the level of incorporation of molybdenum (Mo) and phosphorus, which are two limiting factors for the glass formulation. The cold crucible technology enables this optimisation process to take place. Given that the radiological activity levels of these solutions are low when compared to the fission product solutions packaged in glasses produced in accordance with specifications 300 AQ 16 or 300 AQ 60, they should not constitute a limiting design factor for the CSD-U. The constraints linked to the packages are more chemical in nature. ASN's decision on the CSDU waste package should be given in the first half of 2011.

Specification 300 AQ 60 Rev. 00 applies to CSD-V packages with high actinide content produced using "hot crucible" technology. AREVA has obtained ASN's agreement on production of this package, pending the results of studies to characterise the behaviour of the glass. In July 2008, AREVA sent ASN additional information in order to obtain authorisation to continue production beyond 31 December 2008. ASN issued the authorisation in a decision of 16 December 2008. Production of the CSD-V using the cold crucible process will be the subject of a new authorisation request that will be forwarded to ASN in 2011.

Specification 300 AQ 061 Rev. 0A applies to the CSD-B package resulting from packaging using vitrification of intermediate level effluents, resulting primarily from rinsing operations carried out for final shutdown of the UP2 400 plant. The solutions to be vitrified are characterised by their high sodium content. Therefore, in order to optimise the number of packages to be produced, the composition of the CSD-B must maximise the incorporation of sodium into the glass. For the same reason as for the CSD-U package, the main constraint is chemical in nature. AREVA sent ASN a production authorisation application for this package so that it could begin active production testing. ASN authorised production of this package at the end of 2009.

The COMURHEX waste installation in Malvési

The waste produced by the installation is stored on the Malvési site in former settling ponds named B1 and B2. This waste primarily contains natural radionuclides. Nonetheless, some traces of artificial radionuclides, resulting from the spent fuel reprocessing which took place in the installation until 1983, were detected in the ponds. The presence of artificial radionuclides in the waste implies that storage is covered by the BNI regime.

In compliance with the ASN Commission's decision of 22 December 2009, the COMURHEX company submitted license application for the creation of a BNI at the end of 2010. A safety options file was submitted by the licensee on 1 March 2010. The perimeter of this new BNI, proposed at this stage by the licensee, follows the foot of the bund wall around ponds B1 and B2. In the file, the licensee also presents the works that will be carried out beyond the BNI perimeter (of which the purpose is to limit releases of radioactivity into the environment) and the project for covering of ponds B1 and B2. In a letter of 13 September 2010, ASN indicated to the licensee that it saw no objection to continuation of the work, but that additional information and justification concerning the stability of the block, control of underground flows, covering of the ponds and monitoring of the BNI should be provided when submitting the file requesting authorisation for creation.

Ponds B1 and B2 are already subject to ASN regulation. Two inspections were carried out in 2010, of which one addressed environmental monitoring. The organisation put in place by the licensee was deemed globally efficient, with an approach to improvement regarding monitoring that is in line with the development of knowledge.

2|1|3 EDF waste management

Description of waste produced by EDF

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 the waste from dismantling of power plants being decommissioned.

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 currently stored in the plant pools pending interim storage in the future ICEDA centralised installation on the Bugey site. Decree 2010-402 of 23 April 2010 authorised EDF to create the ICEDA installation. The draft authorisation decree for ICEDA received a favourable opinion from the ASN Commission at the end of September 2009. 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 2010, ASN carried out inspections of the site to ensure satisfactory execution of some important operations relating to the civil engineering work.

Construction progress on the waste packaging and interim storage site (ICEDA) at Bugey – October 2010

Operating and maintenance waste

This consists of ion exchanger resins (water treatment), filters, concentrates, evaporators, sludges, cleaning and upkeep waste (rags, vinyl sheets and bags, gloves, etc.). Some waste comes from replacement and maintenance operations and can be of large size (vessel heads, steam generators, fuel storage racks, etc.).

Some of the waste produced is dealt with in the Centraco plant in Marcoule (metal melting or incineration of liquids, resins or other incinerable materials), in order to reduce the volume of ultimate waste.

For the other types of operating and maintenance waste, various packaging methods exist, in particular:
– solid waste compacting in the Aube waste repository, followed by packaging in metal drums filled with a cement-based material;
– resin encapsulation in a polymer, inside a concrete container;
– filter encapsulation in a cement-based material, inside a concrete container.

This waste is stored in the Aube waste repository; in particular, low level waste is stored in the Morvilliers VLL waste centre. It contains beta and gamma emitters but few or no alpha emitters.

Legacy waste

This is structural waste (graphite sleeves) from fuel used in the former gas-cooled reactors (GCRs). This is low level, long-lived waste 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.

Dismantling waste from plants being decommissioned

This is, essentially, very low level waste (metals or rubble) but also graphite waste (from stacks still present in GCRs).

EDF waste management strategy

EDF fuel use policy (see chapter 12) has consequences for the fuel cycle installations (see chapter 13) and for the quantity and quality 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. The file was examined on 30 June 2010 by the Advisory Committees for laboratories and plants and for waste, on the basis of a report presented by IRSN. Subsequent to this examination, ASN introduced two-yearly update notes to strengthen monitoring of the cycle and of developments in it, and required EDF to provide a “cycle” file updated to 2016.

The Saint-Laurent-les-Eaux silos

The Saint-Laurent-des-Eaux (BNI 74) silos consist of 2 semi-buried reinforced concrete bunkers. They are made tight by steel plating.

From 1971 to 1994, waste was stored in bulk in the silos. This waste was mainly graphite sleeves containing fuel elements from the nearby GCRs, as well as technological waste.

As this installation no longer complied with current safety criteria, ASN asked EDF to empty the silos before 2010. The solution proposed by EDF was based on the availability of a final disposal route for the graphite waste by 2010, however the delay in the search for a host site is likely to put this deadline back to at least 2019. In response to ASN's request for development of an alternative strategy pending the availability of a disposal facility for graphite waste, EDF proposed, in July 2009, the introduction of a containment barrier around the silos. In July 2008, ASN approved the principle of the geotechnical containment proposed by EDF, provided that EDF submitted additional data, which it did in 2009. The geotechnical containment installation work was carried out in 2010. On 4 January, EDF provided ASN with a safety review file for this modified installation; this will be examined in 2011. Examination will include, notably, verification of the performance of the geotechnical containment.

2|1|4 Management of waste from other licensees

Examination of the waste management strategy of other BNI licensees is carried out by ASN on the basis of their waste studies (see point 1.3).

2|2 Radioactive waste management in medical, industrial and research activities

2|2|1 Origin of waste and radioactive effluents

Many areas of human activity use radioactive sources, and notably diagnostic and therapeutic activities. This activity may lead to the production of radioactive waste and effluents.

Sealed sources are mainly used for radiotherapy (telegammatherapy and brachytherapy) and for measurement. Given their characteristics (usually radionuclides with half-lives of several years and high activity levels), these sources must be recovered by their supplier once they are no longer needed, or by their manufacturer in the event of defaulting by the supplier. These sealed sources are not likely to produce radioactive effluents in normal conditions of use and storage.

The use of unsealed sources in nuclear medicine, biomedical and industrial research gives rise to the production of solid waste: small items of laboratory equipment used to prepare sources (tubes, multiwell plates, gloves, etc.), medical equipment used to administer treatment (syringes, needles, cotton swabs, compresses which could be soiled with biological products, etc.), remains of meals consumed by patients having received diagnostic or therapeutic doses, etc. Liquid radioactive effluents also arise from source preparation (radioactive liquid residues, contaminated material rinsing water, scintillating products used to count certain radionuclides, etc.), as well as from the patients who excrete the radioactivity administered to them.

2|2|2 Management and disposal of radioactive waste and effluents

Faced with this problem of health care waste contaminated by radionuclides, which appeared with the growth of nuclear medicine, the public authorities have initiated a process of regulation of the activities and information of both patients and practitioners concerning good practices to be observed in managing this waste. A circular from the Minister for Health (DGS/DHOS 2001/323 of 9 July 2001) clarified the provisions of the 30 November 1981 order on the conditions for the use of artificial radionuclides used in unsealed sources for medical purposes.

The order of 23 July 2008 was published on 2 August 2008, concerning approval by the Ministers for Health and the Environment of ASN decision 2008-DC-0095 of 29 January 2008 setting out the technical rules to be followed for the management of effluents and waste contaminated or likely to have been contaminated by radionuclides as the result of a nuclear activity. This decision was taken pursuant to article R-1333-12 of the Public Health Code. It includes the broad outlines of the

Solid waste containers in the interim storage area of the nuclear medicine department – Nancy CHU – December 2010

Site of the former Bois Noirs treatment plant (Loire *département*)

circular of 9 July 2001 and contains measures with regard to:
– the development and approval of effluent and waste management plans;
– the creation of contaminated waste zones;
– waste storage conditions;
– the conditions for decay management of waste and effluents contaminated by radionuclides with a half-life of less than 100 days and their discharges;
– the conditions for management and disposal of waste and effluents contaminated by radionuclides with a half-life of more than 100 days;
– installation discharge outlet monitoring conditions;
– conditions requiring use of a radioactivity detection portal at site exits.

ASN has finalised the drafting of guidelines for application of this decision, which will specify good practices for the management of waste and effluents resulting from nuclear activities outside BNIs. The guidelines were published on the ASN website at the start of 2011, to allow consultation by stakeholders.

2|3 Management of waste containing natural radioactivity

There is measurable natural radioactivity in the environment due to the presence of radionuclides that have been or are still being produced by various physical processes. As a general rule, this radioactivity leads to no significant risk. In France, exposure to natural radioactivity varies from region to region but is about 2.5 mSv/year on average.

2|3|1 Uranium mining waste

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 only carried out in 8 plants. The management strategy currently being used is in-situ management given the very large quantities of waste produced; the current approach for improvement of this management consists in taking steps to reduce the long-term risk.

The uranium mine workings produced two categories of products:
– 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);
– mining waste rock, comprising the soil and rock excavated to access the minerals of interest. The waste rock with an average uranium content corresponding to the characteristic natural background level is differentiated from the barren rock consisting of the mineralised rock excavated when working a field, but which has insufficiently high content to allow processing at an economically acceptable cost.

From amongst the processing residues, two categories can be distinguished, in terms of their specific activity levels:
– low-content ore (about 300 to 600 ppm) with a total average specific activity of 44 Bq/g (including about 4 Bq/g of radium 226). These corresponding residues, produced by static leaching (about 20 Mt), are placed either in stockpiles, or in open-cast mines, or used as the first covering layer in dynamic processing residue disposal sites;
– ore with a high average content (about 1‰ to 1% in French mines) having a total average specific activity of 312 Bq/g (including about 29 Bq/g of radium 226). These residues, produced by dynamic leaching (about 30 Mt) are either placed in former open-cast mines, sometimes with an additional dyke, or in pools with a surrounding dyke, or behind a dyke damming a thalweg.

