AUTORITÉ
DE SÛRETÉ
NUCLÉAIRE

ABSTRACTS

ASN REPORT

on the state of nuclear safety and radiation protection in France in 2018

The Nuclear Safety Authority presents its report on the state of nuclear safety and radiation protection in France in 2018.

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.

The Nuclear Safety Authority (ASN)

ROLES – OPERATIONS – KEY FIGURES

ASN was created by the 13 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.

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 17 August 2015, ASN's roles now include monitoring the security of radioactive sources against malicious acts. Inspection is ASN's primary monitoring activity. More than 1,800 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 reports on its activities to Parliament. It 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 enables all members of the public to take part in the drafting of its decisions with an impact on the environment.

In line with the principle of transparency, itsupports the actions of the Local Information Committees of the nuclear facilities.
ASN's main information channel is its website *asn.fr*.

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 Flamanville 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 decisions, 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 eight Advisory Committees of Experts, from a variety of scientific and technical backgrounds.

Operations

The Commission

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

Bernard DOROSZCZUK	Philippe CHAUMET-RIFFAUD	Sylvie CADET-MERCIER	Lydie ÉVRARD	Jean-Luc LACHAUME
Chairman	Commissioner	Commissioner	Commissioner	Commissioner
13 November 2018 for 6 years	10 December 2014 for 6 years	21 December 2016 for 6 years	10 March 2017 for 6 years	21 December 2018 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 designates the various ASN inspector categories. 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 departments

The ASN departments are headed by a Director General, appointed by the ASN Chairman. They carry out ASN's day-to-day duties and prepare draft opinions and decisions for the ASN Commission. They comprise:

- head office departments organised according to topics, which oversee their field of activity at a national level, for both technical and transverse matters (international action, preparedness for emergency situations, information of the public, legal affairs, human resources and other support functions). They more specifically prepare draft doctrines and texts of a general scope, examine the more complex technical files and the "generic" files, in other words those which concern several similar facilities;
- eleven regional divisions, with competence for one or more administrative regions, covering the entire country and the overseas territories. The divisions conduct most of the oversight in the field of nuclear facilities, radioactive substances transport operations and small-scale nuclear activities. They represent ASN in the regions and contribute to public information within their geographical area. 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 affected by the accident.

1. *Administrative region headed by a Prefect.*

Key figures in 2018

Personnel

516
staff members

of which **318**
inspectors

84%
management

ASN Actions

1,813
inspections
representing 4,178 days
of inspection

21,602
inspection follow-up letters
available on *asn.fr*
as at 31 December 2018

20 Advisory
Committee
meetings

327
technical opinions
sent to ASN **by IRSN**

2,606
individual licenses
for facilities or activities

Budget

€84.45 MILLION

total budget for ASN

€84.3 MILLION

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

Information

Nearly **850** **answers**
to queries from the public and stakeholders

17

press conferences

63

information notices

9

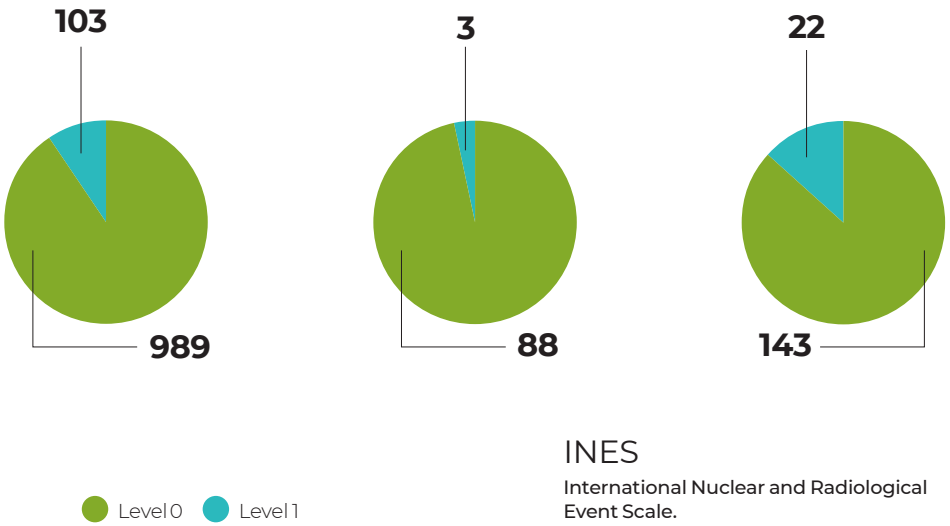
emergency exercises

Number of significant events rated on the INES scale

1,092
events in Basic Nuclear Installations

91
events in the transport of radioactive substances

165
events in small-scale nuclear facilities (medical and industry)

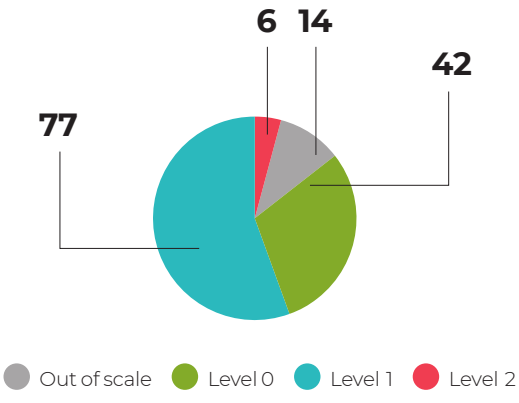


INES

International Nuclear and Radiological Event Scale.

Number of significant events rated on the ASN-SFRO scale

139
significant events



ASN-SFRO

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

ASN organisation chart as at 1st March 2019

COMMISSION

Commissioners
Sylvie Cadet-Mercier
Philippe Chaumet-Riffaud
Lydie Évrard
Jean-Luc Lachaume

Chairman
Bernard Doroszczuk

Head of Private Office
Laurent Felber

GENERAL DIRECTORATE

Deputy Directors General
Julien Collet
Daniel Delalande
Anne-Cécile Rigail

Director General
Olivier Gupta

Chief Inspector
Christophe Quintin

Head of Staff
Bastien Poubeau

DEPARTMENTS

Nuclear power plant department
Rémy Catteau

Nuclear pressure equipment department
Simon Liu

Waste, research facilities and fuel cycle facilities department
Christophe Kassiotis

Transport and sources department
Fabien Féron

Ionising radiation and health department
Jean-Luc Godet

Environment and emergency department
Christophe Quintin (acting)

Legal Affairs department
Olivia Lahaye

Information, Communication and Digital Usages department
Céline Acharian

International relations department
Frédéric Joureau

General Secretariat
Brigitte Rouède

Management and Appraisal Mission
Alain Rivière

Regulation and Oversight Support Mission
Julien Husse

DIVISIONS

1 Bordeaux division
Regional representative: Alice-Anne Médard
Regional Head: Hermine Durand

2 Caen division
Regional representative: Patrick Berg
Regional Head: Adrien Manchon

3 Châlons-en-Champagne division
Regional representative: Hervé Vanlaer
Regional Head: Jean-Michel Férat

4 Dijon division
Regional representative: Jean-Pierre Lestoille
Regional Head: Marc Champion

5 Lille division
Regional representative: Laurent Tapadinhas
Regional Head: Rémy Zmyslony

6 Lyon division
Regional representative: Françoise Noars
Regional Head: Caroline Coutout

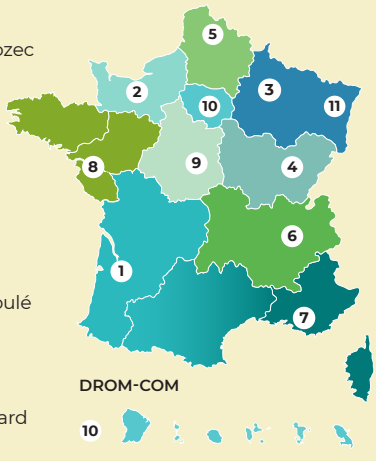
7 Marseille division
Regional representative: Corinne Tourasse
Regional Head: Aubert Le Brozec

8 Nantes division
Regional representative: Annick Bonneville
Regional Head: (acting) Yoann Terliska

9 Orléans division
Regional representative: Christophe Chassande
Regional Head: Alexandre Houlé

10 Paris division
Regional representative: Jérôme Goellner
Regional Head: Vincent Bogard

11 Strasbourg division
Regional representative: Hervé Vanlaer
Regional Head: Pierre Bois



The Caen and Orléans Divisions cover the Bretagne and Île-de-France regions respectively for the regulation and oversight of BNIs only.

Competence
Independence
Rigour
Transparency

asn.fr

info@asn.fr

You can also follow ASN on the social networks

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ADVICE TO THE READER

FIND THE FULL REPORT
on the state of nuclear safety and radiation protection
in France in 2018 on ***asn.fr***

Anticipation, Maintaining safety margins, Mobilisation of the competencies in the nuclear sector:

Three challenges for nuclear safety and radiation protection in France

Montrouge, 21 March 2019

Nuclear safety and radiation protection were on the whole maintained at a satisfactory level in 2018. Technical dialogue with the licensees and the activity managers enabled the subjects to be dealt with in sufficient depth, with regard to the nuclear safety and radiation protection issues.

In the nuclear field

The fuel cycle consistency analysis entailed extensive mobilisation on the part of the licensees and led to a comprehensive, up-to-date and forward-looking view of the safety issues and of the spent fuel storage capacity needs.

The EDF and Framatome review of all the dossiers concerning the forged parts produced at Le Creusot was carried out within the time-frame.

The licensees are aware that management of facilities ageing and of maintenance operations, along with compliance of the facilities with their safety requirements, still need to be improved.

For all the licensees, the recovery and packaging of legacy waste, along with decommissioning operations, are still experiencing difficulties which lead either to delays, or to changes in strategy following several years of study. In these areas, particular vigilance is required concerning the key factors that are project management and the resources allocated to execution of these operations.

Finally, an excessive number of deviations is still being found in the large-scale works carried out during reactor outages and in the manufacturing of new equipment.

In the medical field

ASN considers that the state of radiation protection remained stable in 2018 with the professionals on the whole giving satisfactory consideration to radiation protection, with the exception of fluoroscopy-guided interventional practices.

The number of Significant Radiation Protection Events (ESR) reported to ASN in 2018 rose on the whole, but the vast majority of them were level 0 or 1 on the ASN-SFRO scale and thus with no expected clinical consequences.

The persistence of radiotherapy events of a recurring nature, rated level 2 in 2018 (dose error or laterality error for example), requires an in-depth analysis of their causes and reinforcement of prevention measures.

From left to right: Jean-Luc LACHAUME – Commissioner; Lydie ÉVRARD – Commissioner; Bernard DOROSZCZUK – Chairman; Philippe CHAUMET-RIFFAUD – Commissioner; Sylvie CADET-MERCIER – Commissioner

For the medium and long term, ASN has three messages:

- In the nuclear industry, time-frames are long. If something is not initiated or demonstrated in the short term, it will not be operational in 10 years' time. It is ASN's role to encourage the stakeholders to anticipate whenever nuclear safety or radiation protection are at stake.
  It does this with respect to the consistency of the nuclear fuel cycle and the management of radioactive materials and waste. In the future, it will do so for the implementation of the future multi-year energy plan, but also in the medical sector, when technological or radiopharmaceutical innovations require that specific radiation protection issues be taken into consideration beforehand.
- Faced with potential hazards, faced with the ageing of facilities or the possible discovery of a hitherto unidentified fault, the licensees must make sure that they keep sufficient margins for safety and do not seek to reduce them with a view to optimization or to justify retaining the status-quo. ASN must remain vigilant on this point.
- The nuclear sector must devote efforts to maintaining and developing the key industrial competencies vital to the quality of the work done and the safety of the facilities. Difficulties in the performance of conventional industrial operations (welding, electromechanical work, civil engineering and non-destructive testing), were encountered during the construction of new facilities and during work on facilities in operation. These difficulties have raised doubts regarding the ability of the sector to carry out the large-scale work involved in the continued operation of the existing facilities, decommissioning or the construction of new reactors, with the required level of quality.
  This situation requires a collective and strategic re-engagement by the industry on professional training and on industrial competencies, in order to achieve the level of quality and safety expected of the nuclear sector. This process, initiated notably with the creation of the French Nuclear Energy Industry Group (GIFEN), must now be intensified.

The nuclear fuel cycle: significant progress in 2018

ASN periodically examines the overall consistency of the industrial choices made by EDF, Orano Cycle, Framatome and Andra to ensure that the fuel cycle is well-managed in terms of nuclear safety and radiation protection issues.

In this context, the need for new spent fuel storage capacity was identified. EDF sent the safety options dossier for a centralised storage pool project. Following an assessment in 2018, ASN will issue an opinion in 2019.

In 2018, ASN issued its opinion on the fuel cycle consistency dossier for the period 2016-2030. It considers that this file satisfactorily presents the consequences of different fuel cycle evolution scenarios on the facilities, on transport operations and on waste. However, the consequences of unforeseen events which could affect the operation of the cycle need to be studied in greater depth. ASN underlines the risk of saturation of the spent fuel storage capacity if no new facilities are built, as well as the need to anticipate any strategic evolution in the operation of the fuel cycle at least ten years in advance.

In this respect, ASN asked the industry to examine, with regard to nuclear safety and radiation protection, the consequences of the multi-year energy plan on the nuclear fuel cycle, each time it is revised.

Prevention, detection and handling of fraud: progress made in 2018

The EDF and Framatome review of the manufacturing files for all the forged equipment from the Le Creusot plant was completed in 2018. The ASN analysis of this review on each reactor revealed no new deviation prejudicial to their safety, which would have required corrective measures prior to their restart authorisation. Some additional controls or tests however still need to be carried out. The EDF and Framatome examination of the manufacturing files of cast parts is continuing.

