AUTORITÉ DE SÛRETÉ NUCLÉAIRE

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Abstracts

ASN REPORT

on the state of nuclear safety and radiation protection in France in 2016

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AUTORITÉ DE SÛRETÉ NUCLÉAIRE

The ASN (Nuclear Safety Authority)
presents its report on the state of nuclear safety and radiation protection in France in 2016.

This report is required by Article L. 592-31 of the Environment Code.

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

SUMMARY

From left to right

Margot TIRMARCHE - Commissioner
Pierre-Franck CHEVET - Chairman
Lydie ÉVRARD - Commissioner
Sylvie CADET-MERCIER - Commissioner
Philippe CHAUMET-RIFFAUD - Commissioner

On the whole, 2016 was satisfactory despite a worrying context

Montrouge, 14th March 2017

The year was marked by the detection of a serious generic anomaly. Eighteen EDF reactors were potentially affected by excess carbon in the steel used in the manufacture of the steam generators. Specific checks were ordered by ASN on all these reactors and five of them had to be shut down early.

This is not the first time this type of generic anomaly has been found: for the French electrical system, it confirms the need to ensure that there is sufficient margin to deal with the shutdown of several reactors following the detection of a generic anomaly.

In addition, irregularities dating back to the manufacture of large reactor components have been detected in the Creusot Forge plant. Numerous design and manufacture conformity deviations were also found during the periodic safety reviews on the installations.

These findings mean that:
- In the future, for new constructions and modifications made to existing facilities, improvements are necessary in design, manufacturing and installation, as well as in the corresponding inspections. This is now a priority in the light of the major work that would be necessary to extend the operating service life of the older facilities.
- With regard to past activities, the historical manufacturing review initiated by Areva must be completed and the conformity deviations remedied during the periodic safety reviews.

This complex situation must give rise neither to denial, nor to defeatism: denial of the scale and even sometimes the reality of the problems observed; defeatism which would discourage the completion of the necessary manufacturing reviews, or undermine the motivation of those involved in safety on a day to day basis.

This situation demands that both the consequences and causes of anomalies and irregularities be identified and dealt with: this is the absolute pre-requisite for consolidating nuclear safety.

Apart from these anomalies or irregularities, the operating safety of Basic Nuclear Installations (BNI) was on the whole maintained at a high level, although particular vigilance is still required in the field of radiation protection, particularly for the medical sector, in which four level 2 incidents occurred in 2016.

This assessment of 2016, with its positive and negative points, comes at a worrying time:
- Safety and radiation protection challenges will grow over the period 2017-2020:
  - The evaluation of the continued operation of the 900 MWe reactors beyond their fourth safety review is a key issue. ASN will issue a generic opinion in 2019 on this subject after analysis of the studies yet to be produced by EDF.
  - The other main nuclear installations, in particular fuel cycle installations and research reactors, will undergo a periodic safety review during the same period. By the end of 2017, ASN will have received about fifty review files for analysis.
  - Deployment of the post-Fukushima improvements will need to be continued, more particularly with regard to the fixed equipment of the "hardened safety core" supplementing the mobile means already in place.
  - The projects or construction sites for new installations, EPR, *Cigéo*, *Réacteur Jules Horowitz* (RJH), ITER are behind schedule. Safety is not generally a factor, except for the Flamanville EPR vessel anomaly, which is being given special treatment.
- The main industrial firms, Areva, CEA, EDF, who hold prime responsibility for the safety of their installations, are experiencing economic or financial difficulties. Wide-reaching reorganisations are in progress. Time will be needed for them to take full effect.
- For 2017, ASN and the Institute for Radiation protection and Nuclear Safety (IRSN) obtained additional staff, although the personnel levels are still inadequate for dealing with these issues comprehensively. A situation such as this is not however sustainable and ASN is once again asking for a review of the financing of safety

regulation, to enable it to have appropriate resources tailored to its needs and those of IRSN.

This worrying context must encourage all stakeholders to exercise the greatest vigilance to ensure that safety remains a priority. For its part, ASN will be attentive to the technical and financial capacity of the industrial firms, as well as to ensuring that they maintain in-house skills that are vital for safety. It will in particular ensure that the necessary safety investments are actually made.

* * *

Towards the harmonisation of nuclear safety and radiation protection in Europe

At the European level, three Directives on nuclear safety, waste management and radiation protection were adopted or updated in recent years.

European harmonisation of safety and radiation protection remains a priority for ASN, which is actively involved in the work of ENSREG[1], WENRA[2] and HERCA[3].

In 2018, a comparative review of reactor ageing management practices will be carried out in Europe. The framework of the review was defined in 2016 and ASN will draft the French report in 2017 for subsequent inclusion in this review.

ASN is heavily committed to the harmonisation and coordination of emergency situations management in Europe. In 2017, three emergency exercises are scheduled to test cross-border coordination.

The continued operation of ageing installations is a major issue

The first of the fourth ten-yearly outage inspections will take place in 2019. It will be a challenge on the one hand for industry – which will have to conduct the studies and then carry out the necessary work and on the other for ASN and IRSN – which will have to analyse the proposals and then check the modifications actually made.

ASN intends to issue a generic opinion in 2019 on the continued operation of the 900 MWe reactors beyond forty years. This opinion will be drafted with the participation of the public. The periodic safety reviews of each 900 MWe reactor, which will lead to a public inquiry, will then be staggered until 2030. Furthermore, following the Fukushima Daiichi accident, ASN prescribed the deployment of a "hardened safety core". This comprises mobile equipment which, in the event of an accident, can be connected to the installation, along with fixed equipment. This mobile equipment has already been fully deployed in France. The fixed equipment, which requires a large number of studies and a significant production lead-time, will be deployed during the course of the next periodic safety reviews.

Installations other than power reactors cover a wide variety of activities: research, fuel cycle, waste management, production of radiopharmaceuticals and industrial irradiators, etc. These installations are mainly ageing. Several dozen of these installations will have to undergo a periodic review, often for the first time. For both ASN and IRSN, this already means a considerable increase in the workload, which will only get heavier in the coming years. An analysis approach proportionate to the safety issues is being set up to deal with this.

In any case, ASN will ensure that the safety improvements (earthquake resistance, fire protection, etc.) prescribed further to these reviews are actually carried out, despite the economic, financial and budget constraints faced by the licensees.

During the first periodic safety review of the UP3 plant on the La Hague site, which began in 2010, ASN asked Areva to examine the conformity and ageing of the evaporators used to concentrate the fission products. This led to the identification of faster than anticipated corrosion on this equipment. ASN thus set operating conditions to limit the phenomenon and specified more frequent corrosion measurements. Depending on the results of these measurements, ASN may be obliged to require shutdown of the facility. In 2016, Areva proposed the safety options for new evaporators, which could enter service in 2021.

Pressure equipment: a worrying situation

In 2005, regulations reinforced the requirements regarding verification of nuclear pressure equipment conformity. In 2015, these reinforced checks led to the detection of significant excess carbon in certain parts of the Flamanville EPR reactor vessel: ASN will issue a position statement on the serviceability of the vessel in mid-2017.

An anomaly of the same type was subsequently also identified on certain steam generators of 18 reactors in operation. Five of these reactors have been shut down early, at ASN's request, so that the necessary inspections could be carried out. Based on the results of these inspections, ASN was able to authorise restart of these reactors, subject to restrictions on their operating conditions.

Following the EPR vessel anomaly, ASN asked for a historical review of the quality of past manufacturing in the Creusot Forge plant. This has already led to the detection of major irregularities: "concealed" files showing anomalies hidden from the customer and the regulatory authority and the suspected falsification of measurement

1. *European Nuclear Safety Regulators Group.*
2. *Western European Nuclear Regulators Association.*
3. *Heads of the European Radiological protection Competent Authorities.*

or examination reports. In 2016, these irregularities already led to the shutdown of Fessenheim reactor 2 and the extension of the shutdown of Gravelines reactor 5. The review is scheduled to continue: the anomalies identified will be processed. Thought is already being given as to how to better prevent and detect this type of irregularity during manufacturing checks.

EPR, an advanced design but a difficult birth

The Flamanville EPR reactor is a "Generation III" pressurised water reactor, offering a significantly higher level of safety than the reactors currently in service. The EPR in particular offers greater protection against external hazards and increased means of mitigating the consequences of accidents with core melt.

ASN underlines the fact that EDF still needs to carry out significant work before start-up, to examine the serviceability of the nuclear pressure equipment, the vessel in particular and, more generally, to guarantee the performance of the safety systems.

The industrial contractors must learn the lessons of the difficulties encountered on the Flamanville EPR, in terms of design, manufacturing and construction.

Improved protection of the population in the event of an accident

In 2016, the Government decided to extend the scope of the Off-site Emergency Plans (PPI) triggered by the public authorities in the event of an accident from 10 to 20 km around the NPPs. This decision is consistent with the proposal from the European radiation protection and safety authorities (HERCA and WENRA) to harmonise measures to protect the populations in the event of a severe accident. Interministerial work is now required to define the practicalities of this extension.

In 2016, a new national distribution campaign for iodine tablets, supervised by ASN, was launched for the populations located within the zone around the NPPs covered by the current PPIs. This campaign was an opportunity to raise awareness of the nuclear risk among the persons concerned.

The increasing urban development around BNIs requires particular vigilance, in order to maintain the effectiveness of the population protection measures contained in the contingency plans, more specifically their evacuation. ASN is thus consulted on urban development projects around BNIs and published a guide on this subject in 2016.

Decommissioning, complex operations taking longer than expected

The decommissioning of a Basic Nuclear Installation (BNI) is a lengthy and complex operation involving risks. To date, about thirty BNIs of all types have been shut down or are undergoing decommissioning in France.

In 2016, for technical reasons, EDF stated that it intended to change its decommissioning strategy for the Gas-Cooled Reactors (GCR). This means that EDF is proposing to postpone their decommissioning by several decades. In July 2016, ASN asked EDF to optimise its industrial process in order to comply with the principle of decommissioning within a time-frame that is as short as possible, as stipulated by the Environment Code.

CEA will also be decommissioning a number of civil or defence-related BNIs. In general, ASN observes significant delays in the performance of decommissioning operations. This situation is prejudicial to safety. At the request of ASN and the Defence Nuclear Safety Regulator (ASND), CEA proposed its new decommissioning strategy at the end of 2016. It will be the subject of a joint position statement to be issued by ASN and ASND in 2018, at which time the adequacy of the human and budget resources allocated to these operations will be closely examined.

In June 2016, Areva transmitted its decommissioning strategy for the installations concerned on the La Hague and Tricastin sites, and it will be reviewed in 2017 for a position statement to be issued in 2018.

Radiotherapy and interventional imaging: two priorities for radiation protection

As part of the process to transpose the European Radiation Protection Directive, ASN will ensure that the requirements are appropriate to the potential consequences of medical activities. ASN also intends to issue resolutions on quality assurance in medical imaging, on continuing training of professionals in the field of radiation protection of persons exposed to ionising radiation for medical purposes and on the "diagnostic reference levels".

ASN maintains its inspection priorities in radiotherapy and interventional imaging. In these two fields, ASN will ensure that the preliminary risk assessment is reinforced, as a result of changes, both technological and organisational, and will focus in particular on the adequacy of the human resources allocated to these activities. In interventional imaging, optimisation of the doses received by the patients on the one hand and by the professionals on the other, in particular with regard to the lens of the eye, remains the main objective.

The growth of new imaging techniques implies greater initial and continuing radiation protection training for the entire medical profession.

Radon, measures to protect exposed individuals

For the French population, radon is the leading source of exposure to ionising radiation of natural origin: about 20% of the French population is potentially exposed to radon. After tobacco, this gas is the second risk factor for developing lung cancer.

The home is the main location for exposure to radon. *The 2016-2019 National Radon Action Plan,* published by ASN in January 2017, gives priority to raising the awareness of the public and the main players concerned by the radon risk. In addition, the law requires mandatory information of persons buying or renting property in the *départements* with a high radon risk.

Furthermore, for facilities open to the public and for the workplace, ASN assists the local authorities and employers with measurement of the radon concentration. It also takes part in the transposition of the European Radiation Protection Directive into French law, which will more particularly allow improved monitoring of annual occupational exposure.

Important decisions for waste disposal are to be made in the near future

It is intended that long-lived, high and intermediate level waste will eventually be disposed of in the *Cigéo* underground facility. Act 2016-1015 of 25th July 2016 set the reversibility conditions for such a repository which shall, on the one hand, be able to adapt to changes in energy policy (for example, disposal of spent fuels as-is) and, on the other, allow recovery of waste packages already emplaced in the repository. In 2017, ASN will rule on the safety options for this repository, taking account of the conclusions of the peer review conducted under the supervision of the International Atomic Energy Agency at the end of 2016. On these bases, a *Cigéo* creation authorisation application should be submitted in 2018.

The production of very low level radioactive waste will rise significantly with the future decommissioning of the current fleet of NPPs. In order to minimise transport traffic, might it not be wise to envisage several regional repositories rather than a single centralised facility? ASN considers that a public debate needs to be held on this subject.

As the commissioning calendar for the repositories for such waste remains uncertain, storage capacity for these wastes must be increased. More specifically with regard to spent fuels, ASN considers that the licensees must anticipate saturation of the storage capacity in the NPPs or the pools in the Areva plant in La Hague: the safety options for a new centralised pool will be examined soon.

More efficient oversight, but greater resources are still needed

The Energy Transition for Green Growth Act marked a significant step forward for safety and radiation protection. ASN's duties and powers have been extended - more particularly to include oversight of the protection of sources against malicious acts - and the role of IRSN has been reinforced. This Act also consolidated the Local Information Committees and more generally the provisions concerning the information and involvement of the citizens.

ASN and IRSN also obtained an increase in their oversight and assessment resources in the 2015-2017 three-year budget Plan. ASN restates the need for financing of its human resources that is in keeping with the unprecedented nuclear safety and radiation protection challenges.

The Nuclear Safety Authority (ASN)

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

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

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

Competence
Independence
Rigour
Transparency

ASN

Its roles

Regulating
ASN contributes to drafting regulations, by giving the Government its opinion on draft decrees and Ministerial Orders, or by issuing statutory resolutions of a technical nature.