In France, the mining processing residues account for 50 million tons spread over 17 disposal sites, regulated as installations classified on environmental protection grounds.

The national inventory of uranium mine sites is part of the MIMAUSA programme (history and impact of uranium mines, summary and archives), overseen by the Ministry for Ecology. ASN is a member of the programme's steering committee.

The inventory is available from the following website: *www.irsn.fr.*

The inventory will be completed by an inventory of mining waste rock by 2014.

Article 4 of act 2006-739 of 28 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. ASN in 2008 validated the modelling methodology chosen by AREVA for assessing the long-term impact of the residue disposal facilities, with a normal evolution scenario and four altered evolution scenarios dealing with loss of the covering, construction of homes above the disposal site, construction of a road, presence of a child playing on the backfill. Nine mine sites were modelled in the study provided by AREVA at the start of 2009. ASN made known its opinion to the minister on 25 August 2009 (see ASN Opinion 2009-AV-0075). ASN considers that the study submitted by AREVA on the long-term impacts on health and on the environment of the disposal sites for mining residues resulting from former uranium ore extraction and processing installations constitutes a crucial milestone for verification of the safety of these disposal sites. However, ASN is also of the opinion that further analyses are needed to ensure a more robust long-term safety case for these sites. This work represents the first real application by a licensee of the approach officially set out in the circular from the Minister for the Environment on 7 May 1999 concerning the rehabilitation of uranium ore processing residue disposal sites. The study of the nine sites selected gives an initial quantified assessment of the long-term impact of mining residues on national territory and informs the public of these results. From the results of this study, the additional exposure of the population, assuming these disposal sites evolve normally, is less than 1 millisievert/year in the active surveillance phase. The conceivable exposure for scenarios with significant deterioration of the sites remains below a few tens of millisieverts/year.

The 2010–2012 PNGMDR specifies the additional analyses to be conducted by AREVA in the coming years, relative to:
– characterisation studies for mining residues from disposal sites other than those studied;
– the geomechanical assessment of the strength of the embankments surrounding the mining residue disposal sites, specifying the requirements for checking the long-term safety of these sites;
– the analysis of the results of the dosimetric impact assessment performed in 2008, in particular to study the feasibility and relevance of increasing the quality of the covering on all mining residue disposal sites;
– assessment of the dosimetric impact of the mining waste rock.

Moreover, subsequent to these studies and in line with the commitments made, AREVA has begun looking into the possibility of replacing the water covering at the Bois Noirs Limouzat site by a solid cover and has presented its action plan for monitoring former uranium mines.

Further to these actions, in a circular dated 22 July 2009, the ministry responsible for sustainable development and ASN established an action plan covering the following areas of work:
– controlling the former mining sites;
– improving understanding of the environmental and health impact of the former uranium mines and their surveillance;
– waste rock management: achieving a better understanding of its uses and reducing its impacts if necessary;
– improving information and dialogue.

At the end of 2009, AREVA began steps to consolidate the inventory of places where waste rock is reused, in order to detect any incompatibilities that might need to be remedied.

AREVA accordingly made measurements from a helicopter around the former mine sites in France.

A first fly-over stage took place in the Limousin region between November 2009 and end of April 2010. The second fly-over, in other regions, began in May 2010 and was completed by the end of 2010. The areas concerned are the *départements* of Saône-et-Loire, Allier, Puy-de-Dôme, Lozère, Loire, Nièvre, Morbihan and Vendée.

The data has to be subjected to statistical processing to identify the geographical areas that require ground verification. The first maps of Limousin were obtained at the end of September 2010. The results for Limousin are being processed and interpreted.

The ground reconnaissance and verification phase will continue until 2013.

The numbers of places where waste rock have been used will only be known after completion of all of the ground reconnaissance. ASN is particularly attentive to follow-up of these different phases and to any emergency situation that may be revealed.

The final report from the pluralistic expert group of the Limousin mining sites (GEP Limousin) was submitted to the ministry in charge of ecology and to the Chair of ASN on 15 September 2010, and a joint ministry and ASN press conference was held on 17 September 2010. The GEP Limousin's approach was to use detailed analysis of some sites in the Limousin area to develop a broader vision of the situation of former uranium mining sites in France. The GEP Limousin became aware of the difficulties arising from the legacy management of this file and of the considerable progress made in recent years to find solutions to those difficulties both for the Limousin area and nationally. The Group is of the opinion that progress should continue and be broadened in order to develop a clear perspective on the sustainable management of these sites over the next decade. The strategy to be implemented to achieve this must encompass the different aspects of the issue (technical, institutional, social) and must be supported by an effort to follow-up on actions. The strategy must be shared with local people and must allow for the specific nature of each area.

The ASN Chair and Ministry for Ecology 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 working group on the PNGMDR.

2 | 3 | 2 Waste resulting from other activities

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 legislation on installations classified for the purposes of environmental protection (ICPE) (under Part I of Book V of the Environment Code).

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*, 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 25 July 2006 stipulates the conditions for acceptance of waste containing enhanced natural or concentrated radioactivity in disposal facilities. This circular comes with a methodological guide drafted by IRSN under the supervision of a steering committee made up of representatives of industry, disposal centre licensees, environmental protection associations, experts and Government departments. This circular states that enhanced natural waste must not constitute a majority of the waste received by the disposal centre;
– 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 very low level waste. ANDRA is currently seeking a site for this disposal centre.

In 2004, ASN asked the Robin des Bois association to conduct a study into the effects of naturally occurring radioactivity enhanced by human activities, and the sites polluted as a result in France. This study covers industrial activities involving phosphates, monazite, rare earths, ilmenite, zirconium (refractories, abrasives, sanding, ceramics, foundries), ferrous and non-ferrous metals, mineral and spring waters, drinking water, spas, wells, geothermal activities, oil and gas, coal (combustion ashes), wood (combustion ashes) and papermaking.

This extremely comprehensive study allowed refinement of the identification of potential sources of exposure of workers and the public to ionising radiation and was sent to the local, regional and national administrative bodies. In 2008, ASN continued to work with the Robin de Bois association, asking it to carry out a new study on the stores of legacy waste containing enhanced natural radioactivity and more particularly the stores of phosphogypsum and coal ash.

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 of disposal of this type of waste. Most of the recommendations target ICPEs. On these matters, ASN is working with the relevant departments of the Ministry for Environment, notably regarding the uptake of these recommendations.

2|4 Management of incidental contamination

The obligation for systematic installation of radioactivity detection systems in disposal or recycling centres for "conventional" waste authorised by order of a *préfet* enables detection of the presence of radioactivity in the waste.

Initial feedback on the incidents that have occurred since 2003 led ASN, in 2003, to draft guidelines intended to be disseminated rapidly to all licensees of establishments in which the presence of radioactive elements had been found. These situations are to be the subject of a declaration to the relevant authorities.

ASN has also extended to the small-scale nuclear activities the principles of notification of the public authorities concerning significant events involving safety, radiation protection or the environment that already apply to BNIs and radioactive material transport. ASN thus defined a number of criteria which should lead to the notification of significant events in the field of radiation protection, along with the corresponding notification form. In particular, anomalies in waste management must lead to the declaration of significant events.

UNDERSTAND

Mining residue disposal sites

Mining residue storage sites have been set up near uranium ore treatment facilities in former open-cast mines or in basins closed by an encircling dyke or behind a dyke blocking off a thalweg. These storage sites can cover surface areas varying from a few hectares to several tens of hectares, and enclosing from a few thousand to several million tonnes of residues.

Following the gradual closure of the mining works, the redevelopment of these sites consisted in placing a solid cover over the residues to provide a geomechanical and radiological protection barrier to limit the risks of intrusion, erosion, dispersion of the stored products and the risks relating to internal and external exposure (radon) of the neighbouring populations. The radioactivity measurements carried out on the storage sites give values of the same order as the measurements taken in the environment of the site.

3 LONG-TERM MANAGEMENT OF RADIOACTIVE WASTE

3|1 Long-term management of very low level waste

The VLL waste management streamlining process initiated by ASN in 1994 indicated the necessity for the creation of a disposal site for this type of waste. At the request of the nuclear licensees, technical studies were conducted by ANDRA and by the "ultimate" waste and polluted earth processing and disposal company (SITA FD) as of 1996 with a view to creating a repository intended for very low level radioactive waste. The Morvilliers site, not far from the Aube repository, was chosen. This ICPE, licensed by order of the *préfet* dated 26 June 2003, offers a disposal capacity of 650,000 m3 and has been in service since August 2003.

After two years of operation, ANDRA applied to the Aube *préfet* for modification of the operating conditions. This concerned modifications to the architecture of the disposal cells (increasing the surface of the two face-to-face cells with a unit area of 10,000 m² each, to a single cell of 24,000 m²), the slope of the covering and the leachates pumping rule. This authorisation, granted by a supplementary order of the *préfet* on 21 July 2006, enables ANDRA to take account of experience feedback from the actual conditions of operation of the disposal centre.

3|2 Long-term management of low level and intermediate level short-lived waste

Most intermediate and low level waste with a short half-life (less than 30 years) is sent for final disposal to ANDRA's surface waste repositories. The principle underlying operation of these repositories is the confinement and protection of 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.

3|2|1 The Manche repository

The Manche radioactive waste repository (CSM) occupies an area of about 15 hectares at the end of the La Hague peninsula. It was commissioned in 1969 and was the first radioactive waste repository to be operated in France. The CSM was initially managed by CEA but was placed under ANDRA's responsibility on 24 March 1995. CSM operations ceased in July 1994. The repository entered the surveillance phase in January 2003 (decree 2003-30 of 10 January 2003 authorising ANDRA to modify the Manche radioactive waste repository – BNI 66, located within the municipality of Digulville-Manche to allow it to enter the surveillance phase).

Isolated problems with the repository covering were identified a few years ago and required limited consolidation work. In January 2009, ANDRA transmitted a file on the benefits of fitting a new covering to ensure the long-term passive safety of the repository. ANDRA also submitted the final safety report as well as the surveillance plan for the facility.

In accordance with the recommendations of the commission assessing the situation of the Manche repository (known as the "Turpin Commission"), in March 2008, ANDRA drafted an interim version of the "Concise History" intended to preserve essential information about the repository for future generations.

Aerial view of the Manche repository

These documents were presented to the Advisory Committee for waste in December 2009. At the beginning of 2010, ASN established its position on the additional measures to be taken by ANDRA for step-by-step installation of the new covering layer, but also for enhancing the environmental monitoring of this centre and consolidating the work being done on preserving records about the repository.

ASN therefore requested that the surveillance effort be maintained and knowledge of the long-term behaviour of the repository be further developed. A progress report on engineering of the repository cover is to be presented to ASN within 5 years. In addition, ANDRA will organise exercises to test the system for maintaining the site history.