In 2018, ASN defined and deployed an action plan designed to optimise the prevention, detection and handling of suspected cases of fraud. At its request, the industry reinforced its measures in this area. ASN has enhanced its own oversight process with specific provision for fraud detection during the course of inspections. It also provided whistle-blowers with a new service on its website, enabling fraud or falsification alerts to be collected and processed.

Continued operation of the 900 MWe reactors: the high level of mobilisation must be maintained

In 2018, with the support of IRSN, ASN continued to examine the fourth periodic safety review of the 900 MWe reactors, in order to define the conditions in which they can continue to operate. ASN will issue a resolution on the generic part of the reactor periodic safety review at the end of 2020. The review will then be carried out reactor by reactor: it will start with Tricastin 1 and run until 2030.

The inspections performed and the deviations detected show that the compliance of the facilities with their safety requirements needs to be reinforced: Management of this compliance will thus be a key aspect of ASN oversight in 2019, more particularly during the reactor conformity checks.

Periodic safety reviews for facilities other than power reactors: an approach proportionate to the issues

Since 2017, the licensees have been carrying out periodic safety reviews of several tens of facilities (research, fuel cycle, decommissioning, waste, radiopharmaceuticals, irradiators). ASN has implemented an examination method commensurate with the issues. Some facilities warranting particular attention, owing to the risks inherent in the activity and the nature of the radioactive substances they contain, or because they were designed on the basis of old safety standards, will be subject to an in-depth examination.

Flamanville EPR: significant work still to be done by EDF

The Flamanville EPR reactor is designed to provide a higher level of safety than the reactors currently in operation.

ASN stresses the fact that EDF still has a significant amount of work to do before fuel can be loaded into the reactor, in order to demonstrate compliance of the facility with its safety requirements.

Construction work and equipment manufacturing have experienced numerous difficulties, mainly due to a loss of experience in the performance of major construction sites. These difficulties also indicate shortcomings in the licensee's monitoring of certain activities on the construction site. The approach proposed by the latter for dealing with the anomalies detected in the main steam system pipe welds is currently being examined. ASN will issue its opinion on the acceptability of this approach in 2019.

ASN will be particularly vigilant with regard to the satisfactory performance of tests prior to start-up and to the handling of any deviations. Furthermore, the results of tests performed on the EPR reactors abroad and exchanges between safety regulators will enable ASN to identify particular topics that require reinforced attention and oversight.

Waste: an issue involving numerous stakeholders

The *Cigéo* project for the deep geological disposal of high and intermediate level long-lived waste reached a major milestone in 2018, with the ASN opinion on the safety options dossier. The project as a whole has reached a satisfactory level of technical maturity. Certain subjects however still require additional work before the creation authorisation application can be submitted. ASN more particularly issued additional requests concerning bituminised waste packages and a multi-disciplinary expert review is in progress on these aspects. Andra intends to submit the creation authorisation application for this disposal centre in 2020. It will take account of the ASN opinion issued regarding the safety options dossier.

In conjunction with the Ministry responsible for Energy, ASN was closely involved in drafting the project management report and in preparations for the public debate concerning the next National Radioactive Material and Waste Management Plan, organised by the National Public Debates Commission (CNDP). This report aims to shed light on the main questions submitted to the debate, more particularly the management of materials, spent fuel storage needs, the management of very low level waste and of higher level wastes, as well as on the practical arrangements of the industrial phase of the *Cigéo* project.

In 2018, ASN also examined CEA's strategy for decommissioning and waste and materials management. Jointly with the Defence Nuclear Safety Authority (ASND), this for the first time concerned all civil and defence-related facilities. It notably examined the prioritisation of operations according to their nuclear safety and radiation protection implications, so that CEA could more efficiently manage these large-scale projects at a time of a constrained budgetary context. ASN will issue its opinion on this strategy in 2019.

Medical: persistence of points requiring particular attention and the need for anticipation

Improving the analysis and prevention of significant radiation protection events

The overall increase in the number of ESR notified indicates greater transparency, in particular in nuclear medicine and radiology (conventional and computed tomography). However, for radiotherapy, the fall in the number of ESR notified that has been observed since 2015, continued in 2018. The causes of this drop should be identified.

In 2018, ASN observed that the number of serious ESR notifications was still high. To prevent such events, with the support of a multidisciplinary expert group and as part of a continuous improvement approach, ASN aims to achieve broader publication of recommendations and summary documents intended for those in charge of the activities. Under ASN coordination and following on from the work done on radiotherapy Operating Experience Feedback (OEF), this expert group will in 2019 exploit national OEF about the most serious or frequent ESR in the imaging and nuclear medicine fields, reactively and operationally.

At the same time, in conjunction with the learned societies, a review will be carried out on the scales currently used for the ESR classification and the changes that would appear to be needed.

Continuing the graded approach to oversight

In 2019, ASN will continue to deploy tools for a graded approach to radiation protection oversight. The actions undertaken as of the end of 2017 will be supplemented by decisions concerning the new registration system, which could more particularly concern fluoroscopy-guided interventional practices and scanners.

Anticipating technological change

A committee to analyse new medical practices or technologies using ionising radiation will be operational in 2019 in order to ensure that they are deployed under the best radiation protection conditions for patients, personnel and the environment. This committee could notably recommend prospective data collection and support measures for professionals.

Source security: continued implementation of oversight

In 2018, ASN contributed to the preparation of the "Source Security" Order, which is coordinated by the Ministry responsible for Energy, and it made changes to its internal organisation for the management of sensitive information. Measures to implement source security oversight will continue in 2019.

Nuclear accident management: improvement actions to be continued

The nuclear crisis management system in France is robust. However, the emergency exercises need to be carried out in mobilisation conditions that are more representative of the organisations and they should more closely involve the populations living in the vicinity of the nuclear facilities.

ASN is working with all stakeholders to revise post-accident doctrine, so that it is simpler and more operational. The increased radius for the distribution of stable iodine tablets around the NPPs from 10 to 20 km and the performance of a major exercise will also help improve the nuclear accident management system.

International: new steps in the sharing of good practices

The first Topical Peer Review planned by the European Directive on Nuclear Safety concerned the management of nuclear reactor ageing. This review, held under the aegis of ENSREG (European Nuclear Safety Regulators Group), enables practices to be compared and led to recommendations regarding ageing management. It showed that the approach adopted by the European countries was satisfactory with regard to power reactors and that it should be extended to research reactors. In 2019, each country will draw up a national action plan to incorporate the conclusions of this review.

France hosted an *Artémis* peer review mission as required by the European Directive on Radioactive Waste Management, carried out under the aegis of the International Atomic Energy Agency (IAEA) to examine the organisation in place for managing radioactive materials and wastes. The review pointed out that the French system covered all the issues and presented many strong points, more particularly in terms of skills and the continuous progress approach. Areas for improvement were identified, for instance effective performance of dismantling as short as possible and optimisation of very low level waste management. These conclusions were made public in a report.

ASN continued its involvement in the sharing of good practices in the field of radiation protection. For example, in accordance with the justification principle, it proposed replacing the use of high-level sealed sources with an alternative technology.

ASN financial resources: the system must be more robust

The resources dedicated to the regulation and oversight of nuclear safety and radiation protection remain a sensitive subject. In its final observations issued at the end of 2018 following its inspection of ASN, the Court of Audit notably pointed out that the contribution from several budgetary programmes meant that the total cost of external oversight of civil nuclear safety in France was difficult to identify clearly. Moreover, in the light of the major issues involved in the oversight of nuclear safety, the Court of Audit recommended that financing arrangements more appropriate to ASN's duties and working methods be implemented, in order to consolidate its independence and free it from budgetary regulation mechanisms. ASN will continue to address this subject in the future.

EDITORIAL BY THE DIRECTOR GENERAL

Accountability: a duty and a requirement

Olivier GUPTA – Director General

Montrouge, 21 March 2019

Mirroring the arrival, at the end of 2018, of two new members of the Commission, including the Chairman, more than 10% of the ASN personnel were renewed during this period. In addition, several consultative groups reporting to ASN, whose mandate expired in 2018, underwent changes in composition with the arrival of new members: the Scientific Committee and five of the Advisory Committees of Experts. A sixth Advisory Committee for Decommissioning activities was also set up, in the light of the growing importance of these issues.

This major renewal in no way impeded the correct performance of ASN's duties, nor the continuity of its oversight policy and its position statements. This is notably explained by the collective nature of ASN operations. In this way, the review of the potentially falsified dossiers from the Le Creusot plant (nearly two million pages) was completed on-time. In the field of small-scale nuclear facilities, the transposition of the radiation protection "Basic Safety Standards" Directives, a major regulatory undertaking, led to the publication of a decision setting out the list of activities requiring notification.

All of the work done by ASN was carried out under the watchful eye of the regulatory authorities, peers, members of parliament and members of the general public. ASN was summoned to hearings by Parliament on fifteen occasions in 2018. It was inspected by the Court of Audit, which referred to it as a *"benchmark independent institution regarding nuclear safety matters"*. It welcomed foreign peers to address the management of radioactive materials and wastes during the course of the *Artémis* mission and again reported on its actions in this field during the IAEA Joint Convention review meeting. It is also involved in exchanges with the general public on the conditions for the continued operation of the 900 MWe reactors, as part of the consultation process around the fourth periodic safety review of these reactors.

By implementing the action principles defined in its multi-year strategic plan, ASN more particularly made progress in two areas: field inspections and international outreach.

Increasing the efficiency of ASN actions in the field

The points requiring particular attention, in all areas, are today mainly to be found in the field, as are therefore ASN's oversight actions. In 2018, the ASN inspectors carried out more than 1,800 inspections. This figure encompasses a variety of methods: from a one-day inspection by an inspector on a precise topic, to an "in-depth" review involving about ten inspectors for a week, analysing the various aspects of risk control on a site, such as the inspection held on the Gravelines NPP in May 2018.

Several changes were made to field inspections in 2018.

Firstly, ASN reinforced the targeting of inspections on the facilities and activities with the most significant potential consequences, in accordance with the graded approach principle defined in its multi-year strategic Plan.

Thus in the medical field, the inspections of fluoroscopy-guided interventional practices, where the risks are highest, were more numerous, while the number of computed tomography inspections fell significantly.

Targeting will continue to be optimised in the coming years, notably by taking advantage of innovative

projects initiated in 2018, such as the data mining of the 21,000 inspection follow-up letters, in order to cross-reference information and thus improve the pertinence of the checks.

Then, the inspection methods themselves have changed. The inspections are more modular in the small-scale nuclear sector. They are now partly defined according to the specific features of the facility or what the inspector discovers in the field. In the Basic Nuclear Installations, a new system for the oversight of reactor outages has been finalised: it intends to replace some of the off-site documentary examinations by on-site inspections. This will be trialled as of 2019.

Finally, 2018 saw the implementation of a new system to combat fraud and falsification. In addition to the creation of a portal for whistle-blowers, the first "anti-fraud" inspections were carried out to test an investigation methodology which will eventually become systematic. In 2019, specialists on this subject will be joining ASN.

Consolidating the French and European approach through international action

In 2018, ASN also continued its long-standing commitment to international actions. Over the course of the past twenty years, it has more particularly been a driving force in the development of a nuclear safety Europe, from both the technical and institutional viewpoints.

The technical work was supported by the European Nuclear Regulators Association (WENRA). As it approaches its 20th birthday, WENRA has adopted a new strategy, to which ASN made a significant contribution and which aims to consolidate the networking between the safety regulators of the various European countries, by developing comparable baseline safety requirements (whether in terms of technical requirements or inspection methods), with the support of technical organisations (such as IRSN) which are themselves also networked across Europe. In addition, to reinforce the harmonisation of the national decisions taken by each of the regulators, a consultation system will be developed, enabling the counterpart Authorities to be asked for their thoughts informally before a position is adopted on a complex subject.

Whatever the future development of nuclear energy in Europe, ASN and its European counterparts must continue to promote their high safety requirements on the world stage. To this end, WENRA has opened its doors to the leading nuclear countries outside Europe, notably the countries supporting new designs, and will now enable them to acquire associate member status. One of the concrete challenges for ASN will be to promote the safety requirements linked to the fourth periodic safety review of the 900 MWe reactors (more particularly in countries with reactors designed by Framatome).

Outlook

The roadmap for 2019 also promises to be intense, addressing a number of major issues, such as:

- the welds on the EPR main secondary systems;
- the continued preparation of the ASN opinion on the generic phase of the fourth periodic safety review of the 900 MWe reactors;
- opinions on the CEA and Orano decommissioning and waste management strategies;
- opinions on the safety options for the centralised spent fuel storage pool and the new-generation EPR project;
- the contribution to the public debate on the National Plan for Radioactive Materials and Waste Management.

Finally, ASN will continue with work to update the regulations applicable to small-scale nuclear activities.

* * *

The engagement by the ASN teams is strong and unwavering. This commitment enables us to look with serenity towards the performance of the 2019 action programme. This work will also be made possible by the involvement of ASN's partners, members of the Advisory Committees, the Scientific Committee or the various transverse working groups, which actively contribute to the performance of ASN's duties. They have our thanks.

ASN ASSESSMENTS **PER LICENSEE** AND **PER FIELD OF ACTIVITY**

ASN carries out its oversight role by using the regulatory framework and individual resolutions, inspections, and if necessary, enforcement measures, in a way that is complementary and tailored to each situation, to ensure optimal control of the risks that nuclear activities represent for people and the environment. ASN reports on its duties and produces an assessment of the actions of each licensee, in each field of activity.