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

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 oversight, although it also has appropriate powers of enforcement and sanction.

Informing
Primarily through its website *www.asn.fr* and its *Contrôle* magazine, ASN informs the public and the stakeholders (Local Information Committees, environmental protection associations, etc.) of its activities and the state of nuclear safety and radiation protection in France.

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

Regulation and monitoring of diverse activities and facilities

Nuclear power plants, radioactive waste management, nuclear fuel shipments, packages of radioactive substances, medical facilities, research laboratories, industrial activities, etc. ASN oversees an extremely varied range 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 substances nationwide, every year.

The support of experts

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

Its organisation

The Commission

The Commission defines ASN general policy regarding nuclear safety and radiation protection. It consists of five Commissioners, including the Chairman.

Pierre-Franck CHEVET **Chairman**	Philippe CHAUMET-RIFFAUD **Commissioner**	Sylvie CADET-MERCIER **Commissioner**	Lydie ÉVRARD **Commissioner**	Margot TIRMARCHE **Commissioner**
DATE APPOINTED				
12th November 2012 for 6 years	10th December 2014 for 6 years	21st December 2016 for 6 years	10th March 2017 for 6 years	12th November 2012 for 6 years
APPOINTED BY				
President of the Republic			President of the Senate	President of the National Assembly

Impartiality

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

Independence

The Commissioners perform their duties on a full-time basis. Their mandate is for a six-year term. It is not renewable. The duties of a Commissioner can only be terminated in the case of impediment or resignation duly confirmed by a majority of the Commissioners. The President of the Republic may terminate the duties of a member of the Commission in the event of a serious breach of his or her obligations.

Competencies

The Commission issues resolutions and publishes opinions in ASN's *Official Bulletin*. The Commission defines ASN external relations policy both nationally and internationally. The Commission defines ASN regulatory policy. The Chairman appoints the nuclear safety inspectors, the radiation protection inspectors, the health and safety inspectors for the nuclear power plants and the staff responsible for verifying compliance with the requirements applicable to pressure vessels. The Commission decides whether to open an inquiry following an incident or accident. Every year, it presents the ASN *Report on the state of nuclear safety and radiation protection in France* to Parliament. Its Chairman reports on ASN activities to the relevant commissions of the French Parliament's National Assembly and Senate as well as to the Parliamentary Office for the Evaluation of Scientific and Technological Choices. The Commission drafts ASN internal regulations and appoints its representatives to the High Committee for Transparency and Information on Nuclear Security.

Commission figures in 2016

76 sessions

32 opinions

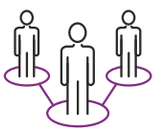
42 resolutions

Headquarters and the regional divisions

ASN comprises a headquarters 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 headquarters are organised thematically and are responsible at a national level for their fields of activity. The ASN regional divisions operate under the authority of the regional representatives, appointed by the ASN Chairman. They are ASN's representatives in the regions and contribute locally to ASN's public information role. The divisions carry out most of the direct inspections on nuclear facilities, radioactive substances transport operations and small-scale nuclear activities. In emergency situations, the divisions assist the Prefect of the *département**, who is in charge of protecting the general public, and supervise the operations carried out to safeguard the facility on the site.

* Administrative region headed by a Prefect.

Key figures in 2016



483 staff members

82 % management

294 inspectors

1,793 inspections

of nuclear facilities, of shipments of radioactive substances, of the medical, industrial and research sectors, of approved organisations

18,350 inspection follow-up letters

available on *www.asn.fr*
as at 31st December 2016

395 technical opinions

sent to ASN by IRSN

25 Advisory Committee meetings

2,820 authorisations and licenses

20 press conferences

27 press releases

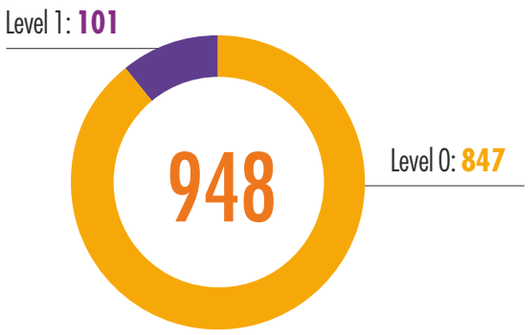
72 information notices

7 emergency exercices

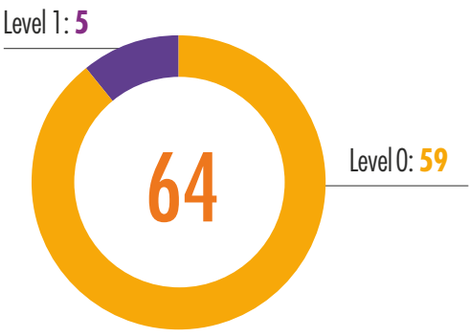
€80.79 million
total budget for ASN

€85 million
IRSN budget devoted to expert appraisal work on behalf of ASN

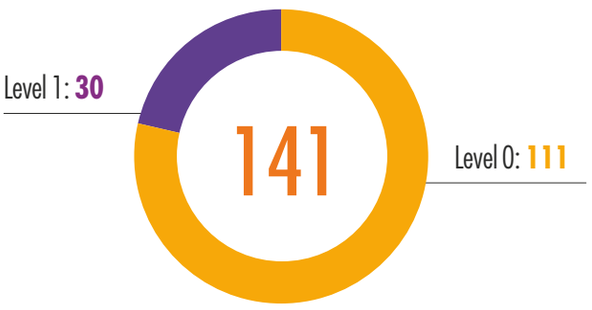
Number of significant events rated on the INES scale* in 2016



Basic Nuclear Installations



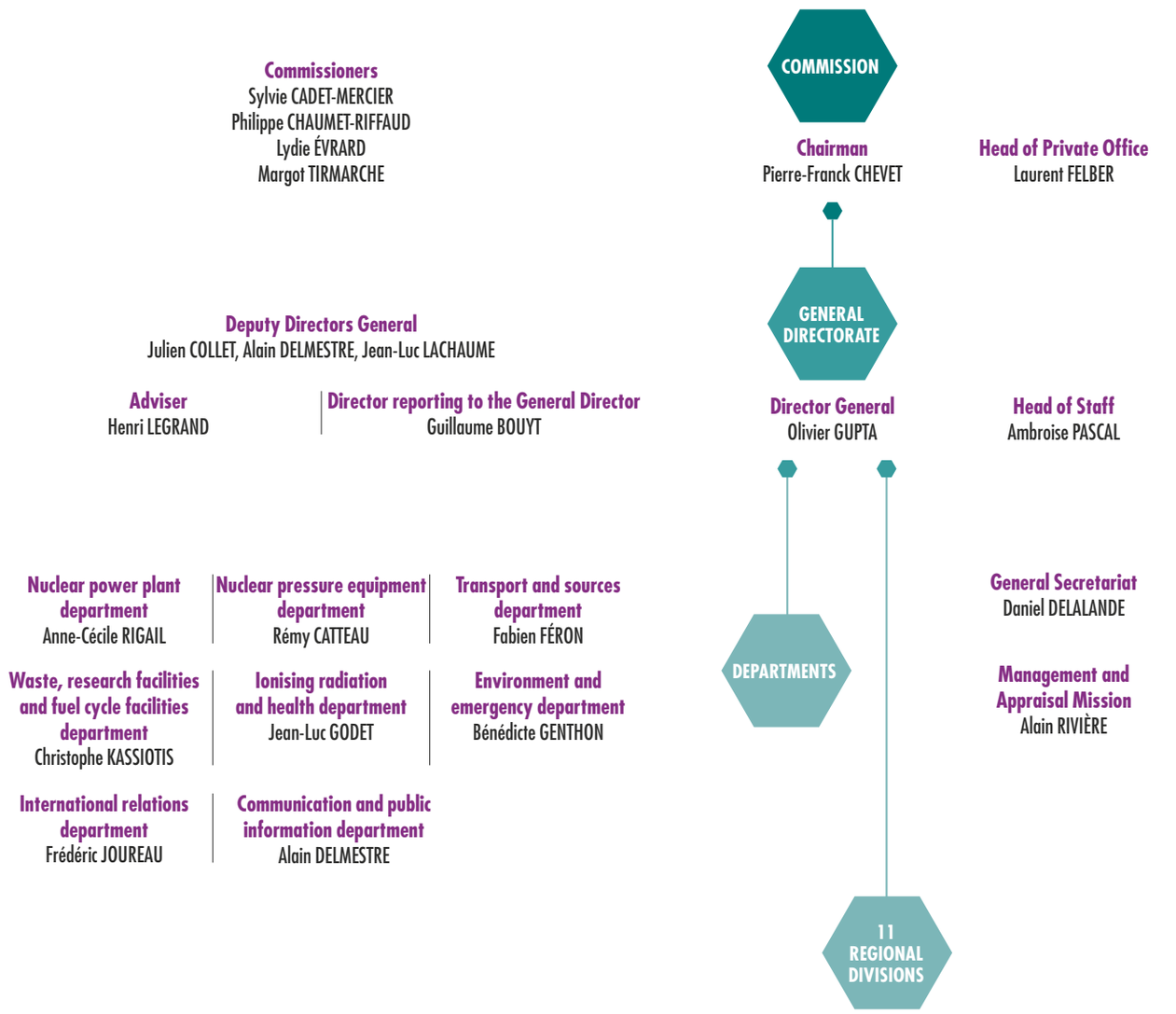
Transport of radioactive substances



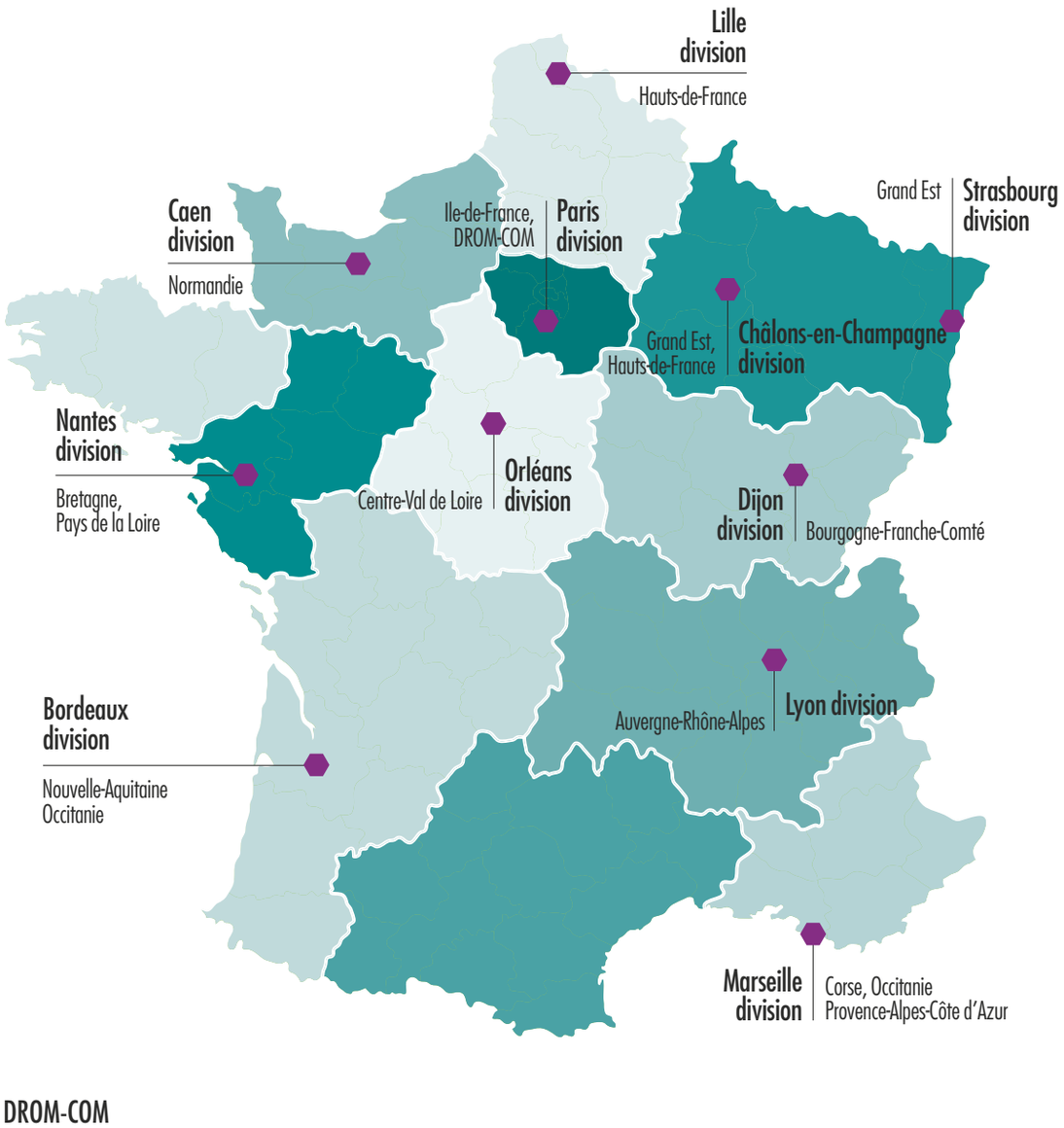
Small-scale nuclear activities (medicine and industry)

* INES : *International Nuclear and Radiological Event Scale*

ASN organisation chart as at 14th March 2017



ASN in the regions



DROM-COM

Division Caen and Orléans respectively involved in the Bretagne region and Ile-de-France region for control of the only BNIs.

In a difficult context, **stringency and serenity** underpin all ASN resolutions

Olivier GUPTA - Director General

Montrouge, 14th March 2017

In the current context, with its numerous tensions and decisions with significant implications, ASN ensures that its operations enable it to issue resolutions that are balanced, robust and taken with collective responsibility.

ASN has modified its regional organisation to ensure greater legibility for all stakeholders and is enhancing its efficiency in order to focus its resources on activities with the greatest nuclear safety and radiation protection implications.

Finally, following ten years during which the regulatory framework has been considerably reinforced, ASN is conducting a review in 2017 of its responsibilities and of the future development of its oversight procedures.

