AUTORITÉ DE SÛRETÉ NUCLÉAIRE

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Abstracts

ASN REPORT

on the state of nuclear safety and radiation protection in France in 2017

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AUTORITÉ DE SÛRETÉ NUCLÉAIRE

The Nuclear Safety Authority
presents its report on the state of nuclear safety and radiation protection in France in 2017.

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 and transmitted to the Parliamentary Office for the Evaluation of Scientific and Technological Choices, pursuant to the above-mentioned Article.

Summary

A year that was on the whole satisfactory: a less worrying context, but several subjects requiring vigilance

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

Montrouge, 1st March 2018

In 2017, the safety of the operation of the large nuclear facilities and radiation protection in the industrial and medical fields remained on the whole satisfactory. However, with regard to the EDF NPP fleet, vigilance is required in the light of the difficulties encountered in the management of equipment conformity. In the medical sector, the persistence of level 2 incidents, more specifically in radiotherapy and during fluoroscopy-guided interventions, also warrants reinforced oversight.

The general context would appear to be less worrying:
- With regard to the carbon segregation anomaly in the steels of certain large components of nuclear power reactors, a number of important steps were taken: for the plants in operation, checks were requested on the steam generators more specifically concerned, which had been manufactured in Japan, leading to the early shutdown of 12 reactors one year ago. As for the EPR reactor pressure vessel, reinforced in-service checks will be required and the closure head should be replaced before the end of 2024.
- The review of all manufacturing files at the Creusot Forge plant is taking place satisfactorily: this review, requested by ASN, aims to detect any irregularities, notably the potential falsification of manufacturing documents. ASN will be vigilant in ensuring that this review, scheduled for the end of 2018, is seen through to completion and that all relevant lessons are learned.
- EDF and Areva have completed their reorganisation and their recapitalisation: their full deployment should enable these companies to regain the financial and technical capability they need to address the challenges facing them today. ASN will pay particularly close attention to this.

Unprecedented challenges face all the nuclear stakeholders. To a large extent, they were foreseeable:
- The nuclear industrial fleet was built about forty years ago, or even slightly before as concerns the CEA research facilities: the question today arises of extending the lifetime of these ageing facilities. It implies the examination of three subjects: compliance with their original design and construction baselines, management of ageing phenomena and improvements bringing them closer to today's safety baselines. These three subjects are technically complex and essential for safety; they require a strong industrial commitment.
- New nuclear facilities are currently under construction: whether the Flamanville EPR reactor, the Jules Horowitz reactor or the ITER project in Cadarache are concerned, there have been numerous difficulties and significant delays, mainly owing to the lack of design and construction experience.

There is another major issue: the lessons learned from the Fukushima Daiichi accident. This led to a large number of safety reinforcements on all French nuclear facilities; nonetheless major works will still be needed in the coming years.

Against this backdrop, ASN considers that vigilance is required to ensure that the operating safety of the large installations and radiation protection in the industrial and medical fields are maintained at a satisfactory level, with particular attention being paid to the detection of incidents, their notification and their processing, all of which are key factors in the continuous improvement of safety.

For the medium and long term, ASN has two messages:
- The electrical system must have sufficient margin to be able to deal with a generic anomaly affecting the NPP fleet. ASN already issued an opinion on this point in 2013: the French fleet is standardised and this feature was an advantage not only in terms of safety, but also in economic terms. Maintaining this advantage presupposes, on the one hand, continuing to detect anomalies as early as possible and, on the other, preparing to deal with the combined shutdown of several nuclear reactors concerned by a major anomaly.
- A lasting solution must be found for high and intermediate level, long-lived waste: existing or future surface and even sub-surface interim storage facilities are able to manage this waste in the short to medium term, but not on the time-scale of several hundred thousand years, the period for which they are harmful. Over time-scales such as these, nobody can guarantee the existence of the human and societal control necessary to maintain the safety of a sub-surface facility. The internationally adopted reference solution for long-term management is deep geological disposal. This is the solution chosen by France, which has also determined that a repository such as this must be reversible for a period of about a century. The *Cigéo* project, for which the safety options constitute significant progress, is designed to address this need. Its creation authorisation application should be submitted in 2019.

In this context made complex by safety and budget constraints, ASN has overhauled its regulation and oversight strategy: its aim is to focus on areas producing the greatest benefit for the protection of humans and the environment, taking account of both the risks inherent in the activities and the behaviour of those responsible for them. Conversely, for situations considered to be positive, ASN must be able to explicitly scale back its regulation and oversight.

Over the past three years, ASN and IRSN were granted additional resources. ASN is fully conscious of the efforts made in this respect by the Government and by Parliament. However, it reaffirms the need for reforms in the financing of the regulation and oversight of nuclear safety and radiation protection, which would enable it in the future to have access to resources that could be easily adapted to its needs.

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Falsification, changes required in monitoring and oversight practices

The review of the quality of production by the Creusot Forge plant highlighted a number of irregularities: concealment of technical anomalies from the customer and the regulatory authority and potential falsification of measurement or examination results. These irregularities were detected neither by the Creusot Forge plant's internal checks, nor by the monitoring carried out by Areva and EDF. Nor were the inspections carried out by ASN able to identify them. ASN has examined ways of improving the oversight and monitoring arrangements in order to improve the prevention and detection of this type of irregularity. The resulting action plan will be finalised in the first half of 2018.

Increased safety requirements for continued operation of the facilities

In 2020, ASN plans to issue a generic opinion on the continued operation of the 900 MWe reactors beyond their fourth periodic safety review. The public will participate in the drafting of this generic opinion. The safety reviews of the thirty-four 900 MWe reactors will run from 2020 to 2030; the first safety review report will be that of Tricastin 1 in 2020.

The safety review will be carried out on the basis of the safety requirements applicable to the most recent reactors, more specifically with regards to internal and external hazards and severe accidents. Equipment compliance with the initial baseline safety requirements will also need to be verified, with particular attention paid to ageing phenomena.

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 also often ageing. Several tens of these installations underwent a periodic safety review in 2017, many of them for the first time.

Given the complexity of the subjects to be dealt with, this periodic safety review approach will take several years, both for the licensees and for ASN.

EPR, advances in safety but a difficult construction phase

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 more effective means of mitigating the consequences of accidents with core melt.

ASN underlines the fact that EDF still needs to carry out significant work before loading fuel into the reactor, to demonstrate on the one hand the serviceability of the nuclear pressure equipment, the primary and secondary systems in particular and, on the other, the performance of the safety systems.

In 2018, ASN will be particularly vigilant with respect to the performance of the pre-startup tests, a key factor in guaranteeing the facility's compliance with its baseline safety requirements.

Radioactive waste management, a major safety challenge

The public debate which should be held at the end of 2018 on the National Radioactive Material and Waste Management Plan (PNGMDR) will be an opportunity to obtain the opinion of the public on the most important issues: the reusable nature of materials, storage capacity, in particular for spent fuels and the highest level wastes, the management of very low level waste with a view to forthcoming decommissioning work, as well as the disposal of low level, long-lived waste and the disposal of high and intermediate level, long-lived waste.

The periodic studies conducted to assess the consistency of the fuel cycle, taking account of possible changes in energy policy, are input into the PNGMDR. In 2018, ASN will issue an opinion on the consistency of the fuel cycle in the light of the consequences for nuclear safety and radiation protection, as well as on the storage facilities, which offer little capacity margin.

ASN aims to ensure that the national system for radioactive materials and waste management remains pertinent on a long-term basis. In this respect, France welcomed an Artemis mission in early 2018. This is an international review by experts coordinated by the International Atomic Energy Agency. The auditors pointed out that the French system, which deals with all the issues, has a number of strong points, more particularly in terms of skills and the continuous progress approach. Improvement suggestions were made and will be taken into account in the next PNGMDR.

Progress necessary in radiotherapy and interventional radiology

ASN observes that there are still inadequacies in certain radiotherapy units, more particularly in the management of technological or organisational changes. Vigilance is thus still required, all the more so as four incidents rated level 2 on the ASN-SFRO scale were notified in 2017.

There is a significant rise in interventions using X-ray imaging, thus constituting a growing concern for ASN. Inspections in this field show the persistence of radiation protection difficulties, both for the patients and for the health care personnel, as borne out by the notification of three significant events rated level 2 on the INES scale. These difficulties are primarily the result of a lack of radiation protection culture and often inadequate levels of medical physics staffing, owing to the budget difficulties experienced by the facilities.

Radioactive sources, our first steps in the field of security

ASN is at present contributing to finalising the regulations on source security. It will therefore be updating its resolution on the content of authorisation applications for the possession and utilisation of these sources. After an inventory conducted by the ASN regional divisions and the implementation of specialised training for staff, the first inspections in this field will take place in the second half of 2018.

Improved protection of the population in the event of an accident

The latest iodine tablets information and distribution campaign, which began in 2016, was completed in 2017 within the 10 km radius of the NPPs.

Following the recent extension of the off-site emergency plans around the NPPs, in which this radius is increased from 10 km to 20 km, an information campaign will be carried out among the local residents prior to the distribution of iodine tablets outside the 10 km radius. ASN will support this approach alongside other local and national stakeholders. For the NPPs at the borders, particular attention will be given to coordinating steps taken by the various States concerned.

Radon, new public protection measures

Prolonged exposure to radon, a radioactive gas of natural origin, can lead to the risk of lung cancer. Whether in the professional sector, in public buildings or private homes, steps must be taken to reduce this exposure, particularly in priority geographical areas in which the geological characteristics amplify the exhalation of radon.

The deployment of the 3rd National Plan (2016-2019) for Radon Risk Management, published by ASN in January 2017, and the new map of the municipalities considered to be high-risk, are two steps forward in ensuring better protection of the public. The home is where the dose received during the course of a lifetime is often the highest (time spent there, significant concentration in some rooms in the home). For existing homes, the plan therefore comprises new provisions concerning mandatory information of buyers and tenants, as well as the installation of measurement systems.

Towards a European approach to nuclear safety and radiation protection

Internationally, more specifically at the European level, ASN is heavily involved in the work done by ENSREG[1], WENRA[2] and HERCA[3].

Within ENSREG, ASN produced a report in 2017 on the management of the ageing of the French reactors. The reports produced by the member States concerned will be reviewed in 2018 by experts from the European safety regulators. Pending its decision on continued operation, ASN will pay particular attention to the conclusions of this review.

At an ENSREG conference, ASN presented its own opinions on the improvement of the oversight and regulation system, in order to improve the prevention and detection of irregularities such as those detected in the Creusot Forge plant.

ASN also informed its counterparts of its technical analysis of the carbon segregation anomaly in the steel used to produce large components, which could eventually lead to changes in the manufacturing codes.

Within HERCA, ASN is more specifically involved in European coordination of population protection measures in the event of a nuclear accident.

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

Olivier GUPTA
Director General

Towards a new regulation policy

Montrouge, 1st March 2018

The question has been heard a number of times: is ASN under pressure? It cannot be denied that the current context is a potential source of tensions and the workload is considerable, but the very nature of ASN's duties requires that it issue its resolutions rigorously yet calmly. This is what we did throughout 2017 and this is to a large extent the result of a working method profoundly rooted in the very culture of ASN itself.

However, the context required that we redefine a strategic plan in order to take account of the challenges of the current period and that we take a fresh look at our regulation and oversight policy: this fundamental work has been carried out and 2018 will see the implementation of the resulting changes.

ASN's working method, a real advantage in the current context

ASN devotes efforts to identifying subjects on which it wishes to see progress being made in the nuclear safety and radiation protection situation. These subjects are often complex, of long duration and require a degree of perseverance.

The case of social, organisational and human factors is a prime example of this. After the Fukushima Daiichi accident, ASN considered that this subject needed to be looked at again, with the involvement of all stakeholders concerned and, as early as 2012, it created a steering committee for social, organisational and human factors. The work done by several thematic groups set up within this committee, more particularly on maintenance and emergency situations, was completed in 2017 and their reports were made public.

On a completely different point, ASN has for a long time been pointing out that the monitoring of the security of radioactive sources – in other words their protection against malicious acts – was covered by no State structure and proposed taking charge of this point. This has now been done and the first inspections on the subject will take place in 2018. The ASN working method, its ability to adapt and the flexibility of its organisation are no doubt crucial in its ability to take on new subjects and ensure progress in dealing with them, year after year.

ASN has built a decision-making process that is rigorous, collective and open.

Rigorous: each decision on a complex subject is the result of an investigation conducted by ASN in accordance with procedures. This demands real know-how, that of being able to identify the issues, ask oneself questions, listen to the licensee, collect the opinions of experts and check that all aspects of importance for the decision have been examined.

Collective: the decisions are prepared within ASN by several persons who together assess various options and their consequences.

Open: ASN consults the public on its draft resolutions, both directly and indirectly, via the Local Information Committees.

Finally, ASN is particularly active in networks involving foreign counterparts, with which it has built up a relationship of trust enabling difficult subjects to be discussed. With regard to the carbon segregation anomaly in the steels used to manufacture certain large components, the discussions between ASN and its counterparts in 2017 will thus lead to this subject being better incorporated into the industrial standards in the future. On a different topic, at its plenary session of October 2017, the Western European Nuclear Regulators Association (WENRA) decided to start work on the safety improvements to reactors that could be reasonably envisaged beyond forty years in service. This work will be of great value to ASN when preparing its own resolutions on the subject.