ASN ASSESSMENTS **PER LICENSEE**

EDF

The Nuclear Power Plants (NPP) in operation

ASN considers that the safety of EDF's NPPs was maintained at a satisfactory level in 2018. However, EDF must make improvements with regard to certain subjects. This is more particularly the case with managing the compliance of the facilities with their baseline safety requirements, which needs to be reinforced.

On the whole, the number of significant events in 2018 was stable in relation to 2017. No significant event exceeded level 1 on the INES scale. The verifications conducted by EDF regularly bring to light defects which affect several NPPs. Most of these defects are deviations related to the design of equipment, its installation or its maintenance and compromise its ability to perform its function in all the situations considered in the nuclear safety case.

The conformity of the facilities

As in previous years, ASN considers that the actual conformity of the facilities needs to be appreciably improved. This is more particularly the case with the seismic strength of the equipment. EDF must continue with the targeted inspections it has been gradually implementing for the past few years and which will allow regular detection of the equipment needing to be strengthened. Managing the conformity of the facilities in operation will be a major focus for ASN oversight in 2019, notably on the occasion of the fourth ten-yearly outage inspection of the Tricastin NPP reactor 1.

In 2018, EDF began a revision of its internal baseline requirements in order to improve deviations processing and ensure reactive information of ASN: this is a first step forwards. In 2018, ASN also noted that, by comparison with previous years, EDF placed greater emphasis on rapidly restoring the conformity of its facility after detecting a deviation.

In order to combat the risk of fraud, EDF has modified its inspection practices, making greater use of unannounced or cross inspections. In 2018, EDF also completed its review of the manufacturing files of the forged components produced by the Creusot Forge plant. The ASN examination of the deviations identified by this review did not reveal any new deviations in 2018 requiring repair or immediate replacement of any equipment item, but it nonetheless issued requests for additional justifications in order to back up the demonstrations provided by EDF. Examination of these additional justifications will continue in 2019.

Maintenance

EDF has taken steps to reduce the occurrence of maintenance quality defects: their number is however still too high. Some of them could have been avoided by taking greater account of operating experience feedback from other EDF reactors, including on the same site.

ASN however finds that most sites have successfully been able to carry out large-scale maintenance operations, such as the preparation for and performance of the ten-yearly outage inspections, which constitute a considerable drain on their human resources, notably those with the most experience, owing to the particularly intense maintenance phases.

ASN also considers that proactive measures must be taken by EDF to reinforce its maintenance programmes for certain equipment items. ASN in particular notes very high levels of fouling in certain internal structures of the steam generators in several reactors, which could impair their operating safety. These fouling levels are the result of maintenance that was insufficient to guarantee satisfactory cleanness. ASN considers that the in-service monitoring of the other equipment on the main primary system is carried out appropriately. In 2017, this notably led to the detection of a crack on the vessel bottom head penetration of Cattenom NPP reactor 3, with no change being observed in 2018.

With a view to the continued operation of its reactors, the "major overhaul" programme and in the light of the lessons learned from the accident at the Fukushima NPP, ASN considers that it is important for EDF to continue with the efforts it has already begun in order to remedy the difficulties encountered and improve its maintenance programmes.

ASN also observes shortcomings in the traceability and error-reduction measures concerning maintenance work. A number of anomalies are notably the result of incorrect application of a maintenance procedure, or even the inappropriate nature of the procedure itself. The workers still have to deal with constraints linked to work organisation, for which they are not responsible, such as insufficient preparation for certain activities, unplanned scheduling changes and problems with worksite coordination. The analyses carried out by the sites following significant events often lead to corrective measures that are no more than isolated awareness-raising sessions for staff, departments, or contractors identified as being responsible for the deviation. The analysis of the root causes must be taken further in order to identify any organisational weaknesses.

ASN regularly notes EDF's difficulty in ensuring appropriate and proportional monitoring of subcontracted activities, whether performed within the NPP itself or at the suppliers of goods and services. ASN however observes increased mobilisation by those responsible for monitoring outside contractors in the NPPs. It considers that EDF must further strengthen the role, the involvement and the competence of these persons, so that they can detect any inappropriate technical action at the earliest possible opportunity.

Operation

2018 was marked by difficulties encountered by EDF during post-outage reactor restarts. The scheduling, performance and analysis of the results of periodic tests are areas in which virtually all the sites need to improve. More particularly, ASN's inspectors on several occasions found incorrect conclusions regarding equipment availability following periodic testing. EDF has initiated improvement measures, the effects of which are not yet measurable.

The management of certain sensitive activities, such as temporary system configuration changes in order to carry out periodic tests, would appear to be progressing on certain sites. This progress, which must be placed in the context of the action plans being run by EDF for several years now, still remains to be consolidated.

In recent years, EDF has reinforced its organisation for managing hazard-related risks, such as the organisation put into place to detect and eliminate the risk of falling objects in the event of an earthquake (lighting, fire-fighting resources, etc.). However, ASN regularly observes that the steps taken by EDF to prevent hazards and mitigate their consequences need to be further improved. This is in particular the case with measures concerning the fire risk.

In addition, the inspections of the emergency organisation and resources confirmed that the organisation, preparedness and management principles for emergency situations covered by an On-site Emergency Plan (PUI) have been correctly assimilated.

Continuation of reactor operations

Finally, ASN notes the ambitious steps taken by EDF to enable its reactors to continue to operate. The steps planned as part of the fourth periodic safety review of the 900 MWe reactors will thus lead to significant improvements in the safety of the installations. ASN is however still waiting for additional demonstration data on certain subjects which, at this stage of the examination, could well lead to requests for significant additional measures. This is notably the case regarding seismic resistance, the efficiency of the systems recirculating the water present at the bottom of the reactor building sumps and the need or otherwise to increase the thickness of the basemat of certain containments. EDF deployed considerable engineering resources for this review. However, ASN found that the EDF engineering teams were saturated and this must be taken into account when preparing the other reviews.

Personnel radiation protection and environmental protection

In 2018, radiation protection was addressed differently by the various NPPs, notably with respect to radiological cleanness management within the facilities and the steps taken to prevent the risk of contamination. Faced with this situation, ASN is reinforcing its oversight of implementation of the action plans requested to correct these situations on the reactors concerned.

EDF's organisation for managing the detrimental effects and impact of NPPs on the environment needs to be improved on most sites and ASN considers that the licensee needs to raise its level of vigilance on these topics. Despite the action plan implemented by EDF to limit the incidents of liquid spillage into the environment, events leading to such spills were still too numerous in 2018. With regard to waste management, ASN observed progress by certain sites which had previously been under-performing, but still needs EDF to significantly improve its organisation on this topic.

Individual NPP assessments

The ASN assessments of each NPP are detailed in the Regional Overview in this report. Certain sites stand out positively:

- in the field of nuclear safety: Saint-Alban/Saint-Maurice and Fessenheim;
- in the field of environmental protection: Paluel;
- in the field of radiation protection: Saint-Alban/Saint-Maurice and, to a lesser extent, Blayais and Chinon.

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

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

The Flamanville EPR reactor under construction

ASN considers that the organisation put into place for the preparation for Flamanville EPR operations is on the whole satisfactory. EDF must however further adapt its practices regarding equipment qualification and the performance of start-up tests, so that they are carried out in the planned conditions and so that their actual representativeness is correctly documented.

The deviations found on the main steam letdown pipes revealed a lack of rigorousness in the welding operations and a breakdown in EDF monitoring of its contractors. ASN therefore asked that the review of the quality of the Flamanville 3 EPR reactor equipment be extended to include a broader scope of equipment and subcontractors, while adapting the depth of the review to the specific implications concerned. The licensee proposed an approach for dealing with the anomalies detected. It is currently being examined. ASN will issue its opinion on the acceptability of this approach in 2019. EDF must be vigilant in ensuring that the necessary repairs are carried out and the worksite completed, with priority being given to the quality of the work done.

NPPs being decommissioned and waste management facilities

ASN is concerned by the delays in the main decommissioning operations for all the Gas-Cooled Reactors (GCR) and for the Brennilis reactor, as well as in the commissioning of the radioactive waste management facilities such as Iceda.

ASN considers that waiting for complete decommissioning of one GCR reactor before beginning to decommission the others, which means that the decommissioning of these reactors would then be postponed by several decades, is unacceptable if not justified by industrial experience feedback, and it asked EDF to examine possible ways of optimising the GCR decommissioning schedule.

The nuclear safety of EDF's facilities being decommissioned remains on the whole satisfactory. Progress with the decommissioning of the Chooz A and Superphénix reactors is in line with the schedules in their decrees.

Following internal contamination events affecting workers on the Saint-Laurent A site in 2016 and Chooz A in 2017, EDF implemented an action plan for improved management of the risks linked to the presence of radionuclides emitting "alpha" radiation, which is one of the main decommissioning challenges.

ASN observes that the technical dialogue with the teams in charge of the plants being decommissioned and of waste management is sometimes difficult. Generally speaking, ASN considers that EDF's files are either insufficiently detailed (for example, the general operating rules for waste management), or incomplete (for example, the environmental assessments are missing from the reviews). ASN asks that EDF provide technical data enabling the risks to be assessed and operational conclusions to be reached more rapidly. ASN also observes that the EDF three-yearly reports on the long-term costs of decommissioning of facilities contain very little detail when compared with those from the other licensees.

Orano Cycle

ASN considers that the level of safety in the facilities operated by Orano Cycle is on the whole satisfactory, with the context being less worrying following the group's recapitalisation and reorganisation.

The facilities operated by Orano Cycle are located on the La Hague and Tricastin sites and the issues involved are both chemical and radiological.

ASN considers that the level of safety of the facilities in operation on the La Hague site is on the whole satisfactory. In a very short period of time, Orano Cycle designed and implemented new means to deal with extreme situations in their facilities, notably new emergency buildings that are robust to extreme hazards, plus water make-up resources.

However, progress is still required in terms of the traceability of the inspections performed, the training of workers in charge of these inspections, the skills of the new contractors carrying out maintenance work and their familiarity with the facilities, as well as their monitoring by Orano Cycle.

ASN considers that Orano Cycle must continue the actions undertaken to improve the follow-up and processing of deviations and the corresponding operating experience feedback from the La Hague site. It considers that Orano Cycle must take better account of organisational and human factors in its modifications or in the implementation of the group's baseline safety requirements. Finally, ASN notes that Orano Cycle must improve the way its fire risk management measures interface and interact with the measures adopted for physical protection of the nuclear materials on the La Hague site.

ASN considers that ageing management, in a context of faster than expected corrosion of the fission product evaporator-concentrators and of other equipment in the La Hague plant, is a priority issue. Orano Cycle has developed an approach involving the selection of equipment for which ageing is to be monitored. The principles of this approach are acceptable but its effective implementation in the field and its traceability need to be improved.

With regard to the various Legacy Waste Repackaging (RCD) and decommissioning projects, which have major safety implications at La Hague, ASN observes significant delays in their implementation. Some delays are linked to Orano Cycle giving priority to its plants in operation, to changes in scenarios and to the need to modify design studies, which is sometimes identified only belatedly. ASN asked Orano Cycle to reinforce its project management capabilities in order to advance the RCD and decommissioning operations successfully.

ASN considers that the safety level of the facilities on the Tricastin site has progressed, notably thanks to the gradual shutdown of the oldest facilities, the commissioning of facilities with reassessed safety standards and the

completion of the work done as a result of the lessons learned from the Fukushima Daiichi accident. ASN also observes that the pooled emergency organisation and management resources now make it possible to manage an emergency situation, whichever facility is affected. The presence of a local intervention force, its organisation, the means at its disposal and the quality of the intervention are a real asset in the emergency response organisation on the Tricastin platform, where the facilities operated entail the risk of accidents that can develop rapidly. Radioactive substance transports, which are now centrally organised, are managed satisfactorily.

ASN considers that for the Tricastin site, follow-up of the undertakings made to ASN and monitoring of the contractors needs to be improved, notably to ensure the conformity of the subcontracted work.

CEA

ASN considers that the safety of the facilities operated by CEA remains on the whole satisfactory, despite a worrying budgetary context. Safety concerns surround the continued operation of facilities designed according to old safety standards. The main challenge for CEA is however to ensure the decommissioning of facilities that have been finally shut down, to recover and package legacy waste and to manage its radioactive waste and materials with no identified use.

CEA operates a large number of facilities of varying types and safety implications, such as research reactors and laboratories conducting experiments on behalf of the nuclear industry (NPPs, fuel cycle, waste management), along with storage facilities.

Some of these facilities, built to support the French NPP fleet in the 60s and 70s, are in operation, others are shut down and preparing for decommissioning, while others are currently undergoing decommissioning. The Jules Horowitz research reactor, which was authorised in 2009, is currently under construction.

The facilities in operation are today old and the future projects designed to replace some of them are uncertain (Mosaïc, Zephyr). Their postponement could lead CEA to try to continue with the operation of ageing facilities for which it would be hard to ensure compliance with current safety standards. ASN could thus be required to restrict the operating conditions, or even request the shutdown of certain facilities. CEA will be required to define and present a medium/long-term strategy for its civil nuclear research experimental facilities, with particular vigilance with regard to the credibility of the timelines and the financial resources.

ASN considers that, at all levels within the organisation of CEA, responsibility for safety must be borne by the persons with the necessary resources, skills and authority. It also considers that CEA must be attentive to preserving the resources and attractiveness of the positions dealing with safety.

ASN considers that CEA must reinforce its monitoring and its management of the activities carried out by the outside contractors and subcontractors. This is particularly important for facilities managing waste, effluents, or storage. On this subject, it would be a good idea for the best practices observed in certain facilities to be extended to all the others.