3|2|2 The low and intermediate level short-lived waste (LL-ILW-SL) repository

In 1992, the low and intermediate level waste repository (CSFMA) took over from the Manche repository, taking full advantage of operating experience feedback gained from it. Licensed by decree in September 1989[3], this installation, located in Soulaines-Dhuys (Aube *département*) offers a storage capacity for 1,000,000 m^3 of waste located in 400 storage units. Operations performed comprise packaging of the waste sent by its producers, either by injecting mortar into the 5 or 10 m^3 metal containers, or by compacting the 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 21 August 2006 authorising ANDRA to discharge liquid and gaseous effluents and to abstract water for the Aube repository (BIN 149).

In 2006, ASN issued an opinion in favour of extension of the disposal activities to the zone not yet used and asked for additional safety studies on the risks of explosion and fire, and for estimation and monitoring of the impact of long-lived radionuclides and chemically toxic substances. In August 2008, ANDRA sent ASN its response to the recommendations made by the Advisory Committee and to ASN's requests. The general operating rules were revised in 2009 to take account of modifications made following the revision of the safety report and were approved by ASN in March 2010, after IRSN had made known its recommandations.

After approval by ASN of the design modifications, ANDRA, in 2009, began the construction of a new Tranche (Tranche 8) consisting of seven lines of structures. The extension of the disposal area required adaptation of the radiological, physico-chemical and piezometric monitoring of the groundwater in the Aptian sands. At the end of 2010, the situation in terms

3. Draft decree amending the decree of 4 September 1989 authorising the Commissariat à l'énergie atomique (i.e. ANDRA) to create a radioactive waste disposal facility at Soulaines-Dhuys and La Ville aux Bois (Aube *département*).

of operation of the repository was as follows: 120 storage structures have been built, of which:
– 104 are completely filled with packages,
– 6 are in use,
– 110 are awaiting use.

In addition, 33 structures are being built in Tranche 8. 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 the study were communicated to the Soulaines CLI at the end of October 2010. In view of the results, which did not indicate any link between the repository and any possible effects on health, it was decided not to push this investigation any further. Conversely, to respond to the population's concerns, trends in incidences of cancer, especially lung cancer, will continue to be monitored.

3|2|3 Package acceptance rules

In May 1995, ASN defined requirements for approval of radioactive waste packages intended for the surface repository (RFS III.2.e). This basic rule establishes the roles of waste producers and of ANDRA, the main requirements for waste packages as well as the procedures for approval of waste packages by ANDRA.

As part of this, ANDRA draws up general and specific specifications for each type of package (dimensional, physical, chemical, radioactive and other characteristics). For their part, waste producers justify the measures taken to comply with specifications by means of technical tests and organisational procedures. This system undergoes initial assessment, followed by periodic assessment by the producer, ANDRA and ASN, which may lead to approval suspension or revocation. A report on the quality of waste packages received at the repository is forwarded each year to ASN, which is also informed systematically of measures taken by ANDRA when the quality of packages is such that they cannot be accepted.

As part of the review of the safety of CSA, conducted in 2006 by the Advisory Committee for waste, ANDRA has made a commitment to ASN to revise the specifications for acceptance of packages. This revision, initially planned for 2010, should be completed in 2011.

ASN is particularly attentive to the strategy implemented by ANDRA to check the quality of the packages accepted in its repositories. In addition to traditional quality control, ASN also reaffirmed the need for ANDRA to continue to conduct "super-inspections" (package destruction to verify its content), which means that it needs appropriate installations for this type of inspection.

3|3 Long-term management of long-lived low level waste

Originating primarily from the radium and derivatives industries, active in the first half of the 20th century, or from certain chemical industries, waste containing radium is usually relatively low level but very long-lived. The radioactive elements it contains, when they decay, also produce radon, a naturally radioactive gas which must not be allowed to build up. The current interim storage facilities for this type of waste are thought to be not very satisfactory.

The past operation of GCR plants (EDF Chinon, Bugey and Saint-Laurent-des-Eaux reactors and CEA G1, G2, and G3 reactors at Marcoule) and their current decommissioning, also produce waste containing graphite and significant quantities of long-lived radionuclides. This waste consists mainly of graphite stacks and sleeves, activated by neutron irradiation.

In June 2008, ANDRA issued an information file about its search for a site to host a low level long-lived radioactive waste repository, to those *communes* which in principle offer potentially favourable geology. This type of sub-surface disposal centre (several tens of metres deep) could be located in a hillside, or excavated. A number of repository design options could be contemplated and their technical feasibility is currently being examined. Studies and research are also under way to gain a clearer understanding of the nature of this waste (inventory and behaviour of very long half-life radionuclides, understanding of radionuclide release mechanisms, etc.) and to determine its compatibility with the characteristics of the planned repository. As part of the site selection process, the Government consulted ASN and the National Review Board about the analysis methodology adopted by ANDRA. ASN had analysed this methodology in light of the general safety guidance memorandum for the LL-LL waste disposal site search which it published in June 2008, and it sent the minister its opinion on 15 January 2009. ASN stated that there was nothing, from a geological standpoint, to rule out continued investigation into the siting of a LL-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 June 2009, ANDRA announced the Government's decision to conduct detailed investigations on two *communes* in the Aube *département* Auxon and Pars-lès-Chavanges, and thus check the feasibility of siting a shallow depth disposal centre for LL-LL waste. The municipal councils of the two above-mentioned *communes* decided to withdraw from the project in the summer of 2009. ANDRA will therefore have to find new potential sites. A public debate will be held before the final site is chosen, following the detailed investigations phase. The pre-selected communes will be asked to delibarate on the matter again, before the site is chosen, in order to confirm whether or not they are candidates.

The waste to be accepted in this repository will mainly be graphite and radium-containing waste but, as requested by the decree of 16 April 2008, ANDRA is also examining the possibility of taking other types of low level long-lived waste, such as objects containing radium, uranium and thorium, and used low level long-lived sealed sources, as well as other waste from the processing of liquid effluents incorporated into bitumen by an encapsulation process and then packaged in metal drums. The quantified inventory and waste characterisation work should also be pursued so that ANDRA can propose a model inventory for repository sizing design. ASN considers it important, from the point of view of safe management of LL-LL waste, to find a disposal solution for this waste in the near future. Furthermore, ANDRA should pursue the process of searching for a site while strengthening the dialogue and cooperation with stakeholders.

3 | 4 Long-term management of long-lived high and intermediate level waste

3 | 4 | 1 Separation/Transmutation

Separation/transmutation processes are aimed at isolating and transforming long-lived radionuclides in nuclear waste into short-lived radionuclides or stable elements.

Separation covers a number of processes, the purpose of which is to separately recover certain long-lived radionuclides, minor actinides and fission products. These species are intended to be transmuted either by fission, for the minor actinides, or by neutron capture for the fission products, resulting in short-lived nuclides or stable atoms. The studies conducted on this subject complement those carried out by ANDRA on the impact of this transmutation on deep disposal. The determining parameter for the determination of the space required for a repository is the thermal capacity of the glass packages (closely associated with the presence of minor actinides): the greater the heat given off by the packages, the greater the space must be between them in the repository, and therefore the greater the footprint of the repository.

The relationship between the minor actinides content, the length of the interim storage period and the underground footprint of the repository means that combinations are then possible in order to optimise the storage/disposal arrangement, in light of other, essentially economic, criteria.

The separation-transmutation strategy can only be implemented in a facility that includes fast neutron reactors, critical (RNR) or sub-critical (Accelerator Driven System – ADS). Current work on the subject is therefore aiming to anticipate reactor development.

The act of 28 June 2006 and the PNGMDR orient studies and research towards the industrial possibilities for transmutation of minor actinides.

The first deadline is 2012 when, according to the act, 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.

After the TSN Act was passed, the following strategic decisions were taken by CEA on 20 December 2006. Studies and research into critical reactors will concern sodium-cooled (FNR-Na) and gas-cooled (FNR-He) fast neutron reactors. For the first technology, priority is given to designing and producing a prototype by 2020.

3 | 4 | 2 Long-term storage

The purpose of research into long-term interim storage is to allow the safe management of waste packages between their production and their final disposal. In the case of thermal packages, it also allows cooling under surveillance. Throughout the storage phase, it must be possible to recover the packages.

CEA in 2005 sent the Government its report on the packaging and long-term storage of high level, long-lived waste. The report presents the research work carried out, along with the findings. The act of 28 June 2006 now gives ANDRA responsibility for continuing interim storage studies.

The act no longer considers storage to be a final management solution but stipulates that studies must be carried out into storage so that “no later than 2015, new interim storage installations can be created, or existing installations modified, in order to meet the requirements, particularly in terms of capacity and duration”.

Storage and placing of HL and IL-LL waste in repositories complete one another so as to optimise waste management. The needs to extend the creation of interim storage facilities must be surveyed to ensure provision of adequate storage capacities for waste before its final disposal. Once final disposal repositories are functioning, storage will allow better organisation of their operation and the construction of new repository tranches. Some wastes need to be placed in storage for a period while their radioactivity declines before they can be placed in a repository.

As regard to these considerations an IL-LL and HL-LL waste storage programme must accompany the future disposal of waste. The programme is covering:
– identification of the storage needs, according to various disposal scenarios. An initial inventory was supplied at the end of 2009;
– production of storage concepts, giving details on their feasibility, durability and performance. Options were proposed in 2009;
– preparation of new storage capacities, for implementation in 2015 and for which the projects must be described in 2011.

3 | 4 | 3 Disposal in deep geological formations

The Programme Act of 28 June 2006 on the sustainable management of radioactive materials and waste sets a schedule prior to the 2025 commissioning, subject to authorisation, of a reversible deep geological repository. ANDRA has drawn up a development plan (PDD) for the HL-LL waste project, which presents the project research and studies strategy for the period 2007-2014 to meet the objectives of the act of 28 June 2006. The development plan is divided into 8 thematic programmes (experimentation, reconnaissance, phenomenology, simulation, engineering, information, surveillance, transport) and 5 cross-disciplinary activities (safety, reversibility, cost, occupational health and safety, impact assessment). The cross-disciplinary activities consolidate the data obtained by the programmes at the different stages of the project and give an overall, complete picture of the performance of the project. Each cross-disciplinary activity is described in a document giving the input data, the deliverables, the interfaces with the programmes and the other cross-disciplinary activities.

The PDD was presented to the Advisory Committee for waste in December 2007. In June 2010, ANDRA forwarded the updated 2008–2014 scientific programme, the results of which are used to support the safety case.

The project milestones are as follows:
– in 2012, public debate file;
– in 2014, authorisation decree application file;
– Act on reversibility;
– in 2025, commissioning.

To date, the studies for waste disposal in deep formations are carried out in the Bure underground laboratory, authorised by the decree of 3 August 1999 authorising ANDRA to install and operate an underground laboratory within the municipality of Bure.

Study of the rock enables its physical-chemical properties to be determined in terms of repository safety. Scientific experiments are also designed to enhance the available knowledge concerning:
– the geology of the region and its history, with the possibility of predicting its future behaviour;
– the regularity of the clay layer in the transposition zone (zone in which the repository could be located);
– water circulation in the limestone and marl terrain above and below the clay layer;
– the impact of excavation of the underground structures and the possibility of mitigating or cancelling out the effects;
– the performance of argillites in containing the radioactive elements and delaying their migration.