With regard to resources, ASN has so far obtained the resources it needs to carry out its duties. Fifty positions were created at ASN between 2015 and 2017, together with an increased workload which, in the current public budget context, represents a significant effort on behalf of the regulation and oversight of nuclear safety and radiation protection. For the coming three years, ASN evaluates its needs at 15 additional posts, both to absorb the workload involved in the ongoing subjects and to allow the implementation of regulation to address the problem of fraud.

At the same time, ASN is working on making its regulation and oversight more efficient: After creating a categorisation of nuclear facilities according to the potential consequences, in 2016, ASN extended the remote-notification system in 2017 and reviewed the regulation and oversight arrangements for small-scale nuclear facilities. Actions in this area will continue in 2018, together with the new ASN Strategic Plan.

A new strategic plan and a new regulation and oversight policy

Throughout the course of 2017, ASN worked on an in-depth overhaul of its strategy and on an adaptation of its regulation and oversight methods to present and future issues. Apart from an analysis of the current context, ASN listened to the various stakeholders, including interviews with the licensees and activity managers, the representative learned societies in the medical nuclear field, representatives of civil society, trade union organisations in the nuclear industries, the main administrations and organisations with which ASN is in contact, as well as foreign counterparts.

All the ASN staff contributed to drafting a new three-year strategic plan and a new regulation and oversight policy, which they will be implementing on a daily basis, as of this year.

The regulation and oversight policy thus defined emphasises the reinforcement of a graded approach. Two parameters must be taken into consideration when evaluating regulation and oversight priorities: on the one hand, the risks inherent in the activities for individuals and the environment and, on the other, the behaviour of those responsible for the activities and the means they deploy to manage these risks.

ASN thus intends to reinforce its regulation and oversight of fields or facilities considered to have priority; one example of this being the “reinforced monitoring” of a facility. Conversely, when the potential consequences are low, or for situations considered to be positive in terms of protection of individuals and the environment, it aims to scale back its regulation and oversight.

This graded approach must apply not only to regulation and oversight, but also to the procedures and methods for information of and participation by the public and the stakeholders: these

methods and procedures must be adapted so that they better inform the debates and decisions for those subjects with the most significant implications and consequences.

This graded approach will be implemented both for basic nuclear installations and for small-scale nuclear facilities, including for medical activities. In this field, concrete measures were already taken in 2017. Regulation and oversight priorities were redefined per activity sector. Inspections are now more modular, to take better account of the actual situation in the field.

Over and above the graded approach, three other aspects resulting from ASN's strategy are worth underlining.

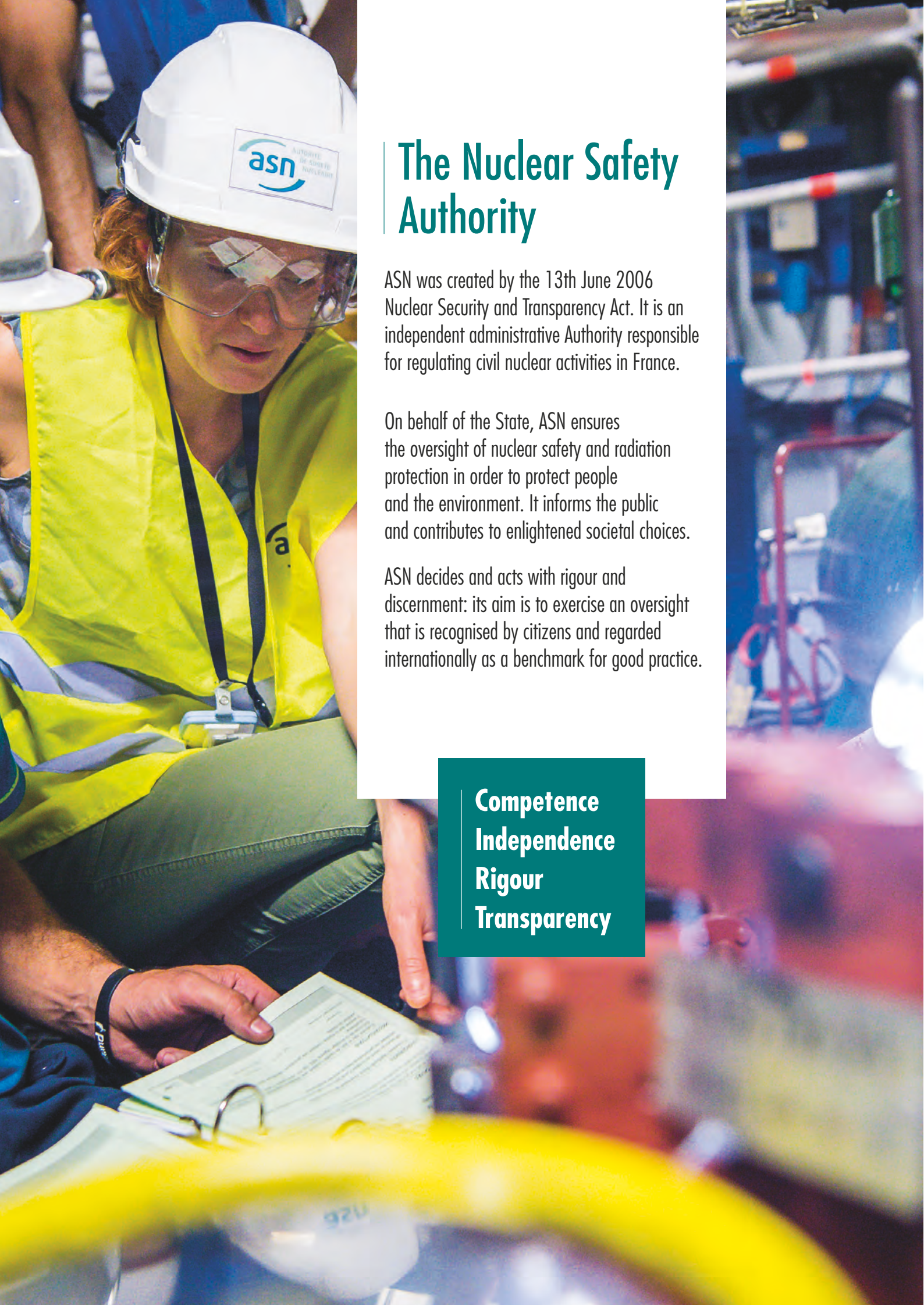
First of all, the fact that ASN continues to place emphasis on technical dialogue with the licensees, because its resolutions are based on a technical assessment – in the broadest sense of this term, in other words including social, organisational and human aspects. This goes hand in hand with regulations which set goals rather than means. As this technical dialogue lies at the heart of the examination processes, ASN intends to further reinforce its technical involvement in the analysis of the files submitted to it. It also intends to ensure improved management and monitoring of external analysis and assessment.

Then, as of 2018, ASN intends to implement changes to its regulation and oversight methods. I am more specifically thinking of those which are made necessary in order to deal with fraud, including by carrying out inspections at the suppliers. More broadly speaking, ASN intends to reinforce the effectiveness of its actions in the field, by more closely linking examination of the files submitted by the licensees to the field inspections and reinforcing the ability of the inspectors to qualify and rank the anomalies they detect.

Finally, ASN intends to continue its involvement at an international and more specifically European level, with two goals: to promote top-down harmonisation and benefit from the opinion of its peers. ASN has succeeded in creating a European safety doctrine with its counterparts, extensively inspired by the French approach. The aim is now to go further in harmonising rules and practices. ASN more particularly hopes that the launch of a review of the WENRA association's strategy will be an opportunity to promote a voluntary interaction between all the European safety regulators in the construction of national decision-making and to increase the use made of the European technical support organisations within ETSON (European Technical Safety Organisations Network).

Much has been accomplished during the course of 2017, be it in terms of preparing major resolutions (such as that on the EPR reactor pressure vessel or the safety options file for *Cigéo*), regulatory work (such as the transposition of Directives concerning basic radiation protection standards), or the preparation of the new strategy. This report also bears witness to the diversity and scale of the actions taken.

2018 will be no less dense. Over and above the day to day regulation and oversight actions, apart from the workload which will continue to grow in order to prepare the major resolutions, ASN intends to carry out the various projects which will constitute the tangible implementation of the strategic orientations decided on in 2017. Thanks to the constant engagement by all ASN staff and the strength of our common culture, I am confident of our ability to successfully carry out all of these actions, further enhancing the protection of individuals and the environment.



The Nuclear Safety Authority

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.

On behalf of the State, ASN ensures the oversight of nuclear safety and radiation protection in order to protect people and the environment. It informs the public and contributes to enlightened societal choices.

ASN decides and acts with rigour and discernment: its aim is to exercise an oversight that is recognised by citizens and regarded internationally as a benchmark for good practice.

Competence
Independence
Rigour
Transparency

ASN

Roles

Regulating
ASN contributes to drafting regulations, by giving the Government its opinion on draft decrees and Ministerial Orders, or by issuing technical regulations. It ensures that the regulations are clear, accessible and proportionate to the safety issues.

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. Since the Energy Transition for Green Growth Act of 17th August 2015, ASN's roles now include monitoring the security of radioactive sources against malicious acts. Inspection is ASN's primary monitoring activity. Nearly 2,000 inspections are thus carried out every year in the fields of nuclear safety and radiation protection. ASN has a range of notification and enforcement powers (formal notice, administrative fines, daily fines, ability to carry out seizure, take samples or require payment of a guarantee, etc.). ASN's sanctions will be enforced by a Sanctions Committees, created within ASN, in order to maintain the principle of separation between the investigative and sentencing functions.

Informing
ASN informs the public and other stakeholders (environmental protection associations, Local Information Committees, media, etc.) about its activities and the state of nuclear safety and radiation protection in France. ASN's main information channel is its website *www.asn.fr*.
In line with the principle of transparency, ASN supports the actions of the Local Information Committees of the nuclear facilities.

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 monitors and regulates an extremely varied range of activities and facilities.

This regulation covers:
- 58 nuclear reactors producing nearly 80% of the electricity consumed in France, along with the EPR reactor currently under construction;
- all French fuel cycle facilities, from fuel enrichment to reprocessing;
- several thousand facilities or activities which use sources of ionising radiation for medical, industrial or research purposes ("small-scale nuclear facilities"); several hundred thousand shipments of radioactive substances nationwide, every year.

The support of experts

When drawing up its resolutions, ASN calls on outside technical expertise, in particular that of the French Institute for Radiation Protection and Nuclear Safety (IRSN). The ASN Chairman is a member of the IRSN Board. ASN also calls on the opinions and recommendations of seven Advisory Committees of Experts, from a variety of scientific and technical backgrounds.

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
12th November 2012 for 6 years	10th December 2014 for 6 years	21st December 2016 for 6 years	10th mars 2017 for 6 years	12th November 2012 for 6 years
		APPOINTED BY the President of the Republic	**APPOINTED BY** the President of the Senate	**APPOINTED BY** the 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.

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 oversight 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 regional divisions assist the Prefect of the *département*[1], who is in charge of protecting the general public, and supervise the operations carried out to safeguard the facility on the site.

1. Administrative region headed by a Prefect.

Commission figures in 2017

86 sessions

17 opinions

42 resolutions

Key figures in 2017

508 staff members

83% management

311 inspectors

1,751 inspections

19,894 inspection follow-up letters
available on *www.asn.fr*
as at 31st December 2017

386 technical opinions
sent to ASN by IRSN

22 Advisory Committee meetings

2,888 individual licenses
for facilities or activities

€84.4 million
total budget for ASN

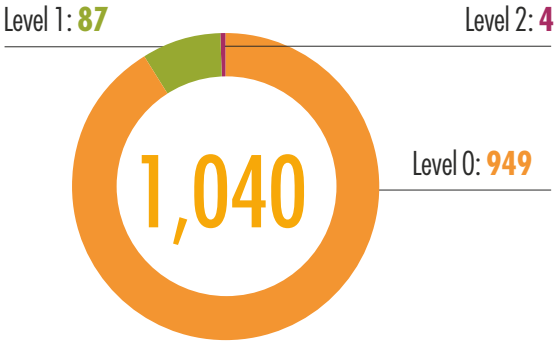
€84.3 million
IRSN budget devoted to analysis and assessment work on behalf of ASN

16 press conferences

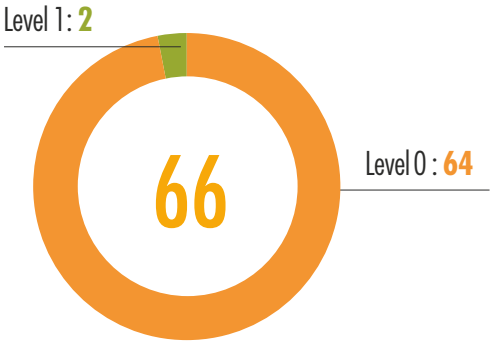
87 press releases and information notices