The operation of ASN

In the current situation, the correct working of ASN and its technical support organisation, IRSN, is decisive.

ASN intends first of all to continue to work with rigour, based on methodical technical assessments and with reference to regulatory requirements and, more generally, to the nuclear safety and radiation protection objectives; with perseverance, seeing its investigations through to completion; with calm and serenity, without ignoring the context but at the same time without giving way to precipitation. This is what ASN did in 2016, more particularly on the most sensitive subjects such as the carbon content anomaly on certain steam generator channel heads.

ASN also aims to preserve its ability to produce collective resolutions, so that they do not rely on a single person and so that each link in the decision-making chain contributes its own competence and expertise. This method of operation is valid, including at the highest level, because the most important decisions do not rest on a single person, but on a commission, as required by law.

Abstracts ASN report on the state of nuclear safety and radiation protection in France in 2016

Finally, ASN and IRSN must continue to work smoothly at all levels, each within its own field. The joint ASN-IRSN approach in place since 2014 to assess the means needed for oversight and assessment is thus particularly welcome. With regard to day to day operations, the 2016 audit of the implementation of the convention governing relations between ASN and IRSN underlined the quality of the relationship, while identifying avenues for progress that ASN and IRSN will be implementing as of 2017.

Organisation

In 2016, ASN will have completed the majority of its review of the regional reforms. On the basis of the principles set out by the Commission, the discussions with the personnel and their representatives led to the best possible arrangement, which can be implemented in 2017. This was a major milestone. The geographical scope of competence of ASN's 11 regional divisions is now more consistent with the boundaries of the new administrative regions, leading to greater legibility for ASN's contacts in the regions.

Means and efficiency

For several years now, ASN has been working on enhancing the efficient use of its resources, to ensure oversight that is both effective and commensurate with the issues at stake. 2016 thus saw the adoption of the system of BNI classification according to the risks they present: the nature and scale of oversight measures, the degree of detail of investigations and the hierarchical level of the signature of documents concerning an installation are thus adapted to its nuclear safety and radiation protection implications. This work will continue in 2017, more specifically with the drafting of a statutory resolution to clarify the system for BNI modifications, to ensure that it is more closely tailored to the corresponding implications.

ASN has initiated a wide-ranging review of the system authorising and regulating activities in small-scale nuclear facilities. The aim is more specifically to examine how this system needs to be changed to boost its efficiency, on the basis of an approach proportionate to the risks, taking account of ongoing legislative and regulatory changes related to the transposition of the Directive on Basic Radiation Protection Standards. By means of a statutory resolution, ASN will more particularly specify the scope of application of the notification, registration and authorisation systems.

Finally, with a view to simplifying matters for those in charge of nuclear activities and making administrative processing easier, ASN opened its electronic notification portal in 2016. It is first of all operational for companies notifying transports of radioactive materials and in 2017 will be broadly expanded to include all activity files requiring notification in the small-scale nuclear sector and for notification of significant events.

Checks and inspections

The considerable reinforcement of the legislative and regulatory framework over the past ten years means that the nuclear safety and radiation protection oversight system is far better placed to deal with the current challenges.

ASN now has appropriate enforcement powers, reinforced by the Ordinance of 11th February 2016. One example of these powers is that in 2016 it succeeded in obtaining conformity of the CIS bio international facility with regard to the fire risk. ASN will continue to use these measures whenever required, with discernment and conviction.

A body of orders, resolutions and guides clarifies and stabilises the requirements so that those responsible for nuclear activities have a clearer understanding of the objectives and the acceptable means of achieving them. The procedures are also more clearly defined.

The legislative and regulatory framework promotes not only transparency but also public participation. The role of the Local Information Committees (CLI) in public information has been reinforced and ASN urged each CLI to hold meetings open to the public, as required by law. ASN contributes to the process started in 2016 and which will continue in 2017, under the supervision of the High Committee for Transparency and Information on Nuclear Safety (HCTISN), in order to clarify the public consultation procedures on the occasion of the fourth ten yearly outage inspections of the NPPs.

Finally, a formal framework for work at the European level was also finalised: in 2017, ASN will host an IRRS (Integrated Regulatory Review Service) follow-up mission, under the peer review system made mandatory in Europe. It will participate actively in preparing for a topical peer review on the management of reactor ageing.

ASN's independence and powers give it a high level of responsibility in the implementation of oversight, especially at a time of major challenges. The current situation requires

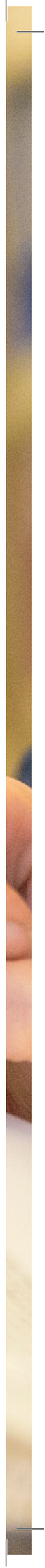
that ASN take a questioning look at its responsibilities, role and position, from three perspectives:

- Despite the difficulties they are experiencing, how does ASN ensure that the licensees fully exercise their responsibility for nuclear safety and radiation protection?
- How does ASN exercise in full its role as architect of the oversight system, of which IRSN is a part? It is more particularly up to ASN, with the support of IRSN, to continue to specify oversight priorities, whether in the field or in terms of analysis of files.
- How can ASN reinforce the effectiveness of its actions in a manner commensurate with the issues and challenges? The aim is more specifically to advance oversight so that it is better able to detect fraudulent situations, while recognising that this can never be exhaustive and that the presence of ASN inspectors in the field remains a crucial aspect of the system.

ASN intends to continue to examine these subjects in 2017 within the context of preparation of its new multi-year strategic plan. The goal is to define a new direction for ASN, in a difficult context in which ASN must fully exercise the responsibilities entrusted to it by the legislator.

* * *

I wish to thank all ASN personnel for their commitment in carrying out ASN's duties in 2016. I know that I can rely on them to meet the challenges facing ASN in 2017.



Significant events

in 2016

01 Nuclear activities: ionising radiation and health and environmental risks

Ionising radiation may be of natural origin or caused by human activities, referred to as nuclear activities.

The exposure of the population to naturally occurring ionising radiation is the result of the presence of radionuclides of terrestrial origin in the environment, radon emanations from the ground and exposure to cosmic radiation.

Nuclear activities are activities entailing a risk of exposure to ionising radiation, emanating either from an artificial source or from natural radionuclides. These nuclear activities include those conducted in Basic Nuclear Installations (BNIs) and the transport of radioactive substances, as well as in all medical, veterinary, industrial and research facilities where ionising radiation is used.

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

The effects of ionising radiation on living beings can be "deterministic" (health effects such as erythema, radiodermatitis, radionecrosis and cataracts, which are certain to appear when the dose of radiation received exceeds a certain threshold) or "probabilistic" (probability of occurrence of cancers in an individual, but no certainty). The protective measures against ionising radiation aim to avoid deterministic effects, but also to reduce the probability of occurrence of radiation-induced cancers, which constitute the main risk.

Understanding the risks linked to ionising radiation is based on health monitoring (cancer registers), epidemiological investigation and risk assessment via extrapolation to low doses of the risks observed at high doses. There are still however numerous uncertainties and unknowns, in particular with regard to radio-sensitivity, certain radiation-related diseases at high doses, the effects of low doses, the radiological signature of cancers and certain non-cancerous diseases.

Exposure to ionising radiation in France

The entire French population is potentially exposed to ionising radiation, but to differing degrees, depending on whether the ionising radiation is of natural origin or the result of human activities.

On average, the exposure of an individual in France was estimated by the French Institute for Radiation Protection and Nuclear Safety (IRSN) at 4.5 millisieverts (mSv) per year in 2015, varying by a factor of from 1 to 15 depending on the location, the eating habits, the medical exposures, etc.; the sources of this exposure are as follows:

- For about 2.9 mSv/year, naturally occurring radioactivity, including 0.6 mSv/year for radiation of telluric origin (excluding radon), 0.3 mSv/year for cosmic radiation, 0.6 mSv/year for internal exposure from food and tobacco, and about 1.4 mSv/year, for radon, with considerable variation related to the geological characteristics of the land (a new map of the country was produced in 2011 according to the radon exhalation potential) and to the buildings themselves; in zones defined as high-priority, periodic measurements must be taken in places open to the public and in the workplace. A national action plan for the period 2011-2015 has been implemented; its results and a new plan for the period 2016-2019 were published.
- For about 1.6 mSv/year (estimate for 2012), diagnostic radiological examinations, with a clear upwards trend (+ 23% from 2007 to 2012); particular attention must thus be paid to controlling the doses delivered to patients.
- For about 0.02 mSv/year, the other artificial sources of exposure: past airborne nuclear tests, accidents affecting facilities, releases from nuclear installations.

Nuclear activity workers undergo specific monitoring (more than 350,000 individuals in 2015); in 2015, the annual dose remained below 1 mSv (annual effective dose limit for the public) for 96% of the workforce monitored, while 20 mSv (regulation limit for nuclear workers) was exceeded for two individuals; the collective dose has fallen by about 50% since 1996 while the population monitored has grown by about 60%. For workers in activity sectors entailing technological enhancement of naturally occurring radioactive materials, the doses received in 85% 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, 83% are between 1 mSv per year and 5 mSv per year, while 17% are below 1 mSv per year.

Outlook

For occupational radiation protection, the main objectives for the coming years concern compliance with the new exposure limit for the lens of the eye (set at 20 mSv/year as of 2017), more specifically in the field of interventional practices.

2017 will also be marked by the deployment of the 2016-2019 Third National Action Plan for management of the risk related to radon.

02 Principles and stakeholders in the regulation of nuclear safety and radiation protection

Nuclear activities must be carried out in compliance with the eight fundamental principles of the Environment Charter, the Environment Code and the Public Health Code.

- the principle of nuclear licensee responsibility for the safety of its facility;
- the "polluter-pays" principle: the polluter responsible for the environmental damage bears the cost of pollution prevention and mitigation measures;
- the precautionary principle: the lack of certainty, in the light of current technical and scientific knowledge, should not delay the adoption of proportionate prevention measures;
- the participation principle: the populations must take part in drafting public decisions;
- the justification principle: a nuclear activity may only be carried out if justified by the advantages it offers by comparison with the exposure risks it can create;
- the optimisation principle: exposure to ionising radiation must be kept as low as is reasonably achievable;
- the limitation principle: the regulations set an individual's ionising radiation exposure limits as a result of a nuclear activity;
- the prevention principle: anticipation of any environmental damage through rules and actions taking account of the *"best available techniques at an economically acceptable cost"*.

The safety approach, governed more particularly by the ten fundamental principles of the International Atomic Energy Agency (IAEA), is characterised by the requirement for continuous improvement.

The nuclear activity regulators

The French nuclear safety and radiation protection oversight organisation is defined more specifically in the Environment Code. It was reinforced more recently by the 17th August 2015 Energy Transition for Green Growth Act (TECV) and the Ordinance of 10th February 2016 containing various nuclear-related provisions.

Parliament defines the applicable legislative framework and monitors its implementation, more particularly via its specialist committees or the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST) to which ASN presents its report each year on the state of nuclear safety and radiation protection in France.

On the advice of ASN, the Government defines the general regulations for nuclear safety and radiation protection. Again on the advice of ASN, it also takes major individual decisions concerning BNIs (creation authorisation, etc.). It is responsible for civil protection in an emergency.

In the current governmental organisation, the Minister for the Environment, Energy and the Sea, responsible for international climate

relations, is responsible for nuclear safety and, together with the Minister for Social Affairs and Health, for radiation protection.

In each *département*, the Prefect – as the State's representative – is responsible for population protection measures. The Prefect is also involved during various procedures to oversee local coordination and provide the Ministers or ASN with an opinion.

ASN is an independent administrative Authority. It is tasked with regulating nuclear activities and contributes to public information. It sends the Government proposals for regulatory texts and is consulted on the texts prepared by the Ministers. It clarifies the regulations through statutory resolutions. It issues certain individual authorisations and proposes others to the Government. Nuclear activities are monitored and inspected by the ASN staff and by organisations duly authorised by ASN. If noncompliance is detected, ASN may adopt enforcement measures and apply sanctions. ASN

contributes to France's European and international actions within its areas of competence. Finally, it provides its assistance for management of radiological emergencies.

On technical matters, ASN relies on the expertise provided by IRSN and by the Advisory Committees of Experts. ASN also convenes pluralistic working groups enabling all the stakeholders to contribute to drafting doctrines and action plans and monitor their implementation.

ASN is also committed to the field of research, in order to identify areas requiring further investigation in order to meet the medium to long term expert assistance requirements. It has set up a Scientific Committee.

ASN is run by a Commission of five full-time, irrevocable Commissioners, nominated for a non-renewable 6-year mandate by the President of the Republic (who appoints the President and two commissioners), the President of the Senate and the President of the National Assembly.

A sanctions committee within ASN, established under the TECV Act, is responsible for the application of administrative fines in the event of any breach of the regulations.

ASN has head office departments and eleven regional divisions around the country. Its total workforce stands at 483 employees. In 2016, the ASN budget stood at €80.79 million. Moreover, about 400 IRSN staff work on providing ASN with technical support. In 2016, IRSN thus devoted €85 million to this work, equally funded by a subsidy from the State and revenue from a tax paid by the licensees of the large nuclear installations.

In total, the State's budget for transparency and the regulation of nuclear safety and radiation protection amounted to €176.54 million in 2016.

Consultative bodies

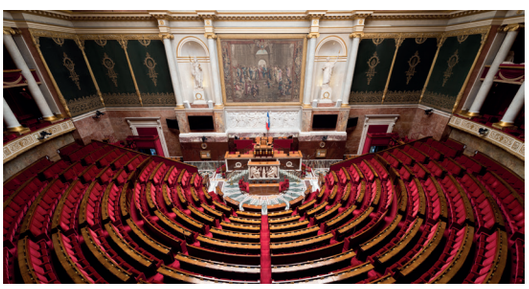
The organisation of nuclear security and transparency is also based on consultative bodies, in particular the High Committee for Transparency and Information on Nuclear Security (HCTISN), an information, consultation and debating body dealing with the risks linked to nuclear activities, the High Council for Public Health (HCSP) which contributes to the definition of multi-year public health objectives, evaluates the attainment of national public health targets and contributes to their annual monitoring, as well as the High Council for the Prevention of Technological Risks (CSPRT) tasked with giving an opinion on some draft regulatory texts. For each BNI, consultation takes place within a Local Information Committee (CLI).