In 2009, study and research continued on the choice of a site and the repository design. Among the experiments carried out by ANDRA, the surface reconnaissance campaign allowed examination of the lateral continuity and spatial variability of the properties of the formations studied, in order to obtain exhaustive information about the transposition zone. At the end of 2009, a 30 km² zone of interest for detailed geological investigations (ZIRA), with a view to siting the underground facilities of the future repository, and zones for installation of surface facilities (ZIIS) was proposed to the ministers in charge of energy, research and the environment. On 5 January 2010, ASN communicated its favourable opinion on the choice of the ZIRA to the Government.

ASN inspection to the Bure laboratory – November 2009

After government approval of the ZIRA, ANDRA undertook detailed reconnaissance (notably 3D seismic survey) in the ZIRA of which the results should be available by the end of 2011. Working with local authorities, ANDRA will also examine the surface development areas in the ZIIS allowing it, by 2012 at the latest, to forward the file necessary for organisation of the public debate, and to propose a site for the future repository (surface and underground).

In 2009, in Saudron near Bure, ANDRA inaugurated a technology demonstration and information centre for the disposal and reversibility concepts. This centre hosts prototypes and technology demonstrators built to test and validate the industrial concepts contemplated for the nuclear installations in the repository.

At the end of 2009, ANDRA forwarded a file presenting an update of safety and reversibility options for disposal in the repository, of the model inventory for waste packages used for design of the repository and the main design solutions 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 will decide on its position on this file at the start of 2011. It has already accepted that the files examined allow identification of the important points for the safety case for a future deep underground repository in the formation selected. It has also observed that some subjects require more investigation by ANDRA before submission of a request for authorisation to create a repository, for both the operating phase and the period after closure of the repository.

ASN has verified, by inspections at ANDRA's head office and on site at Bure, that the experiments are conducted in accordance with processes ensuring the quality of results obtained.

In February 2007, ASN published the safety guide for final disposal of radioactive waste in deep geological formations, replacing the Basic Safety Rule III.2.f., following the favourable opinion given by the Advisory Committee for waste. In response to questions by the Advisory Committee experts, in 2008, ASN set up a working group for more in-depth consideration of the subjects of values for radiation protection and for the safety case over long time scales. The conclusions of these considerations were presented in March 2010 to the Advisory Committee on waste. ASN observed, in particular, that the approach described in the safety guide is consistent with the doctrine applied internationally where these subjects are concerned.

3|4|4 Specifications and approval certificates for waste packages unsuitable for surface disposal

ANDRA, together with the waste producers, chose a gradual approach whereby initially, and until 2001, the only specifications required were those related to knowledge. It also defined requirements concerning qualification of the process and management of production applicable to all waste producers, so that surveillance can be implemented and nonconforming packages identified. In 2003, most Level 1 approvals (compliance with first package requirements for inclusion in the design specifications for deep geological formation disposal) were granted. The performance specifications for Level 2 waste packages stipulate the package properties which, as things currently stand, would seem to determine the design or impact assessment of a possible repository. ANDRA anticipates a change in this approach in order to link the specifications drafting process to that for production of an application for authorisation to create a geological repository.

The implementation of this approach is being closely followed by ASN, in particular through inspections at ANDRA and on the premises of the waste producers.

The regulatory context has changed since 2006, owing to:
– the fourth paragraph of Article 14 of Programme Act 2006-739 of 28 June 2006 on the sustainable management of radioactive materials and waste, which specifies that in compliance with nuclear safety rules, ANDRA must submit specifications for radioactive waste disposal and provide the competent government authorities with an opinion concerning the waste packaging specifications;
– the guide published by ASN “on final disposal of radioactive waste in deep geological formations”, which presents the safety functions relating to the packages and, in its Appendix 1, the main principles for packaging.
– work undertaken by ASN on regulations, especially with a view to revision of the general regulations applying to BNIs.

In order to take account of these changes, ASN resumed work on the conditions for approval of changes to packages production for waste that cannot be disposed of in surface or sub-surface repositories (known as “N3S” packages). The aim of this work is to meet a two-fold objective:
– operational implementation of the changing context, describing the package approval process and the roles of the different parties;
– harmonisation of all practices; in the current situation, the packaging conditions for packages produced at La Hague are subject to ASN approval. The packages produced on the other sites are not explicitly bound by such a requirement.

ASN therefore undertook the drafting of a decision on the waste packaging authorisation procedures. A first draft was published in 2010 to be viewed on ASN’s website. The decision will be published after entry into force of the future order on the general regulations applying to BNIs.

The draft decision aims to establish requirements in the area of waste packaging and the process of validation of these types of packaging, while providing a framework for the procedures for reception of waste packages at the repository site.

4 SITES POLLUTED BY RADIOACTIVE MATERIALS

4|1 The organisation and regulation of action by the public authorities

Article 14 of Act 2006-739 of 28 June 2006 on the sustainable management of radioactive materials and waste (article L 542-12 of the Environment Code) 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 requisition when the parties responsible for this waste or these sites have defaulted. The last paragraph of article 15 stipulates that ANDRA shall receive a subsidy from the State, which contributes to funding the missions of general interest entrusted to it. For this purpose, ANDRA’s board in April 2007 set up a National Funding Commission for Radioactive Matters, CNAR. This arrangement replaces the two financial systems that previously existed: the radium fund and the agreement between producers in the nuclear power generating sector and ANDRA.

4|2 Abandoned radioactive objects

The Government circular of 17 November 2008, co-signed by the General Directorate for Risk Prevention (DGPR), the General Directorate for Health (DGS), the General Directorate for Energy and Climate (DGEC) and ASN, explains ANDRA’s public service duties, the responsibility it assumes for certain types of radioactive waste and the management of sites polluted by radioactive materials.

Furthermore, the public authorities, more particularly the *préfet*s, can ask ANDRA, CEA or IRSN to take charge, at least temporarily, of radioactive waste. The conditions in which the *préfet*s refer to these organisations are specified in Government circular DGSNR/DHOS/DDSC 2005/1390 of 23 December 2005 concerning the principles for intervention in the case of an event liable to lead to a radiological emergency, outside the situations covered by an emergency or response plan. ANDRA takes charge of wastes when the parties responsible have defaulted.

4|3 Sites polluted by radioactive substances

4|3|1 General

A site polluted 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. The circular of 17 November 2008, intended for the *préfet*s, 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. This circular is thus able to deal with legacy radioactive contamination of sites caused by past craft or industrial activities involving radioactivity (see the radium clock making industry, radium extraction workings of the 1920s to 1930s, the laboratories of the early 20th century which discovered radioactivity, and so on). These sites are not generally ICPEs.

The methodology guide for management of industrial sites potentially contaminated by radioactive substances, which was published in October 2000 (version 0), describes the applicable approach for dealing with the various situations likely to be encountered in the rehabilitation of sites (potentially) contaminated by radioactive materials.

A working group comprising representatives from IRSN, INERIS, the Ministry for Ecology and ASN, was set up in 2009 to further develop this guide and to, notably, allow an approach that is consistent with the general doctrine on management of sites and soils contaminated by chemicals and to foster public involvement throughout rehabilitation projects.

In 2009, the public authorities (DGPR and ASN) felt that it was important to set up a pluralistic working group to determine clean-up objectives for sites contaminated by radioactive substances. This group comprises the regulatory authorities (ASN, DGPR, DGS, the Regional Directorate for the Environment, Planning and Housing, the French Health Monitoring Institute), licensees (CEA, AREVA, ANDRA), associations (CRIIRAD, Robin des Bois), representatives of the public (local elected officials, OPECST) and French and foreign experts (IRSN, FANC). The outcome of the work done by this group was used in drafting of the guide. The group's work was presented by ASN at the 5-day event organised by the French Society for Radiation Protection (SFRP) on optimisation of radiation protection in the areas of nuclear electricity generating, industry and the medical sector, on

Derelict industrial site of the Bayard company in Saint-Nicolas d'Aliérmont

TO BE NOTED IN 2010

Operation Radium Diagnosis

Operation the Radium Diagnosis was launched in Ile-de-France in October 2010.

The State has decided to carry out free 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, etc.).

These medical or craftwork activities, which are not attached 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 performed with rigour and is free of charge for the occupants of the places concerned: the diagnosis consists in taking systematic measurements to detect the presence of any traces of radium or to confirm the absence of radium.

The diagnoses are carried out by a team of specialists from the French Institute for Radiation Protection and Nuclear Safety (IRSN), accompanied by an ASN referral agent who will have contacted the occupants beforehand to tell them about the operation. On completion of the diagnosis, the occupants are informed verbally of the results, with subsequent written confirmation by post.

If traces of pollution are found, rehabilitation operations are carried out free of charge by ANDRA, the French National Agency for Radioactive Waste Management, in agreement with the owners.

Ultimately, each person concerned is given a certificate guaranteeing the results of the operation.

At the end of 2010 seven sites representing 42 premises or houses had undergone diagnosis. Nine of the premises revealed traces of pollution and have'been or are currently being rehabilitated. ASN will see to it that ANDRA carries out the rehabilitation work as required.

30 September 2010. The approach presented was judged relevant and consistent with ICRP recommendations.

Following on from this work, in November 2010, ASN, DGPR and IRSN provided a draft of the methodological guide entitled "gestion des sites potentiellement pollués par des substances radioactives " (management of sites potentially contaminated by radioactive substances). Publication of the guide is planned for the first half of 2011.

In 2010, ASN also continued its work with a view to formalising the basic principles of its doctrine in the area of management of sites polluted by radioactive substances. ASN already believes that the solution involving the contamination being maintained in-situ should not be considered the reference solution for management of sites polluted 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.

4 | 3 | 2 The polluted sites inventories

Several complementary inventories are available to the public.

• The ANDRA national inventory
Since 1993, ANDRA has been publishing a national inventory of radioactive waste giving information on the condition and location of radioactive waste around the country, including on sites identified as being polluted by radioactive materials. The June 2009 edition is available on the ANDRA website, *www.andra.fr.*

• The Ministry of Ecology's databases
The MEEDDM has created a web portal specifically for polluted sites and soils (*www.sites pollues.ecologie.gouv.fr*). This portal gives access to two databases, whatever the nature (chemical or radioactive) of the polluted site. They are:

– "BASOL" which is an inventory of the sites polluted or likely to be polluted and requiring preventive or remedial action on the part of the public authorities;
– "BASIAS" which is a record based on regional historical inventories of former industrial sites, a trace of which must be kept. Its purpose is to maintain inventoried site records in order to provide information of use for town planning, land transactions and environmental protection.

4 | 3 | 3 Some of the files in progress

Coudraies area 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 is to clean out land that can be cleaned and to demolish the two houses that cannot be subject to this type of work.