10 emergency exercises

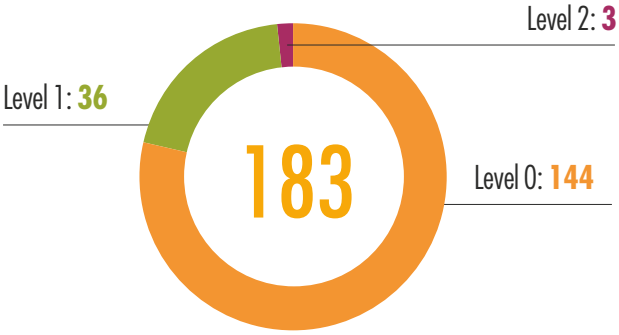
Number of significant events rated on the INES scale



Basic Nuclear Installations (BNIs)

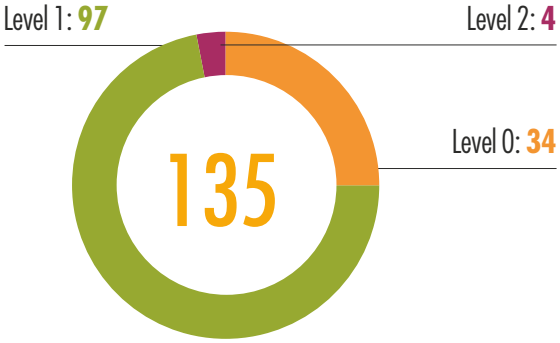


Transport of radioactive substances



Small-scale nuclear activities (medical and industry)

Number of significant events rated on the ASN-SFRO scale



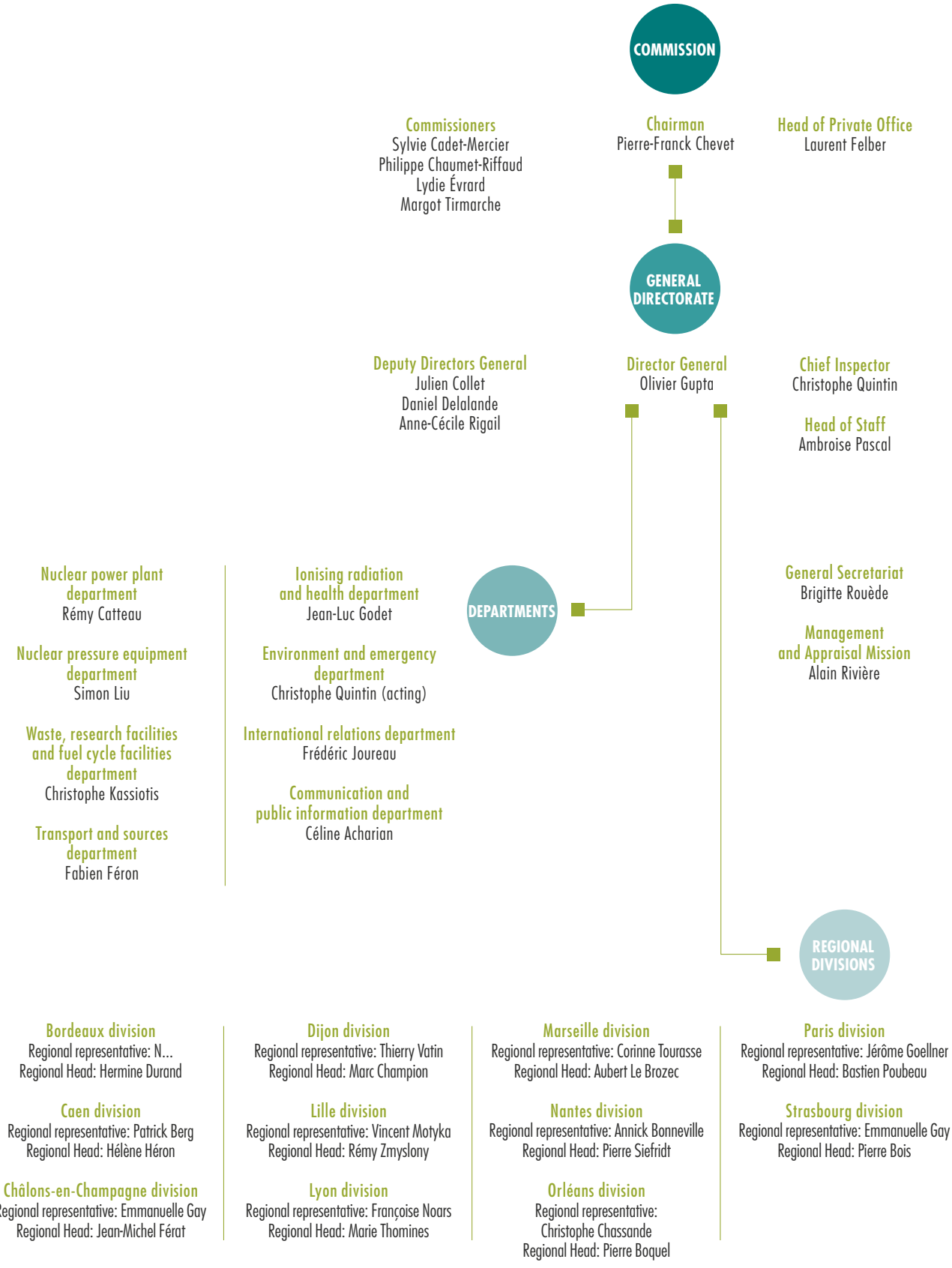
INES

International Nuclear and Radiological Event Scale.

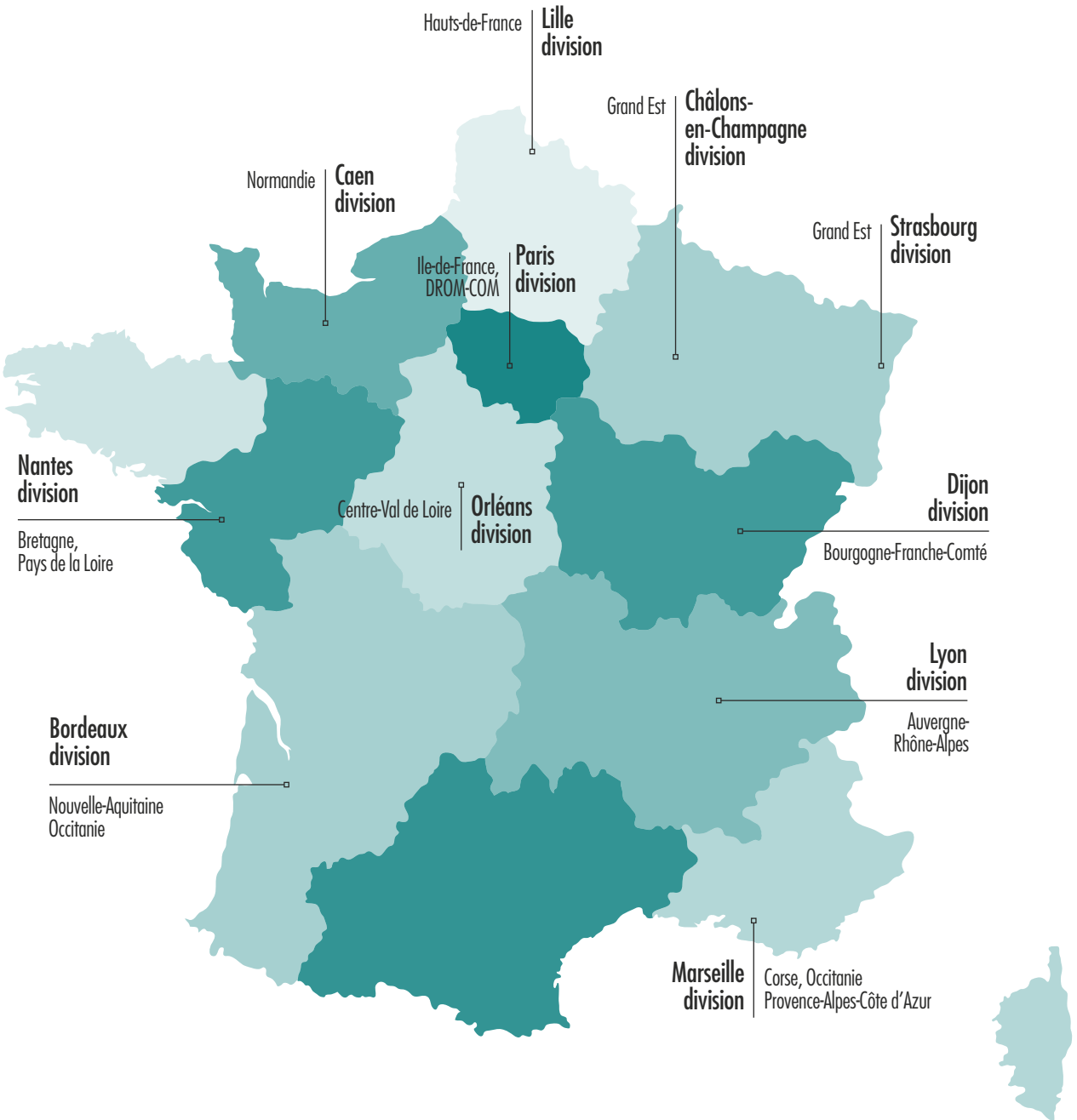
ASN-SFRO

Scale for radiation protection events affecting patients undergoing a medical radiotherapy procedure.

ASN organisation chart as at 1st March 2018



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.

Significant events and outlook

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, radon emanations from the ground and exposure to cosmic radiation.

Nuclear activities include those conducted in Basic Nuclear Installations (BNIs) and the transport of radioactive substances, as well as activities conducted in all medical, veterinary, industrial and research facilities where ionising radiation is used.

Ionising radiation 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" (clinical effects such as erythema, radiodermatitis, radionecrosis or cataract); these effects occur systematically once the radiation dose exceeds a certain threshold. Ionising radiation is also the cause of probabilistic effects, primarily the occurrence of cancers, the probability of which increases with the dose received by the subject. The protective measures against ionising radiation aim to avoid deterministic effects, but also to minimise the probability of occurrence of radiation-induced cancers, which constitute the main risk.

Understanding the risks linked to ionising radiation is based on follow-up studies of cohorts of exposed subjects (Hiroshima, Nagasaki, nuclear accidents, etc.) epidemiological surveys, the study of cancer registers and pre-clinical experimentation data. Risk management is based on the

hypothesis of the linear relationship without threshold and evaluation of the low-dose risks by an extrapolation from those observed at high doses.

Numerous unknown factors and uncertainties nonetheless persist, more particularly with regard to the actual effects at low doses, the deterministic risks for the vascular system, the radio-sensitivity of certain subjects and the existence or otherwise of a radiological signature for radiation induced cancers.

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 3 depending on the location, the eating habits, the medical exposures, etc. The sources of this exposure are as follows:

- accounting for about 2.9 mSv/year, radioactivity of natural origin, including 0.6 mSv/year for telluric radiation (except radon), 0.3 mSv/year for cosmic radiation, 0.6 mSv/year for internal exposure due to food or tobacco, as well as about 1.4 mSv/year for radon, although with considerable variations linked to the geological characteristics of the land and the buildings themselves. A new national radon exhalation potential map was drawn up in 2011. In the zones defined as high priority, periodic measurements must be taken in places open to the public and in workplaces; a third national action plan has been defined for the period 2016-2019;
- accounting for about 1.6 mSv/year (2012 estimation), radiological diagnostic examinations, trending upward (+ 23% between 2007 and 2012); particular attention must be given to managing the doses delivered to patients;
- accounting for 0.02 mSv/year, the other sources of artificial exposure: past airborne nuclear tests, accidents in facilities, discharges from nuclear facilities.

Nuclear workers receive specific monitoring (more than 370,000 people in 2016); in 2015, the annual dose remained below 1 mSv (annual effective dose limit for the public) for 96% of the workforce monitored and the regulation limit of 20 mSv applicable to nuclear workers was only exceeded once; the collective dose has fallen by about 50% since 1996 even though the population monitored has grown by about 60%.

Finally, aircrews are subject to particularly close monitoring owing to their exposure to cosmic radiation at high altitude. Of the recorded doses, 82% are between 1 mSv per year and 5 mSv per year, while 18% are below 1 mSv per year.

Outlook

For occupational radiation protection, monitoring of exposure of the lens of the eye, with gradual compliance with the new limit for this tissue (set at 20 mSv/year as of 2022) constitutes the main objective in the next few years, more specifically in the field of fluoroscopy-guided interventional medical practices.

Managing the doses of ionising radiation delivered to persons during a medical examination remains a priority for ASN. A second action plan, which continues on from the previous one (2011-2017), was drawn up jointly with the stakeholders (institutional and professional) and will be published in the first quarter of 2018.

Deployment of the 3rd National Plan for Radon Risk Management, which accompanies the publication of the new map of the municipalities considered as high-priority with respect to this risk, should allow improved communication aimed at the public in order to encourage the implementation of measurements in existing homes and gradually organise the collection and analysis of the results.

02 The principles of nuclear safety and radiation protection and the regulation and oversight stakeholders

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 stipulates that the costs resulting from the measures to prevent, reduce and combat pollution must be borne by the polluter;
- 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 regulation and oversight organisation is defined more specifically in the Environment Code. It was recently reinforced by the Energy Transition for Green Growth Act (TECV) 2015-992 of 17th August 2015 and Ordinance 2016-128 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 Government organisation, the Minister for Ecological and Solidarity-based Transition is responsible for nuclear safety and, together with the Minister for Solidarity and Health, for radiation protection.