ASN recalls the need to rapidly notify it of any significant events that occur in the facilities. It also considers that the analysis of notified events should be carried out in greater depth, on the one hand to identify the relevant corrective measures and on the other to foster the sharing of experience.

With regard to the periodic safety reviews, ASN observes that 16 review reports were transmitted with no delay at the end of 2017, which represents a considerable workload for CEA. On the basis of the inspections carried out on this topic, ASN found that CEA has now better assimilated the problems relating to the review, thanks to the implementation on each site of a transverse organisation specifically devoted to these processes. ASN will be attentive to the correct performance of the works identified in the periodic safety reviews. It thus observes that CEA makes undertakings for each dossier, although sometimes without being able to ensure that the human or financial resources are actually available. This can subsequently lead to certain undertakings not being met. ASN thus observed delays in the availability of new emergency management buildings, designed to take account of the lessons learned from Fukushima, for the Saclay and Cadarache centres. The compensatory measures proposed by CEA will need to be rapidly operational. ASN remains vigilant with respect to compliance with CEA's schedule of commitments, the completeness of the dossiers transmitted, the quality of the answers to requests and compliance with the requirements.

With respect to the scope of the delays found in CEA's decommissioning and waste management projects, ASN and ASND asked CEA, in July 2015, to conduct an overall review of its strategy for decommissioning, radioactive materials and waste management, its prioritisation of operations, human resources and the efficiency of its organisation, as well as the pertinence of the amount of the financial resources allocated to these operations. CEA has implemented a new organisation, which represents significant progress. This progress will have to be confirmed in the medium-term through compliance with the highest priority project timelines.

Andra

Andra is the sole licensee of a radioactive waste disposal BNI in France. ASN considers that the licensee's organisational and technical resources are appropriate for operation of the existing centres and that the operation of these centres is satisfactory.

Over the past ten years, ASN has found a significant improvement in the approval and monitoring activities for packages of Low and Intermediate Level, Short-Lived Waste (LLW / ILW-SL). ASN hopes to see a ramp-up of the system with regard to waste packaged for the planned future facilities.

ASN considers that the design of *Cigéo* has on the whole reached satisfactory technological maturity at the Safety Options Dossier (DOS) stage. Some of the safety options, more particularly concerning the possible disposal of bituminised waste and management of the fire risk, nonetheless need to be supplemented for the purposes of the creation authorisation application. From the Andra organisation viewpoint, the fact of becoming the licensee of a facility of the scale and complexity of *Cigéo* is a real challenge.

With regard to Low Level, Long-Lived Waste (LLW-LL), the National Radioactive Materials and Waste Management Plan (PNGMDR) has set out the steps for defining and designing disposal solutions. ASN notes that the definition of the design options is behind schedule.

ASN's assessments of the other licensees are presented in the Regional Overview part and in the various chapters of this report.

ASN ASSESSMENTS **PER FIELD OF ACTIVITY**

THE MEDICAL FIELD

In 2018, ASN considers that the state of radiation protection in the medical field remained stable, with the professionals on the whole giving satisfactory consideration to radiation protection, with the exception of fluoroscopy-guided interventional practices.

In **external radiotherapy**, the improvement in treatment safety, which has been underway for several years, continued. It is however still faced with significant technological changes, with potential risks arising when the organisational and human factors are not correctly managed. These technological changes require risk assessments, but the professionals do not as yet have complete expertise in the relevant methodology. After a marked rise in the number of Significant Radiation Protection Events (ESR) in this field of activity, ASN has observed that the numbers have fallen over the past three years. The reasons for this drop must be identified.

With regard to health care safety, the **brachytherapy** situation is comparable to that of external radiotherapy. The radiation protection of workers and the management of High-Level Sealed Sources (SSHA) are considered to be on the whole satisfactory, although this level must be maintained by means of a continuous training effort. In the current context, greater attention must be given to increased SSHA access security, to prevent unauthorised access to these sources.

The radiation protection of patients and professionals in **nuclear medicine** is dealt with satisfactorily. Also in this sector, training efforts must be maintained. In addition, the coordination of preventive measures during work by outside contractors (for equipment maintenance, cleaning of the premises, etc.) must be improved. One of the issues of radiation protection is also good management of radioactive effluents; this is all the more important as internal targeted radiotherapy treatments, which require the administration of high activity levels to the patients, will undoubtedly become more widespread, resulting in an increased level of discharged radioactivity.

In the field of **fluoroscopy-guided interventional practices**, ASN considers that the important measures it has been recommending in recent years are not always sufficiently followed in order to improve the radiation protection of patients and professionals during interventional practices, notably for surgery in the operating theatres. The inspections frequently reveal deviations from the regulations, concerning the radiation protection of both patients and medical staff, and ASN is regularly notified of events concerning interventional surgeons who have exceeded the dose limits for the extremities. The state of radiation protection is however far better in the units which have been using these technologies for a long time, for example in imaging units where interventional cardiology and neurology activities are carried out. Extensive work to raise the awareness of all professionals is needed in order to help medical, paramedical and administrative professionals in facilities, so that they have a clearer perception of the implications, notably those professionals working in operating theatres.

For ASN, continuous training of professionals and intervention by the medical physicist are certainly the two key points for guaranteeing management of the doses delivered to the patients during interventional procedures.

The growing number of diagnostic examinations using computed tomography is contributing to a high collective dose level, with **medical imaging** being the leading source of the population's artificial exposure to ionising radiation. The medical justification for these procedures is as yet insufficiently operational, owing to the insufficient training of the prescribing physicians, or even the lack of availability of other diagnostic means (MRI, ultrasonography). In July 2018, ASN published the second action plan for the management of ionising radiation doses delivered to persons undergoing medical imaging. This plan aims

to reinforce the justification of the procedures and the optimisation of the ionising radiation doses delivered to the patients.

THE INDUSTRIAL AND RESEARCH SECTOR

Among the nuclear activities in the **industrial** sector, industrial radiography and more particularly gamma radiography, are priority sectors for ASN oversight owing to their radiation protection implications. ASN considers that the risks are addressed to varying extents within the companies, even though worker dosimetry monitoring is generally carried out correctly. If the risk of incidents and the doses received by the workers are on the whole well managed by the licensee when this activity is performed in a bunker in accordance with the applicable regulations, ASN is still concerned by the observed shortcomings in terms of the demarcation of the operations area during site work.

In the other priority sectors for ASN oversight in the industrial sector – industrial irradiators, particle accelerators including cyclotrons, suppliers of radioactive sources and devices containing them – the state of radiation protection is considered to be on the whole satisfactory. With regard to suppliers, ASN considers that preparations for the expiry of the sources administrative recovery period – which by default is 10 years – and the checks prior to delivery of a source to a customer, are areas in which practices still need to be improved.

In the field of **research**, the actions carried out in recent years have led to improvements in the implementation of radiation protection within the research laboratories. The most significant improvements concern the waste and effluent storage conditions, more particularly the adoption of inspection procedures prior to their disposal. For ASN, however, this subject remains a point requiring particular attention. In addition, the registration and analysis of events which could lead to accidental or unintentional exposure of persons to ionising radiation, including as a result of insufficient traceability of the radioactive sources being held, are as yet not systematic enough.

With regard to the **veterinary uses of ionising radiation**, ASN can see the result of efforts made by veterinary bodies over the past few years to comply with the regulations, notably in conventional radiology activities on pets. For practices concerning large animals such as horses, or performed outside veterinary facilities, ASN considers that the implementation of radiological zoning, the wearing of operational dosimeters and the radiation protection of persons from outside the veterinary facility who take part in the radiographic procedure, are points requiring particular attention.

TRANSPORT OF RADIOACTIVE SUBSTANCES

ASN considers that in 2018, the safety of transport of radioactive substances is on the whole satisfactory. Even if a few transport operations were affected by incidents, primarily on the roads, they should be compared with the 770,000 transport operations carried out each year and led neither to dispersal of the package contents into the environment, nor to any significant exposure of humans.

The main causes of the 91 significant events concerning the transport of radioactive substances on the public highway which occurred in 2018, were:

- material non-conformities affecting a package. These however had no real consequences on the radiation protection of people or the environment, although they did weaken the package (whether or not an accident occurred);
- non-compliance with internal procedures leading to the shipment of non-conforming packages, delivery errors, or packages being temporarily mislaid.

The inspections carried out by ASN also frequently identify such deviations. The consignors and carriers must therefore demonstrate greater day-to-day rigorousness.

With regard to transport operations involved in the fuel cycle and, more generally, for BNIs, ASN considers that the consignors must further improve how they demonstrate that the contents actually loaded into the packaging comply with the specifications of the approval certificates and the corresponding safety analysis files.

ASN observes progress over previous years, as well as better application of the recommendations made in ASN Guide No. 7 (volume 3). The improvements still needed generally concern the description of the authorised contents per type of packaging, a demonstration that no radioactive content is lost or dispersed in normal transport conditions and the impossibility of exceeding the applicable dose limits with the maximum authorised content.

At a time when the uses of radionuclides in the medical sector are generating a high volume of transport traffic, progress is still needed in understanding the regulations applicable to these transports and the arrangements made by certain hospitals or nuclear medicine centres for the shipment and receipt of packages. ASN considers that the radiation protection of carriers of radiopharmaceutical products, who are significantly more exposed than the average worker, needs to be improved.

NOTABLE EVENTS 2018

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Flamanville EPR reactor

Main secondary system pipe welds

At the beginning of 2017, EDF informed ASN of deviations that had occurred during welding of the main steam lines (VVP system) for the Flamanville EPR reactor.

For these pipes, EDF had adopted a «break preclusion» approach, which implies tightened design, manufacturing and in-service monitoring requirements such as to consider that a break of these pipes is extremely improbable. This choice means that the licensee does not study the consequences of a break on these pipes in the facility's nuclear safety case.

In order to achieve the expected high standard of manufacturing quality, the licensee (EDF) and the manufacturer (Framatome) defined tightened requirements, more specifically with respect to the mechanical properties. However, these tightened requirements were not specified to the subcontractor responsible for producing these welds. The inspections carried out during production showed that, for some of these welds, not all of these requirements had been met.

In addition, in March 2018, EDF identified a number of flaws during the pre-service inspection of these pipes, as required by the regulations prior to commissioning. These flaws should have been detected by the manufacturer on completion of manufacturing. This finding led EDF to implement a verification programme for all the welds on the main secondary systems, which include the VVP pipes. These new checks revealed flaws requiring repair. ASN verified the performance of these new inspections by EDF.

All of these deviations, as well as the ASN findings during its inspections, highlighted a lack of expertise in the welding operations carried out on the VVP pipes and a breakdown in EDF monitoring of its contractors.

In July 2018, EDF undertook to restore the required mechanical properties of the welds concerned by the deviations identified, except for the eight welds located in the annulus between the two containments of the reactor building, where access is harder. One of these eight welds also comprises a manufacturing flaw that EDF proposed maintaining as-is.

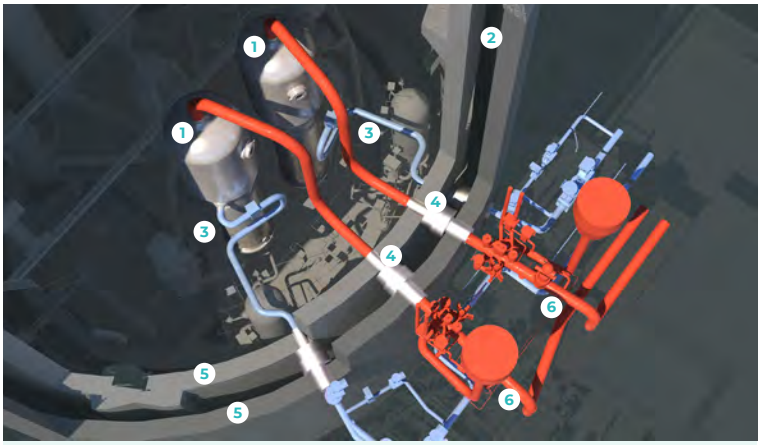
In December 2018, EDF sent ASN a file aiming to demonstrate that the quality of these eight welds is sufficient, enabling their breakage to be precluded with a high level of confidence. This demonstration is more particularly based on an in-depth characterisation of the welds material.

ASN's examination of the EDF file, with the support of IRSN, will continue in 2019. ASN will consult its Advisory Committee for Nuclear Pressure Equipment (GP ESPN) on 9 April 2019 concerning the approach proposed by EDF.

In addition, the identification of shortcomings in EDF's monitoring of its contractors led ASN to ask EDF to conduct a review of the quality of the Flamanville 3 EPR reactor equipment, extended to include a broader scope of equipment and subcontractors, while adapting the depth of the review to the specific implications concerned.

In brief

The welds on the main steam lines in the Flamanville EPR reactor are affected by design and construction deviations. In its letter of 2 October 2018, ASN considered that priority should be given to restoring the conformity of the welds and asked EDF to send it a file presenting its deviations processing approach. This file was examined by ASN, with the technical support of IRSN and their conclusions are presented to the GP ESPN meeting in April 2019.



1 Steam generators 2 Annulus 3 Feedwater Flow Control System
4 Penetrations 5 Double containment 6 Steam System (VVP)

Nuclear power plants

Fourth periodic safety review of the 900 MWe nuclear reactors

In the same way as any BNI, the nuclear reactors undergo an in-depth periodic safety review every 10 years, in order to check their level of safety and make any necessary improvements.

A review with major implications

The 34 EDF reactors with a power of 900 MWe were commissioned between 1977 and 1987 and the first ones are approaching their fourth periodic safety review. This is the context in which the conditions for the continued operation of these reactors will be defined.