A property was purchased at the end of 2005, with the site being made safe by ANDRA in 2006 and 2007. Surveillance was put into place in 2008 and demolition of the house should be undertaken at the start of 2011. Two properties were cleaned-out in 2008 and early 2009. ANDRA purchased a second property in June 2010. A public meeting was held on 22 September 2010 at the town hall of Gif-sur-Yvette, attended by the mayor, ANDRA, ASN and representatives of the *sous préfecture* to consider the fate of the properties purchased.

Sanitary requirements for the Coudraies district were incorporated in May 2007 into the local development plan for Gif-sur-Yvette.

Following a request by a local resident and after analysis of the history of the district, ASN also initiated a process to clear up any ambiguity concerning a few plots of land in the Clos Rose district of Gif-sur-Yvette. The results were presented to the inhabitants in the last quarter of 2010 and at the CNAR of 7 December 2010. Of 11 plots investigated, two houses have radium activity concentrations above 400 Bq/m^3. Additional investigations are to be carried out to identify the radon transfer pathways in the houses and to indicate the steps necessary to reduce these radon activity concentrations.

Making safe the Isotopchim site in Ganagobie (Alpes-de Haute-Provence département)

From 1987 to the end of 2000, the Isotopchim Company was involved in carbon 14 and tritium labelling of molecules intended for medical applications in Ganagobie (Alpes de Haute-Provence *département*). In 2000, the company went into liquidation, leaving a contaminated environment (incidental release of carbon 14 into the atmosphere and aqueous releases into the sewers) along with a large amount of chemical and radioactive waste on site.

Since the end of 2000, several inventories have been produced and an initial rehabilitation project reviewed. ANDRA has been cleaning out the site since December 2002, notably sending the flasks containing concentrated solutions to the appropriate disposal routes. This priority 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. Greater security (installation of an operational fire detection system and replacement of the fence) was put into place in July 2009. Additional analysis of the remaining liquid waste was initiated in order to define the disposal routes. Removal of the remaining VLL solid waste was validated by the CNAR and has started. ANDRA is also looking for an interim storage solution for the liquid waste pending availability of a disposal route for all of this waste.

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 fallow.

The CNAR of 8 December 2009 was asked for an opinion on rehabilitation of this site. The CNAR selected a project involving partial excavation of the contaminated land and construction above this of public sports amenities. On advice from ASN, the CNAR nonetheless felt it necessary to see that development of the site should not hinder subsequent operations in areas

UNDERSTAND

French National Funding Commission for Radioactive Matters (CNAR)

The meeting of the board of governors of ANDRA of 24 April 2007 created the national funding commission for radioactive matters (CNAR). This commission must give opinions on the utilisation of the public subsidy provided for in article 15 of the aforementioned act of 28 June 2006, on both the fund assignment priorities and the polluted site treatment strategies and the principles of subsidised collection and disposal of waste. This commission also delivers an opinion on the individual files submitted to it.

The commission is chaired by the executive director of ANDRA and includes representatives from the supervising ministries (DGEC, DGPR, DGS), ASN, IRSN, the Association of Mayors of France, environmental defence associations and qualified key figures.

ANDRA ensures the secretaryship of the CNAR.

The commission met quarterly in 2010, to address matters such as the attribution of public funds for the management of polluted sites considered to require priority treatment, such as Orflam-Plast, Gif-sur Yvette, Bandol, Isotopchim, Bayard in Saint-Nicolas d'Aliermont, and occasionally for the collection and disposal of certain wastes. This commission is equivalent to the Technical Commission (formerly the national funding commission) that exists within the ADEME for the management of sites polluted by non-radioactive substances.

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 will be called upon to validate the various phases of this site work and hold points are planned after each phase. The first phase, which began on 19 October 2010, consists, primarily, in removal of the bulky items from the former school premises. Work to remove asbestos has also started. This first site phase should conclude with demolition of the buildings. The second of the two work phases, which consists in carrying out soil clean-up, should begin in early 2011 and be completed in September 2011.

A local information and monitoring commission (CLIS), of which ASN is a member, was established by the *préfet* for the Val-de-Marne *département* and a monitoring committee was also set up by the town hall.

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. Until August 2006, buildings still existed on the site. Starting in 1966, they were partly occupied by various companies handling butcher's waste transit activities. The Charvet company, the current owner of the site, carried out the same activities from the 1990s to mid-2005. The site, closed since the business ceased operations, was illegally occupied from December 2005 to June 2006. Access to the site is now closed. The Charvet site has been identified as being eligible for financing under France's recovery plan, and is part of the project to rehabilitate an eco-zone on the *Ile-Saint-Denis* island. On 29 September 2009, the CNAR accepted the rehabilitation project based on a scenario involving partial excavation of the contaminated earth, allowing the creation of a park or comparable activity, taking account of possible subsequent intervention for that part of the site on which the contaminated soil and rubble would 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 (EPIC).

The first comprises sorting of the contaminated waste from conventional waste and removal from site. The waste sorting and packaging facility was inspected by ASN on 30 June 2010.

During validation of the rehabilitation scenario, the CNAR, in September 2009, decided that it was necessary to further the hydro-geological studies of the site to decide on the risk of pollution of groundwater and to stipulate appropriate management methods and procedures.

A local information and monitoring commission (CLIS) is being constituted. ASN will have a seat on this commission, alongside representatives from public administrative bodies.

Former Curie laboratories in Arcueil (Val de Marne département)

By order of the *préfet* on 20 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 validated the objectives for sorting conventional waste from contaminated waste, in line with the waste evacuation routes. It would appear that all the waste and furniture present on this site will need to be removed before radiological characterisation of the site prior to its rehabilitation. A public meeting was held on 22 June 2009.

An ASN inspection was carried out on 16 October 2009.

After an unauthorised entry to the site in June 2010 (unauthorised entry and theft), ensuring of the safe condition of the site was reinforced. In parallel, the local education authority managing the site decided to close down the work as it had exceeded its budget. The site is therefore closed for several months.

Decontamination of the former Curie laboratories site in Arcueil

Établissements Charvet in *Ile-Saint-Denis*

The Haÿ-les-Roses sub-prefecture, in agreement with the Arcueil town council, decided to organise a public meeting in mid-December 2010 to explain the progress made on the site to the inhabitants of Arcueil as well as informing them about recently occurring events (incident and active safetying of site). ASN participated in the meeting.

Orflam-Plast in Pargny-sur-Saulx (Marne département)

In 1934, the UTM Company (UTM standing for monazite treatment unit) started to produce lighter flints by extracting the cerium contained in imported monazite ore, and then began to make lighters under the brand name ORFLAM PLAST. Using the same ore, the company also produced pure thorium nitrate for export until 1959. Direct processing of the raw material ceased in 1967, when this activity was replaced by materials that were pre-treated prior to import and free of either thorium or uranium. The Orflam-Plast company was wound up by a decision of the court of commerce in May 2006. The consequence of this judgement was to relieve the liquidator of all responsibility for the site.

In an administrative decision, the Orflam site was transferred to the State property department on 24 November 2008.

Since the beginning of 2008, rehabilitation of the site has been managed by the National Funding Commission for Radioactive Matters (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 sediment, water, and aquatic fauna and the measurements obtained enabled the pond to be opened for fishing at the end of August 2009. Spectrometry mapping was carried out by a helicopter on 29 and 30 June 2009 over a 60 km² area. The active zones previously identified were confirmed and no other zone showing thorium activity significantly higher than the local natural background level was brought to light. At the end of 2009, the CNAR ruled on the rehabilitation scenarios for the contaminated areas both off and on the site, so that work could begin in mid-2010. 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 activities could be re-authorised in July 2010. The rehabilitation work on the “peupleraie” site should be completed in early 2011. Work on the plant site should begin in 2011. Specific restrictions for land use will be introduced for each of the sites.

4|4 Public service storage facilities

ANDRA has a public service storage duty. So far, however, it has not operated any storage facilities, simply signing agreements with other nuclear licensees for access to their storage capacity. For example, the Socatri company was authorised by decree in 2003 to provide interim storage on behalf of ANDRA for low level long-lived waste, CEA at Cadarache for interim storage of radium lightning conductors and depleted uranium radioactive objects, and CEA at Saclay for interim storage of used radioactive sources for which there are currently no disposal routes.

In September 2009, ANDRA approved the creation of a storage facility for diffuse nuclear waste, in particular low level, long-lived waste. This facility will not however be able to accept tritiated waste.

5 OUTLOOK

In 2010, 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 management strategies put in place by the licensees. In particular, ASN remains attentive to the implementation by AREVA of its strategy for retrieval of old waste from La Hague site.

In accordance with the joint ASN and ASND request, in 2010, CEA sent a file on the management strategy for waste produced in civil nuclear installations to both of the authorities. The file presents the management strategy for waste produced and to be produced in the future, identifying the needs for facilities for treatment, packaging, transport packages and placing in storage. It will be examined by an Advisory Committe with a view to ASN establishing a position. Furthermore, ASN has observed an overall difficulty on the part of CEA to fulfil its commitment, notably in terms of meeting its deadlines, leading it to postpone the deadlines for removal from storage of waste present in the oldest installations. In addition, in 2011, ASN will continue to follow attentively the retrieval from storage of wastes presenting the greatest safety risk.

With regard to the long-term management of radioactive waste, ASN is encouraged by the way ANDRA operates its waste centres currently in service. ASN considers that there must 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 follow attentively the process of search for a site and development of disposal solutions.

The Authority considers that key steps will be taken to develop the disposal project in coming years. By means of the opinion that it gave on the file submitted by ANDRA in 2009, ASN will set out the main areas of focus for between now and submission of the license application for creation that should take place at the end of 2014. ASN remains vigilant to ANDRA's providing of the expected elements. It will also pursue the development of its doctrine on reversibility.

After consultation, ASN also expressed several opinions in 2010 on the strategies for management of polluted sites. Under the renewed regulations, ASN has been strengthened since 2009 and will continue its work in 2011 in collaboration with the relevant administrative departments and bodies, and with other stakeholders. In 2011, ASN intends to publish its doctrine in the area of management of sites polluted by radioactive substances. 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. This option can only be an interim solution or reserved for situations in which the complete clean-out option cannot be contemplated owing to the volume of waste to be excavated.

In 2011, ASN will also continue to work on revising regulations, following the publication of Act 2006-686 of 13 June 2006 on transparency and safety where nuclear matters are concerned, in particular by stipulating, via its decisions, the measures applicable to BNIs concerning the production of nuclear waste, the storage of this waste, its packaging and its disposal.