In each *département* , the Prefect – as the State's representative – is responsible for population protection measures in the event of an accident. 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 body of statutory texts by issuing regulations. 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 non-compliance 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, 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. The President of the Republic nominates the Chairman and two Commissioners. The President of the Senate and the President of the National Assembly each nominate one Commissioner.

A Sanction Committee within ASN, established under the TECV Act, will be 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 508 employees. In 2017, the ASN budget stood at €84.41 million. Moreover, about 400 IRSN staff work on providing ASN with technical support. In 2017, IRSN thus devoted €84.3 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 €179.27 million in 2017.

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 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 tasked with giving an opinion on some draft regulatory texts. For each BNI, consultation takes place within a Local Information Committee (CLI).

Outlook

ASN will be implementing its new 2018-2020 multi-year strategic plan, notably with reinforced implementation of a graded and efficient approach to its regulation and oversight, improved oversight of technical investigations and consolidation of its operations to enhance regulation and oversight. In a context of unprecedented safety challenges, the ASN opinion of 1st June 2017 recalled that for the next three-year plan for 2018-2020, it has requested 15 additional full-time equivalent staff.

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, 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 of 5th December 2013 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 safety of nuclear installations, modified by Directive 2014/87/Euratom of 8th July 2014. Council Directive 2011/70/Euratom of 19th July 2011 also establishes a European Community framework for the responsible and safe management of spent fuel and radioactive waste.

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 rules applicable to the large nuclear installations and to the management of radioactive wastes. 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. This legal framework has been the subject of profound overhauls in recent years, notably owing to the transposition into national law of the European directives adopted under the EURATOM Treaty.

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 (imaging, radiotherapy, nuclear medicine), human biology, research, industry and certain veterinarian, forensic or foodstuff conservation applications.

The Public Health Code, modified at the beginning of 2018 to ensure the transposition of Directive 2013/59/Euratom, creates a new system of procedures for the manufacture, possession, distribution - including import and export - and utilisation of radionuclides. The existing simple notification system will thus be extended to activities which in the past required licensing and, for other activities the licensing system will be simplified with the implementation of a new system of registration. This new system will be gradually implemented as of 1st July 2018.

The Public Health Code changes made at the beginning of 2018 were accompanied by new provisions concerning protection against malicious acts for the most dangerous radioactive sources, the implementation of the justification principle, the implementation of the optimisation principle with the introduction of reference levels for exposure to naturally occurring radiation, for the management of nuclear or radiological emergency situations and for the management of sites and soils contaminated by radioactive substances.

The general rules applicable to small-scale nuclear facilities are the subject of ASN regulations. In 2017, the minimum technical design rules applicable to premises in which electrical devices generating X-rays are used were updated (ASN resolution 2017-DC-0591 of 13th June 2017) and new radiation protection continuous training arrangements for health professionals were defined (ASN resolution 2017-DC-0585 of 14th March 2017).

The Labour Code was also profoundly overhauled at the beginning of 2018, with reinforcement of the occupational risk assessment approach, possible out-sourcing of the function of adviser to certified organisations and a gradual reduction in the dose limit for the lens of the eye (the exposure limit for the lens of the eye is reduced from 150 mSv/year to 20 mSv/year, with a transitional period running from 1st January 2018 to 31st December 2022 during which the exposure limit value is set at 100 mSv over five years, without exceeding 50 mSv/year).

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 reference level in premises open to the public and in the workplace was reduced from 400 Bq/m^3 to 300 Bq/m^3. In the workplace, after optimisation, an annual dose value higher than 6 mSv/year will lead to the workers being classified as "exposed workers".

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 130 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 in accordance with the principle of immediate dismantling.

In 2017, ASN took part in the continued drafting of the regulatory part of the Environment Code for BNIs, the transport of radioactive substances and Pressure Equipment (PE).

ASN is working on an overhaul of the BNI general technical regulations: after publication of the Ministerial Order of 7th February 2012 setting the general rules for BNIs, ASN began to publish a series of fifteen statutory resolutions; in 2017, it adopted four resolutions and published four new guides. These guides, which are not legally binding, present ASN doctrine in the form of recommendations. 30 guides have so far been published in all the fields in which ASN is competent.

The PE specifically designed for BNIs is subject to particular rules, overhauled in 2015 and 2016, which will be supplemented by an order. This will itself be followed by a number of regulations.

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-operational clean-out of the contaminated premises and remediation of soil must be managed, from the site up to storage or disposal.

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

Outlook

2018 will in particular be devoted to continued implementation of the reforms adopted in 2015 and 2016 on the legislative texts and to contributing to preparing the implementing orders for the decrees modifying 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 new system for notification and registration of certain small-scale nuclear activities. It will continue to create general technical regulations for BNIs, contribute to the revision of the Order of 7th February 2012 and the definition of the framework applicable to the protection of radioactive sources against malicious acts.

04 Regulation of nuclear activities and exposure to ionising radiation

In France, the party responsible for a nuclear activity must ensure that this activity is safe.

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 nuclear safety and radiation protection, in order to protect people and the environment from risks associated with radioactivity.

Inspection is the key means of monitoring available to ASN: one or more ASN inspectors (nuclear safety inspectors, radioactive substance transport safety inspectors, labour inspectors and radiation protection inspectors) go to a site or department, or to carriers of radioactive substances. 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.*

The inspection concerns material, organisational and human aspects.

ASN's regulatory actions are also carried out by other means such as examination of authorisation applications and analysis of significant events. It is proportionate to the level of risk presented by the facility or activity. Following safety and radiation protection assessments in each activity sector, its regulatory and oversight activities lead to issue of resolutions, prescriptions, inspection follow-up documents, plus administrative or criminal penalties as applicable.

Assessment

In 2017, ASN was notified of:

- 1,165 significant events concerning nuclear safety, radiation protection and the environment in BNIs; 1,040 of these events were rated on the INES scale[1] (949 events rated level 0, 87 events rated level 1 and 4 events rated level 2). Of these events, 18 significant events were rated as "generic events" including three at level 1 and three at level 2 on the INES scale;
- 66 significant events concerning the transport of radioactive substances, including two events rated level 1 on the INES scale;
- 655 significant events concerning radiation protection in small-scale nuclear activities, including 183 rated on the INES scale (of which 36 were level 1 events and 3 were level 2 events).

2017 was marked by several events rated level 2 on the INES scale in the field of NPPs and in the medical field.

In 2017, following the inspections carried out, the ASN inspectors transmitted twelve reports to the Public Prosecutors.

In 2017, ASN took three administrative actions (formal notice, deposit of sums, etc.) against managers of nuclear activities.

With regard to protection of the environment, 2017 was marked by the adoption of ASN resolution 2017-DC-0588 of 6th April 2017 setting rules for the intake and consumption of water, the discharge of effluents and environmental monitoring specifically applicable to PWR nuclear reactors, and by the launch of the 2016-2021 micro-pollutants plan, through which ASN will closely monitor the gradual reduction in copper and zinc discharges from the NPPs.

Finally, the October 2017 meeting of the action plan follow-up committee created following the publication of the tritium White Paper was able to measure the latest progress made in understanding the origins, levels and behaviour of tritium in the environment.

1. INES: International Nuclear and Radiological Event Scale.

Outlook

In 2018, ASN intends to perform about 1,800 inspections of BNIs, of radioactive substances transport activities, activities involving the use of ionising radiation, organisations and laboratories that it has approved and activities related to pressure equipment.

Further to the irregularities found in the manufacture of certain NPP equipment items, ASN in 2017 initiated a review of BNI licensee monitoring of their contractors and subcontractors.

ASN will also implement the conclusions of its review of the reinforced effectiveness of the oversight of small-scale nuclear activities. Furthermore, the revision of the Labour Code and the Public Health Code will enable ASN to finalise the revision of the criteria and procedures for

the notification of significant radiation protection events.

In the field of environmental protection, ASN will continue with its regulatory work to implement the provisions of the TECV Act and the transposition to BNIs of the 24th November 2010 Directive on Industrial Emissions, known as the "IED Directive" and the 4th July 2012 Directive concerning major accidents involving hazardous substances, known as the "Seveso 3 Directive".

05 Radiological emergency and post-accident situations

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, regularly tested and revised.

These emergency situations are covered by specific material and organisational arrangements, which involve both the licensee and the party responsible for the activity and the public authorities.

ASN takes part in management of these situations, for questions concerning the regulation and oversight of nuclear safety and radiation protection. It has the following four roles:

- 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 to deal with a nuclear accident in a BNI more specifically comprises:

- the participation of ASN staff in the various units of the French Inter-ministerial Crisis Committee;
- at the national level, an emergency centre in Montrouge, consisting of three Command Posts (PC): a Strategic Command Post consisting of the ASN Commission, a Technical Command Post in constant contact with its technical support organisation, IRSN, and a Communication Command Post.
- at the local level, ASN representatives visit the *département* and zone Prefects to help them with their decisions and their communication actions; ASN inspectors may also go to the site affected by the accident.

Significant events

In 2017, the national emergency centre was activated on 14 occasions, for four real situations and ten national exercises. Of the national exercises, two concerned defence BNIs or sites under the responsibility of the Defence Nuclear Safety Authority (ASND) and two included a malicious initiator.

The programme of exercises comprised two atypical exercises: an NRBC exercise (Nuclear, Radiological, Bacteriological or Chemical malicious act) and a training exercise for the ***départements*** in the Auvergne-Rhône-Alpes region in the deployment of post-accident measures (restrictions on the consumption and sale of local produce).

The real situations in 2017 concerned two Greenpeace intrusions on the Cattenom and Cruas-Meysse NPPs, and two activations of the On-site Emergency Plan (PUI) on the Bugey NPP. The first activation, as a result of a fire on a roof in a controlled area during a worksite, had no environmental consequences, as the fire was rapidly extinguished, and was rated level 0 on the INES scale. The second event concerned the blockage of a valve which led to the shutdown of reactor 2. The licensee implemented its incident management procedures, enabling a controlled state to be restored in a few hours. This event, rated level 1 on the INES scale, had no environmental impact. Following each of these events, ASN carried out inspections and learned the necessary lessons.

In 2017, ASN also took part in several international exercises organised by the IAEA, Switzerland and Spain, as well as one tabletop exercise with Germany.

Finally, during the national exercise on the Cattenom NPP, ASN tested

coordination with representatives of the German nuclear safety regulator and the Government of Luxembourg.

ASN resolution 2017-DC-0592 of 13th June 2017 supplements the provisions of the BNI Order of 7th February by specifying the licensees' obligations for preparedness for and management of emergency situations, as well as ASN's requirements regarding the content of the PUI. Most of the provisions of this resolution give official status to existing practices which were not incorporated into the regulations. This resolution also transposes certain WENRA[1] reference levels and takes account of the lessons learned from the Fukushima Daiichi accident. It more particularly requires that the emergency crew members take part in at least one simulation or exercise per year and specifies the information that the licensee must transmit to the authorities.

Outlook

The nuclear safety Authorities confirmed the need to continue with international work to improve the coordination of the respective approaches by each country in an emergency situation. In 2018, 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 in the event of an accident, more specifically as part of the follow-up to the HERCA[2]/WENRA approach.

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 and the pre-distribution of stable iodine tablets up to 20 km, ASN will in 2018 contribute to the PPI update work done 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.

In 2018, ASN will continue to play an active role in the work carried out on the national plan for response to a major nuclear or radiological accident, in particular that concerning the perimeters of the Off-site Emergency Plans (PPI) for BNIs other than NPPs. ASN will also take part in the revision, coordinated by the General Secretariat for Defence and National Security of the Interministerial Directive of 7th April 2005 on the action of the public authorities in the case of an event leading to a radiological emergency situation. It will also initiate the revision of the post-accident doctrine through the work of the Steering Committee for Management of the Post-accident Phase (Codirpa).

In order to control urban development around nuclear sites, ASN will in 2018 be restarting a working group on the examination of active institutional controls, together with the services of the Ministry responsible for the Prevention of Risks and Urban Development, as well as the Ministry of the Interior.

The adoption of an on-call duty system at ASN is a priority action for 2018 in order to reinforce ASN's ability to deal with a nuclear or radiological emergency situation.

Finally, in 2018, ASN will be publishing a guide for a standard On-site Emergency Plan (PUI) template and its justification part, following on from the publication of its June 2017 resolution on emergency situations.

1. Western European Nuclear Regulators Association.

2. Heads of European Radiological Protection Competent Authorities.

06 Informing the public and the other audiences

For ASN, information of the public lies at the very heart of its activities. The 2006 Acts on Transparency and Security in Nuclear matters[1] and the 2015 Act on Energy Transition for Green Growth[2], explicitly gave ASN the role of ruling on the state of nuclear safety and radiation protection in France. All year round, ASN therefore informs the citizens, media, institutional audience and professionals of the situation of the BNIs and small-scale nuclear activities with regard to the requirements of nuclear safety and radiation protection. It reports on all of

1. Act 206-686 of 13th June 2006 on Transparency and Security in the Nuclear field (TSN Act).
2. Energy Transition for Green Growth Act 2015-992 of 17th August 2015 (TECV Act).

its regulation and oversight activities and the corresponding actions it takes, and disseminates its resolutions and position statements, with explanations whenever necessary.