Outlook

Faced with unprecedented challenges, ASN considers that a significant reinforcement of its human and financial resources and those of IRSN is essential. Despite the decisions that have gone in its favour (creation of 50 additional posts for 2015-2017), it remains preoccupied by the inadequacy of these budgetary measures.

In 2017, ASN will continue to monitor stakeholder involvement and seek to reinforce guarantees of the independence of its assessment work and the transparency of its decision-making process.

03 Regulations



The specific legal framework for radiation protection and nuclear activities is based on the international norms, standards or recommendations drawn up by various organisations, in particular the International Commission for Radiological Protection (ICRP), a non-governmental organisation, the International Atomic Energy Agency (IAEA) and the International Standard Organisation (ISO).

At a European level, under the EURATOM Treaty, various directives concern nuclear safety and radiation protection, in particular Council Directive 2013/59/Euratom setting the basic standards for health protection against the dangers arising from exposure to ionising radiation and Council Directive 2009/71/Euratom of 25th June 2009 setting a community framework for the nuclear security of nuclear installations.

At the national level, the Public Health Code defines general population protection rules (dose limits for the public, etc.) and creates a system of oversight for nuclear activities. The Environment Code sets out the rules applicable to large nuclear facilities and to radioactive waste. Other texts are more specialised, such as the Labour Code, which deals with radiation protection of workers, or the Defence Code, which contains provisions regarding defence-related nuclear activities or the prevention of malicious acts. Finally, various texts apply to certain nuclear activities but without being specific to them. This legal framework has been the subject of extensive revision for a number of years now.

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

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, which is currently being revised, creates a system of authorisation, registration or notification for the manufacture, possession, distribution, including import and export, and utilisation of radionuclides. ASN issues licenses and authorisations, carries out registration and receives notifications. The revision of the Code, in particular the creation of registration and the inclusion of protection against malicious acts for the most dangerous radioactive sources, will be effective on 1st July 2017.

The general rules applicable to small-scale nuclear facilities are the subject of ASN statutory resolutions.

Exposure of individuals to radon: human protection is based primarily on the obligation of monitoring in geographical areas where the concentration of naturally occurring radon can be high. This monitoring is mandatory in certain premises open to the public and in the workplace. A strategy to reduce this exposure is necessary, should the measurements taken exceed the action levels laid down in the regulations. The reform in progress should lead to a reduction in the reference level for facilities open to the public (from 400 Bq/m^3 to 300 Bq/m^3).

Basic Nuclear Installations (BNIs): these are the most important nuclear facilities; they are the facilities of the nuclear electricity generating sector (nuclear power plants, main facilities of the "fuel cycle"), the large storage and disposal facilities for radioactive substances, certain research facilities and the large accelerators or irradiators. There are nearly 150 of them, spread over about 40 sites.

The legal regime for the BNIs is defined by section IX of Book V of the Environment Code 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 BNI is liable to create for humans and the environment, whether or not radioactive in nature. It in particular requires that the creation of a BNI be authorised by a decree issued on the advice of ASN and that ASN authorise start-up of the installation, stipulate requirements regarding its design and operation with respect to protection of the population and the environment and authorise delicensing of the installation.

In the event of final shutdown of a facility, its licensee proceeds with decommissioning in the conditions defined by a decree issued on the advice of ASN and on the basis of the licensee's file, in accordance with the principle of immediate dismantling.

ASN is working on a revision of the BNI general technical regulations: after publication of the Ministerial Order of 7th February 2012 setting the general rules applicable to BNIs, ASN thus initiated the publication of about fifteen statutory resolutions; in 2016, it adopted three resolutions and published a guide on how it consults the licensees and the public on its projects. This system is supplemented by guides, which are not legally binding and which present ASN policy; 26 guides have so far been published.

Pressure equipment specially designed for BNIs is subject to special rules updated in 2015 and 2016.

The transport of radioactive substances: the safe transport of radioactive substances 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 to be deployed in the event of an incident or accident.

The regulations concerning the transport of radioactive materials are based on the IAEA recommendations integrated into the international 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 amended Order dated 29th May 2009, known as the "TMD Order".

ASN is in particular responsible for approving package models for the most dangerous shipments.

Contaminated sites and soils: the management of sites contaminated by residual radioactivity warrants specific radiation protection measures, in particular if remediation is envisaged. Depending on the current and future uses of the site, decontamination objectives must be set and the removal of the waste produced during post-operation clean-out of the contaminated premises and remediation of soil must be managed, from the site up to storage or disposal.

In 2012, ASN published its doctrine for the management of sites contaminated by radioactive substances.

The revision of the provisions of the Public Health Code will make it possible to implement institutional controls for polluted sites and soils.

Outlook

2017 will be devoted more specifically to the implementation of the wide-ranging reforms to the legislative texts adopted in 2015 and 2016. Three decrees should renew the regulatory provisions of the Environment, Public Health and Labour Codes. ASN is also expected to adopt resolutions tailoring its oversight more closely to the issues, in particular through a change in the rules applicable in the event of the modification of a BNI and the implementation of the registration of certain small-scale nuclear activities. It will continue to create general technical regulations for BNIs and define the framework applicable to the protection of radioactive sources against malicious acts.

04 Regulation of nuclear activities and exposure to ionising radiation

In France, nuclear activity licensees are responsible for the safety of their activity.

They cannot delegate this responsibility, and must ensure permanent surveillance of both this activity and the equipment used. Given the risks for humans and the environment linked to ionising radiation, the State regulates nuclear activities, a task it has entrusted to ASN.

Control and regulation of nuclear activities is 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 nuclear safety, in order to protect workers, patients, the public and the environment from risks associated with radioactivity.

Inspection is the key means of monitoring available to ASN. It requires one or more ASN inspectors (nuclear safety inspectors, radioactive substance transport safety inspectors, labour inspectors and radiation protection inspectors) to go to a monitored site or department, or to carriers of radioactive substances. It consists in performing spot checks on the conformity of a given situation with regulatory or technical baseline requirements. After the inspection, a follow-up letter is sent to the person responsible for the inspected site or activity and published on *www.asn.fr*.

ASN's regulatory actions are also carried out by other means such as examination of authorisation applications and analysis of significant events. The inspection is proportionate to the level of risk presented by the installation or the activity and the way in which the licensee assumes its responsibilities. ASN has a broad vision of control and regulation, encompassing material, organisational and human aspects. Its regulatory duties entail the issue of resolutions, prescriptions, inspection follow-up documents, plus administrative or criminal penalties as applicable, along with assessments of safety and radiation protection in each activity sector.

This arrangement is supplemented by systematic technical inspections in certain fields, carried out by approved organisations.

Assessment

1,793 inspections were carried out in 2016 by the ASN inspectors. These 1,793 inspections represent 1,872 days of actual inspection in the field.

ASN also continued to experiment with methods other than inspections, in order to better address activities with lesser implications.

In 2016, ASN was notified of:

- 1,048 significant events concerning nuclear safety, radiation protection and the environment in BNIs; 948 of these events were rated on the INES scale[1] (847 events rated level 0 and 101 events rated level 1). Of these events, 12 significant events were rated as "generic events" including one at level 1 on the INES scale;
- 64 significant events concerning the transport of radioactive substances, including five events rated level 1 on the INES scale;

1. *INES : International Nuclear and Radiological Event Scale.*

- 585 significant events concerning radiation protection in small-scale nuclear activities, including 141 rated on the INES scale (of which 30 were level 1 events).

ASN was notified of no event rated level 2 or higher on the INES scale in 2016.

In 2016, following the inspections carried out, the ASN inspectors transmitted eight reports to the public prosecutors.

In 2016, ASN took nine administrative actions (formal notice, deposit of sums, etc.) against managers of nuclear activities. Moreover, for the first time, ASN took the decision to suspend a test certificate, concerning a reactor 2 steam generator at the Fessenheim NPP. This steam generator contains manufacturing anomalies that are important enough to compromise the safety demonstration used as the basis for issue of this certificate.

In an Ordinance of 10th February 2016, further to the TECV Act of 17th August 2015, measures supplemented ASN's powers of administrative sanction, making them more incremental. ASN can now impose daily fines on a BNI licensee until such time as the nonconformities observed have been remedied.

Outlook

In 2017, ASN intends to carry out about 1,800 inspections on BNIs, radioactive substances transport operations, activities employing ionising radiation, organisations and laboratories it has approved and activities involving pressure equipment. ASN will as a priority inspect the activities with potentially serious consequences, defined in consideration of the experience feedback from 2016.

Further to the irregularities found in the manufacture of certain NPP equipment items, ASN has initiated and will in 2017 be continuing a review of BNI licensee monitoring of their contractors and subcontractors, of ASN oversight and of the alert mechanisms.

ASN will continue to revise the procedures for notification of significant events, taking into account the feedback from the events notification guide in small-scale nuclear activities and the changes in regulations in the BNI sector.

It will continue with changes to its sanctions policy, implementing the provisions of the TECV Act and the Ordinance of 10th February 2016.

In the environmental field, ASN will continue its regulatory work to implement the provisions of the TECV Act. It will continue with the transposition of the European "IED", Industrial Emissions Directive, and the "Seveso 3" Directive on major accidents involving hazardous substances. ASN will also initiate a revision of the BNI Order of 7th February, more specifically to take account of recent changes to the general environmental regulations.

05 Radiological emergency and post-accident situations

Nuclear activities are carried out with the two-fold aim of preventing accidents and mitigating any consequences should they occur. Despite all the precautions taken, an accident can never be completely ruled out and the necessary provisions for managing a radiological emergency situation must be planned for, tested and regularly revised.

Radiological emergency situations therefore include:
- emergency situations occurring in a BNI;
- accidents involving Radioactive Material Transports (RMT);
- emergency situations occurring in the field of small-scale nuclear activities.

Emergency situations affecting nuclear activities can also comprise non-radiological risks, such as fire, explosion or the release of toxic substances.

ASN takes part in management of these situations, for questions concerning the regulation of nuclear safety and radiation protection and, drawing on the expertise of its technical support organisation, IRSN, performs the following four main assignments:

- ensure and verify the soundness of the steps taken by the licensee;
- advise the Government and its local representatives;
- contribute to the circulation of information;
- act as Competent Authority within the framework of the international conventions.

The ASN emergency response organisation set up for an accident or incident in a BNI more specifically comprises:

- at the national level, an emergency centre in Montrouge, consisting of three Command Posts (PC):
  - a "Strategy" Command Post, consisting of the ASN Commission, which, in an emergency situation, could be called on to issue resolutions and impose prescriptions on the licensee of the installation concerned;
  - a Technical Command Post (PCT) in constant contact with its technical support organisation, IRSN, and with the ASN Commission. Its role is to adopt a stance for advising the Prefect, who acts as the director of contingency operations;
  - a Communication Command Post (PCC), located close to the Technical Command Post. The ASN Chairman or his representative acts as spokesperson, a role which is distinct from that of the head of the Technical Command Post.
- at the local level:
  - ASN representatives working with and advising the Prefect in his decisions and communications;
  - ASN inspectors present on the site affected by the accident.

Significant events

In 2016, the national emergency centre was activated for seven national exercises and, for the first time, for the purposes of an exercise on a national defence site, jointly with the Defence Nuclear Safety Regulator (ASND).

Three exercises concerned an accident scenario involving the transport of radioactive substances in *départements* in which there is no BNI. The national exercise on 20th and 21st September 2016 on the Areva site at La Hague was combined with the major governmental exercise SECNUC 2016 and involved activation of the Interministerial Crisis Committee (CIC).

In 2016, no real event led to activation of the national emergency centre.

The decision to extend the perimeter of the PPI (Off-site Emergency Plans) to 20 km around NPPs and the preparation for immediate evacuation within a radius of 5 km is consistent with the recommendations of the approach by HERCA-WENRA (Heads of European Radiation Control Authorities - Western European Nuclear Regulators' Association) published at the end of 2014 to improve harmonisation of the emergency management systems across Europe.

In October 2016, the Ministry for the Interior notified the Prefects of *départements* containing an NPP of the approach to be followed to implement the national plan for the response to a major nuclear or radiological accident. More particularly the pertinence of the activation of the PPI during the reflex phase over 2 km was again confirmed, as was the response strategy covering the entire country. The new measures to be incorporated into the PPI for the NPPs are clarified: extension from 10 to 20 km of the PPI radius and the pre-distribution of stable iodine tablets, the preparation for immediate evacuation over 5 km, the introduction of initial instructions to restrict the consumption of foodstuffs as of the emergency phase, taking account of the local context for the population protection decisions. Following its opening for public consultation, ASN Guide No.15 on the management of activities around BNIs was published in the second half of 2016.

Outlook

In accordance with the nuclear emergency duties entrusted to it by the Environment Code, ASN makes an active contribution to the review process currently being carried out by the public authorities following the Fukushima Daiichi accident, with the aim of improving the national radiological emergency organisation.

The regional implementation of the national plan for the response to a major nuclear or radiological accident will continue to be tested in 2017 during exercises, in particular in those *départements* in which there is no BNI.

Following the Government's September 2016 adoption of the principle of extending the radius of the PPI perimeter around NPPs from 10 to 20 km, the preparation of immediate evacuation over 5 km and the pre-distribution of stable iodine tablets up to 20 km, ASN will in 2017 contribute to the PPI update work carried out by the offices of the Prefects and to the new population information and iodine tablets distribution campaign for inhabitants in the zone between 10 and 20 km from the NPPs.

The nuclear safety Regulators confirmed the need for continued work internationally to improve the coordination of the respective approaches of each country in an emergency situation. In 2017, ASN will continue with the European initiatives taken with a view to harmonising actions on either side of the borders to protect populations in an emergency situation and to develop a coordinated response by the safety and radiation protection Authorities in the event of a near or remote accident, more specifically as part of the follow-up to the HERCA/WENRA approach. In 2017, ASN will organise an exercise with one or more border countries to test this approach and define joint working documents.