This fourth periodic safety review comprises particular challenges:

- Some equipment is reaching its design lifetime. The studies concerning the conformity of the installations and the management of equipment ageing therefore need to be reviewed to take account of the degradation mechanisms actually observed and the maintenance and replacement strategies adopted by EDF.
- The modifications associated with this periodic safety review will enable the integration of the modifications specified by ASN following the Fukushima Daiichi NPP accident to be completed on these reactors.
- The safety reassessment of these reactors and the resulting improvements must be carried out in the light of the new generation of reactors, such as the EPR, the design of which meets significantly reinforced safety requirements.

At the end of 2020, ASN will issue a position statement on the EDF generic studies applicable to all reactors

In 2013, EDF sent ASN its objectives for this periodic safety review, in other words, the level of safety to be achieved for continued operation of the reactors.

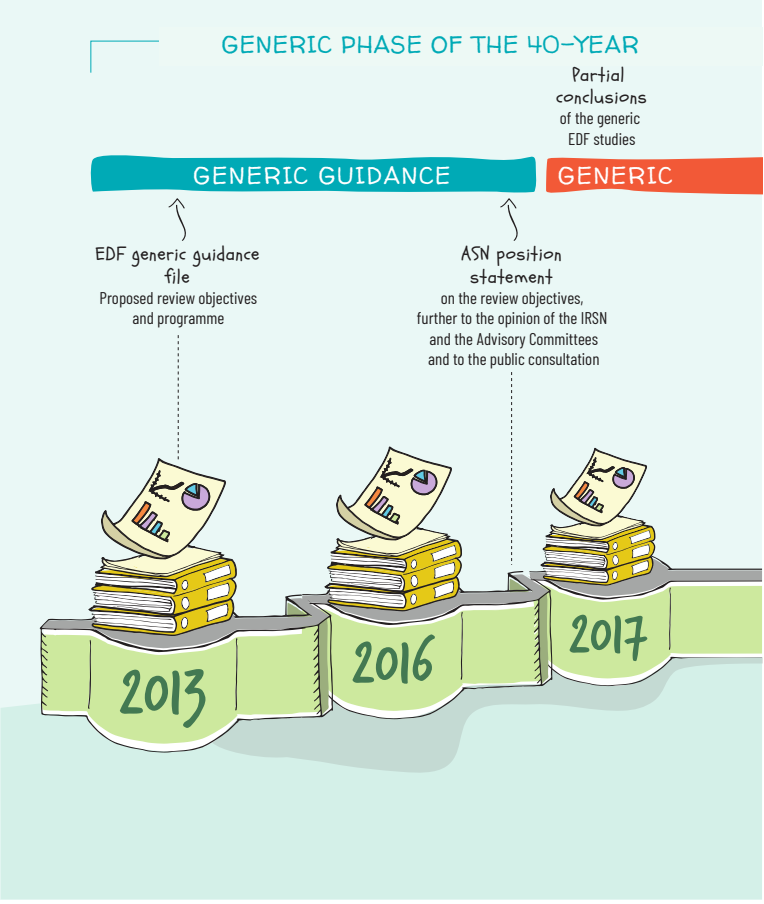
After examining the objectives proposed by EDF, with the support of IRSN, and following consultation of its Advisory Committees, ASN released a position statement on these objectives and issued additional requests in April 2016. EDF supplemented its programme of work and in 2018 presented ASN with the measures it envisages taking in response to these requests.

With the support of IRSN, ASN is continuing to examine the generic studies linked to this review. In 2018, ASN more particularly obtained the opinion of its Advisory Committees on the management of ageing and obsolescence and on the mechanical strength of the reactor pressure vessels.

It will again ask them for their opinion in 2019 and 2020 regarding:

- nuclear pressure equipment, more particularly the thermomechanical loads stressing the vessels;
- the accident studies in the safety case;
- the ability of the installations to withstand internal and external hazards;
- the probabilistic safety analyses;
- the management of accidents with core melt.

In September 2018, ASN sent EDF its initial observations on the inspections and modifications EDF intends to implement on its reactors in order to meet the objectives of the periodic safety review. ASN will issue a position statement on the generic studies for this periodic safety review at the end of 2020.



ASN will issue its opinion on the continued operation of Tricastin NPP reactor in 2022.

In brief

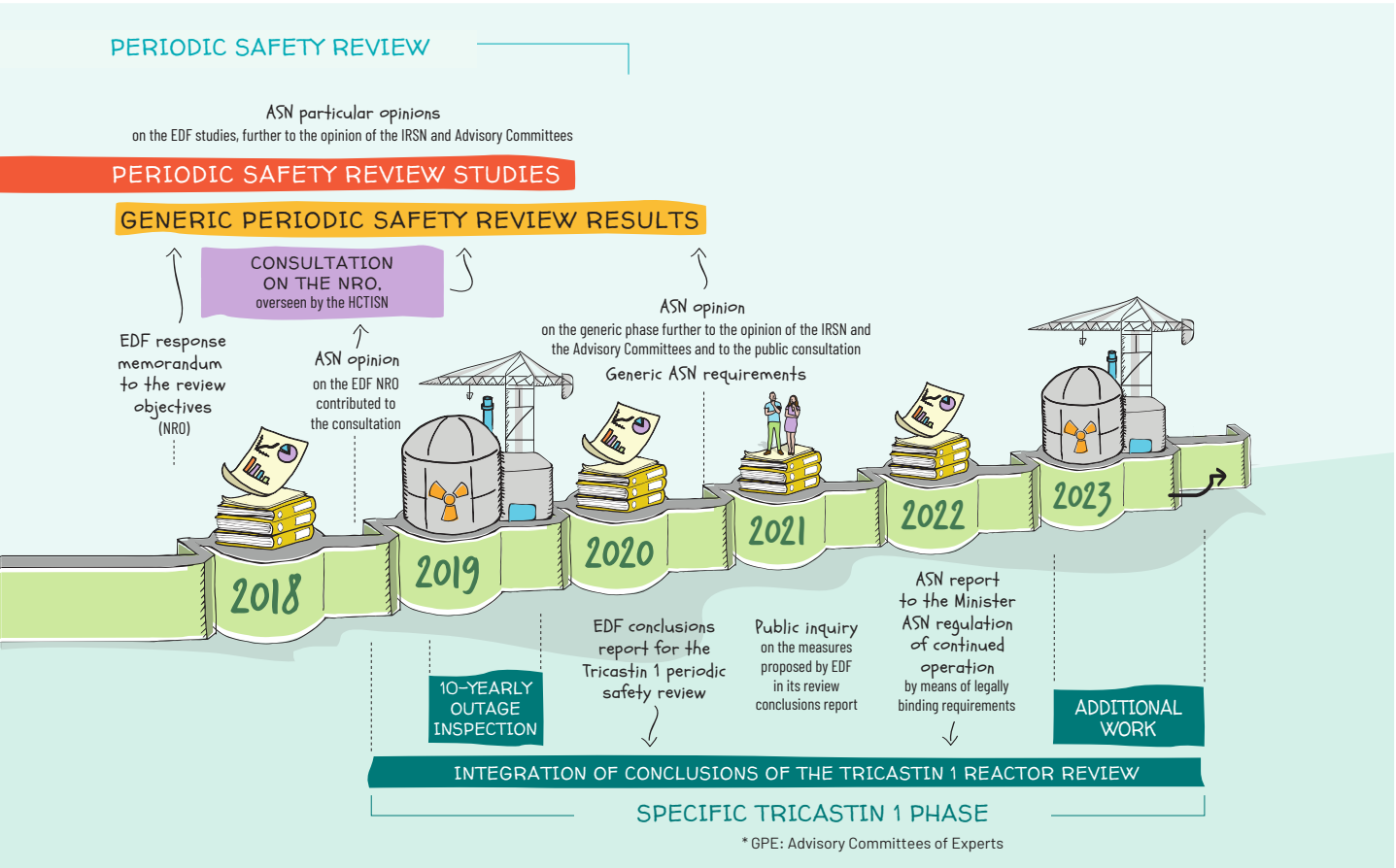
The periodic safety review has a two-fold objective:
- in-depth examination of the state of the facility, taking account of its ageing, in order to verify its compliance with the applicable baseline safety requirements;
- improve its safety level to take account of operating experience feedback and the technical progress made on the most recent reactors.

2019: the year of the first of the 4th ten-yearly outage inspections

In 2019, Tricastin NPP reactor 1 will undergo its fourth ten-yearly outage inspection, which is a major step in its fourth periodic safety review. During this outage, EDF will carry out a significant part of the required inspections and deploy the first safety improvements associated with the review. ASN will issue a position statement on the continued operation of this reactor in 2022, after its position statement on the generic studies and its examination of the periodic safety review report for this reactor, that will be submitted by EDF in 2020.

Involving the public at each step

For the purposes of this periodic safety review, ASN has been involving the public since 2016 in the drafting of its position statement regarding the objectives proposed by EDF. This approach continued in 2018, under the aegis of the High Committee for Transparency and Information on Nuclear Security, in the form of a consultation on the measures planned by EDF to meet these objectives. ASN will also consult the public on the position it is to adopt at the end of 2020 for the generic phase of the periodic safety review. Pursuant to the law, a public inquiry will then be held, reactor by reactor, after submission of the periodic safety review conclusions report for each of them.



Nuclear safety and radiation protection

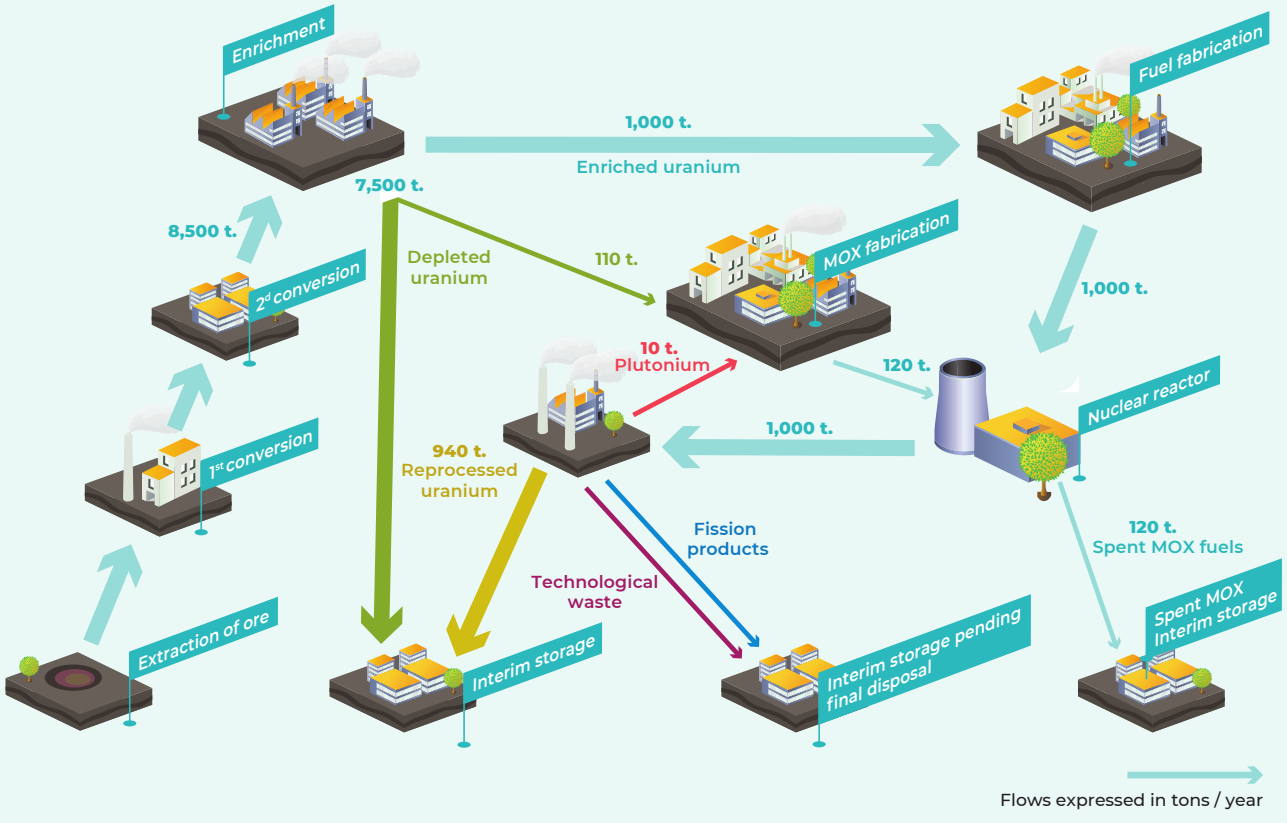
Nuclear fuel cycle consistency

ASN monitors the overall consistency of the industrial choices made with regard to fuel management and which could have consequences for safety. In this context, ASN periodically asks EDF to submit a «Cycle Impact» file prepared jointly with the fuel cycle stakeholders and presenting the consequences – for each step of the nuclear fuel cycle – of EDF's strategy for using the different types of fuel in its nuclear reactors.

In 2015, ASN asked EDF to conduct an overall review of the "Cycle Impact" file by 2016. This update of the "Cycle Impact" file comprises a number of innovations with respect to the previous approaches initiated in 1999 and 2006:

- The study period, which habitually covered ten years, was increased to fifteen years, in order to take account of the time actually observed in the nuclear industry for designing and building any new facilities identified as being necessary for implementation of the strategy.
- Radioactive substances transport contingencies were explicitly taken into account.
- Nuclear reactor closures were studied for the period of time considered, in particular assuming stable electricity demand until 2025, to take account of the planning provisions included in the Energy Transition for Green Growth Act 2015-992 of 17 August 2015.
- The strategy for managing and storing spent fuels pending reprocessing or disposal was explained.