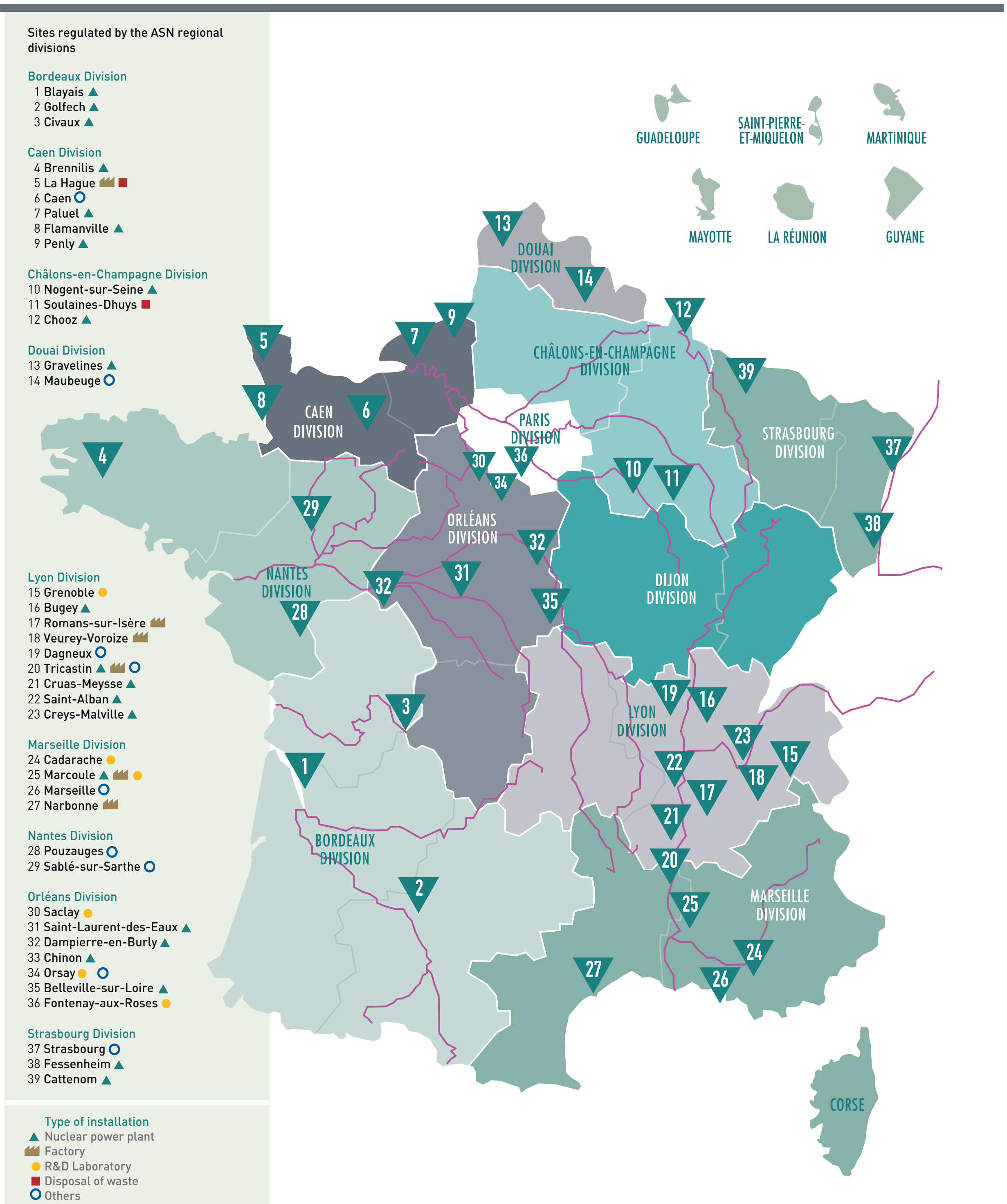
Moreover, in 2011, ASN will continue with its operations for diagnostic analysis of sites likely to have hosted activities involving handling of radium in Ile-de-France and will extend these operations to other regions.

Finally, ASN will maintain its close involvement in international work by maintaining its active participation in working groups, especially within the framework of the IAEA's Waste Safety Standards Committee (WASSC) which validates the reference standards for radioactive waste management, and within WENRA, as well as by participating in the work of the different international organisations on disposal of radioactive waste and especially on reversibility.

APPENDIX

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, Douai, 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 31.12.2010

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. 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, a decree (see decree 2007-830 of 11 May 2007 concerning the list of basic nuclear installations) sands thresholds for each category dandermining the point at which they become subject to the BNI system.

For technical or legal reasons, the concept of a basic nuclear installation can reflect a number of different physical situations: for example in a nuclear power plant, each reactor can be considered as a separate BNI, or a given BNI can in fact consist of two reactors. Similarly, a fuel cycle plant or a CEA centre can comprise several BNIs. This legal arrangement in no way alters the regulation conditions:

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 31.12.2010, there were 126 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

NPP name	Name and location of the installation	Licensee	Type of installation	BNI

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	Radioactive materials storage	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	LA MANCHE STORAGE CENTRE (CSM) 50448 Beaumont-Hague	ANDRA	Disposal facility 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	Particles 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

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
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	Radioactive materials storage	163

LOCATION OF INSTALLATIONS REGULATED BY THE DOUAI DIVISION

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
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

NPP name	Name and location of the installation	Licensee	Type of installation	BNI

LOCATION OF INSTALLATIONS REGULATED BY THE LYON DIVISION

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
GRENOBLE 15	MÉLUSINE 38041 Grenoble Cedex	CEA	Reactor	19
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 substances	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	Storage or interim storage of radioactive substances	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	Interim storage of new fuel	102
BUGEY 16	ACTIVATED WASTE PACKAGING AND INTERIM STORAGE INSTALLATION (ICEDA) 01120 Saint-Vulbas	EDF	Packaging and interim storage of radioactive substances	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	Use 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 (SOCATRI) 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 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 nuclear reactor	91
CREYS-MALVILLE 23	FUEL EVACUATION FACILITY (Creys-Malville) 38510 Morestel	EDF	Radioactive materials storage	141

NPP name	Name and location of the installation	Licensee	Type of installation	BNI

LOCATION OF INSTALLATIONS REGULATED BY THE MARSEILLE DIVISION

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
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 AND SCARABÉE (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Reactors	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	Radioactive materials storage	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	Use of radioactive materials	55
CADARACHE 24	RADIOACTIVE WASTE INTERIM STORAGE AREA (Cadarache) 13115 Saint-Paul-lez-Durance	CEA	Disposal 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

NPP name	Name and location of the installation	Licensee	Type of installation	BNI
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

NPP name	Name and location of the installation	Licensee	Type of installation	BNI

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	Use of radioactive materials	49
SACLAY 30	SPENT FUEL TEST LABORATORY (LECI) (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Use of radioactive materials	50
SACLAY 30	SOLID RADIOACTIVE WASTE MANAGEMENT ZONE (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Radioactive materials storage	72
SACLAY 30	POSÉIDON – CAPRI IRRADIATION FACILITIES (Saclay) 91191 Gif-sur-Yvette Cedex	CEA	Use 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	Radioactive materials storage	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	Use of radioactive materials	94
CHINON 33	CHINON INTER-REGIONAL WAREHOUSE 37420 Avoine	EDF	Interim 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	Radioactive materials storage	133
CHINON 33	CHINON A2D 37420 Avoine	EDF	Radioactive materials storage	153
CHINON 33	CHINON A3D 37420 Avoine	EDF	Radioactive materials storage	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 the publication of decree 63-1228 of 11 December 1963 concerning nuclear installations and for which neither said decree nor the TSN Act (Articles 33 and 62) stipulates authorisation rather than notification.

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.

"CE marking"	mandatory, regulatory marking for certain products in the European Union, guaranteeing product conformity with the "essential requirements" defined by a European directive
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
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)
AERB	Atomic Energy Regulatory Board (Indian regulatory body)
AFCEN	French Association for NSSS Equipment Construction Rules
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)
AGATE	effluent advanced management and processing facility (CEA – Cadarache)
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
ANSES	National Agency responsible for Health and Safety of Food, the Environment and Work (since July 2010)
ANSN	See NNSA
ANSTO	Australian Nuclear Science and Technology Organisation
AP 913	maintenance doctrine (EDF)

AP1000	Pressurised Water Reactor designed by Westinghouse
APE	state-based approach (principle governing incident or accident situation operating strategies)
APEC	fuel evacuation facility (EDF – Creys-Malville – Isère)
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)
ARS	Regional Health Agency (since 2010)
ASF	systematic training approach
ASG	steam generator auxiliary feedwater system (PWR)
ASN	French 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 1100 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
BEA-TT	French Land transport accident investigation bureau
BEAD-air	French Defence Air Accident Investigation Bureau
BEA-mer	French Marine 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)
Bel V	Technical Safety Organisation and subsidiary of FANC (since 2008)
BMU	German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety
BNFL	British Nuclear Fuels Limited
BNI	Basic Nuclear Installation
BO	Official Bulletin
Bq	becquerel (unit of radioactivity)
BRGM	French Geological and Mining Research Office
BSF	drum storage building (EDF – Chooz)
BTE	effluent treatment building
BWR	Boiling Water Reactor
CABRI	research reactor (CEA – Cadarache)
CADA	Committee of Access to Administrative Documents
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)
CBNI	Classified Basic Nuclear Installation
CBRN	Chemical, Biological, Radiological and Nuclear (CBRN) hazard
CCAP	French Central Committee for Pressure Equipment
CCINB	BNI Consultative Committee (until 2010)
CDE	definitive cessation of operational activity (notion qualifying a phase in the life of a BNI, used before the 2006 reform)
CEA	French Atomic Energy Commission (now the Atomic Energy and Alternative Energy Commission)
CEDRA	radioactive waste packaging and interim storage unit (CEA – Cadarache)
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
CFCa	Cadarache fabrication complex (COGEMA – MOX facility)
CFU	Colony forming unit (CFU per litre is the unit used to measure the concentration of legionella)
CG	*Conseil général* (*département*-level elected council)
CGEDD	French Departmental Council for the Environment and Sustainable Development (Ministry for Ecology, Energy, Sustainable Development and the Sea, in charge of Green Technologies and Climate Negotiations)
CGIET	General Council for Industry, Energy and Technologies (Ministry for the Economy, Industry and Employment)
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)
CICNR	French Interministerial Committee for Nuclear or Radiological Emergencies – since 2003
CIDEN	Nuclear Environmental and Decommissioning Engineering Centre – EDF
CIPN	Nuclear Equipment Engineering Department – EDF
CIRCE	transfer packaging containing radioactive organic waste (CEA – Fontenay-aux Roses)
CIRIL	Interdisciplinary ion laser research centre – CNRS & CEA – Caen
CIS-Bio International	Company specialising in 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
ClF3	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

CNSC Canadian Nuclear Safety Commission

Co Cobalt

CO_2 carbon dioxide

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 LOGISTICS nuclear materials packaging and transport company (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)

Contrôle magazine published by ASN

COPAT Plant Unit Shutdown Steering Committee (EDF)

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)

CP	Command Post
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)
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
CSLU	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)
CSNI	Committee on the Safety of Nuclear Installations (NEA)
CSP	– French Public Health Code – main secondary cooling system (PWR)
CSPRT	High Council for the Prevention of Technological Risks (since 2010)
CSS	– Commission on Safety Standards (IAEA)
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