In 2017, in order to prepare the offices of the Prefects for the performance of public protection measures or post-accident actions, certain exercises will be followed up by a phase focusing on civil protection objectives, or workshops on the post-accident phase.

Finally, in 2017, ASN will finalise the draft of the resolution on the obligations of BNI licensees relative to the preparation for and management of emergency situations and the content of the on-site emergency plan, aiming to clarify the provisions of Title VII of the Order of 7th February 2012 setting the general rules for BNIs.

One of the priority actions for 2017 will be to make progress with setting up an on-call duty team at ASN.

06 Informing the public and the other audiences

After the Act of 13th June 2006 on Transparency and Nuclear Security (TSN), the TECV Act of 17th August 2015 reinforced the transparency provisions. It makes explicit ASN's duty to give its assessment of the state of nuclear safety and radiation protection in its annual report. The Act also comprises a range of provisions applicable to the CLIs, in particular the requirement for each CLI to hold a public meeting at least once a year.

ASN informs the general public, the media, the institutional public and professionals of its activity. It publishes its resolutions and its positions on its website. Every year, ASN presents its Report on the state of nuclear safety and radiation protection in France to Parliament.

ASN also encourages the involvement of civil society in nuclear safety and radiation protection and in particular collates observations from the stakeholders and the public on its draft decisions and resolutions on *www.asn.fr.*

In 2016, ASN coordinated the information and iodine distribution campaign for the residents living around the NPPs, in order to raise their nuclear risk culture awareness.

Significant events

ASN presented its *Report on the State of Nuclear Safety and Radiation Protection in France* to the OPECST. This report, which constitutes the reference document on the state of the activities regulated by ASN in France, is submitted each year to the President of the Republic, to the Government and to Parliament.

In 2016, ASN was called to regular hearings by Parliament on its activities, on subjects concerning nuclear safety and radiation protection.

In 2016 ASN organised twenty national and regional press conferences.

In January 2016, ASN presented its New Year's greetings to about thirty journalists from the national and international press.

On 26th May, ASN organised a press conference attended by some forty journalists to present its *Report on the state of nuclear safety and radiation protection in France*.

On 5th December, ASN held a press conference with IRSN on the situation of the steam generators made of steel containing a high carbon concentration.

The ASN regional divisions then held regional conferences to present the results of their activities for the year.

In partnership with the National Association of Local Information Committees and Commissions (Anccli) ASN organised the 28th CLI conference in Paris, in November 2016.

ASN took part in the Mayors and local authorities fair, on a joint stand with IRSN for the first time.

ASN, the Local Information Committee for the Tricastin large energy facilities and IRSN, organised a seminar on the service life extension of the French 900 MWe nuclear reactors beyond 40 years.

ASN coordinated the fifth stable iodine distribution campaign around EDF's NPPs, with the support of a pluralistic steering committee comprising representatives from the ministries responsible for national education, the interior and health, IRSN, the regional health agencies, the national orders of pharmacists, physicians and nurses, CLIs and the Anccli, the Association of representatives of communes containing NPPs and EDF.

The national levels for iodine collection from pharmacies stand at 51% for private individuals, 36% for companies and facilities open to the public (ERP) and 85% for schools. 390,000 boxes of tablets were collected from pharmacies, as opposed to 320,000 in 2009, or an increase of 22%.

The w*ww.asn.fr* website is the main outlet for ASN information. The content of the ASN website is available on mobile phones and tablets, but also on the main social networks.

Outlook

In 2017, ASN will continue to actively contribute to implementing steps to reinforce nuclear transparency in accordance with the requirements of the TECV Act.

ASN will expand public information about its professions and the skills of its personnel. It will for example study the creation of a "recruitment" section on its website, in order to present the full diversity of its professions and competencies and offer career prospects to people from different backgrounds.

It will reinforce transparency on the subjects under its responsibility, together with the other stakeholders. ASN will improve the conditions in which members of the public can express their opinion on the draft regulatory texts on *www.asn.fr*.

The development of the ASN-IRSN travelling exhibition, the strengthening of ties with schools and the national education authority, the creation of information initiatives for the populations situated in the PPI zones around the nuclear installations are all means of making the various audiences more aware of the culture of risk and questions concerning nuclear safety and radiation protection.

The campaign for informing and distributing iodine tablets to the populations living near the EDF nuclear power plants took place in 2016. In 2017, ASN will continue to inform the population about the nuclear risk with the extension of the PPI zones from 10 to 20 km; it will ensure correct implementation of the obligation of regular information of the persons living within the PPI zone, as set out in the TECV Act. In 2017, actions will focus on schools as well as on companies and facilities open to the public. The aim is to improve the level of iodine tablet collection by facilities open to the public and ensure close to 100% coverage by schools.

ASN will continue its interchanges with elected officials and stakeholders. After the presidential and legislative elections, it will more particularly meet the new members of Parliament to present its roles to them. It will continue its participation in the debates on nuclear safety and radiation protection.

ASN will continue to support CLI activities. For those CLIs that so wish, this support will more particularly concern their actions to involve the population in their work, such as holding meetings open to the public, as required by the TECV Act.

07 International relations

ASN is actively involved in international cooperation, enabling it to contribute to reinforcing nuclear safety and radiation protection worldwide, while consolidating its competence and its independence.

Significant events

Europe is a priority for ASN actions. Several European directives set common requirements and standards across Europe in the fields of nuclear safety and radiation protection. ASN contributes to drafting these rules, in particular through ENSREG (European Nuclear Safety Regulators Group), which assists the European Commission. ENSREG is currently overseeing the first European peer review, which will be held in 2017 and 2018 and will concern management of reactor ageing.

The European Authorities carry out numerous initiatives aimed at harmonising nuclear safety and radiation protection regulations and practices. Two associations, WENRA and HERCA, bring together the heads of the European nuclear safety and radiation protection authorities respectively. These associations strengthened their cooperation in the field of management of transboundary emergency situations. HERCA has carried out several actions to support transposition of the Euratom Directive on basic radiation protection standards.

Beyond Europe, ASN plays an active role in the work overseen by the UN's IAEA agency. IAEA defines safety standards, which are then used by

its Member States to draft their own national regulations. These standards are also used as the basis for peer audit missions by the safety regulators and nuclear licensees. ASN is also involved in the peer audits of its counterparts. An ASN commissioner for example headed the first review of the new Japanese safety regulator (NRA – Nuclear Regulation Authority).

ASN also takes part in the work done by the Organisation for Economic Cooperation and Development's Nuclear Energy Agency (NEA), allowing the exchange of information, experience and practices between the national regulatory Authorities. In 2016, the NEA published a report on the lessons learned from the Fukushima Daiichi accident and green papers on defence in depth and on safety culture among the regulators. ASN also takes part in several ASN groups, one of which is devoted to inspection practices in the various Member States.

ASN plays an active role in the international MDEP (Multinational Design Evaluation Programme) initiative, the aim of which is to develop innovative approaches to pool the resources and knowledge of safety regulators tasked with evaluating and overseeing the construction of new reactors. ASN contributes in particular to the group devoted to the EPR reactor, as well as to the groups working on codes and standards, digital instrumentation and control and multinational inspection of nuclear component manufacturers.

ASN also works with many countries through bilateral agreements. ASN takes care to share its best practices and conversely to understand the methods used in other countries. Personnel exchanges are organised regularly, ranging from a few days to assignments lasting several years.

ASN is continuing with its commitment to international assistance programmes. The purpose of this assistance is to enable the countries concerned to acquire the safety and transparency culture that is essential for a national system of nuclear safety and radiation protection regulation. In 2016, ASN took part in projects for the benefit of the safety and radiation protection regulators of Algeria, China, Madagascar, Morocco, the Democratic Republic of the Congo and Vietnam.

ASN acts as the national point of contact for international conventions on nuclear safety and the safety of spent fuel and radioactive waste management. These conventions are an important tool in reinforcing nuclear safety worldwide, in particular through the three-yearly meetings at which each country submits a report on the implementation of these conventions for peer review.

ASN is the competent Authority for the Convention on the Early Notification of a Nuclear Accident and the Convention on Assistance in the case of a Nuclear Accident or Radiological Emergency. The purpose of these conventions is to facilitate the circulation of information and cooperation between countries in the event of a nuclear accident.

Outlook

In 2017, ASN will continue to work on developing the European approach to nuclear safety and radiation protection. It will make an active contribution to the European peer review on the management of reactor ageing.

In 2017, ASN will host the follow-up mission to the peer review carried out by IAEA in 2014, in order to assess the progress accomplished since then.

The 7th review meeting of the contracting parties to the convention on nuclear safety will be held in 2017, for which ASN will present the French report.

Finally, ASN will continue its involvement in the cooperation instruments assisting third party countries in the field of nuclear safety.

08 Regional overview of nuclear safety and radiation protection

ASN has 11 regional divisions through which it carries out its regulatory responsibilities throughout metropolitan France and in the French overseas *départements* and regional authorities.

In 2016, ASN adapted its operations to the creation of the new regions. It retains all its local establishments, which are responsible for its actions in the field. Several ASN regional divisions may thus be required to coordinate their actions within a given administrative region. As at 31st December 2016, the ASN regional divisions comprised 216 staff members, including 154 inspectors.

Under the authority of the regional representatives, the ASN regional divisions carry out field inspections on BNIs, on radioactive substances transports and on small-scale nuclear activities. They investigate most of the licensing applications submitted to ASN by the nuclear activity licensees within their regions. For these activities and within these installations, they check application of the regulations relative to nuclear safety, radiation protection, pressure equipment and Installations Classified on Environmental Protection grounds (ICPEs). They carry out labour inspection duties in the nuclear power plants.

In a radiological emergency situation, the ASN regional divisions assist the Prefect of the *département,* who is responsible for protection of the population, and oversee the steps taken by the licensee on the site to make the facility safe. To ensure preparedness for these situations, they take part in preparing the emergency plans drafted by the Prefects and in periodic exercises.

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

The purpose of this chapter is to present an assessment of nuclear safety and radiation protection in each region, in addition to ASN's overall assessment for each major activity and main licensee. It also presents the local issues and approaches particularly representative of ASN's regional actions, more specifically in terms of public information and transboundary relations.

09 Medical uses of ionising radiation

For more than a century, medicine has made use of various sources of ionising radiation, both for diagnostic purposes and for therapy. While their benefits and usefulness have long been medically proven, these techniques however contribute significantly to the population's exposure to ionising radiation.

Behind exposure to natural ionising radiation, medical exposure represents the second source of exposure for the population and the leading source of artificial exposure. Protection of the patients benefiting from medical imaging examinations or therapeutic care using ionising radiation is regulated by the Public Health Code, while that of personnel working in the corresponding facilities is regulated by the Labour Code.

In France, there are several thousand conventional or dental radiology devices, just over a thousand computed tomography facilities, more than a thousand facilities carrying out interventional radiology and fluoroscopy-guided procedures, 225 nuclear medicine units using unsealed sources for *in vivo* or *in vitro* diagnostics and for internal radiotherapy.

In addition, as at the end of 2016, 176 external radiotherapy centres equipped with 476 treatment devices, handling some 180,000 patients every year, were identified by ASN. 750 radiotherapists were identified.

Nuclear medicine comprises about 700 specialist practitioners, along with another 1,000 physicians from other specialities working together in nuclear medicine units (interns, cardiologists, endocrinologists, etc.)

In 2016, ASN issued 883 authorisations, of which 58% were for computed tomography, 22% for nuclear medicine, 15% for external radiotherapy, 4% for brachytherapy and 1% for blood product irradiators.

Significant Radiation Protection Events (ESR) in 2016

Since July 2015, the radiotherapy units have been able to carry out on-line notification of ESR on an on-line notification portal shared by the French Health Products Safety Agency (ANSM) and ASN. It will be extended to cover the entire medical sector at the beginning of 2017.

After a gradual rise over the period 2007 to 2014, the number of ESR notified to ASN dipped slightly in 2015. In 2016, 493 ESR were notified: 160 concerned radiotherapy (mainly patient positioning anomalies) or brachytherapy, 117 nuclear medicine, 116 computed tomography and 24 interventional radiology. 67% of the ESR concern patients and 10% of the ESR concern workers, primarily in nuclear medicine.

The occurrence of four ESR rated 2 on the ASN-SFRO (French Society for Radiation Oncology) scale should be noted[1]. These events are the result of errors in the target volume to be treated (1 ESR), the side to be treated (1 ESR), dose fractionation (1 ESR) and finally a dose error in brachytherapy (1 ESR).

The events notified to ASN in 2016 show that the consequences with the most significance in radiation protection terms concern:

- for the workers; nuclear medicine and interventional radiology;
- for the patients; interventional radiology during lengthy, complex procedures, radiotherapy – in particular for hypofractionated treatments – and nuclear medicine, with radiopharmaceuticals administration errors;
- for the public and the environment; nuclear medicine, with leaks from radioactive effluent pipes and containments.

The lessons learned from the significant radiation protection events notified to ASN underline the need to increase the involvement of Radiation Protection Officers (RPO) and medical physicists in the management of radiation protection, and to develop the training of the professionals using ionising radiation.

The radiation protection situation in radiotherapy

The safety of radiotherapy treatments is a priority area of regulation and oversight. ASN used to systematically inspect radiotherapy centres every two years, but since 2016 it inspects every three years. An annual frequency is however applied in certain particular cases, more specifically for centres which are at risk in terms of human resources or organisation.

Experience feedback from the events of which ASN is notified underlines the considerable potential consequences of hypofractionated treatments, which lead to a higher level of irradiation per session. In 2016, ASN focused its inspections on this type of treatment.

ASN considers that the management of the quality and safety of care is now integrated into the operation of the radiotherapy centres, even if there are disparities between them. It however observes that insufficient account is taken of risk management approaches in order to make the treatments even safer.

ASN wishes to draw attention to the need to analyse the impact on the activity of the workers of both the increase in activity (number of treatments, treatment complexity) and of changes, whether technical (use of a new technique or practice), human (shortage of radiotherapists) or organisational (grouping of units, merging or acquisition or centres, cooperation between facilities). These changes can weaken the existing safety barriers and be the cause of ESR.