ASN encourages the involvement of civil society in the drafting of its resolutions: for example, it consults the stakeholders and the public regarding draft resolutions and ensures that the principles of nuclear safety and radiation protection are understood by as many people as possible: it produces explanatory documents and aims to make the most technical issues accessible to the general public.

It also publishes notices, guides and reports aimed at professionals and an informed audience.

Significant events

In 2017, ASN continued the information and iodine distribution campaign in the vicinity of the BNIs, systematically issuing reminders to the facilities open to the public which were behind schedule.

To improve information of the public, a new version of the ASN website was created, simplifying access to information and to published documents (more than 87 information notices and press releases in 2017), and meeting new browsing requirements (maps, enriched content). After this overhaul, the number of visitors to the site increased by 40%.

The ASN news feeds on the social networks put across the main position statements and were followed by more than 8,000 subscribers on Twitter, more than 4,500 on LinkedIn and nearly 3,000 on Facebook. The bi-monthly ASN newsletter, which summarises topical events, was distributed to more than 4,000 subscribers.

The exhibition produced by ASN and IRSN visited about sixty different locations during the course of 2017 (the travelling exhibition is the responsibility of both IRSN and ASN).

ASN gave about twenty local and national press conferences and its spokespersons were on hand to reply to more than 600 press queries in 2017.

In 2017, ASN was given about ten hearings by Parliament concerning its activities and in November presented its report to the OPECST on the *State of nuclear safety and radiation protection in France in 2016* (previous edition of this present document). ASN regularly consulted the public on its draft resolutions. Three consultations concerned draft regulations and three other draft guides.

ASN contributed to the smooth running of the 35 CLIs, that also play an important role in transparency and information on nuclear safety. It ensured that they were correctly informed about matters relating to nuclear facilities and brought the CLI representatives together for a national conference in November. Throughout the year, representatives of the ASN regional divisions were available for CLI meetings.

ASN created or updated and then published and distributed six guides for the attention of a professional audience (can be consulted on *www.asn.fr)*. Two new numbers of the *"La Sécurité du patient"* (patient safety) bulletin, co-signed by several learned societies, were sent out to the 180 radiotherapy centres in France. ASN organised several professional seminars for physicians or for those in possession of radioactive sources.

ASN prepared itself for crisis communications about ten times in 2017, by means of "simulated media pressure" during emergency exercises.

Outlook

In 2018, ASN will be reinforcing its general public information measures, aiming to make the technical subjects presented more accessible. It will continue its actions to promote the transparency of information on nuclear matters. It will notably improve the conditions in which the public can be consulted on draft opinions and regulatory texts.

It will assist with implementing steps to inform the populations located within the PPI zones around nuclear facilities, which have been extended out from 10 to 20 kilometres. It will ensure that the local populations in these PPI zones are actually kept regularly informed.

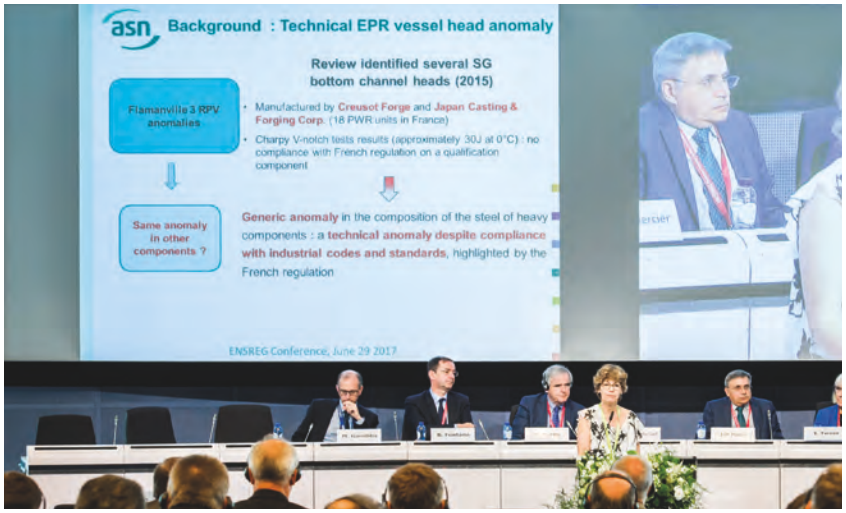
In 2018, ASN will develop public information about its roles, its fields of work and its regulation and oversight activities. It will hold discussions with elected officials and stakeholders and will remain at their disposal to shed light on any question concerning nuclear safety and radiation protection.

ASN will continue to support the activities of the CLIs – more particularly in their public information role – and will maintain a high-quality dialogue with them.

07 International relations

ASN is active in international cooperation in order to advance nuclear safety and radiation protection in France and around the world. Being active means publicising our regulations and their foundations, informing our counterparts of some of our technical analyses, in order to promote the establishment of the most demanding doctrines and regulations, primarily at the European level and then within multilateral frameworks. For our facilities, this implies taking advantage of international operating experience feedback.

ASN's international actions are carried out within bilateral, European and multilateral frameworks.



Significant events

ASN informed the international community of the problem relating to the carbon macrosegregations detected on certain forged components of nuclear pressure equipment. Our main counterparts have taken this subject on board, firstly on a bilateral basis and then within WENRA, which led to the definition of a draft recommendation concerning the manufacturing checks to be carried out by the licensees and the changes to the manufacturing codes.

ASN was also a driving force in the drafting of major documents concerning the transposition of the European "BSS" (Basic Safety Standards) Directive, more specifically application of the justification principle in the medical and radon fields.

ASN was also heavily involved in the work to implement the 2009/71/Euratom "safety" Directive, modified in 2014. The revised national action plan concerning post-Fukushima measures was submitted to the European Nuclear Safety Regulators Group (ENSREG) which is currently chaired by ASN. ASN is also vice-chair of the steering committee for the first thematic peer review of management of the ageing of power reactors and research reactors: ASN experts are also contributing to this review. This review process is considered to be a central instrument which will make it possible to promote best practices in the field. Pending its decision on continued operation, ASN will pay particular attention to the conclusions of this review. ASN is also vice-chair of the steering committee for the stress tests review to be conducted by the European Union in Belarus in 2018.

Finally, ASN was in charge of organising the ENSREG 2017 conference held on 28th and 29th June 2017 in Brussels, which attracted more than 400 stakeholder representatives on the subject of nuclear safety. Four round tables tackled the issues involved in the implementation of European Directives on Waste and Safety, but also looked at possible longer-term efforts to converge the authorisation processes for power reactors, the implications of continued reactor operations beyond 40 years, notably the introduction of safety improvements resulting from the most recent standards and, finally, a new challenge following the discovery of irregularities in the production of certain major reactor components. ASN's first thoughts on adapting oversight in the light of the risk of fraud were thus shared and enhanced: promoting the safety culture, processing of the information collected, in particular from whistle-blowers, protecting data integrity, adapting surveillance and monitoring methods, were extensively debated.

From a multilateral viewpoint, ASN in 2017 became the first regulator to have hosted two international audit missions (IRRS – Integrated Regulatory Review Service) run by the IAEA and covering all of its activities. With 40 recommendations and suggestions applied (or applied *"subject to completion of the currently ongoing measures"*), the audit team, chaired by William Dean (NRC – American Nuclear Regulatory Commission), concluded that France had significantly reinforced the framework of its regulation and oversight of nuclear safety and radiation protection. The IAEA did however point out that ASN needed to demonstrate vigilance with regard to the question of human resources, in the light of the safety issues facing nuclear facilities in France. The mission also suggested to ASN that its action should disseminate the safety culture in-house as broadly as possible and specify the conditions for the classification of emergency situations by the licensees.

France also presented its national report at the 7th review meeting of the contracting parties to the Convention on Nuclear Safety, held at the IAEA headquarters. This presentation enabled ASN to communicate about nuclear safety and radiation protection issues, in particular those which will require closer attention in the coming years: finalisation of implementation of the post-Fukushima measures; technical cooperation on the subject of carbon macrosegregations for certain nuclear pressure equipment; the irregularities detected in the production of some

of this equipment; the periodic safety review and continued operation beyond 40 years of the power reactors, but also of fuel cycle facilities.

Finally, at the beginning of 2018, France hosted an ARTEMIS mission (Integrated Review Service for Radioactive Waste and Spent Fuel Management, Decommissioning and Remediation), an international review by experts organised by the IAEA. This review offered foreign experts an opportunity to assess the French system for management of radioactive wastes and spent fuel, decommissioning and post-operational clean-out. The auditors more specifically underlined the many strong points of the French system, in particular the coverage of all the issues linked to the management of radioactive waste, as well as the skills available and the continuous progress approach adopted. The auditors also made suggestions and spotlighted best practices.

Outlook

ASN will continue its actions within a European framework, with regard to nuclear safety and radiation protection, more particularly through bilateral cooperation agreements, but also and above all through involvement in the work of ENSREG, notably the thematic review concerning management of the ageing of power reactors and research reactors with a power level of more than 1 MWth, a review which led to the drafting of a national report published in December 2017.

ASN will also aim to ensure that its policies and positions carry weight within multilateral frameworks, in particular with respect to the IAEA.

To this end, ASN:
- will continue bilateral exchanges with foreign safety regulators on regulatory practices and on priority subjects such as monitoring of the manufacture of nuclear pressure equipment;
- will actively take part in the work of HERCA, WENRA, IAEA, the Nuclear Energy Agency (NEA) and INRA (International Nuclear Regulators Association);
- will present the national report to the first thematic peer review of ageing management (ENSREG) to be held from 14th to 18th May 2018 in Luxembourg;
- will contribute to the performance of stress tests on the Ostrovets NPP in Belarus;
- will contribute to examining the definition of technical objectives to improve safety, as related to Article 8 of the 2014 Directive;
- will be a driving force behind the WENRA task force which is to define a strategy document;
- will examine the possibility of holding a transboundary "Large Region" conference on nuclear safety and radiation protection, in order to achieve more balanced cooperation;
- will present the national report within the framework of the Joint Convention (2018);
- will continue its involvement in the European 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. Consequently, several ASN regional divisions can be required to coordinate their work in a given administrative region. As at 31st December 2017, the ASN regional divisions comprised 225 staff members, including 159 inspectors.

Under the authority of the regional representative (see chapter 2, point 2.3.2), the ASN regional divisions carry out field inspections on the BNIs, on radioactive substance transport and on small-scale nuclear activities; they examine the majority of the licensing applications submitted to ASN by the persons/entities in charge of nuclear activity within their

regions. They check application within these installations of the regulations relative to nuclear safety and radiation protection, to pressure equipment and to Installations Classified for Protection of the Environment. They ensure labour inspectorate duties in the nuclear power plants.

In radiological emergency situations, the ASN regional divisions check the on-site measures taken by the licensee to make the installation safe and assist the Prefect of the *département*, who is responsible for protection of the population. To ensure preparedness for these situations, they help prepare the emergency plans drafted by the Prefects and take part in the 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 of the BNIs, and maintain regular relations with the local media, elected officials, associations, licensees and local administrations.

This chapter presents ASN's overall assessment by broad sector of activity as well as its assessment of nuclear safety and radiation protection in each region. It also reports on the local issues and procedures that are particularly representative of the regional action of ASN, especially with regard to informing the public and cross-border 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, 232 nuclear medicine units using unsealed sources for *in vivo* or *in vitro* diagnostics and for internal radiotherapy.

In addition, as at the end of 2017, 172 external radiotherapy centres equipped with 476 treatment devices, handling some 200,000 patients every year, were identified by ASN. 750 radiation oncologists were listed.

Nuclear medicine comprises about 700 specialist practitioners, along with another 1,000 physicians from other

specialities working together in nuclear medicine units (residents, cardiologists, endocrinologists, etc.)

In 2017, ASN issued 634 licenses, of which 56% were in computed tomography, 24% in nuclear medicine, 16% in external-beam radiotherapy and 4% in brachytherapy.

Significant Radiation Protection Events (ESR) in 2017

Remote-notification of significant events via a single vigilance portal created by the Ministry for Solidarity and Health was extended to the entire medical field in April 2017.

Since 2012, the number of events notified to ASN stands at about 500 per year. In 2017, the number of ESRs notified to ASN in the medical field increased (568 in 2017 as opposed to 493 in 2016). This rise is mainly due to a large number of notified events in radiology (conventional and computed tomography) and, to a lesser extent, in nuclear medicine. On the other hand, the number of events notified in radiotherapy has been gradually falling for the past two years (about 150 in 2016 and 2017 as against about 240 from 2008 until 2015).

About 80% of the events notified come from computed tomography (29%), radiotherapy (25%) and nuclear medicine (26%) units.

The events notified in the medical field mainly concern exposure of patients (53%) and foetuses in women unaware that they were pregnant (30%), this latter category seeing a significant rise (with no consequences for the unborn child).

The events of which ASN was notified in 2017 reveal that the most significant activities from the radiation protection viewpoint concern:

- for workers: fluoroscopy-guided interventional practices with overdoses (external exposure of operators and in particular their hands) and nuclear medicine (contamination of workers, external exposure);
- for patients: interventional practices with deterministic effects observed in patients having undergone long and complex procedures, radiotherapy with overdoses linked more particularly to overlapping procedures and prescription errors and, lastly, nuclear medicine, with radiopharmaceutical delivery errors;
- for the public and the environment: nuclear medicine, with source losses, leaks from pipes and radioactive effluent containment systems.