DFK Franco-German Committee for Nuclear Plant Safety Issues

DfT Department for Transport (United Kingdom)

DG/TREN Directorate-General for Energy and Transport (European Commission)

DGAC General Directorate for Civil Aviation – Ministry for Ecology, Energy, Sustainable Development and the Sea, in charge of Green Technologies and Climate Negotiations

DGCCRF General Directorate for Competition Policy, Consumer Affairs and Fraud Control – Ministry for the Economy, Industry and Employment

DGDDI General Directorate of Customs and Excise (Ministry for the Budget, Public Accounts, the Civil Service and State Reform)

DGEC General Directorate for Energy and Climate (Ministry for Ecology, Energy, Sustainable Development and the Sea, in charge of Green Technologies and Climate Negotiations)

DGITM General Directorate for Infrastructure, Transport and the Sea (Ministry for Ecology, Energy, Sustainable Development and the Sea, in charge of Green Technologies and Climate Negotiations)

DGOS General Directorate for Health Care (Ministry of Work, Employment and Health) (since 2010)

DGPR General Directorate for Risk Prevention (Ministry for Ecology, Energy, Sustainable Development and the Sea, in charge of Green Technologies and Climate Negotiations)

DGS General Directorate for Health – Ministry for Health and Sport

DGSNR General Directorate for Nuclear Safety and Radiation Protection (ASN central structure until the November 2006 reform)

DGT
- Director General for Labour
- General Directorate for Labour (Ministry for Labour, Labour Relations, the Family, Solidarity and Urban Affairs

DHOS Directorate for Hospitalisation and Health Care Organisation – Ministry for Health, and Sport (until 2010)

DHUP Directorate of Housing, Planning and Landscape (Ministry for Ecology, Energy, Sustainable Development and the Sea, in charge of Green Technologies and Climate Negotiations)

DIADEM irradiating or alpha waste from decommissioning

DIN Nuclear Engineering Division – EDF

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)

DOS safety options file (for BNIs)

DOT Department of Transportation (USA)

DPAEP	Directorate for Personnel Management and Adaptation of the Professional Environment (Ministry for the Economy, Industry and Employment) (since 2006)
DPI	Production and Engineering Directorate (EDF)
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 – Regional Director for the Environment, Planning and Housing
DRI	International Relations Department (ASN)
DRIRE	– Regional Director for Industry, Research and the Environment (until 2010) – Regional Directorate for Industry, Research and the Environment (until 2010)
DRL	Diagnostic Reference Level
DRTEFP	Regional Labour, Employment and Professional Training Directorate
DRYPAC	sludge drying process (until 2010)
DSC	– Director of Civil Security – Directorate for Civil Security (Ministry of the Interior, Overseas France and Territorial Communities) (since 2008)
DSND	Delegate for Nuclear Safety and Radiation Protection for National Defence Installations and Activities (see ASND)
DSS	Social Security Directorate – Ministry for Health
DTPA	diethylene-triamine-penta-acetate (substance used in nuclear medicine)
DTS	Transport and Sources Department (ASN – since beginning of 2011)
DUP	declaration of public interest procedure
E.ON	electricity and gas production and distribution company (Germany, various countries in Europe and the United States)
EAN	European ALARA Network (the aim of which is to promote implementation of the ALARA principle)
EAS	reactor building containment spray system (PWR)
EBRD	European Bank for Reconstruction and Development
EC	European Community
ECURIE	European Community Urgent Radiological Information Exchange System
EDE	containment annulus ventilation system (PWR)
EDF	*Électricité De France*
EDS	solid waste interim storage area
EEC	European Economic Community
EESC	European Economic and Social Committee
EEVLH	glass storage building extension on the La Hague site (AREVA NC – La Hague)
EEVSE	glass storage building (AREVA NC – La Hague)

EFOMP	European Federation of Organisations in Medical Physics
EFPD	effective full-power day
EGRA	Expert Group on the Regulatory Application of Authorisation (sub-group of the NEA's CRPPH)
EIS	element important for safety
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
ELAN II B	former sealed source fabrication installation (CEA – La Hague)
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)
ENT	Ear, Nose and Throat
EOLE	research reactor (CEA – Cadarache)
EP	public inquiry
EPA	Environmental Protection Agency (United States)
EPAL	Emergency Preparedness and Action Levels (population protection measures harmonisation group – HERCA)
EPR	Evolutionary Pressurized Water Reactor (new type of nuclear reactor developed by AREVA NP)
EPRD	revenue and spending forecast (public establishment "budget")
ERNET	Emergency Response Network (IAEA)
ERP	establishment open to the public
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
ETARE	establishments listed for emergency response purposes
ETPT	French acronym for Full-Time Equivalent (FTE)
EU	European Union
EURANOS	European approach to nuclear and radiological emergency management and rehabilitation strategies
EURATOM	European Atomic Energy Community
EUROCLI	European Association of Local Information Committees 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)

EVEREST	French acronym for "evolving towards entry without standard suit" (entry into a controlled area in working overalls – initiative implemented by EDF)
FANC	Belgian Federal Agency for Nuclear Control
FANR	Federal Authority for Nuclear regulation (regulatory body of the United Arab Emirates)
FAO	Food and Agriculture Organization (UN)
FBFC	Franco-Belgian Fuel Fabrication Company
FDG	fluorodeoxyglucose (substance used in nuclear medicine)
FISA	Fission Safety (biennial conferences on nuclear reactor safety organised by the European Union)
FMEA	Failure Modes and Effects Analysis
FNR	fast neutron reactor
FOD	Field Operations Directorate (HSE directorate)
FOPH	Federal Office of Public Health (Switzerland)
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)
FTE	Full-Time Equivalent
G8	Group of the 8 leading industrial nations (G7 + Russia)
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)
Génération 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
GIAG	serious 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
GIMELEC	French industry association for electrical equipment, automation and related services
GL	guideline level (set by the Codex Alimentarius for Radionuclides in Foods)
GOR	general operating rules
GP	(or GPE) Advisory Committee (reporting to ASN)
GPD	Advisory Committee for waste (reporting to ASN)
GPESPN	Advisory Committee for nuclear pressure equipment (reporting to ASN)

GPMDR	"Radioactive Materials and Waste" Advisory Committee (ANCCLI) (reporting to ASN)
GPMED	Advisory Committee for medical exposure (reporting to ASN)
GPPA	"Territories – Post-nuclear-accident management" Advisory Committee (ANCCLI) (reporting to ASN)
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)
GRNC	Nord Cotentin Radioecology Group (pluralistic experts group set up by ASN and the ministries concerned to look at 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
GWd	gigawatt day (unit of energy)
GWd/t	gigawatt day per ton (volume energy unit)
Gy	gray (unit of absorbed dose)
H1N1	pandemic H1N1 virus
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
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	Heads 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 Commission – Petten – Netherlands)
HL	High-level
HLLLW	high level long-lived waste
HSE	Health and Safety Executive (United Kingdom)
HSE/ND	Health and Safety Executive/Nuclear Directorate (UK regulatory body – HSE)
HSK	Swiss Federal Nuclear Safety Inspectorate (Swiss regulatory body)
HT	tritium gas
HTO	tritiated water
HTR	High Temperature Reactor
Hydrotéléray	network for continuous measurement of radioactivity in major rivers (IRSN)
IAEA	International Atomic Energy Agency (UN)
IARC	International Agency for Research on Cancer (part of the WHO and located in Lyons)
ICAO	International Civil Aviation Organization

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)
ICRP	International Commission on Radiological Protection
ICRU	International Commission on Radiation Units and Measurements
ICSI	Institut for an Industrial Safety Culture
ICSN	French acronym for the Nuclear Safety Cooperation Instrument (NSCI) (European Union)
IDSP	weighted scanner dose index
IDT	Uncoupling and transit installation
IEC	International Electrotechnical Commission
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
IL-LL	intermediate level long-lived (waste)
ILO	International Labour Organization (UN)
IMDG	*Code International Maritime* Dangerous Goods Co
IN	Nuclear Inspection (EDF)
INCa	French National Cancer Institute
INERIS	French National Institute for the Study of Industrial Environments and Risks
INES	International Nuclear Event Scale
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 (comprising the regulators from Canada, France, Germany, Japan, Spain, Sweden, United Kingdom and the United States) – 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
IO	ITER Organization
IONISOS	company operating irradiation installations
IPA	Instrument for Pre-Accession Assistance (European Union)
IPN	French Nuclear Physics Institute – Orsay
IRCA	Cadarache irradiator (CEA)

IRE	National Radioelements Institute, Fleurus – Belgium
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
IS Ouest	*Institut de Soudure Ouest* (Welding Institute - West)
ISIS	research reactor (CEA – Saclay)
ISO	International Organisation for Standardization
ISOE	Information System on Occupational Exposure (OECD)
ISOTRON	company operating ionisation installations
IT	conventional safety inspection/conventional safety inspectorate
ITER	International Thermonuclear Experimental Reactor (to be installed in 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)
JAR	Joint Aviation Requirements (rules drafted by the JAA)
JAR-OPS	Joint Aviation Requirements-Operations (rules drafted by the JAA concerning aircraft operations)
JFR	French radiology days (annual conference organised by SFR) JNES
JNES	Japan Nuclear Energy Safety Organization (technical support organisation for the Japanese regulatory body)
JO	French Official Gazette
KEPCO	Kansai Electric Power Company (Japanese electricity production utility)
KEY	experimental sealing of drifts by pouring an “anchoring key” (ANDRA – Bure)
KINS	Korea Institute of Nuclear Safety (technical support organisation for the South Korean regulatory body)
KKU	Unterweser nuclear power plant (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)
LIL	low and intermediate level (waste)
LIL-SL	low or intermediate level short-lived (waste)
LL-LL	low level long-lived (waste)
LOLF	French constitutional bylaw on budget acts
LPC	Chemical Purification Laboratory (AREVA NC – Cadarache)
LUDD	Laboratories, Plants, Waste and Decommissioning
LURE	Electromagnetic Radiation Laboratory (CNRS – Orsay)
M€	mégaeuros (million euros)
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)
MBq	megabecquerel (million becquerels)
MCMF	central fissile material warehouse (CEA – Cadarache)
MDB	River authority
MDEP	Design Evaluation Programme (multinational initiative for which the NEA is secretary and Multinational which is designed to pool the knowledge of the regulatory bodies who will be responsible for regulatory assessment 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)
MEA	Management and Expertise Office (ASN)
MEAH	National mission for hospital appraisal and audit
MEDDTL	Ministry for Ecology, Sustainable Development, Transport and Housing (since November 2010)
MEEDDAT	Ministry for Ecology, Energy, Sustainable Development and Spatial Planning (from 2008 to June 2009)
MEEDDM	Ministry for Ecology, Energy, Sustainable Development and the Sea, in charge of Green Technologies and Climate Negotiations (since June 2009)
MELOX	MOX fuel fabrication plant (Marcoule)
MELUSINE	research reactor (CEA – Grenoble)
MEM	Moroccan Ministry of Energy and Mining
MERM	radiographer
METI	Japanese Ministry of Economy, Trade and Industry
Meuros	Million euros
MeV	megaelectron volt