With regard to brachytherapy, the departments benefit from the organisation set up for external radiotherapy, concerning both the deployment of a quality management system and the radiation protection of workers and patients. ASN considers that efforts must be made to reinforce the radiation protection training of workers if a high-level source is present and to carry out internal radiation protection technical inspections.

The radiation protection situation in nuclear medicine

ASN considers that the radiation protection of workers, patients and protection of the environment are on the whole progressing. However, with regard to worker protection, it is important that the individual job studies be completed and that continuing training be reinforced. ASN considers that patient radiation protection needs to be improved by in particular applying quality assurance procedures to the checks to be made when using automated systems.

1. *This scale is designed for communication with the public in comprehensible, explicit terms, concerning radiation protection events leading to unexpected or unforeseeable effects on patients undergoing a radiotherapy medical procedure.*

The radiation protection situation in computed tomography

ASN is continuing with its oversight of the regulation of patient radiation protection in the field of computed tomography, given the rise in the contribution of this imaging technique to the average effective dose per inhabitant.

ASN observes that application of the principles of justification and optimisation continue to differ widely from one site to another. The training of professionals needs to be improved in order to achieve better management of the doses of radiation delivered to the patients, while maintaining the medical benefits of this imaging technique.

The radiation protection situation in interventional practices

As in 2015, ASN considers that the urgent measures it has been recommending for several years to improve the radiation protection of patients and professionals in the exercise of interventional practices, particularly in operating theatres, have not been sufficiently implemented. These measures must in particular concern the training of all the professionals associated with this form of care, especially those who have not received patient radiation protection training at university level, the intervention by the medical physicist and the increase in the means allocated to the PCRs.

In the field of medical physics, the efforts made since 2007 to boost the numbers of medical physicists must be continued in order to meet the medical imaging needs.

Owing to the implications for both professionals and patients and owing to a lack of radiation protection culture among intervention personnel, in particular in the operating theatres, ASN maintained its oversight of the facilities performing fluoroscopy-guided interventions as a national priority in its inspection programme for 2017.

Outlook

In radiotherapy, ASN together with the professionals will examine the conditions for anticipating and better managing growth in activity, as well as technical, human and organisational changes and will examine risk management policies in the large health groups.

In the field of imaging, ASN will continue its work to promote the development and initial and continuing training of all professionals involved in performing the procedures, in order to improve the management of the doses delivered to the patients. The development of quality assurance in imaging and the increased involvement of medical physicists in optimising the doses delivered to the patients are also areas in which progress is required. Interventional practices, more particularly in the operating theatres, remain an inspection priority.

10 Industrial, research and veterinary uses and source security

Small-scale nuclear activities stand out through their extreme heterogeneity and the very large number of licensees concerned. Industrial and research uses of radioactive sources, that is to say from radionuclides, are mainly industrial irradiation, gammagraphy inspection of materials, checking of physical parameters such as dust levels or density, neutron activation and various detection techniques, plus trackers. Electrical devices emitting ionising radiation are used for similar purposes, as well as for veterinary diagnostic radiology.

ASN must therefore adapt its efforts to the radiation protection issues of these activities if it is to regulate them effectively. ASN is in particular attentive to overseeing the management of ionising radiation sources, monitoring their conditions of possession, utilisation and disposal and ensuring the accountability and monitoring of source manufacturers and suppliers.

Assessment

In 2016, with regard to the users, ASN examined and notified 277 new licenses, handled 971 license renewals or updates and revoked 325 licenses for users and holders of ionising radiation sources. ASN granted 139 licences and renewed

265 licenses to use X-ray generating devices and issued 324 notification acknowledgements. With regard to the suppliers, 65 licence or license renewal applications were examined. ASN also carried out 389 inspections of users and suppliers.

Industrial radiography activities are an inspection priority for ASN, with nearly 100 inspections per year. ASN finds that the way the companies address the risk varies widely. ASN is worried by the radiological zoning defects observed.

ASN's monitoring of establishments and laboratories using radioactive sources for research purposes shows a distinct improvement in radiation protection. At the same time, ASN presented the generally satisfactory results of an inspection campaign carried out in 2015 on laboratories using the "Mössbauer" spectrometry technique.

ASN's inspectors also identified good field practices in the veterinary sector, as a result of the efforts made over the past few years. ASN continued its verification of the withdrawal from service of smoke detectors using radioactive sources, lightning arresters and radioactive lightning conductors.

At the Nuclear Security Summit in Washington in April 2016, France initiated an international undertaking to support research, development and the implementation of technologies which do not use high level sealed radioactive sources. ASN and the National Nuclear Security Administration (United States) thus jointly chaired a think tank on the replacement of these sources by alternative technologies. In December 2016, ASN presented the results of the working group at the international conference on nuclear security organised by IAEA.

Unlike in previous years, no incident was rated level 2 on the INES scale in 2016. The most notable incident of 2016 concerns the deterioration of a gamma radiography device used in worksite conditions in a BNI.

Given the number of cases of abnormal radioactivity being detected in metals and consumer goods around the world, ASN considers that France needs to rapidly implement a nationwide radioactivity detection strategy. It made its position known to the authorities in charge of these checks and organised a number of discussion meetings on this subject in 2016.

In the regulatory field, 2016 was the first year of application of ASN resolution 2015-DC-0521 of 8th September 2015 concerning the registration of movements with IRSN and resolution 2015-DC-0531 of 10th November 2015 in which ASN broadened the scope of activities subject to notification.

ASN continued with transposition into French law of European Directive 2013/59/Euratom of 5th December 2013, which will in particular introduce an intermediate administrative system between notification and authorisation, a simplified authorisation known as the "registration system", tailoring the regulatory constraints more closely to the radiation protection issues.

Finally, in 2016, the legislative process necessary for creating a regulatory framework for measures by those responsible for nuclear activities to protect sources against malicious acts was completed by Ordinance 2016-128 of 10th February 2016. ASN, together with the High Defence and Security Official at the Ministry for the Environment, continued to prepare the texts necessary for the effective implementation of oversight. As ASN was designated the oversight authority for these measures regarding most radioactive sources, it also continued the steps begun to plan ahead for training of its staff and develop appropriate tools so that this new role could be taken on board rapidly and efficiently. It has virtually completed its survey work on the existing facilities. In the civil sector, this concerns about 4,000 sources distributed around some 250 facilities in France.

Outlook

As of 2017, ASN will be preparing for the entry into force of the new administrative systems applicable to nuclear activities, issuing the necessary resolutions for the nuclear activities concerned by these new systems. It will also modify the resolutions concerning the content of the authorisation application files, including elements necessary for the oversight of source security.

ASN will extend its electronic notification portal to all activities subject to notification, simplifying the process for the professionals (this arrangement is already in use for notification of transport activities).

ASN will continue to carry out its licensing and oversight duties, tailoring its efforts and the oversight procedures to the specific radiation protection implications of the particular activities.

11 Transport of radioactive substances

About 770,000 consignments of radioactive substances are transported each year in France. This represents about 980,000 packages of radioactive substances, which account for just a few per cent of the total number of dangerous goods packages transported each year. 88% of the transported packages are intended for the health, non-nuclear industries or research sectors, of which about 30% is accounted for by the medical sector alone. The nuclear industry accounts for about 12% of the annual traffic of radioactive substances.

The content of the packages varies widely: their radioactivity level varies from a few thousand becquerels for low-activity pharmaceutical packages, to trillions of becquerels for spent fuel. Their weight also varies from a few kilogrammes to about a hundred tonnes. Road transport accounts for about 90% of radioactive substances shipments, rail 3% and sea 4%. Air transport is widely used for small and urgent packages over long distances, for example, low activity radiopharmaceutical products. All of these shipments can be international.

The main participants in transport arrangements are the consignor and the carrier. ASN checks that transport safety regulations are correctly applied for radioactive and fissile substances used for civil purposes. The major risks in the transport of radioactive substances are the risks of irradiation, contamination, criticality, but also toxicity or corrosion. To prevent them, the radioactive substances in the packages must be protected in particular from fire, mechanical impact, water ingress into the packaging facilitating criticality reactions, chemical reaction between package components. Safety is thus based above all on the robustness of the package, which is the subject of rigorous regulatory requirements. Given the international nature of these shipments, the regulations are drawn up on the basis of recommendations issued under the aegis of the International Atomic Energy Agency (IAEA). Although all packages must comply with strict rules, only 3% require ASN approval. If a package is unable to meet all the regulatory prescriptions, the regulations nonetheless allow for its transport by means of a shipment under special arrangement which requires ASN approval of the proposed compensatory measures.

Assessment

With regard to authorisations, ASN issued 37 approval certificates for packages or special arrangement shipments during the course of 2016. The Areva TN company submitted an approval request for the TN G3 package model, intended for the transport of spent fuel from the EDF NPPs to the La Hague plant. ASN referred this subject to the Advisory Committee for Transports (GPT).

Since the implementation of the BNI Order, on-site transports of radioactive substances within the facilities must be covered by the licensee's baseline requirements. Even if the licensees have taken steps in the right direction on this point, ASN notes that some have yet to achieve a satisfactory result. ASN received additional data in 2016 and this is currently being examined.

ASN performs inspections at all the stages in the life of a package: from manufacture and maintenance of packaging, to package preparation, shipment and reception. Inspections also concern preparedness for emergency situations.

In 2016, ASN carried out 106 inspections in radioactive substance transport. In particular, following the identification of irregularities during the manufacture of nuclear industry equipment by the Creusot Forge plant, ASN conducted an inspection in November 2016 of the Areva TN company which produces the transport packages for which Creusot Forge is a subcontractor. The inspectors noted that Areva TN had initiated measures to detect and process potential irregularities but that these actions were unable to detect all the irregularities affecting the components of the transport packaging manufactured by Creusot Forge. ASN thus asked Areva TN to take part in the exhaustive review of the Creusot Forge files, with regard to its particular field of activity.

ASN considers that the radiation protection situation of the carriers could be improved, in particular for the carriers of radiopharmaceuticals, who are significantly more exposed than the average worker. ASN intends to publish a guide in 2017 to help carriers achieve a clearer understanding of the regulatory requirements and best practices with regard to radiation protection.

In 2015, ASN adopted a resolution, which came into force in 2016, requiring that companies transporting radioactive substances be subject to the notification obligation. Notification is submitted in electronic format on *www.asn.fr*. ASN therefore now has a clearer picture of the characteristics of the companies, enabling it to tailor its

oversight resources more closely to the issues.

In the event of an accident involving transport, it should be able to minimise the consequences for the public and the environment. In addition to the national emergency exercises, ASN is looking to organise local transport emergency exercises to allow more frequent drills by the offices of the Prefect and the emergency services. Together with the Ministry of the Interior, ASN tasked IRSN with drawing up a scenario that could be easily applied in each *département*. These local emergency exercises could take place as of 2017.

In 2016, concerning the transport of radioactive substances, ASN was notified of 58 level 0 events and 5 level 1 events on the INES scale. More than half of these events concern the nuclear industry. The medical and non-nuclear sectors are the cause of relatively few transport events when compared with the corresponding traffic levels, probably owing to a lack of notification.

Outlook

In 2017, ASN intends to maintain its oversight of the manufacture and maintenance of packages requiring approval, in particular for the older packaging, and to take account of the irregularities in the manufacture of certain package components. With regard to on-site transports, ASN considers that the licensees concerned must step up their efforts so that the measures in progress can be completed.

12 EDF Nuclear Power Plants

58 Nuclear Power Plants (NPPs) operated by EDF are at the heart of the nuclear industry in France. ASN imposes stringent safety requirements on power reactors, the regulation and oversight of which mobilises nearly 200 of its staff and as many IRSN experts on a daily basis.

ASN developed an integrated approach to regulation that covers not only the design of new installations, their construction, modifications, integration of feedback, but also social, human and organisational factors, radiation protection, environmental protection, worker security and the application of labour legislation.

Significant events

Experience feedback from the Fukushima Daiichi accident

EDF deployed temporary or mobile measures to enhance protection against the main situations of total loss of the heat sink or electrical power supplies. The Nuclear Rapid Intervention Force (FARN) has been fully operational since the end of 2015. EDF has also begun to implement a large part of the final measures, more particularly the construction of buildings intended to house the high-capacity ultimate back-up diesel generator sets.

In 2016, ASN issued a position statement on the natural external hazard levels to be considered for the "hardened safety core" and asked EDF to carry out additional studies.

Examination of NPP operating life extensions

In April 2016, ASN issued a position statement on the orientations of the generic study programme to be carried out to prepare for the fourth periodic safety reviews of the nuclear reactors. ASN is currently examining the generic studies linked to this review. In 2019, Tricastin reactor 1 will be the first 900 MWe reactor to undergo its fourth ten yearly outage inspection. The fourth ten-yearly outage inspections for the 900 MWe plant series reactors will run until 2030.

In 2016, Paluel reactor 1 was the first 1,300 MWe reactor to undergo its third ten-yearly outage inspection. These third ten-yearly outage inspections for the 1,300 MWe plant series reactors will run until 2023.

In February 2015, ASN ruled on the orientations of the periodic safety review associated with the second ten-yearly in-service inspections of the 1,450 MWe reactors. It is currently examining the generic studies for this review. The second ten-yearly inspections for the 1,450 MWe plant series reactors will run from 2018 to 2022.

The Flamanville 3 EPR reactor

ASN is currently examining the commissioning authorisation application for Flamanville 3, transmitted by EDF in March 2015. In 2016, it more specifically examined the safety case studies, the safety of fuel storage and handling, the design of the safety systems and protection against the effects of internal and external hazards.

On 12th December 2015, ASN issued a position statement concerning the approach used to demonstrate the mechanical properties of the Flamanville 3 EPR vessel closure head and bottom head proposed by Areva NP. Subject to its observations and requests being taken into consideration, ASN considers that the approach proposed by Areva NP is acceptable in principle and had no objection to the initiation of the new planned programme of tests, held in 2016.

In December 2016, Areva NP sent ASN a technical file resulting from the test programme. ASN will issue a position statement on the serviceability of the vessel no later than the end of the first half of 2017.