Four level 2 events (ASN-SFRO[1] scale) were notified in 2017 in radiotherapy. These were overdoses following overlapping of two treatments, a prescription error (target volume) and an overdose in contact radiotherapy. In addition, three events involving the regulation dose limits of the extremities (hands) of interventional practitioners being exceeded were notified at the end of 2017 and rated level 2 on the INES scale.

State of radiation protection in external-beam radiotherapy and brachytherapy

The safety of health care using external-beam radiotherapy and brachytherapy has been a priority area of regulation and oversight since 2007. 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.

In external-beam radiotherapy, although the fundamentals of safety are in place (equipment checks, training of professionals, quality and risk management policy), ASN continues to observe considerable disparities between the centres. Difficulty is being experienced with maintaining quality and in some cases it is even regressing, more particularly owing to a lack of evaluation or to the departure of the operational quality manager. In addition, risk assessments remain relatively theoretical and insufficiently deployed ahead of an organisational or technical change. ASN stresses that the long-term involvement of all professionals in the management of quality and risks, in particular radiation oncologists, is necessary to enhance health care security.

With regard to brachytherapy, although the departments benefit from the organisation set up for external-beam radiotherapy, concerning the deployment of a quality management system, the same disparities are observed. ASN also considers that efforts must be continued to reinforce the radiation protection training of workers if a high-level source is present.

The radiation protection situation in nuclear medicine

ASN considers that the radiation protection of workers and patients and protection of the environment continued on the whole to make progress, in particular in the performance of internal inspections and continuous training. However, shortcomings persist with regard to coordinating the general worker protection measures during an intervention by an outside contractor, and also with regard to improving the safe delivery of the radiopharmaceutical drug to the patients and optimisation of the protocols for the use of scanners coupled with gamma cameras.

The radiation protection situation in computed tomography

In 2017, ASN continued its monitoring of radiation protection in the field of computed tomography, given the increase in the contribution of this imaging technique to the exposure of the population.

Even if radiation protection of the workers is satisfactorily addressed, that of the patients must be improved. The justification for the examination request, the search for a non-irradiating alternative technique and the training of professionals in radiation protection of patients, in particular external physicians on temporary assignment, must be reinforced. The same applies to optimisation of the examination protocols and the revision of practices after analysis of the diagnostic reference levels.

The radiation protection situation in interventional practices

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 monitoring of the facilities performing fluoroscopy-guided interventions as a national inspection priority.

The inspection findings confirm the observations made over the last few years. Thus, radiation protection of professionals is still applied to a greater extent in the fixed interventional radiology facilities (cardiology, neuro-radiology, vascular imaging, etc.) than in the operating theatres in which mobile devices are used.

Regulatory deviations are frequently observed during inspections, concerning radiation protection of both patients and professionals and ASN is regularly notified of overdoses on the hands of interventional surgeons. These inadequacies concern the training of all the professionals associated with health care, especially those who have not received initial university level patient radiation protection training, the intervention by the medical physicist and the means allocated to the Radiation Protection Experts-Officers[2].

As in the previous year, ASN considers that the measures it has been recommending for several years to improve the radiation protection of patients and professionals during interventional procedures in operating theatres are still not sufficiently implemented.

1. *ASN-SFRO scale for classifying radiation protection events affecting patients undergoing medical radiotherapy procedures.*

2. *In France, the Radiation Protection Expert-Officer (RPE-O) [formerly referred to in ASN documents as the PCR (Person Competent in Radiation protection), reflecting the French term and acronym* "Personne compétente en radioprotection *(PCR)"], is appointed by the employer of persons exposed to ionising radiation in the course of their work. Under the responsibility of the employer, the RPE-O participates in preparing the notification or licensing file and assessing the nature and extent of the risks to which the workers are exposed and in organising radiation protection. The RPE-O carries out internal radiation protection controls and keeps track of third-party radiation protection controls carried out by approved organisations. The RPE-O monitors worker radiation protection. Lastly, the RPE-O is involved in defining and implementing worker safety training for aspects concerning radiation protection and participates in the management of cases where worker exposure limit values are exceeded. These duties correspond to those of both Radiation Protection Expert (RPE) and Radiation Protection Officer (RPO), hence the adoption of the umbrella term Radiation Protection Expert-Officer (RPE-O).*

Outlook

In the field of radiotherapy, ASN will continue to support the work done by the learned societies looking to implement clinical peer reviews (audits) of practices, considering that these audits constitute a necessary complement to the quality management system it has been monitoring for several years. ASN will remain particularly attentive to the question of the means needed to deploy these audits. ASN will also set up a committee to coordinate intelligence regarding new techniques and new practices using ionising radiation in the medical field, bringing together the institutions, learned societies and professional associations involved in radiotherapy. Finally, work to better anticipate and manage organisational and technical changes will be continued in 2018, with volunteer radiotherapy centres and the assistance of professionals, hospital federations and health care institutions.

Verification of the control of doses in medical imaging remains a priority for ASN, particularly when associated with interventional practices. The recent and rapid development of new imaging techniques, including the arrival of CT scanners in the operating theatre and their implementation by specialists (surgeons, neurosurgeons, cardiologists, urologists, rheumatologists, orthopaedic surgeons, etc.) who too frequently are insufficiently trained in matters of radiation protection, justifies reinforcement of the actions conducted by ASN. ASN called on the Advisory Committee for Radiation Protection in medical and forensic applications of ionising radiation to issue recommendations to improve the radiation protection of both professionals and patients in operating theatres.

At the beginning of 2018, ASN will publish a new action plan for improved control of doses in imaging, in order to continue to promote a radiation protection culture among professionals, following on from the plan drawn up in 2011.

10 Sources of ionising radiation and industrial, veterinary and research uses of these sources

Industrial and research sectors have been using sources of ionising radiation in a wide range of applications and locations for many years now. The radiation sources used are either radionuclides – essentially artificial – in sealed or unsealed sources, or electrical devices generating ionising radiation. The main applications are industrial irradiation, gamma radiography inspection of materials, verification of physical parameters such as dust or density, and various detection techniques. Electrical devices emitting ionising radiation are used mainly in non-destructive testing and for veterinary diagnostic radiology.

Assessment

In 2017, ASN examined and notified 280 new licenses, handled 942 license renewals or updates and revoked 235 licenses for users and holders of ionising radiation sources. It granted 146 licences and renewed 319 licenses to use electrical devices generating X-rays and issued 346 notification acknowledgements. With regard to the suppliers, 62 licence or license renewal applications were examined. ASN also carried out 340 inspections of users and suppliers.

Industrial radiography activities remain an inspection priority for ASN, with 106 inspections in this field in 2017. ASN finds that the way the companies address the risk varies widely. ASN considers that the preparation for interventions is on the whole inadequate and that the flaws observed in radiological zoning is worrying, because this is the main means of radiation protection, more particularly in a worksite configuration.

As in 2016, contrary to previous years, no incident was rated level 2 on the INES scale in 2017. Analysis of the 18 notified events confirms that zoning is a key step in preparing for gamma radiography inspection sites. Experience feedback also shows that a correct check on the safety position of the source is essential in controlling the dosimetric consequences of this activity. The most significant incident in 2017 concerns the abnormal exposure of two operators who were working in the operation area while the source had not been returned to its safety position. The operators' passive dosimeters recorded effective doses of 3 and 9 mSv, which, for one of the operators, corresponded to an overdose in a single operation of more than one quarter the regulation annual individual dose limit (20 mSv).

In the veterinary sector, after the efforts made by the profession in recent years, the ASN inspectors observe that good practices are observed in the field in most structures.

ASN also continued its monitoring of facilities equipped with a cyclotron and producing radionuclides. The radiation

protection organisation of these facilities is satisfactory and they are familiar with the regulations. National action plans have been put in place by the licensees and their implementation is monitored by ASN in order to ensure continuous improvement of radiation protection and safety in these facilities.

ASN's monitoring of establishments and laboratories using radioactive sources for research purposes shows a distinct improvement in radiation protection. However, in this field, ASN observes that notification of events is anything but systematic and that their analysis is insufficient. Nearly half of the structures which were inspected have no procedures for managing significant events.

The significant events notified are still mainly the theft or loss of radioactive sources or the discovery of legacy sources. These events can be explained essentially by poor general source traceability: failure to dispose of them when the laboratories ceased operations in the past, irregular and incomplete inventories.

Finally, in 2017, after the publication of Ordinance 2016-128 of 10th February 2016, ASN – together with the Defence and Security High Official of the Ministry responsible for the Environment – continued to prepare texts necessary for effective implementation of the monitoring and protection of sources against malicious acts. 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. In the civil sector, this concerns about 4,000 sources distributed around some 250 facilities in France.

Outlook

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.

It will prepare the entry into force of the new administrative systems applicable to nuclear activities, by issuing the necessary resolutions as early as possible, so that the nuclear activities concerned can be classified in the notification or registration systems and it will define the legally binding requirements to be satisfied when exercising the activities. It will also modify the resolutions concerning the content of the license application files, more specifically including the elements necessary for monitoring the protection of sources against malicious acts.

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 and in the medical field).

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, accounting for about 3% of all dangerous materials shipments. 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.

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 (which would facilitate criticality reactions) and chemical reactions 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 requirements, 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

In 2017, ASN issued 47 approval certificates for packages or for special arrangement shipments. In 2017, the Advisory Committee for Transports (GPT) made a number of proposals to improve the approval application submitted by Areva TN for the new TN G3 package model, designed for shipment of spent fuel from the EDF NPPs to the La Hague plant. In 2018, ASN will rule on the latest undertakings by the applicant to take account of the GPT's recommendations.

Since the implementation of the Order of 7th February 2012, on-site transports of radioactive substances within the facilities must be covered by the licensee's baseline safety requirements. In 2017, ASN authorised on-site transport operations for dangerous goods taking place in the EDF NPPs and within the perimeter of the Areva plant at La Hague. In 2018, it will inspect the implementation of the baseline requirements and will continue its efforts with licensees who have not yet integrated these on-site transport operations into their general operating rules.

ASN performs inspections at all the stages in the life of a package: from manufacture and maintenance of a packaging, to package preparation, shipment and reception. Inspections also concern preparedness for emergency situations. In 2017, ASN carried out 105 inspections on radioactive substance transports.

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.

In 2017, concerning the transport of radioactive substances, ASN was notified of 62 events rated level 0 and 2 events rated level 1 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.

In the event of an accident involving transport, emergency management should be able to minimise the consequences for the public and the environment. In 2017, ASN therefore drew up a document providing guidelines for the emergency services. It contains general information about radioactivity, general recommendations for the emergency services so that their response can take account of the specific nature of radioactive substance transports, plus sheets organised per type of substance, providing more detailed information and advice for the emergency response coordinator.

ASN also expressed the desire to see the stress tests approach extended to the transport field, in the same way as was done in the BNIs. The GPT therefore met in 2017 to decide on the ASN methodology applying the stress tests approach to transports.

From a regulatory viewpoint, ASN actively participates in the international work being carried out under the aegis of the IAEA since 2015 on the revision of the recommendations regarding the transport of radioactive substances. This work will continue in 2018.

Outlook

In 2018, ASN will continue its work on emergency management preparedness. It will thus contribute to training the emergency services in managing radioactive substance transport accidents and will implement the GPT stress test recommendations, more particularly by updating the guide on the risk assessment of transport infrastructures.

ASN will be publishing a guide in 2018 to help carriers achieve a clearer understanding of the regulatory requirements and best practices with regard to radiation protection.

In 2018, ASN will maintain its oversight of the manufacture and maintenance of packages requiring approval, in particular for the older packaging and of how irregularities in the manufacture of certain package components are addressed. Lastly, it will finalise the examination of the approval applications for the two new package models, TN G3 and DN 30.

12 EDF Nuclear Power Plants

Nuclear Power Plants (NPPs) operated by EDF are at the heart of the nuclear industry in France. The 58 French reactors are technically very similar and thus form a standardised fleet. ASN imposes stringent requirements on these facilities, the regulation and oversight of which mobilises nearly 200 inspectors and as many IRSN experts, on a daily basis.

ASN has developed a proportionate and integrated approach to regulation that covers not only the design of new installations, their construction, the operation of existing reactors, modifications, integration of feedback, but also social, human and organisational factors, radiation protection, environmental protection, occupational safety and the application of labour legislation.

Nuclear reactors operated by EDF

2017 was marked by four significant events rated level 2 on the INES scale, each of which affected several reactors. Of particular note is the event concerning the resistance deficiency found in the Donzère-Mondragon canal embankment protecting the Tricastin NPP. In September 2017, this event led ASN to require that EDF temporarily shut down the four reactors of the NPP as rapidly as possible. In December 2017, further to the investigations and repairs carried out by EDF, ASN considered that the condition of the Donzère-Mondragon canal embankment allowed restart of the reactors of the Tricastin nuclear power plant.

The three other events rated level 2 on the INES scale involved the availability of certain systems important for the safety of the installations, such as electrical systems or the heat sink. Some of the defects identified are linked to equipment design, others to its assembly or maintenance.