Fuel cycle diagram



From mining of uranium ore to the disposal of radioactive waste from spent fuels, ASN examines the “Cycle Impact” file supplied by the fuel cycle stakeholders.

In brief

The “nuclear fuel cycle” comprises the fabrication of the nuclear fuel used in the nuclear power plant reactors, its storage and its reprocessing after irradiation. Several licensees are involved in the cycle: Orano Cycle, Framatome, EDF and Andra.

ASN examination of the “Cycle Impact” file was completed in October 2018.

In June 2016, EDF submitted the “Cycle Impact 2016” file covering the period 2016-2030. This file, which was produced in collaboration with Framatome, Orano Cycle and Andra, more particularly identifies the maximum thresholds (capacity saturations, maximum isotope content of fuel reached, etc.) foreseeable by 2040, on the basis of various energy mix evolution scenarios. After examination, ASN delivered its opinion on 18 October 2018.

It considers that the “Cycle Impact 2016” file provides a satisfactory presentation of the consequences of the various nuclear fuel cycle evolution scenarios on the nuclear facilities, transport operations and waste. However, the consequences of the unforeseen events which could affect the operation of the cycle need to be studied in greater depth.

ASN underlines the need to anticipate any strategic change in the functioning of the fuel cycle by at least ten years so that it can be designed and carried out under controlled conditions of safety and radiation protection. It is a question, for example, of ensuring that – given the incompressible development times for industrial projects – the needs for new spent fuel storage facilities or for new transport packaging designs are addressed sufficiently early.

For the coming decade, it would appear in particular that to avoid reaching the maximum capacity of existing storage facilities too quickly (nuclear reactor spent fuel pools and at La Hague), any reduction in production by reactors consuming MOX fuel must be accompanied by a reduction in that by reactors consuming fuel from Enriched Natural Uranium (ENU), so that all the spent ENU fuel is reprocessed.

The two parts of the equation are fuels and storage capacity.

In the longer term, it will be necessary either to have new storage capacities that are significantly greater than the current and planned volumes, or to be able to consume MOX fuel in reactors other than the 900 MWe reactors, which are the oldest. The time-frame required for the design and production of these options is about ten years. ASN therefore asked the industrial players to start examining these two options without delay.

The Government is currently preparing the “Multi-annual Energy Plan” (MEP), which is updated every five years. The functioning of the nuclear fuel cycle could evolve according to the orientations thus defined in this plan. At the request of ASN, the industrial players will be required to study the consequences, in terms of nuclear safety and radiation protection, of the MEP on the nuclear fuel cycle and its consistency, at each MEP revision.

Oversight tool

National Radioactive Material and Waste Management Plan

Planning Act 2006-739 of 28 June 2006 on the sustainable management of radioactive material and waste, instituted the drafting of a National Radioactive material and waste Management Plan (PNGMDR) every three years.

The PNGMDR is prepared by the General Directorate for Energy and Climate (DGEC) at the Ministry responsible for Energy and by ASN, on the basis of the work done by a pluralistic working group more specifically comprising radioactive waste producers, licensees of management facilities for this waste, evaluation and control authorities and environmental protection associations.

In concrete terms, the PNGMDR gives a detailed inventory of radioactive material and waste management methods, whether operational or to be deployed, and then makes recommendations or sets targets.

ASN contributed to this through seven opinions issued in 2016, the main guidelines of which were incorporated into the 2016-2018 version of the PNGMDR. The Decree and Order of 23 February 2017 set out the prescriptions of the Environment Code and the studies to be conducted in the coming years, respectively. There are 83 of these studies, each one with a pilot and a completion deadline.

The same pluralistic approach to drafting will be adopted for the next edition of the PNGMDR, which will also be preceded by a public debate for the first time. In accordance with the Ordinance of 3 August 2016, the DGEC and ASN referred to the National Public Debates Commission (CNDP) regarding the procedures to be followed for organising participation by the public. The CNDP decided to organise a public debate on the plan.

The debate, which will be held during the course of 2019, will be an opportunity to deliberate on a number of subjects with significant implications.

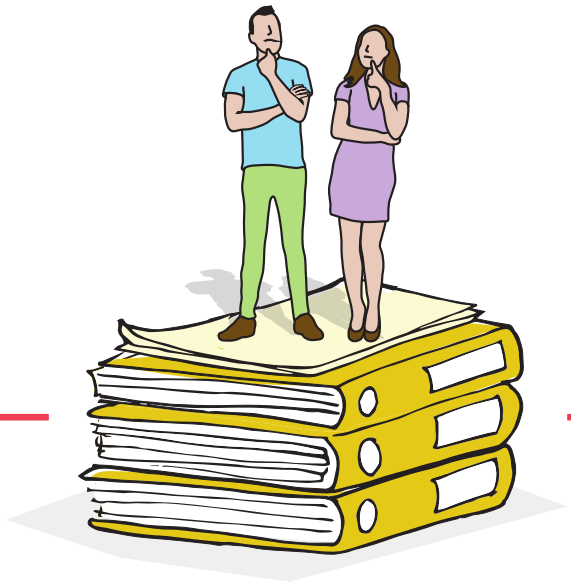
ASN and the DGEC, in cooperation with the particular public debates Commission, drafted a "project manager's report" which presents the main elements of the PNGMDR and identifies the main issues they propose submitting to the debate for the purpose of drafting the new plan. The contributions and thoughts expressed during the debate on the aspects of the PNGMDR which are not directly covered by the project manager's plan, will also be of use for drafting the next edition of the PNGMDR.

In brief

Since the first edition of the PNGMDR in 2007, there have been four successive plans. They have enabled progress to be made in structuring the radioactive material and waste management routes and strengthening the public policies which, in this field, contribute to the protection of human health, safety and the environment.

Classification of radioactive waste and corresponding management routes

<table>
<tr><th>CATEGORY</th><th>VERY SHORT LIVED WASTE</th><th colspan="2">SHORT-LIVED WASTE</th><th>LONG-LIVED WASTE</th></tr>
<tr><td>Very Low Level (VLL)</td><td rowspan="3">VSL
Management by radioactive decay</td><td colspan="2">VLL
Surface disposal (Industrial centre for collection, storage and disposal)</td><td></td></tr>
<tr><td>Low Level (LL)</td><td rowspan="2">LIL-SL
Surface disposal (Aube and Manche waste repositories)</td><td>LL-LL
Near-surface disposal being studied</td></tr>
<tr><td>Intermediate Level (IL)</td><td rowspan="2">IL-LL
Project for deep geological disposal (Cigéo project)</td></tr>
<tr><td>High Level (HL)</td><td>Not Applicable</td><td>HL</td></tr>
</table>



The issues of the next National Radioactive Material and Waste Management Plan identified in the project manager's report for the public debate

Numerous issues are covered by the PNGMDR and not all are developed in the project manager's report. For the purposes of the public debate, the project manager chose to develop five issues, on the basis of the ethical or strategic implications of certain management choices that could be adopted. For each of these five subjects, the project manager presents in its report the challenges and problems as it perceives them and the main characteristics of the management solutions which could be envisaged for the next edition of the PNGMDR, along with their significant impacts.

Managing radioactive material and preventing creating a burden on future generations

- Are the prospects for recycling radioactive material credible?
- How to assess this credibility, with what degree of confidence?
- What management choices should result from this analysis?
- How to mitigate the impacts of current choices on future generations?

Anticipating the evolution of spent fuel storage needs

- What additional technical measures could be used to reinforce the spent fuels storage strategy?
- How to optimise management of the risks and potential hazards linked to the operation of fuel cycle facilities?
- Given the intended reduction of nuclear energy in the electricity mix, on the basis of what scenarios should these additional storage needs be defined?

Very low level waste, a diversity of solutions to optimise its management

- Faced with the future large volumes of low toxicity waste in the coming decades, how should the current management methods for very low level waste be developed?

Low level long-lived waste, appropriate disposal facilities for the potential risks

- Faced with the difficulties being encountered with the development of a disposal centre for all these wastes, what options could supplement the ongoing projects?
- What shape could the new management guidelines take?

Defining the practical aspects of the pilot industrial phase for the *Cigéo* project and the reversibility of deep geological disposal

- In the 2016 Act, Parliament reaffirmed its wish to see the deep geological disposal project continue, in accordance with two principles, that is reversibility and the implementation of a pilot industrial phase prior to its actual commissioning.
- How to implement these two principles and address the expectations of civil society?
- How to involve civil society throughout the lifetime of the project?
- How to have civil society take part in the major decisions linked to the reversibility of the project (changes in energy policy, technological progress)?
- How to take decisions to close the disposal vaults?
- How to monitor and what objectives to set for the pilot industrial phase?

Regulatory news

2018 was marked by considerable activity on standards, more particularly concerning radiation protection, with the publication in June of three Decrees transposing Council Directive 2013/59/Euratom of 5 December 2013 setting Basic Standards for Health Protection against the dangers resulting from exposure to ionising radiation. In the field of Basic Nuclear Installations (BNI), ASN was closely involved in drafting a decree codifying the provisions applicable to BNIs, to the transport of radioactive substances and to nuclear transparency, which entailed extensive consultation with the stakeholders. Some international and national news should also be highlighted.

1 International news

• New IAEA regulations for the transport of radioactive materials – Special Safety Requirements N° SSR-6 – 2018 edition

The International Atomic Energy Agency (IAEA) revised the regulations for the transport of radioactive materials. The new 2018 edition of these regulations more specifically extends the list of Surface Contaminated Objects (SCO) to extremely voluminous solid objects such as BNI steam generators, so that they can be transported with a high level of safety. The new IAEA provisions are incorporated into the 2019 editions of the various international agreements for the various transport modes, such as the European Agreement on the international carriage of dangerous goods by Road (ADR).

The IAEA implementation guide for radioactive materials transport regulations, No. SSG-26, will be updated accordingly in 2019.

2 National news

2.1 Acts

• Act 2018-670 of 30 July 2018 concerning the protection of trade secrets, which transposes Directive (EU) 2016/943 of the European Parliament and the Council of 8 June 2016 on *the protection of undisclosed know-how and business information (trade secrets) against their unlawful acquisition, use and disclosure*, and its implementing Decree 2018-1126 of 11 December 2018 creating a new general system for the protection of trade secrets (Articles L. 151-1 to L. 154-1 of the new Code of Commerce).

"Trade secrets" enable companies to preserve the confidentiality of information which cannot benefit from protection under intellectual property law (patents, drawings and models, copyright), but which is nonetheless important in order to maintain their competitiveness.

The new system defines the information liable to be protected, illicit behaviours and the preventive measures that could be requested before the courts. It aims to provide companies with a degree of protection, notably with respect to their competitors.

The new provisions do not however constitute a radical change for ASN, in that it was already bound to respect "industrial and commercial secrecy" (the former terminology now replaced by trade secrets), a notion which was already present in the legislation specific to the communication of administrative documents and environmental information.

In addition to a change in terminology, also worth noting is:

- whistle-blowers are no longer bound by trade secrecy;
- the use of information covered by trade secrecy (in particular that obtained from a whistle-blower) is licit when it is intended for the protection of a legitimate interest recognised by European or national law.

• Act 2018-727 of 10 August 2018 on Building a State worthy of Societal Confidence ("ESSOC" Act) comprises measures with a direct effect on ASN.

The Act now requires that a copy of the report of a breach of the Environment Code be transmitted, unless otherwise stipulated by the Public Prosecutor, to the infringing party within at least five days and no later than ten days following transmission of the report to the Public Prosecutor.

In terms of environmental assessment, the Act now requires that when a project modification entails a case by case examination, the project manager shall refer to the administrative authority in charge of regulation and oversight (ASN for BNIs) so that this latter can, in place of the environmental Authority, determine whether or not the modification should or should not be subject to an environmental assessment. This concerns requests for significant modifications to BNIs liable to have notable negative impacts on the environment.

The "right to request an inspection and the enforceability of this inspection" could possibly be used by a BNI licensee, a party responsible for the transport of radioactive substances or for a nuclear activity, but this possibility will probably be restricted on nuclear matters, owing to the restrictions and limitations on its effects provided for by the Act.

Thus, anyone may ask to be the subject of an inspection as stipulated by the act or regulation *"except in the case of dishonesty on the part of the applicant, an inappropriate request or when the effect of the request is clearly to compromise the correct functioning of the service or place the administration in a situation whereby it is incapable of correctly carrying out its inspection programme"*. Even if the Act states that the express conclusions of this inspection may be enforceable on the administration, it also states that *"these express conclusions cease to be enforceable: 1° In the event of a change in the subsequent legal or actual situation such as to affect their validity; 2° When the administration carries out a further inspection giving rise to new express conclusions"*. In addition, the provisions on the enforceability of the inspection may not constitute an obstacle

to *"the application of the legislative or regulatory provisions directly protecting public health, the safety of individuals and property or the environment"*.