Lessons learned from detection of the Flamanville EPR vessel anomaly

The detection of this vessel anomaly led ASN to ask Areva NP and EDF to learn all possible lessons from this event.

Following ASN's requests, EDF informed ASN at the end of 2015 that the channel heads of the steam generators fitted to 18 reactors, manufactured by Creusot Forge and Japan Casting and Forging Corporation (JCFC), were also concerned by the carbon segregation problem.

A detailed characterisation of these channel heads by EDF was carried out at ASN's request in order to consolidate the hypotheses utilised by EDF in the fracture strength calculations and to confirm that there was no risk. The need for additional checks on some of the channel heads manufactured by JCFC more particularly led ASN on 18th October 2016 to direct EDF to perform them within three months, entailing the shutdown of five reactors concerned before January 2017.

Further to the detection of several anomalies concerning the production of the Areva NP plant in Le Creusot, in particular including the carbon positive macrosegregations, ASN asked Areva NP to conduct a general review of the quality of its previous and ongoing nuclear activities in this plant.

These reviews revealed irregularities in the oversight of manufacturing, including inconsistencies, modifications or omissions in the production files, concerning manufacturing parameters or test results.

As at the end of 2016, Areva NP has identified 91 irregularities concerning EDF reactors in operation, 20 affecting equipment intended for the Flamanville EPR reactor, one affecting a steam generator intended for but not yet installed in the Gravelines NPP reactor 5 and four affecting transport packaging for radioactive substances. One of these irregularities led ASN in July 2016 to suspend the test certificate for one of the Fessenheim NPP reactor 2 steam generators.

ASN conducted its own analysis of each of the irregularities, jointly with IRSN. Regardless of their actual safety consequences, these irregularities reveal unacceptable practices and some of these irregularities may actually be cases of falsification.

The reviews initiated by Areva NP must continue and could well bring further irregularities to light. ASN is ensuring that the review process is seen through to completion, more specifically by means of inspections at Creusot Forge.

Fall of a steam generator

During the Paluel NPP reactor 2 outage (since May 2015) for its third ten-yearly outage inspection, a steam generator fell while being handled on 31st March 2016. In June 2016, pending its removal, EDF secured the fallen SG in order to prevent any movement.

ASN is examining EDF's proposals to enable the resumption of operations to remove the fallen SG and carry out replacement of the SGs. The reactor building clearance operations will make it possible to access the various equipment items present in it, so that the assessments needed to identify the damage to the installation can be carried out. ASN will monitor performance of the necessary repairs and checks to be conducted with a view to restarting the installation.

Nuclear reactors operated by EDF

ASN considers that there are differences in operational rigour between the various NPPs in 2016. Although there were fewer reactor scrams than in previous years, failure to comply with operating technical specifications is once again the cause of a non-negligible number of significant events, reflecting a lack of rigour in the preparation and execution of operations. More generally, ASN considers that EDF places insufficient emphasis on preventing operating deviations.

ASN notes that the quality of maintenance work could be improved and that the number of quality defects found remains stable. ASN observes the persistence of problems with management of activities owing to problems with the procurement of spares and with equipment repairs. ASN also regularly observes a lack of rigour in technical oversight of interventions and in monitoring of contractors.

In the light of the project to extend the service life of the NPPs in operation, the "major overhaul" programme and the lessons learned from the Fukushima Daiichi accident, ASN considers that it is important for EDF to continue the efforts started to resolve the problems mentioned and improve the effectiveness of its maintenance work.

The inspections carried out by ASN in 2016 during the reactor maintenance and refuelling outages and during reactor operating periods, revealed a number of deviations which called into question the actual availability of certain systems important for the safety of the installations, such as the electrical systems or the safeguard systems.

ASN considers that in 2016, the situation of the second barrier is worrying, further to the discovery of the segregation anomaly in the SG channel heads.

The results of the third ten-yearly outage tests on the 900 MWe reactor containments have so far shown leak rates conforming to regulation criteria (29 of 34 reactors have undergone this test), except for that of Bugey reactor 5, for which ASN is examining the repair file submitted by EDF.

The organisation in place on the sites for managing skills, qualifications and training is on the whole satisfactory. EDF is making major investments in hiring and training in order to anticipate the renewal of the skills threatened by staff retirements.

In a context of a rising volume of maintenance work, the collective dosimetry on all the reactors increased in 2016. The annual regulation limit for whole body external dosimetry (20 mSv) was exceeded on no occasion.

ASN considers that EDF's organisation for the nuisance and impact control of NPPs on the environment is satisfactory on most sites. ASN however notes that a number of the deviations found during the previous inspections remain uncorrected. Incorporating operating experience feedback remains an area for progress and ASN observes that the deviations persist in the operation and monitoring of the installations.

The ASN assessments of each NPP are detailed in chapter 8 of the report. Certain sites stand out positively:

- in the fields of nuclear safety and environmental protection: Fessenheim;
- in the field of radiation protection: Blayais, Chinon, Civaux, and Golfech.

Other sites are on the contrary under-performing with respect to at least one of these three topics:

- in the field of nuclear safety: Belleville-sur-Loire, Cruas-Meysse, Golfech and, to a lesser extent, Bugey;
- in the field of radiation protection: Cruas-Meysse, Dampierre-en-Burly;
- in the field of environmental protection: Cruas-Meysse, Gravelines.

Evaluation of the manufacture of Nuclear Pressure Equipment (ESPN)

The year 2016 was marked by the detection of irregularities which could constitute falsification and concealment of deviations, with varying degrees of scale and severity, in several ESPN manufacturing plants. This was in particular the case in the Areva NP Creusot Forge plant, where these practices had continued for several decades.

ASN considers that these irregularities reveal unacceptable practices. These practices compromise the irreproachable level of quality expected in the manufacture of equipment which is a factor in guaranteeing its in-service resistance. These irregularities more particularly concern primary system equipment, which is among the most important equipment in an NPP and for which the consequences in the event of failure are not examined in the nuclear safety case.

This experience feedback and the ASN inspections highlight significant shortcomings in the quality and nuclear safety culture on the part of some of the staff present in these plants. ASN requires that the various industrial firms, in particular the licensees who are responsible for nuclear safety, implement fundamental organisational measures to guarantee a high level of quality in the supply chains.

Outlook

2017 will see the continued examination of the generic studies for the fourth periodic safety review of the 900 MWe reactors, as well as the second periodic safety review of the 1,450 MWe reactors.

ASN will examine the initial review conclusions reports for the third ten-yearly outage inspections of the 1,300 MWe reactors, so that it can issue a position statement on the continued operation of these reactors.

In 2017, ASN will continue to examine the measures proposed by EDF as a result of the lessons learned from the Fukushima Daiichi accident. ASN will also continue to oversee the work to deploy the fixed items of the «hardened safety core» on the sites (ultimate back-up diesels, ultimate water source, local emergency centre).

Concerning the Flamanville 3 EPR reactor, 2017 will also see continued examination of the commissioning authorisation application for this reactor. ASN will also continue with the conformity assessments of the nuclear pressure equipment most important for safety. ASN will in particular issue its position on whether or not the vessel is suitable for service.

In 2017, ASN will continue the actions it started further to the generic anomaly on the SG channel heads and the irregularities brought to light in the Creusot Forge plant. It will in particular check implementation of the review of all the components manufactured in the past at Creusot Forge. ASN will also finalise its ongoing review of the necessary adaptation of oversight methods in order to combat fraudulent practices.

13 Nuclear fuel cycle installations

The fuel cycle concerns all the steps involved in the fabrication of the fuel and then its reprocessing once it has been used in nuclear reactors.

The main plants in the cycle – Areva NC Tricastin (Comurhex and TU5/W), Georges Besse II (GB II), Areva NP Romans-sur-Isère (ex-FBFC and ex-Cerca), Areva NC Mélox, La Hague and Areva NC Malvési (which is an Installation Classified on Environmental Protection grounds – ICPE) – are part of the Areva group. These plants include facilities which have BNI status.

Significant events

Tricastin uranium storage facility

Following the delicensing of part of the Pierrelatte defence BNI by decision of the Prime Minister of 20th July 2016, the BNI 178 Tricastin uranium storage facility was created. This installation groups the uranium storage facilities and the new emergency management premises. ASN registered this facility in December 2016 and will oversee its operation in 2017.

Together with the ASND, ASN ensured the continuity of nuclear safety oversight for this facility. Joint actions are carried out: an inspection and visits to the facility also took place, enabling ASN to verify the facility's baseline requirements, which must be brought into line with the BNI regulations.

Areva NC monitoring of the status of evaporator capacity

For the periodic safety review of BNI 116, ASN asked Areva in 2011 to examine the conformity and ageing of the fission products concentration evaporators in units T2 (BNI 116) and R2 (BNI 117). In 2014, Areva NC informed ASN of corrosion of these items that was on a scale greater than that considered in the design. During the course of 2015, Areva NC sent ASN the results of the *in-situ* measurement campaigns. As the maintained integrity of these items has major safety implications, the ASN Commission heard the Areva CEO on 11th February 2016. In its resolution 2016-DC-0559 of 23rd June 2016, ASN stipulated the conditions to be met by Areva NC for continued operation of the fission products concentration evaporators in the La Hague plants. ASN is particularly attentive to the development of corrosion in this equipment and may demand shutdown of the facility in the event of excessive deterioration.

In 2016, Areva NC submitted a request to ASN for its opinion regarding the safety options for the new evaporators, with a view to commissioning them in 2021.

Moreover, in 2011, Areva NC brought to light several perforations of the shell of an evaporator used to concentrate fission product solutions before vitrification in the R7 unit (BNI 117). This evaporator could not be returned to service and needs to be replaced. In 2016, the licensee submitted an authorisation application to ASN for replacement of the old evaporator and commissioning of a new one, currently being envisaged for 2018.

Assessment and outlook

Cross-disciplinary aspects

ASN will be continuing its review of several of the Areva Group's BNIs and will extend this process to new facilities at La Hague and Romans-sur-Isère in particular, but also to EDF's inter-regional fuel stores (in Chinon and Bugey). At the end of 2017, ASN shall more specifically issue a position statement on the continued operation or otherwise of the Cerca facility at Romans-sur-Isère, which is required to carry out major reinforcement work.

With regard to the current Areva group, ASN will be particularly vigilant in ensuring that the BNI licensees to be created as a result of the ongoing division process, are in full possession of the capabilities needed to meet their responsibilities. In particular, the capability of the two groups resulting from the division of Areva as it currently stands shall be credible enough to make any modifications to the installations concerned and manage any internal crises.

Fuel cycle consistency

In 2016, ASN started an examination of the new "Cycle impact" file covering the period 2016-2030 and aimed at anticipating the various emerging needs in order to manage the nuclear fuel cycle in France. ASN will in particular focus on monitoring the level of occupancy of the spent fuel underwater storage facilities (Areva and EDF). It asked EDF, as client, to examine the impact on the anticipated saturation dates for these storage facilities of the shutdown of a reactor, of a possible modification in the spent fuel reprocessing traffic, as well as the solutions envisaged for delaying this saturation. ASN considers that Areva and EDF must very rapidly define a management strategy going beyond 2030. The examination of

the «Cycle impact» file submitted in 2016 is ongoing and will be jointly examined at the beginning of 2018 by the Advisory Committee of Experts for Laboratories and Plants (GPU), the Advisory Committee of Experts for Waste, the Advisory Committee of Experts for Nuclear Reactors (GPR) and the Advisory Committee of Experts for Transports (GPT).

Tricastin site

ASN will continue to monitor the reorganisation of the Tricastin platform to ensure that these major organisational changes within the group have no impact on the safety of the various BNIs on the site. It will also ask the platform licensees to complete the unification process scheduled for 2012 or ask that they guarantee their independence by abandoning the pooling of the equipment and entities that they today require.

Romans-sur-Isère site

Given the malfunctions observed in recent years, ASN will pursue its heightened surveillance of the facility in 2017 in order to ensure that nuclear safety performance of this site's licensee is improved. It will be attentive to compliance with the deadlines for performance of the work defined in the facility's safety improvement plan and the revision of its safety baseline requirements. It will also be attentive to ensuring the implementation of the improvements planned as part of the stress tests.

La Hague site

In 2017, ASN will be particularly vigilant with regard to the development of corrosion in the fission products concentration evaporators. Areva NC shall be required to consolidate its methods for inspecting this equipment and its corrosion forecasts. Areva NC has started to replace this equipment, for gradual commissioning between 2020 and 2021. ASN will examine the corresponding applications.

The work done following the stress tests performed in the wake of the Fukushima Daiichi accident should be completed in the first quarter of 2017. ASN will check correct performance and the correct functioning of the equipment installed, along with the corresponding provisions.

With regard to the forthcoming process of reprocessing changes in the La Hague facility, ASN attaches particular importance to two modifications: On the one hand, the TCP project which will allow reprocessing of several fuel assemblies that could not hitherto be treated, thus postponing saturation of the spent fuel storage pools and, on the other, the replacement of the R7 evaporator, for which the particularly corrosive solutions are currently being concentrated in other equipment in the plant and are liable to damage it.

ASN considers that efforts must be continued for the recovery and packaging of legacy waste. ASN will ensure that any changes in Areva's industrial strategy do not lead to failure to comply with the ASN prescriptions concerning the recovery and removal of waste from silo 130 and the STE2 and HAO sludge.

14 Nuclear research and miscellaneous industrial facilities

The nuclear research and miscellaneous industrial facilities are different from the BNIs involved directly in the generation of electricity (reactors and fuel cycle facilities). These BNIs are operated by the Alternative Energies and Atomic Energy Commission (CEA), by other research organisations (for example the Laue-Langevin Institute (ILL), the ITER international organisation and the Ganil) or by industrial firms (for instance CIS bio international, Synergy Health and Ionisos, which operate facilities producing radiopharmaceuticals, or industrial irradiators).

The safety principles applicable to these facilities are identical to those applied to power reactors and nuclear fuel cycle facilities, while taking account of their specificities with regard to risks and detrimental

effects. To improve the way in which these specific risks and detrimental effects are taken into account and in accordance with the resolution of 29th September 2015, ASN placed the installations it regulates into three categories.