These events highlight the difficulties experienced by EDF in ensuring the conformity of its facilities and maintaining this over time. These difficulties also underline the need to continue with the design reviews in progress: these are bearing fruit and revealing anomalies, some of which have been present since the reactors were built. Detection of these deviations also indicates inadequacies in the maintenance programmes of certain equipment items.

ASN also considers that EDF must reinforce its actions and decision-making processes in dealing with deviations.

Non-compliance with general operating rules is still the cause of a considerable number of significant events. These events also reveal flaws in the oversight of the drafting processes for the general operating rules and the preventive maintenance programmes.

ASN considers that the quality of maintenance work could still be improved, as the number of maintenance work quality defects found remains high.

The inspections carried out by ASN on deployment of the modifications resulting from the third periodic safety review of the 1,300 MWe reactors show that EDF experiences difficulties in ensuring consistency between the physical state of the installations at the time of reactor restart and the state considered in the general operating rules. ASN asked EDF to regularise the situation and learn the necessary lessons from this deployment in preparation for the fourth periodic safety review of the 900 MWe reactors.

The organisation in place on the sites for managing skills, qualifications and training is on the whole satisfactory. EDF has allocated major investments to hiring and training, in order to anticipate the renewal of skills as a result of staff retirements.

In a context of a rising volume of maintenance work, the collective dosimetry on all the reactors fell in 2017. On no occasion was the annual regulation limit for whole body external dosimetry (20 mSv) exceeded.

ASN considers that EDF's organisation for management of NPP detrimental effects and impacts on the environment is satisfactory on most sites. Operational management of radioactive and conventional waste on the worksites could on the whole be improved across the NPPs.

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

- in the field of nuclear safety: Fessenheim;
- in the field of environmental protection: Fessenheim;
- in the field of radiation protection: Chinon and, to a lesser extent, Civaux.

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 and, to a lesser extent, Gravelines and Chooz;

- in the field of radiation protection: Nogent-sur-Seine;
- in the field of environmental protection: Dampierre-en-Burly and Nogent-sur-Seine.

Irregularities detected at the Areva NP Creusot Forge plant

The anomalies brought to light in the production by Areva NP's Creusot Forge plant, more specifically carbon segregation problems, led ASN in 2016 to ask the manufacturer to carry out a review of the manufacturing files on the components forged in this plant. These reviews revealed production irregularities concerning inconsistencies, modifications or omissions in the production files and concerning manufacturing parameters or test results.

In its resolution 2017-DC-0604 of 15th September 2017 ASN ordered EDF to send it the results of the review of the production files for the components forged by Creusot Forge, for each reactor in service and no later than two months before its scheduled restart following its next refuelling outage. EDF is required to complete its review no later than 31st December 2018.

The ASN review of the deviations on the first reactors led to additional justification requests but did not reveal any deviations requiring repair or replacement before restart.

In conjunction with this review, ASN is continuing to investigate the irregularity detected on the shell of a steam generator on Fessenheim reactor 2. Following the discovery of this anomaly, ASN suspended the steam generator test certificate on 18th July 2016, the effect of which was to keep this reactor shut down. In July 2017, Areva NP transmitted a file demonstrating the mechanical strength of the component concerned. ASN intends to issue a position statement on this subject in the first half of 2018.

These irregularities revealed unacceptable practices at the Creusot Forge plant that are incompatible with the principles underpinning the safety culture. They reveal shortcomings in EDF's surveillance of its suppliers. Other irregular situations, more specifically concerning repair or modification work on equipment installed in the NPPs, were detected in 2017. EDF presented ASN with an action plan which it has begun to implement.

Experience feedback from the Fukushima Daiichi accident

EDF deployed temporary or mobile measures to reinforce the management of situations involving a total loss of 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 ultimate back-up diesel generator sets.

2017 was marked by continued work to install the equipment of the "hardened safety core". More specifically, the first performance tests on the ultimate back-up diesel generator sets intended for the 900 MWe reactors were successfully run on the Saint-Laurent-des-Eaux site in May 2017. In 2017, ASN also continued examinations to verify that the hardware changes proposed by EDF will be able to meet the safety targets set.

Examination of NPP operating life extensions

After its position statement in April 2016 on the orientation of the generic study programme to be carried out in preparation for the fourth periodic safety review of the 900 MWe NPP reactors, ASN continued in 2017 to examine the generic studies related to this review. These more specifically aim to demonstrate the serviceability of the reactor pressure vessels, the attainment of the safety reinforcement goals for the spent fuel pools, the mitigation of the potential consequences of accidents - including accidents with core melt - and improved resistance of the facilities to internal and external hazards.

The deployment of most of the modifications to the facilities as a result of this periodic safety review and performed during the fourth ten-yearly outage inspection of the 900 MWe reactors, will run until 2030.

The Flamanville 3 EPR reactor

ASN is continuing to examine the commissioning authorisation application for the Flamanville EPR transmitted by EDF in March 2015. In 2017, it issued a position statement on the safety case studies, more particularly the safety of fuel storage and handling.

In December 2015, ASN issued a position statement on the approach adopted by Areva NP to demonstrate the serviceability of the Flamanville EPR reactor pressure vessel closure head and bottom head following the anomaly in the chemical composition of their steel. In 2017, ASN examined the technical file from Areva NP presenting the implementation of the approach. ASN considers that this anomaly is not such as to compromise the commissioning of the reactor pressure vessel, provided that specific checks are carried out during operation, to ensure that no flaws appear. As the feasibility of these checks cannot at present be confirmed for the closure head, ASN considers that the current closure head cannot be used beyond 2024.

Evaluation of the manufacture of nuclear pressure equipment

During the course of 2017, ASN continued to assess the conformity of the manufacture of the replacement nuclear pressure equipment for the NPPs in service and the Flamanville EPR reactor. ASN and the organisations it approves are reviewing the technical documentation and the monitoring of the on-site assembly operations. In 2017, ASN confirmed the conformity of several equipment items.

ASN ensured that all the industrial firms have taken on-board the lessons learned from the carbon segregation anomalies detected in 2016 and the irregularities in the Areva NP Creusot Forge plant.

Outlook

Operating experience feedback from the NPP reactors reveals that there are still inadequacies in the processes employed by EDF to obtain conformity of the facilities with their design and operating baseline requirements and then maintain this compliance over the long term. In 2018, ASN will reinforce its oversight of the processes used by EDF to ensure that they are actually able to detect and then process all deviations from the design and operating baseline requirements, in good time.

Management of the conformity of the facilities in service will be a major focal point of ASN inspections in 2018.

In 2018, ASN will continue to check the performance of the file reviews for all the components manufactured in the

past by the Creusot Forge plant. It will ensure that this review process is seen through to completion, in order to assess all the irregularities which could have affected past production and draw all the possible conclusions for the safety of the facilities.

Monitoring the implementation of the prescribed material and organisational measures enabling EDF to justify satisfactory control of the basic safety functions in extreme situations remains a priority for ASN. In 2018, ASN will continue to review the design, construction and operating provisions adopted by EDF to address the requirements concerning the "hardened safety core". ASN will also continue to oversee the work to deploy this "hardened safety core" on the sites, more particularly the ultimate backup diesels, ultimate water source and local emergency centre.

In 2018, examination of the generic studies will continue for the fourth periodic safety review of the 900 MWe reactors. ASN envisages issuing a position statement on the generic phase of the review at the end of 2020. As part of the actions initiated by the HCTISN in 2017, ASN will also take part in public consultation measures planned for 2018 concerning the steps proposed by EDF to meet the objectives set for this review.

In 2018, 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.

ASN will continue to oversee the installation of equipment, the performance of start-up tests and the preparation of the various support documents for the operation of the Flamanville 3 EPR reactor. In 2018, ASN will issue a position statement on the partial commissioning authorisation application to allow the arrival of nuclear fuel on the site.

Finally, in 2018, ASN will continue the important in-depth work started in 2015 with the manufacturers, licensees and approved organisations, with regard to the application of the regulations concerning nuclear pressure equipment.

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 are on the Orano (ex-Areva NC) Tricastin (Comurhex, TU5, W, Georges Besse II), Marcoule (Mélox), La Hague, Malvési sites and on the Framatome (ex-Areva NP) site of Romans-sur-Isère.

Significant events

Restructuring of the Areva group

2017 was marked by the restructuring of the Areva group, which was split up into several entities, notably Framatome and Orano. With regard to nuclear safety, this entailed a break-up of the group headquarters (engineering in particular) and various organisational changes on the Tricastin, La Hague, Romans-sur-Isère and Marcoule sites. The new entities resulting from this break-up will retain strong operational ties with each other in the exercise of their responsibilities as nuclear licensees. ASN will be particularly attentive to ensuring that the Framatome and Orano BNI licensees are in full possession of the capabilities needed to meet their responsibilities.

A new spent fuel storage capacity

Given the timeline identified for saturation of spent fuel storage capacity in France and the time needed to design and build a new facility, EDF submitted a safety options file in

2017 for a centralised spent fuel pool project taking account of current safety requirements. This project, for which the location has not yet been decided, should allow storage of spent fuels for which reprocessing or disposal cannot yet be envisaged in the near future. The envisaged operating life for this storage facility is about a century. ASN will issue an opinion on the safety options in early 2019.

Monitoring the status of the evaporators at La Hague

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 the La Hague plants. In 2014, Areva NC informed ASN that the corrosion of these items was on a scale greater than that considered in the design. As the maintained integrity of these items has major safety implications, the ASN Commission stipulated the conditions to be met by Areva NC for continued operation of these evaporators. ASN is monitoring the development of corrosion on this equipment, prior to its post-maintenance restart.

In November 2016, ASN issued a position statement on the safety options proposed by Areva NC for the construction of new evaporators, for which commissioning is expected in 2021. In 2017, ASN authorised the construction of the civil engineering works intended for this replacement equipment.

Outlook

Fuel cycle consistency

In 2016, ASN started an examination of the "Cycle impact" file update covering the period 2016-2030 and aimed at anticipating the various emerging needs in order to ensure the management and consistency of the nuclear fuel cycle operations in France, in terms of safety. ASN will in particular focus on monitoring the level of occupancy of the spent fuel underwater storage facilities (Orano 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 circuit, as well as the solutions designed to guarantee that sufficient storage capacity is maintained on a long-term basis.

In 2018, ASN will issue its conclusions on the "Cycle Impact" file submitted in 2016, which will notably be the subject of a joint review by the Advisory Committees for Laboratories and Plants (GPU), for Waste (GPD), for Reactors (GPR) and for Transports (GPT).

Tricastin site

The BNI licensees on the Tricastin platform asked for authorisation to modify their organisation, with the creation of joint management systems. This reorganisation entails transfer of nuclear licensee responsibility to a single party: Orano. ASN will issue a position statement on these subjects in 2018.

Romans-sur-Isère site

Following their periodic safety review and after a year 2017 marked by the continued shutdown of the research reactors fuel fabrication plant for several months, ASN will in 2018 define the conditions for the continued operation of the plants on this site.

La Hague site

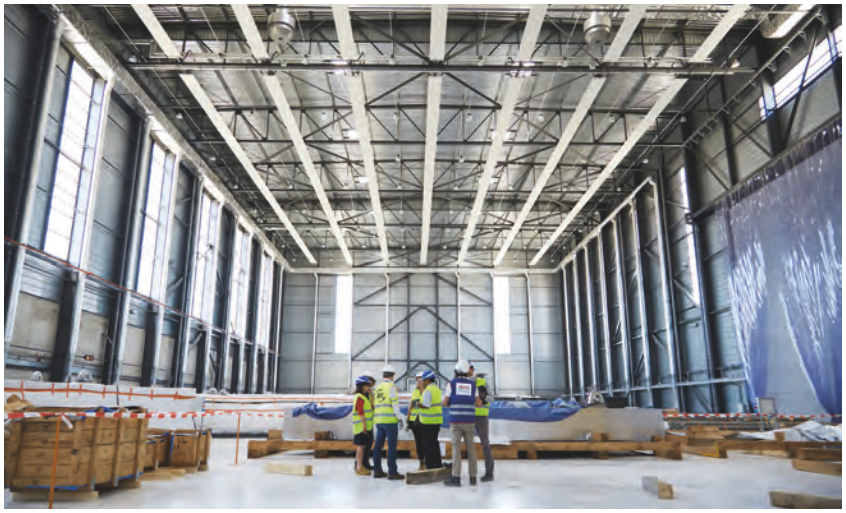
In 2018, ASN will remain particularly vigilant with regard to the development of corrosion in the fission products concentration evaporators. Orano shall continue with reinforced inspection of this equipment. Orano will also be required to maintain its efforts so that it can effect the replacement it envisages between 2020 and 2021. ASN will examine the applications for the construction of new evaporators.

With regard to changes to the site BNIs, ASN will examine the licensee's application to expand compacted waste package storage capacity, which will entail the holding of a public inquiry.

14 Nuclear research and miscellaneous industrial facilities

Nuclear research or miscellaneous industrial facilities are operated by CEA or other research organisations (for example the Laue-Langevin Institute (ILL), the ITER international organisation and the national large heavy ions accelerator - 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 similar to those applied to power reactors and nuclear fuel cycle facilities, while taking account of their specificities with regard to risks and detrimental effects.



Significant events and assessment

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.