MEXT	Ministry of Education, Culture, Sports, Science and Technology – Japan
MHI	Mitsubishi Heavy Industries, Ltd (Japanese company working in the nuclear power plant sector, among others)
MHPE	Maximum Historically Probable Earthquake
MIBI	methoxy isobutyl isonitrile (substance used in nuclear medicine)
MIMAUSA	History and impact of uranium mines: summary and archives – Programme for an inventory of uranium mining sites
MINEFI	Ministry of the Economy, Finance and Industry (from June 1997 to May 2007)
MINERVE	research reactor (CEA – Cadarache)
MIR	inter-regional fuel warehouses (EDF – Bugey and Chinon)
MMS	mobile emergency equipment
MoO3	molybdenum trioxide
MOST	Korean Ministry of Science and Technology (South Korean regulatory body)
MOX	mixed uranium and plutonium oxide fuel
MPL	maximum permitted levels (for radioactive contamination of foodstuffs or feedingstuffs)
MRI	magnetic resonance imaging
MSNR	Nuclear Safety and Radiation Protection Mission (MEEDDAT/DGPR)
MSR	Molten Salt Reactor
mSv	millisievert (thousandth of a sievert)
MWe	megawatt electrical (unit of electrical power)
N4	1450 MWe nuclear reactor series (EDF)
Natura 2000	All the natural sites protected by various European directives concerning birdlife and "natural habitats"
NCACG	National Competent Authorities' Coordinating 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	"centrale nucléaire européenne à neutrons rapides SA" company (former operator of Superphénix)
NF	French standard
nGy	nanogray (thousand millionth of a gray)
NII	Nuclear Installations Inspectorate (HSE – United Kingdom)
NISA	Nuclear and Industrial Safety Agency (METI – Japan)
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)
NRC	Nuclear Regulatory Commission (American regulatory body)
NRR	Office of 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)
NSCI	Nuclear Safety Cooperation Instrument (European Union)
NSSG	Nuclear Safety and Security Group (G8)
nSv	nanosievert (thousand millionth of a sievert)
NSWG	Nuclear Safety Working Group (G7)
NuPEER	Nuclear Pressure Equipment Expertise and Regulation (nuclear pressure vessel symposium)
NUSSC	Nuclear Safety Standards Committee (IAEA)
OA	approved organisation for supervision
OASIS	name of the ASN intranet
OBT	organically bound tritium
OECD	Organisation for Economic Cooperation and Development
OEEI	EDF project to "Obtain Installations in Exemplary Condition"
OHF	organisational and human factors
OPECST	Parliamentary Office for the Evaluation of Scientific and Technological Choices
OPPBTP	Occupational Risk Prevention Organisation for the Building and Civil Engineering Industries
OPS	see JAR-OPS
ORCADE	Project set up by AREVA NC for decommissioning of the La Hague installations
ORPHEE	research reactor (CEA – Saclay)
ORSEC	general plan organising the emergency services at departmental, defence 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)
P'4	second series of 1300 MWe nuclear reactors (EDF)
P4	first series of 1300 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)
PCC	Command and Control Post (evaluation of consequences and measures)
PCD	strategic management command post
PCL	local command post (installation operation)

PCM	logistic management command post
PCR	Person Competent in Radiation protection
PCS	Communal Disaster Contingency Plan
PDD	development plan (ANDRA)
PEGASE	spent fuel and radioactive substances interim storage installation (CEA – Cadarache)
PET	Positron Emission Tomography
PET-CT	Positron Emission Tomography combined with CT scanner
PETSCAN	Scan PET camera coupled with a scanner
PHARE	Poland and Hungary: Action for the Restructuring of the Economy (Programme of Community aid to the countries of Central and Eastern Europe)
PHEBUS	research reactor (CEA – Cadarache)
PHENIX	fast neutron reactor (CEA – Marcoule)
PHIL	linear electron accelerator (CNRS – Orsay)
PIRATOME	defence 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)
POPM	organisational plan in medical radiation physics
POSEIDON	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)
PRA	Probabilistic Risk Assessment
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)
PSA	PSA Peugeot Citroën group
PSAR	preliminary safety analysis report (BNI procedure)
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)
PuO2	plutonium oxide

PU-TMR	emergency plan for the transport of radioactive materials
PV	report, minutes of a meeting
PWR	Pressurised Water Reactor
R&D	Research and Development
R7	vitrification facility (AREVA NC – La Hague)
RADWASS	Radioactive Waste Safety Standards (AIEA)
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)
RBE	Relative Biological Efficiency
RCC	design and construction rules
RCC-E	RCC for electrical equipment
RCC-G	RCC for civil engineering
RCC-M	RCC for mechanical equipment
RCD	waste recovery and packaging
RCV	chemical and volume control system (PWR)
REC II	Reception, Shipment and Monitoring unit for uranium hexafluoride containers (Georges Besse II plant)
REDT	study and technological development reactor
RESERVOIR	aqueous radiaoctive effluent storage installation (CEA – Saclay)
REX	operating experience feedback
RFS	basic safety rule
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 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)
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)
RMT	radioactive material transport
RNA	ribonucleic acid
ROI	industrial tool renewal
ROTONDE (la)	solid waste management installation project (CEA – Cadarache)
RPII	Radiological Protection Institute of Ireland
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
RTGV	steam generator tube rupture
RTN	Rostekhnadzor Russian Federation regulatory body
RTRs	Research and Test Reactors (research reactors using fuel assemblies known as "aluminides")
RTSG	Radioactive Transport Study Group (IAEA working group)
RTV	main steam rupture
RUS	Louis Pasteur University reactor (Strasbourg)
RWMC	Radioactive Waste Management Committee (NEA)
SAFARI	South African nuclear reactor
SAMU	French Emergency Medical Service
SAPPRE	Reflex Phase Population Alert System
SARnet	European Severe Accident Research network
SATURNE	former particle accelerator (CEA – Saclay)
SCHAPI	Central Hydrometeorology and Flood Prediction Support Department – MEEDDAT/DGPR
SCR	Radiation Protection Department
SCWR	Supercritical Water Reactor
SD1, SD2…	Sub-Department 1, 2, etc. (former entities of ASN headquarters before the reform of 2006 ; these acronyms still figure in the references of ASN memos written prior to that date)
SDIS	Departmental Fire and Emergency Response Department
SEC	essential service water system (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 – sodium-cooled fast reactor
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 CEA research reactor (Grenoble)

SILOETTE CEA research reactor (Grenoble)

SIRCOM Communication Department (Ministry for the Economy, Finance and Industry)

SIRLaF International society of radiation biology in French language

SISE-Eau Environment-Water Health Information System

SISE-Habitat Environment-Habitat Health Information System

SISERI Ionizing Radiation Exposure Monitoring 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 Swedish Nuclear Power Inspectorate (Swedish regulatory body until 1 July 2008)

SL short-lived

SMP Sellafield MOX Plant (BNFL MOX fuel production plant in Sellafield)

SNCS *Société Normande de Conserve et de Stérilisation* (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)

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

SPECT-CT single-photon emission computed tomography combined with 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
SPS	Super Proton Synchrotron (CERN – Geneva)
SSE	Safe Shutdown Earthquake
SSI	Swedish Radiation Protection Authority (Swedish regulatory body until 1 July 2008)
SSM	*Sträl Säkerhets Myndigheten* (Swedish 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)
STC	Scientific and Technical Committee (EURATOM)
STD	waste treatment station
STE	– effluent treatment station – technical operating specifications
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	Radiation and Nuclear Safety Authority (Finnish regulatory body)
SÚJB	State Office for Nuclear Safety (Czech regulatory body)
SUPERPHENIX	Fast Breeder Reactor under decommissioning (Creys-Malville – Isère)
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 (EU)
TAR	cooling tower
TBq	terabecquerel (million million becquerels)
TDM	CT 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 (IRSN)
TENORM	Technologically Enhanced Naturally Occurring Radioactive Materials
TEPCO	Tokyo Electric Power Company (Japanese electric utility)
TGAP	General Tax on Polluting Activities
TID	total indicative dose
TMD	Transport of Dangerous Goods
TMP	Treatment of plutonium-bearing materials
TN 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)

TRANSAS	Transport Safety Appraisal Service (IAEA)
TRANSSC	TRANsport Safety Standards Committee (IAEA)
TRM	Transport of radioactive materials
TSN	TSN Act: Act of 13 June 2006 on transparency and security in the nuclear field
TU5	fuel cycle installation (COGEMA – Pierrelatte)
TVO	Teollisuuden Voima Oyj (Finnish electricity utility)
U3O8	uranium oxide (yellowcake)
UAlx	mixture of uranium and aluminium
UCD	Alpha Waste Conditionning Unit (AREVA NC – La Hague)
UF_4	uranium tetrafluoride
UF_6	uranium hexafluoride
ÚJD	Nuclear Regulatory Authority of the Slovak Republic (Slovak regulatory body)
UKEA	United Kingdom Environment Agency (England and Wales)
ULYSSE	"Teaching" reactor (CEA – Saclay)
UMo	uranium-molybdenum alloy
UMoSnAl	uranium-molybdenum-tin-aluminium alloy
UN	United Nations
UNECE	United Nations Economic Commission for Europe
UNGG	former French gas-cooled reactor technology
UNIE	Operation Engineering Unit (EDF)
UNSCEAR	United Nations Scientific Committee on the Effects of Atomic Radiation
UO2	uranium oxide
UO2(NO3)2	uranyl nitrate
UOX	uranium oxide
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)
USNRC	see NRC
UTE	*Union Technique de l'Electricité*
UTM	Monazite treatment unit
UTO	Central Technical Department (EDF)
VATESI	State Nuclear Power Safety Inspectorate (Lithuanian regulatory body)
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
VHL	Very High Level
VHTR	Very High Temperature Reactor
VLL	very low level (waste)
VP	partial inspection outage
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 Program (IAEA)
WENRA	Western European Nuclear Regulators' Association (extended in 2003 to all "nuclear" States that are members of the European Union or currently negotiating membership)
WGIP	Working Group on Inspection Practices (NEA)
WGWD	Working Group on Waste and Decommissioning (WENRA)
WHO	World Health Organization (UN)
WNTI	World Nuclear Transport Institute
WPAQ	Working Party on Atomic Questions (Council of the European Union)
www.asn.fr	address of the Nuclear Safety Authority website
XR	X-ray
ZGDS	solid waste management zone (CEA – Saclay)
ZGEL	liquid waste management zone (CEA – Saclay)
ZIIS	Surface Installations 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	Enhanced surveillance zone

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ASN report on the state of Nuclear Safety and Radiation Protection in France in 2010

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