Significant events and assessment

With regard to CEA, the generic subjects on which ASN focused in 2016 were:

- the periodic safety reviews, in particular concerning the integration of aspects common to the BNIs on a given site;
- the radioactive waste management system and decommissioning of CEA installations;
- safety management at CEA, checked by two specific inspections on the Cadarache and Saclay centres in 2016.

ASN underlines that the performance of these numerous reviews associated with the preparation of the final shutdown and decommissioning authorisation application files represents a major safety issue, which will require significant resources on the part of CEA, in particular with regard to changes to the regulations. ASN will also be vigilant with regard to the actual initiation of the decommissioning operations on the facilities finally shut down, in accordance with French regulations. In 2017 it will examine the updated decommissioning, post-operational clean-out and waste and materials management strategy at CEA.

ASN considers that the level of safety in the facilities operated by CEA is on the whole satisfactory, in particular the operation of its experimental reactors. However, ASN observes a drift in several CEA projects with an impact on safety and considers that CEA must reinforce its surveillance and its oversight of external contractors in a context of large-scale subcontracting.

With regard to the other nuclear installations, ASN remains concerned by the radiopharmaceutical production facility operated by CIS bio international on the Saclay site. CIS bio international is a key player on the French market for radiopharmaceutical products used for both diagnosis and therapy.

Despite the efforts made by CIS bio international to reinforce its integrated management system and human resources and despite a few improvements noted, ASN considers that these reinforcements remain insufficient to ensure that lasting, concrete results are obtained. Operating rigour, the oversight and conformity of operations, the transverse nature of the organisation, compliance with the facility's baseline requirements, with decisions and with the regulations, for implementation of modifications, must be reinforced.

Owing to the large number of undertakings made by CIS bio international following the review, but not complied with, ASN stipulated completion deadlines for them in February 2016. In 2016, ASN applied administrative enforcement measures for non-compliance with a prescription regarding the removal of radioactive materials.

Following an unannounced inspection in February 2016, ASN served CIS bio international with formal notice to comply with several requirements concerning control of the fire risk. CIS bio international complied with this formal notice.

In 2017, BNI 29 will undergo a periodic safety review, for which a conclusions report shall be submitted no later than 31st July 2018. ASN shall be attentive to CIS bio international's compliance with regulations, prescriptions and its undertakings, to improvements in operating safety and to the progress of the work underway.

Outlook

A wide variety of research and other facilities are regulated by ASN. ASN will continue to oversee the safety and radiation protection of these installations as a whole and compare practices per type of installation in order to choose the best ones and thus promote operating experience feedback. ASN will also continue to develop a proportionate approach to the risks and detrimental effects of the installations, as classified by the resolution of 29th September 2015.

CEA

ASN considers that the "major commitments" approach implemented by CEA since 2006 is on the whole satisfactory.

ASN will be particularly attentive to compliance with the deadlines for transmission of the decommissioning files for CEA's old facilities which have been or will shortly be shut down (in particular Phébus, Osiris, MCMF, Pégase, Eole-Minerve). The Rapsodie reactor is also concerned as are the following waste processing facilities: the storage area (BNI 56) in Cadarache, the effluent treatment station (BNI 37) in Cadarache, the solid radioactive waste management area (BNI 72) in Saclay. The drafting of all these decommissioning files and then performance of these decommissioning operations represents a major challenge for CEA, for which it must make preparations as early as possible. Finally, ASN will monitor the preparation work for the decommissioning of the Osiris reactor shut down in 2015.

In 2017, ASN intends to:

- continue with surveillance of the operations on the RJH reactor construction site and prepare for examination of the future commissioning authorisation application;
- begin examining the significant modification authorisation application for Masurca and examine the safety review file completed by CEA;
- complete its examination of the periodic safety review files for the LEFCA and LECA facilities and decide on the conditions for their possible continued operation.

Other licensees

ASN will continue to pay particularly close attention to ongoing projects; that is ITER and commissioning of the Ganil extension.

ASN will continue to examine the periodic safety review files for Ionisos.

ASN will finalise the examination of complete commissioning of the "hardened safety core" on the RHF operated by the ILL, several years ahead of the other licensees.

Finally, in 2017, ASN will maintain its close surveillance of the radio-pharmaceuticals production plant operated by CIS bio international, with regard to the following points:

- increased operational rigour and safety culture;
- performance of the prescribed work for continued operation of the plant following its last periodic safety review;
- post-operational clean-out work on the very-high level units shut down in the facility.

15 Safe decommissioning of Basic Nuclear Installations

The term decommissioning covers all the activities performed after shutdown of a nuclear facility, in order to attain a final condition in which all the dangerous and radioactive substances have been removed. About thirty nuclear facilities of all types are currently shut down or undergoing decommissioning in France.

Assessment

The year 2016 was marked by the transmission by CEA and Areva of the decommissioning and waste management strategy files for their facilities and by EDF's announcement of a change in decommissioning strategy for its first-generation GCR (Gas-Cooled Reactors), with decommissioning being postponed by several decades owing to technical difficulties relating to dismantling under water. ASN asked EDF to justify this new strategy with respect to the "decommissioning within a time-frame that is as short as possible" requirement set out by law.

2016 saw the completion of the decommissioning files for four BNIs which were considered to be exhaustive enough to be submitted to a public inquiry at the beginning of 2017. This concerns the decommissioning files for Areva BNIs 93 (Eurodif) and 105 (Comurhex), EDF BNI 94 (AMI Chinon) and CEA BNI 52 (ATUE Cadarache). They received an opinion from the environmental authority in 2016. No facility was delicensed in 2016 but ASN received a delicensing application for the Active Materials Analysis Laboratory (LAMA) (BNI 61) operated by CEA in Grenoble. In 2016, one could also mention the beginning of decommissioning work on the Chooz A reactor vessel and the publication of the Decree of 2nd June 2016 requiring that CEA carry out decommissioning work on the Phenix power plant (BNI 71). The main significant event in 2016 concerned an outside contractor worker who received more than one quarter of the regulation annual effective dose limit in the plutonium technology facility (ATPu) (BNI 32) operated by CEA in Cadarache. The event was rated level 1 on the INES scale.

In October 2016, ASN carried out an in-depth inspection of Areva's organisation and the progress of legacy waste recovery from the La Hague site, which represents a major safety issue. ASN found that even though efforts have been made to prevent certain operations falling even further behind schedule, sticking points could significantly penalise the progress of other operations. ASN also revealed that the first recovery deadline stipulated by the resolution of 9th December 2014, concerning waste in silo 130, had not been met, even though noteworthy efforts worth

were made to recover these wastes, which was not the case for other projects.

In terms of regulation, ASN issued an opinion on 28th January 2016 on the draft decree updating the procedures surrounding final shutdown and decommissioning of BNIs, by making a clearer distinction than before between final shutdown of the facility and its decommissioning. ASN considers that this Decree, signed on 28th June 2016, represents a notable step forward.

In 2016, ASN updated and published the new version of guide No. 6 concerning final shutdown, decommissioning and delicensing of BNIs and technical guide No. 14 concerning structural post-operational clean-out operations. The provisions of this guide have already been implemented on numerous installations with diverse characteristics, such as

research reactors, laboratories, fuel manufacturing plant, etc. Finally, ASN also published guide No.24 on the management of contaminated soils in nuclear installations.

With regard to the financing of decommissioning and the management of the resulting waste by the licensees, ASN issued an opinion to the General Directorate for Energy and Climate on 26th May 2016 regarding the update documents for 2015 supplied by the licensees. In this opinion, it more particularly recalled the importance of regularly reassessing the hypotheses used by the licensees when defining the amounts of the provisions to be set aside.

Outlook

The main actions to be carried out by ASN in 2017 will be to monitor the decommissioning and waste management projects, in particular the recovery and packaging of CEA and Areva legacy waste, concerning which the delays observed are jeopardising the safety of the sites concerned. In particular, the strategy files from these two licensees, submitted in June and December 2016 respectively, will be the subject of an in-depth examination.

ASN will also issue a position statement on EDF's request for a change in strategy regarding the decommissioning of its first-generation gas-cooled reactors.

The periodic safety reviews of the facilities undergoing decommissioning, for which most of the conclusions files will be transmitted by the licensees in 2017, will also be the subject of close examination, appropriate to the risks and detrimental effects of these facilities.

Finally, in order to clarify the regulations on decommissioning and waste management, updated by the Ordinance of February 2016, ASN will continue to develop new guides in these fields as well as in the field of BNI contaminated sites and soils.

16 Radioactive waste and contaminated sites and soils

The term radioactive waste implies radioactive substances for which no subsequent use is planned or envisaged. These substances can come from both nuclear activities and non-nuclear activities in which the radioactivity naturally contained in substances, which are not used for their radioactive properties, has been concentrated by the processes employed.

A site contaminated by radioactive substances is any site, either abandoned or in operation, on which natural or artificial radioactive substances have been or are employed or stored in conditions such that the site can constitute a hazard for health and the environment. Contamination by radioactive substances can be the result of industrial, craftwork, medical or research activities.

Significant events

A highlight of 2016 was the finalising of the 2016-2018 French National Plan for Radioactive Material and Waste Management (PNGMDR). This three-year plan presents the rules of the radioactive substances management policy nationwide, identifies new needs and determines the objectives to be achieved, more specifically in terms of studies and research to create new management solutions.

At the beginning of 2017, this Plan was transmitted to Parliament and the Decree and Order of 23rd February 2017 establish its prescriptions.

2016 was also marked by the submission of Andra's safety options file concerning the *Cigéo* deep geological disposal project currently being examined by ASN. In accordance with the request from ASN and ASND, Areva also submitted the waste management and decommissioning strategy file for its facilities. After examination, this file will be the subject of a joint opinion by the two authorities.

Finally, in 2016, ASN published a guide on defining and modifying the BNI waste zoning plan in order to make it easier to apply the regulations concerning the operational management of radioactive waste in these facilities.

Assessment and outlook

Generally speaking, ASN considers that the French radioactive waste management system, built around a specific legislative and regulatory framework, a National Plan for Radioactive Materials and Waste Management (PNGMDR) and the agency Andra for management of radioactive waste independently of the waste producers, is capable

of regulating and implementing a structured and coherent national waste management policy. ASN considers that there must eventually be safe management for all waste, more specifically by means of a disposal solution.

The regulations concerning the management of radioactive waste

In 2017, ASN will finalise the resolution concerning the packaging of radioactive waste. It will draw up draft resolutions concerning radioactive waste disposal and storage installations. These draft texts will be made available for consultation by the stakeholders and the public.

Licensee waste management strategies

ASN periodically assesses the strategies put into place by the licensees to ensure that each type of waste has an appropriate solution and that the range of solutions implemented form a coherent whole. ASN in particular remains attentive to ensuring that the licensees have the necessary treatment or storage capacity for managing their radioactive waste and anticipate the construction of new facilities or renovation work on older facilities, sufficiently far in advance. In 2017, ASN will continue to closely monitor the legacy waste or spent fuel retrieval and packaging operations, focusing on those presenting the most significant safety implications.

In this respect, ASN and ASND are evaluating Areva's waste management strategy submitted in mid-2016, and that of CEA, submitted at the end of 2016. ASN and the ASND aim to issue their conclusions in 2018.

Low Level, Long-Lived Waste

With regard to Low Level, Long-Lived radioactive Waste (LLW-LL), ASN considers that progress in the creation of management solutions is essential. Analysis of the file submitted by Andra in 2015, pursuant to the PNGMDR, showed that it will be difficult to demonstrate the feasibility – in the zone investigated – of a repository for all LLW-LL type waste. In its opinion of 29th March 2016, ASN asked that in accordance with the PNGMDR, Andra submit a report by mid-2019, presenting the technical and safety options for this disposal facility and an industrial management system for LLW-LL waste established jointly with the producers of these wastes.

Depending on the results of this report, the waste producers should on the one hand create new storage capacity to avoid delaying decommissioning operations and, on the other, speed up the deployment of alternative strategies if their waste is not compatible with the Andra project.

In 2017, ASN will start revising the safety guide relative to the disposal of LLW-LL type radioactive waste.

High and Intermediate Level, Long-Lived Waste

With regard to the *Cigéo* project for the disposal of High and Intermediate Level, Long-Lived Waste (HLW and ILW-LL), 2017 will see the drafting of ASN's opinion on Andra's safety options file for *Cigéo*, submitted by Andra in 2016, more specifically containing the project's safety options, the technical retrievability options, a preliminary version of the waste acceptance specifications and a project development plan. This file is the first overall safety file for the facility since 2009. In particular, it underwent an international peer review under IAEA supervision in November 2016. The ASN opinion, which will be based on a study of the safety options file by the competent advisory committees of experts and on the report from the IAEA experts, shall specify its requirements regarding the content of the *Cigéo* creation authorisation application that Andra aims to submit in mid-2018.

Management of the former uranium mining sites and polluted sites and soils

With regard to the former uranium mining sites, ASN will in 2017 attempt to address the concerns of the Regional Directorates for the Environment, Planning and Housing regarding the Areva Mines action plan for the management of mining waste rock. It will focus more specifically on the management of potentially sensitive cases, in particular with regard to the radon risk. Together with the Ministry responsible for the Environment, it will continue its work and will ensure that any action taken is completely transparent and involves the local stakeholders.

As far as the contaminated sites and soils are concerned, ASN will in 2017 continue to state its position on the projects for the rehabilitation of contaminated sites on the basis of its doctrine published in October 2012 and will work with the Ministry responsible for the Environment on the revision of the Circular of 17th November 2008 relative to the management of certain types of radioactive waste and sites with radioactive contamination. ASN will issue an opinion at the beginning of 2017 on the draft decree to transpose Directive 2013/59/Euratom, which in particular concerns the procedures for oversight and management of sites and soils contaminated by radioactive substances. It will also maintain its investment in the operational management of the Radium Diagnosis operation, the purpose of which is to detect and, as applicable, treat any radium pollution inherited from past activities. It will pursue its action in collaboration with the government departments concerned and the other stakeholders.

ASN will also continue its involvement in international work on these topics, in particular within IAEA, ENSREG, WENRA, as well as bilaterally with its counterparts.

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