2.2 _ Decrees and Orders

2.2.1 _ Radiation protection

Three Decrees were published on 5 June 2018, more particularly transposing Council Directive 2013/59/Euratom of 5 December 2013 setting Basic Standards for Health Protection against the dangers resulting from exposure to ionising radiation. They more specifically modify the regulatory parts of the Defence, Environment, Public Health and Labour Codes, and thus supplement the regulatory framework of certain nuclear activities:

• Decree 2018-434 of 4 June 2018 implementing various nuclear provisions entirely modifies Chapter III of Part III of Book III of Part one of the Public Health Code (Articles R. 1333-1 to R. 1333-175). It comprises new measures reinforcing the general protection of the population, notably with regard to natural sources of ionising radiation, and of persons exposed for medical purposes. These new provisions transpose the provisions of the Directive of 5 December 2013 and create additional tools for reinforcing the effectiveness of the oversight of nuclear activities: the possibility of implementing land use restrictions on sites contaminated by radioactive substances and monitoring the protection of certain sources of ionising radiation (in particular those used in industry) against malicious acts. The main changes include those concerning:

- the administrative procedures covering the protection of sources against malicious acts ("source security");
- the new system applicable to small-scale nuclear activities (medical, veterinary, industrial and research applications), with the introduction of the registration system (simplified licensing) in addition to the existing notification and authorisation systems, thus reinforcing the graded approach according to the potential issues involved.

• Decree 2018-437 of 4 June 2018 concerning the protection of workers against the hazards of ionising radiation entirely modifies the provisions of Chapter 1 of Part V of Book IV of Part four of the Labour Code, which have been revised in full (Articles R. 4451-1 to R. 4451-135). The changes are not limited to the transposition of the new provisions of the Directive of 5 December 2013 but also propose a simplification of the existing provisions. More particularly, a grading of requirements more closely matching the risks run by the workers was adopted, along with closer harmonisation between the approach applicable to the ionising radiation risk and that adopted for the other occupational risks.

The main changes more specifically concern:

- regulatory limits: the limit for exposure of the lens of the eye is reduced to 20 mSv/year (from 150 mSv/year), although with a transitional implementation period of five years;
- the organisation of radiation protection; this is now based on the appointment of a "Radiation Protection Adviser" who, as chosen by the employer, may be either the Radiation Protection Expert/Officer, or a Certified Radiation Protection Organisation (OCR).

• Decree 2018-438 of 4 June 2018 concerning protection against the risks from ionising radiation to which certain workers are exposed, modifying the health and safety rules for the prevention of risks arising from naturally occurring or artificial ionising radiation applicable to pregnant women, women who have recently given birth, or nursing women, and young workers, more particularly with regard to the dose limit values and the information and training procedures. It specifies the working conditions in which staff holding a limited duration contract and temporary staff may not be employed, in order to take account of technological changes to the working equipment, notably that generating pulsed ionising radiation fields.

Radon

The Order of 27 June 2018 was also published, **determining the zones with radon potential in France.** This Order places municipalities in one of the three radon potential zones defined in Article R. 1333-29 of the Public Health Code, in which information, evaluation or measurement measures and radon exposure prevention measures specified in Articles L. 1333-22 of the Public Health Code, L. 125-5 of the Environment Code and L. 4451-1 of the Labour Code are taken by the parties concerned. This new municipality level map takes the place of the *département* level map which has been in place since 2004 (the list of the 31 priority *départements* is repealed).

Waters intended for human consumption

A health check on the quality of Waters Intended for Human Consumption (EDCH) is performed by the Regional Health Agencies to ensure that these waters comply with the regulation quality references and entail no risk to the health of consumers. ASN published opinion 2018-AV-0315 of 16 October 2018 concerning two draft orders which more particularly aim to create a shared approvals procedure for laboratories measuring radioactivity in the EDCH for the purposes of the health check. This approval, which is currently issued by the Ministry in charge of Health, will only be issued after obtaining an approval within the framework of the national environmental radioactivity monitoring network, issued by ASN (see point 2.3.3 – National environmental radioactivity Monitoring Network).

2.2.2 _ Basic Nuclear Installations (BNIs)

• Decree 2019-190 of 14 March 2019 concerning BNIs and transparency in the nuclear field

The legislative changes made to the BNI System by the TECV Act 2015-992 of 17 August 2015, Ordinance 2016-128 of 10 February 2016 comprising various nuclear provisions and, with respect to ASN, by Act 2017-55 of 20 January 2017 concerning the general status of independent administrative Authorities and independent public Authorities, entails modifications to the regulatory provisions in force.

After the provisions concerning the BNI modification and decommissioning Systems and the rules concerning subcontracting brought about by Decree 2016-846 of 28 June 2016, other provisions concerning the Local Information Committees (CLIs), renewal of the ASN Commission, the ASN sanctions commission, third-party assessments and the transposition of the IED and Seveso Directives for BNIs are yet to be adopted.

Other provisions need to be modified to ensure good interfacing and interaction with new provisions which have been introduced since 2007, for example those concerning the environmental assessment, or following experience feedback, for example concerning the provisions surrounding a change in licensee.

On this occasion, the Minister responsible for Nuclear Safety decided to codify all the regulatory provisions in force (8 decrees). ASN was closely involved in producing this draft decree, which entailed extensive consultation with the stakeholders. After consulting the stakeholders and the public between September 2017 and January 2018, the High Council for the Prevention of Technological Risks – and then ASN – issued their opinions on 13 March and 21 June 2018 respectively.

The draft decree was referred to the Council of State at the end of November 2018 and was published on 16 March 2019 (Decree 2019-190 of 14 March 2019).

• The Order of 3 September 2018 modifying certain provisions applicable to nuclear pressure equipment and certain security accessories designed to protect it

Following the codification in the Environment Code of the provisions applicable to the in-service monitoring of nuclear pressure equipment, the Order of 3 September 2018 brought the various orders dealing with the in-service monitoring of this equipment into line with the Environment Code, while improving the way in which the two texts interface and interact. This modifying Order also clarified conformity assessment procedures and introduced a certain number of additional requirements based on experience feedback from application of the existing texts. Provisions more particularly concerning the accreditation of test laboratories or the conservation of material resulting from the manufacture of components were thus added.

2.2.3 _ Transport of radioactive substances

• Revision of the Order of 29 May 2009 concerning the carriage of dangerous goods by land (called the "TMD Order").

The Order of 29 May 2009 concerning the carriage of dangerous goods by land (known as the "TMD Order") covers the carriage by road, rail and river of dangerous goods, notably radioactive substances. It was modified by the Order of 11 December 2018 in order to take account of the changes to international and community regulations concerning the carriage of dangerous goods by road, which come into force on 1 January 2019. This revision also:

- incorporates new notification procedures on the ASN on-line services portal for events involving radioactive material transports on the public highway;
- specifies the contents of the radioactive materials transport incident and accident management plans mentioned in sections 1.4.1.1 and 1.4.1.2 of the European Agreement on the international carriage of dangerous goods by Road (ADR);
- clarifies the fact that the obligation to draw up a radiological protection programme mentioned in section 1.7.2 of the ADR applies to all companies involved in radioactive materials transport operations;
- specifies the procedures for use of the orange sign on conveyances corresponding to a single UN number which are not for "exclusive" utilisation.

2.3 _ ASN resolutions

2.3.1 _ Radiation protection

• ASN resolution 2018-DC-0649 of 18 October 2018, pursuant to 2° of Article R. 1333-109 and Article R. 1333-110 of the Public Health Code, defining the list of nuclear activities subject to notification and the information to be mentioned in these notifications

This resolution extended the scope of activities subject to notification, more particularly incorporating certain activities using sealed radioactive sources, and set out the generic procedures to be followed so that the activity or equipment could benefit from this system. The activities concerned are grouped into four main areas:

- nuclear activities employing devices for medical purposes;
- nuclear activities in the industrial, veterinary or research fields involving electrical generators of ionising radiation;
- nuclear activities in the industrial or research fields involving sealed radioactive sources or devices containing them;
- activities carried out by third parties relating to the rehabilitation of sites and soils contaminated by radioactive substances.

This resolution also repeals the old resolutions concerning the notification system (resolutions 2009-DC-0146, 2009-DC-0148, 2009-DC-0162, 2011-DC-0252, 2015-DC-0531).

The resolution came into force on 1 January 2019. Until such time as they expire and if there is no modification to the nuclear activity, the existing authorisations prior to this date take the place of the notification required by the resolution.

• ASN resolution 2019-DC-0660 of 15 January 2019 setting the quality assurance obligations in medical imaging using ionising radiation

This resolution defines the quality assurance obligations for medical imaging involving ionising radiation, that is to say in nuclear medicine for diagnostic purposes, in dental and conventional radiology, in computed tomography and for fluoroscopy-guided interventional practices. It obliges the person responsible for the nuclear activity to define a quality management system and to provide details:

- about the processes, procedures and work instructions associated with operational implementation of the two general radiation protection principles, namely justification of procedures and optimisation of doses;
- about the experience feedback process, by reinforcing the recording and analysis of events that could lead to accidental or unintentional exposure of persons during medical imaging procedures.

This resolution enables the quality management system to be tailored to the radiological risks inherent in medical imaging activities and the radiation protection issues.

• Draft resolutions in progress

In 2018, two draft resolutions concerning patient radiation protection were the subject of a public consultation. They concern:

- the diagnostic reference levels in medical imaging;
- continuing training of health professionals in patient radiation protection (modification of ASN resolution 2017-DC-0585 of 14 March 2017 concerning continuing training of professionals in the radiation protection of persons exposed to ionising radiation for medical purposes).

2.3.2 _ Transport of radioactive substances

• Revision of ASN resolution 2015-DC-0503 of 12 March 2015 relative to the notification system for companies transporting radioactive substances on French territory

The transposition into French law of Council Directive 2013/59/Euratom of 5 December 2013 led to a modification of the Public Health Code, with the various nuclear activities being split into the three notification, registration and authorisation administrative systems. Article R. 1333-146 of this Code refers to an ASN resolution to specify the characteristics of radioactive substances, the transport of which is covered by a particular system, the exemption conditions, the composition of the authorisation application file, the examination procedures, and the renewal, revocation and suspension conditions. In early January 2019, ASN consulted the public on the guidelines adopted for updating its resolution 2015-DC-0503 relative to the notification system for companies transporting radioactive substances on French territory. This update aims to introduce an authorisation system for the transport of sources with the highest safety and security implications.

2.3.3 _ The French National Network for environmental radioactivity Monitoring (RNM)

• ASN resolution 2018-DC-0648 of 16 October 2018 modifying ASN resolution 2008-DC-0099 of 29 April 2008 relative to the organisation of the National Network for environmental radioactivity Monitoring and setting out approval procedures for laboratories

ASN resolution 2008-DC-0099 of 29 April 2008, modified for the first time in 2015, sets out the organisation of the National Network for environmental radioactivity Monitoring (RNM) and the procedures for approval of laboratories by ASN.

This resolution was once again modified by ASN resolution 2018-DC-0648 of 16 October 2018, notably in order to introduce a new type of approval corresponding to the measurement of radon 222 in water. This revision allows alignment between the procedures for the approvals issued by ASN for the RNM and by the Directorate General for Health (DGS) for the health checks on waters intended for human consumption, respectively, which are based on common technical requirements: to obtain approval from the DGS, these laboratories must now first have obtained approval from ASN (see point 2.2.1 EDCH).

Pursuant to resolution 2008-DC-0099, ASN proceeded as follows:

- in resolution CODEP-DEU-2018-046580 of 26 September 2018, it appointed qualified persons for a period of five years, along with representatives of the approved laboratories, to sit on the environmental radioactivity monitoring laboratories approval Committee;
- in resolution CODEP-DEU-2018-046583 of 26 September 2018, it renewed the RNM steering Committee which sets the guidelines for the RNM. This Committee comprises representatives of all the network's stakeholders: ministerial departments, regional health agencies, representatives of nuclear licensee or association laboratories, members of the CLI, of IRSN, of ASN, etc.

2.4 _ ASN guides

• ASN Guide No. 29: Radiation protection in radioactive substances transport activities

The inspections carried out by ASN reveal that the risk of exposure to ionisation radiation is not adequately taken into account in the preventive measures relating to the transportation of radioactive substances. Yet some transport activities have significant radiation protection implications, particularly for the workers, owing to their close proximity to the packages. The annual dose for a driver transporting radiopharmaceuticals can thus reach 14 millisieverts per year (mSv/year), the maximum regulatory value being set at 20 mSv/year. ASN Guide No. 29 aims to help carriers meet their regulatory obligations relative to the radiation protection of workers and the general public. It highlights the relationships between the applicable texts, such as the Order of 29 May 2009 relative to the carriage of dangerous goods by land, and the Labour and Public Health Codes. The Guide includes the ASN recommendations regarding the minimum content of the radiological protection programme required by the regulations, along with concrete examples.

2.5 _ The professional guides approved by ASN

On the basis of Article R. 1333-69 of the Public Health Code, ASN resolution 2017-DC-0585 of 14 March 2017, on the continuing training of professionals in the radiation protection of persons exposed to ionising radiation for medical purposes, introduced an approval procedure for continuing professional training guides on patient radiation protection intended for health professionals.

In 2018, nine guides were approved:

- the continuing training guide for the radiation protection of persons exposed to ionising radiation for medical purposes intended for radiographers working in medical imaging (conventional radiology, computed tomography);
- the continuing training guide for the radiation protection of persons exposed to ionising radiation for medical purposes intended for paramedical professionals (radiographers, technicians and nurses) working in nuclear medicine;
- the continuing training guide for the radiation protection of persons exposed to ionising radiation for medical purposes intended for health professionals in the external radiotherapy and brachytherapy sectors, comprising the guide produced with the French Society of Oncological Radiotherapy (SFRO), the French Society of Medical Physics (SFPM) and the French Association of Paramedical Radiography Personnel (AFPPE);
- the continuing training guide for the radiation protection of persons exposed to ionising radiation for medical purposes intended for physicians qualified for radio-diagnosis and medical imaging;
- the continuing training guide for the radiation protection of persons exposed to ionising radiation for medical purposes intended for medical physicists working in medical imaging (conventional radiology, computed tomography, fluoroscopy-guided interventional practices);
- the continuing training guide for the radiation protection of persons exposed to ionising radiation for medical purposes intended for dentists;
- the continuing training guide for the radiation protection of persons exposed to ionising radiation for medical purposes intended for paramedical professionals working in nuclear medicine;
- the continuing training guide for the radiation protection of persons exposed to ionising radiation for medical purposes intended for preparation staff in hospital pharmacies;
- the continuing training guide for the radiation protection of persons exposed to ionising radiation for medical purposes intended for radio-pharmacists.