Construction work on the Jules Horowitz Reactor (RJH) is continuing. 2017 was marked by the end of the civil engineering work. CEA asked for a four-year extension to the commissioning date for its facility owing to a series of delays in the construction work. ASN will examine this application for postponement of commissioning to 2023.

ASN inspected the start-up tests, the aim of which is to check correct operation of the equipment and of the Cabri reactor, more particularly tests on the equipment of the new pressurised water loop. At the beginning of 2018, it granted the authorisation necessary for performance of the first experimental test.

The Éole-Minerve reactors and the Fissile Materials Central Warehouse (MCMF) were finally shut down at the end of 2017. The decommissioning files should be submitted in July 2018 and November 2018 respectively.

Other licensees

ASN supervised the new strategy for gradual commissioning of ITER up until 2035.

ILL continued to install the cooling backup systems and carried out reinforcement work on the High-Flux Reactor (RHF). This work is primarily in response to the undertakings made as a result of the lessons learned from the Fukushima Daiichi accident.

ASN considers that the level of safety of the RHF is satisfactory. It did however observe several deviations from the regulations in terms of safety management. ASN therefore expects ILL to reinforce its organisation, more specifically to improve the management of equipment modifications, as well as the management of periodic checks and tests.

Delays were observed in the implementation of a number of technical requirements for the operation of Ganil. ASN is closely attentive to the resources devoted by Ganil to nuclear safety, so that the requirements are met rigorously and the projects are run efficiently.

With regard to CIS bio international, ASN notes that efforts have been made, in particular the reinforcement and modification of its organisation and its operating processes, making safety management of the UPRA facility more efficient. However, the nature of the significant events which have occurred, the causes of which are almost always organisational and human failures, reflects an unsatisfactory operational safety situation.

ASN also observes that, in the light of the delays that have built up in recent years and despite the efforts made since the end of 2016, the licensee has difficulty in complying with the requirements resulting from the previous periodic safety review, with ASN therefore initiating a formal notice to comply procedure at the beginning of 2018. To conclude, ASN expects to see a lasting turnaround in operating rigour and projects management at CIS bio international.

Outlook

Examination of the 26 periodic safety review conclusion reports submitted in 2017, including 16 for CEA, and ASN's future position statements on the continued operation of the facilities concerned (research reactors, laboratories, plants, waste and decommissioning) are particular challenges for the coming years.

CEA

ASN will remain vigilant to ensuring compliance with the commitments made by CEA, both for its facilities in service and those being decommissioned.

In 2018, it will issue a position statement on the CEA's new decommissioning and waste management strategy, covering all the facilities.

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, Orphée, MCMF, LECA, Eole-Minerve). The drafting of all these decommissioning files and then performance of the decommissioning operations represent a major challenge for CEA, for which it must actively prepare.

In 2018, ASN also intends to:
- continue monitoring the construction of the RJH;
- start the examination of the authorisation application for the substantial modification of Masurca (in-depth refurbishment, notably with the construction of a new storage and handling building).

Other licensees

ASN will continue to pay particular attention to monitoring the facilities being built, that is ITER and the Ganil extension.

ASN will remain vigilant with regard to the safety organisation put into place at Ganil and to compliance with ASN's requirements, more specifically those resulting from the last periodic safety review.

ASN will also remain vigilant with regard to the expected improvements at ILL, in particular for management of material modifications and the management of periodic checks and tests, as well as the satisfactory implementation in 2018 of the new ILL integrated management system, for which deployment began in 2017.

Finally, ASN will maintain its reinforced monitoring of CIS bio international in 2018.

15 | Decommissioning of basic nuclear installations

Decommissioning covers all the activities carried out after shutdown of a nuclear facility, following which the facility can be delicensed. In 2017, 35 nuclear facilities of all types (power and research reactors, laboratories, fuel reprocessing plants, waste treatment facilities, etc.) had been shutdown or were undergoing decommissioning in France, representing more than one quarter of all BNIs.

Significant events and assessment

2017 was notably marked by the examination of the decommissioning and waste management strategies for the CEA and Areva facilities. EDF also gave ASN confirmation of its intention to carry out final shutdown of the Fessenheim NPP once the Flamanville EPR is commissioned: the final shutdown declaration has not yet been sent.

In 2017, ASN called EDF to a hearing about its change in decommissioning strategy for its Gas-Cooled Reactors (GCR) and initiated an examination of the acceptability of this new strategy in the light of the regulatory requirements which demand decommissioning of nuclear facilities as rapidly as possible. ASN also inspected EDF on this subject at the end of 2017.

A comparison of these strategy files with the three-year files updating the long-term costs to be borne by the licensees, examined by ASN on behalf of the Government, shows that the time-lines linked to the technical scenarios and budgets associated with decommissioning are managed by the licensees with difficulty. At this stage, ASN considers that the decommissioning context is a subject of concern for the medium-term. Thus, the financial aspects and the lack of technical expertise in complex projects can lead the licensees to postpone decommissioning, notwithstanding the requirements of the law.

2017 was marked by the final shutdown of BNIs 92 (Phébus reactor), 42 (ÉOLE reactor), 95 (Minerve reactor) and 53 (MCMF) operated by CEA.

2017 saw the continued examination of four decommissioning files, which were the subject of an opinion by the Environmental Authority of the General Council for the Environment and Sustainable Development and were opened up for a public inquiry: BNI 93 Eurodif and BNI 105 Comurhex on the Tricastin site (Areva), BNI 94 AMI Chinon (EDF) and BNI 52 ATUe in Cadarache (CEA).

ASN also began to examine step two of the decommissioning decree for the Superphénix fast neutron reactor (BNI 91) so that the license could be issued for decommissioning of the reactor vessel internals.

Examinations of the periodic safety reviews (BNIs 33, 38 and 47) and of the complete decommissioning files (BNIs 33 and 38) for the Areva La Hague plant were continued in 2017 and presented to the ASN Advisory Committee in April 2017. This latter concluded that the risk management measures taken for the decommissioning operations were on the whole appropriate.

2017 was also marked by the submission of the periodic safety review conclusion reports for most of these facilities.

Finally, BNI 61 LAMA in Grenoble (CEA) was delicensed.

Outlook

ASN's key actions in 2018 will concern the monitoring of progress in decommissioning and waste management projects, especially the retrieval and packaging of CEA and Areva legacy waste, where delays are particularly detrimental to the safety of the sites concerned. ASN will issue a position statement on these files once examination is completed.

In 2018, ASN will examine the justification data concerning the change in EDF strategy regarding the decommissioning of its first-generation GCR reactors, as well as data concerning the safety of these reactors during the period pending decommissioning. ASN will issue a position statement on EDF's request for a strategy change on completion of all the technical and regulatory examinations.

The scheduling of final shutdown and operations in preparation for decommissioning of the reactors of the Fessenheim NPP, the first 900 MWe PWR reactors connected to the grid, will also be a major safety challenge.

The periodic safety reviews of the installations undergoing decommissioning, for which the majority of the conclusions files were submitted by the licensees in 2017, will also be the subject of technical examinations tailored to the risks and detrimental effects these installations represent. In 2018 and 2019, a further ten or so facilities will submit their decommissioning files.

Lastly, in order to clarify the decommissioning and waste management regulations updated by the Ordinance of 10th February 2016, ASN will continue to develop new guides in these areas as well as in the area of contaminated sites and soils in the BNIs.

16 Radioactive waste and contaminated sites and soils

Radioactive wastes are radioactive substances for which no subsequent use is planned or envisaged or which have been reclassified as such by the administrative authority pursuant to Article L. 542-13-2 of the Environment Code. They come from nuclear activities processing artificial or natural radioactive substances, provided that this radioactivity warrants the implementation of radiation protection checks.

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

2017 saw the adoption of the National Plan for Radioactive Materials and Waste Management (PNGMDR) 2016-2018, which was transmitted to Parliament in February. This three-year plan presents the results 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. It is supplemented by Decree 2017-231 of 23rd February 2017 implementing Article L. 542-1-2 of the Environment Code and establishing the requirements of the PNGMDR and the Order of 23rd February 2017 implementing the Decree of 23rd February 2017.

On 8th June 2017, ASN issued its opinion on the fourth three-yearly reports transmitted by the licensees in 2016. These reports describe the evaluation of the costs relating to decommissioning and waste management, the methods applied for calculation of the corresponding provisions and the choices made with regard to the composition and management of the assets allocated to coverage of these provisions. ASN more particularly considers that the contents of the reports issued by the licensees do not all contain the same level of detail and that the EDF file does not contain enough information for ASN to be able to adopt a position on the exhaustiveness of the evaluation of its financial costs.

2017 was marked by the examination of the safety options file for the *Cigéo* deep geological disposal project, submitted by the National Radioactive Waste Management Agency (Andra) in 2016. In January 2018, ASN issued its opinion on this file. It considers that these safety options represent a significant step forward, stipulates which additional justifications will be necessary for a possible creation authorisation application and underlines its reservations with regard to bituminised wastes.

Examination has begun on the Areva and CEA files concerning waste management and facilities decommissioning strategies. ASN and the Defence Nuclear Safety Authority (ASND) will issue a position statement on these strategies in 2018.

Finally, ASN published resolution 2017-DC-587 on 23rd March 2017 relative to the packaging of radioactive waste and the conditions of acceptance of the radioactive waste packages in the disposal BNIs.

Assessment and outlook

ASN considers that the French radioactive waste management system, built around a specific legislative and regulatory framework, a national plan and an agency (Andra) dedicated to the 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 PNGMDR

ASN will continue to monitor the work done on the PNGMDR 2016-2018, more particularly via the pluralistic working group it chairs with the General Directorate for Energy and Climate. Depending on the decision by the National Public Debates Commission, which will be involved in the drafting of the PNGMDR 2019-2021 with regard to the procedures for organising participation of the public, ASN will work alongside the Ministry for Ecological and Solidarity-based Transition, to allow this involvement of the public in the drafting of the plan. ASN will also prepare for drafting of the next PNGMDR through its opinions, as of 2018, on the studies provided for in the PNGMDR 2016-2018.

Finally, ASN will take part in the HCTISN working group on the management of very low level waste.

The regulations concerning the management of radioactive waste

In 2018, ASN will continue with the drafting of resolutions relative to radioactive waste disposal and storage facilities. These draft texts will be made available for consultation by the stakeholders and the public.

ASN will also closely monitor the work to transpose Directive 2013/59/Euratom of 5th December 2013 setting the basic standards for radiation protection.

The licensees' radioactive materials and waste management strategies

In 2018, ASN will continue to monitor the satisfactory performance of the legacy waste and spent fuel retrieval and packaging operations, focusing on those presenting the most significant implications for safety.

ASN, together with the ASND, will complete its examination of Areva's waste management strategy, submitted in mid-2016, and that of CEA, submitted at the end of 2016. ASN and the ASND will present their conclusions in 2018.

In 2018, ASN will continue its monitoring to ensure that CEA meets its commitments concerning its old installations which no longer comply with current safety requirements. ASN will also monitor the progress of CEA's strategic waste management projects (Diadem, BNI 37-A, solid and liquid waste management on the Saclay site) and the preparation of the decommissioning files for the old storage facilities (BNI 56, Pégase, BNI 37-B).

Low Level, Long-Lived Waste (LLW-LL)

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. Andra has undertaken to send ASN an interim report on this subject in 2018.

Depending on the conclusions of this report, the waste producers shall if necessary, 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 2018, ASN will work on revising the safety guide relative to the disposal of LLW-LL type radioactive waste.

High-Level and Intermediate-Level Long-Lived Waste (HLW and ILW-LL)

With regard to the *Cigéo* project for disposal of HLW and ILW-LL waste, ASN will in 2018 monitor the preparation of the creation authorisation decree application by Andra, notably the steps taken following its requests concerning the safety options file.

ASN asks that Andra be vigilant with regard to the industrial development times associated with the results of the R&D programme carried out by Andra and the regulatory milestones in the *Cigéo* installation authorisation process.

ASN underlines the importance it attaches to the progress that the waste producers must make in packaging their waste, particularly the waste resulting from retrieval and repackaging operations.

Periodic safety reviews of radioactive waste management BNIs

In 2018, ASN will continue to examine the conclusion reports of the periodic safety reviews of waste management facilities received in 2016 and 2017. It will continue to monitor the progress of the action plans defined by the licensees for those BNIs for which the files have already been examined.

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

With regard to the former uranium mining sites, ASN will continue to support the public authorities with regard to 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. It will ensure that any action taken is completely transparent and involves the local stakeholders.

With regard to the management of contaminated sites and soils, ASN will continue its analysis of contaminated site remediation projects, on the basis of the principles of its doctrine published in October 2012.

Together with the administrations concerned and the other stakeholders, ASN will also continue to monitor remediation programmes in progress.

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ASN report abstracts on the state of nuclear safety and radiation in France in 2017

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Publishing director: Pierre-Franck Chevet, Chairman of ASN
Editor: Marie-Christine Bardet
Editorial staff: Fabienne Covard
Iconographer: Olivier Javay

ISSN 1967 - 5127
Printer number: - Legal deposit: April 2018
Production: Groupe Rouge Vif
Printing: Imprimerie Fabrègue - 87500 Saint-Yrieix-la-Perche - France

PEFC 10-31-1188

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