ASN has 11 regional divisions through which it carries out its regulatory responsibilities throughout metropolitan France and in the French overseas *départements* and collectivities. Several ASN regional divisions can be required to coordinate their work in a given administrative region. As at 31 December 2018, the ASN regional divisions totalled 226 employees, including 171 inspectors.

Under the authority of the regional representatives, the ASN regional divisions carry out on-the-ground inspections of the Basic Nuclear Installations (BNIs), of radioactive substance transport operations and of small-scale nuclear activities; they examine the majority of the licensing applications submitted to ASN by the persons/entities responsible for nuclear activities 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 (ICPEs). They ensure the labour inspection in the nuclear power plants.

REGIONAL OVERVIEW OF NUCLEAR SAFETY AND RADIATION PROTECTION

In radiological emergency situations, the ASN 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 drawn up by the Prefects and take part in the periodic exercises.

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

This section presents ASN's oversight action in the BNIs of each region and its assessment of nuclear safety and radiation protection.

Actions concerning informing the public and cross-border relations are addressed in chapters 5 and 6 respectively.

IMPORTANT

Oversight of small-scale nuclear activities (medical, research and industry, transport) is presented in chapters 7, 8, and 9.

Medical sector see chapter 7

Research and industry see chapter 8

Transport sector see chapter 9

Auvergne-Rhône-Alpes region

The Lyon division regulates nuclear safety, radiation protection and the transport of radioactive substances in the 12 *départements* of the Auvergne-Rhône-Alpes region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- 4 NPPs operated by EDF:
  - Bugey (4 reactors of 900 MWe);
  - Saint-Alban/Saint-Maurice (2 reactors of 1,300 MWe);
  - Cruas-Meysse (4 reactors of 900 MWe);
  - Tricastin (4 reactors of 900 MWe);
- the nuclear fuel fabrication plants operated by Framatome in Romans-sur-Isère;
- the nuclear fuel cycle plants operated by Orano Cycle and its subsidiaries on the Tricastin industrial platform;
- the Operational Hot Unit at Tricastin (BCOT) operated by EDF;
- the High Flux Reactor operated by the Laue-Langevin Institute in Grenoble;
- the Activated waste packaging and storage facility (Iceda) under construction on the Bugey nuclear site and the Bugey Inter-Regional Warehouse (MIR) for fuel storage operated by EDF;
- reactor 1 undergoing decommissioning at the Bugey NPP operated by EDF;
- the Superphénix reactor undergoing decommissioning at Creys-Malville, and its auxiliary installations operated by EDF;
- the Ionisos irradiation facility in Dagneux;
- the nuclear fuel fabrication plant and pelletizing unit of SICN in Veurey-Voroize, waiting to be delicensed;
- the CEA (French Alternative Energies and Atomic Energy Commission) reactors and plants in Grenoble, decommissioned and waiting to be delicensed;
- the CERN international research centre located on the Swiss-French border;

- small-scale nuclear activities in the medical sector:
  - 22 external-beam radiotherapy departments;
  - 6 brachytherapy departments;
  - 23 nuclear medicine departments;
  - about 150 centres carrying out fluoroscopy-guided interventional procedures;
  - 120 computed tomography scanners;
  - some 10,000 medical and dental radiology devices;
- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - one synchrotron;
  - 700 veterinary structures (practices or clinics);
  - about 30 industrial radiology agencies;
  - about 600 users of ionising radiation in the industrial sector;
  - about 100 research units;
- activities linked to the transport of radioactive substances;
- 3 head offices and 8 agencies of approved bodies.

In 2018, ASN carried out 337 inspections in the Auvergne-Rhône-Alpes region, comprising 116 inspections in the Bugey, Saint-Alban/Saint-Maurice, Cruas-Meysse and Tricastin nuclear power plants, 102 inspections in plants and installations undergoing decommissioning, 109 inspections in small-scale nuclear activities and 10 inspections in the radioactive substance transport sector.

ASN also carried out 47 days of labour inspections in the four nuclear power plants and on the Creys-Malville site. It took part in 13 days of meetings on this theme, including its participation in the health, safety and working conditions committees.

ASN drew up three violation reports in the exercise of its oversight duties.

ASN was notified of 31 significant events rated level 1 on the INES scale, of which 29 occurred in BNIs and 2 in small-scale nuclear activities. In the small-scale nuclear activities, 10 events concerning radiotherapy patients were rated level 1 on the ASN-SFRO scale and one was provisionally rated level 2.

Bugey Site

Bugey nuclear power plant

The Bugey NPP, situated in the municipality of Saint-Vulbas in the Ain *département*, 35 km east of Lyon and operated by EDF, comprises four pressurised water reactors, each of 900 MWe, commissioned in 1978 and 1979. Reactors 2 and 3 constitute BNI 78 and reactors 4 and 5 constitute BNI 89. The site accommodates one of the regional bases of the FARN (Nuclear Rapid Intervention Force), a special emergency response force created by EDF in 2011 following the Fukushima NPP accident. Its role is to intervene in pre-accident or accident situations, on any nuclear power plant in France, by providing additional human resources and emergency equipment.

The Bugey site also accommodates Bugey 1, a graphite-moderated Gas-Cooled Reactor (CGR) commissioned in 1972, shut down in 1994 and currently undergoing decommissioning, and the Activated waste packaging and interim storage facility (Iceda). Lastly, the site accommodates an Inter-Regional Warehouse (MIR) for fuel storage.

Reactors 2, 3, 4 and 5 in operation

ASN considers that the nuclear safety, radiation protection and environmental protection performance of the Bugey NPP is in line with its general assessment of EDF's performance. The NPP maintains a high level of proficiency in the area of operating and maintenance activities. ASN has nevertheless noted weaknesses in environmental protection and the control of fire-related risks.

With regard to nuclear safety, the performance of the Bugey NPP in the areas of reactor management and periodic tests in 2018 is satisfactory. The site must remain vigilant in its preparation and performance of routine operating tasks such as the manoeuvring of valves or installation configuring actions carried out from the control room.

With regard to maintenance, the 2018 workload was higher than in 2017, with three maintenance outages on reactors 4, 5 and 2. The performance of the Bugey NPP showed improvements and ASN notes that an effort has been made to limit the contingencies and technical events resulting from inadequate application of the procedures.

With regard to protection of the environment, ASN notes that the Bugey NPP must improve its prevention of risks of leakage in buried structures (pipes and conduits) carrying radioactive and/or chemical fluids. ASN nevertheless notes that the overall performance of the NPP is satisfactory with regard to regulatory compliance in its management of effluents and waste.

In the area of radiation protection, the performance of the Bugey NPP is mixed. Although the governance principles described in the organization are appropriate, they are not visibly applied in the field. In 2018, ASN noted a large number of deviations from requirements by workers (noncompliance with radiological zoning, noncompliance with radiological checks on leaving controlled areas, etc.)..

Reactor 1 undergoing decommissioning

Bugey 1 is a graphite-moderated Gas-Cooled Reactor. This first-generation reactor functioned with natural uranium as the fuel, graphite as the moderator and it was cooled by gas. The Bugey 1 reactor is an «integrated» Gas-Cooled Reactor, whose heat exchangers are situated inside the reactor vessel beneath the reactor core.

ASN considers that the Bugey 1 reactor decommissioning and vessel characterisation operations are proceeding with a satisfactory level of safety. The licensee ensures rigorous monitoring of the equipment and the ongoing decommissioning works.

Nevertheless, the main decommissioning operations, such as removal of the waste stored in the reactor vessel and decommissioning of the vessel itself, have been postponed due to difficulties in accomplishing the operations to decommission the reactor vessel under water. A scenario of decommissioning «in air» is therefore now being studied. This change of strategy would result in the decommissioning of the Bugey 1 reactor being pushed back by several decades, meaning that the decommissioning deadline (2027) set by its decree would no longer be met.

In addition to this, EDF has carried out the Bugey 1 periodic safety review and submitted it to ASN in December 2018.

Activated waste packaging and interim storage facility (Iceda)

The Iceda facility, authorised by Decree 2010-402 of 23 April 2010, is operated by EDF. It is currently in a test phase and its function will be to process and store activated waste from operation of the nuclear fleet in service and from decommissioning of the first-generation reactors and the Creys-Malville NPP.

The Iceda commissioning authorisation application file was submitted to ASN in July 2016. In its examination of this file, ASN asked for additional technical information relative to the safety case, the defining of the items and activities important to protection, the production quality file, the start-up tests, waste management and the operating documents. EDF submitted its response to ASN's requests at the end of 2018.

The last finishing operations and the pre-commissioning tests were continued in 2018.

The organisation implemented by EDF, the temporary grouping of companies to set up the equipment, and the monitoring of the tests in the facilities are ensured with rigour. The inspectors noted the good overall upkeep of the work site. ASN notes that the test programme is running significantly behind schedule. EDF now envisages commissioning the facility in the second half of 2019.

ASN has moreover continued its examination of the application file for approval of the packaging of Intermediate-Level Long-Lived Waste (ILW-LL) in «C1PGSP» packages in the Iceda facility, submitted by EDF in November 2015 and supplemented in May 2016 at the request of ASN. ASN has not been able to give its approval on the basis of the examination of the file as it currently stands. Further studies are necessary in order to rule on the suitability of this package for the waste it is designed to contain. EDF updated its file at the end of 2018 to integrate ASN's requests.

Inter-Regional Warehouse

The Inter-Regional Warehouse (MIR – BNI 02) operated by EDF at Bugey is a storage facility for fresh nuclear fuel intended for the nuclear power plant fleet in service.

The level of safety of MIR was satisfactory in 2018. The periodic safety review of the facility is in progress, as are the stress tests required by ASN in the wake of the Fukushima NPP accident. The facility has more specifically been modified to improve control of the risk of flooding.

Saint-Alban/Saint-Maurice nuclear power plant

The Saint Alban/Saint Maurice NPP operated by EDF in the Isère *département* on the municipalities of Saint-Alban-du-Rhône and Saint-Maurice-l'Exil, 40 km south of Lyon, comprises two 1,300 MWe pressurised water reactors commissioned in 1986 and 1987. Reactor 1 constitutes BNI 119 and reactor 2 BNI 120.

ASN considers that the radiation protection performance of the Saint-Alban/Saint-Maurice NPP stands out positively with respect to the general assessment of the EDF plants. With regard to nuclear safety and protection of the environment, the performance is in line with the general standard of the EDF plants.

ASN observes that the nuclear safety results for the Saint-Alban/Saint-Maurice NPP in 2018 are satisfactory. ASN notes in particular that the vigilance in fighting fire outbreaks paid off in 2018 and that EDF competently managed the regular outages of reactors 1 and 2, which were affected respectively by a technical problem on the control rod clusters and constraints associated with the rise in temperature of the river Rhône. ASN nevertheless observes that EDF must make progress in the configuring of systems.

Concerning maintenance work, the third ten-yearly outage of reactor 2 went smoothly on the whole, particularly with regard to the integration of modifications.

With regard to environmental protection, the organisation defined and implemented by EDF to meet the regulatory requirements concerning the monitoring of environmental discharges seems satisfactory on the whole. The site has made progress in waste management.

With regard to radiation protection, ASN notes that the operational results were satisfactory. This assessment was confirmed during the tightened inspections campaign conducted in the Rhône-Alpes region in 2018 on the theme of radiation protection.

Cruas-Meysse nuclear power plant

Commissioned between 1984 and 1985 and operated by EDF, the Cruas-Meysse NPP is situated in the Ardèche *département* on the municipalities of Cruas and Meysse and comprises four pressurised water reactors of 900 MWe each. Reactors 1 and 2 constitute BNI 111 and reactors 3 and 4 constitute BNI 112.

ASN considers that the overall performance of the Cruas-Meysse NPP falls short of its general assessment of EDF performance.

In 2018, ASN noted shortcomings more particularly in the handling of deviations and in environmental protection. ASN therefore considers that EDF must rapidly put in place fundamental measures to restore, in the field, the required technical capacities to maintain the conformity of its installations with the equipment design, manufacturing, production and operating requirements.

As regards nuclear safety, ASN notes some improvements with respect to 2017. The Cruas-Meysse NPP is showing greater compliance with the operating technical specifications, with indicators that having been pointing upwards over the last five years. ASN thus notes a drop in the number of reactor trips and better management of the activities that involve placing system components in a given configuration such that the system and equipment meet operating, availability and safety targets. In late 2017, ASN issued a resolution requiring the Cruas-Meysse NPP to ensure tightened oversight of the operations performed on equipment ensuring the dependability of control of nuclear chain reactions. ASN notes that EDF has taken the subject duly in hand, notably by identifying difficulties in personnel training and shortcomings in the knowledge of certain equipment and in reactor management. A follow-up inspection showed that EDF had put in place a suitable organisation to meet the requirements of the ASN resolution. However, a significant event reported by EDF in September 2018 shows that EDF must continue its efforts and maintain its vigilance in this area.

The fire risk remains a subject of concern on the site. Despite a reduction in the number of fire outbreaks in 2018, ASN considers it absolutely vital for the NPP to improve its organisation in this respect.

Concerning reactor outages, ASN considers that the situation shows a mixed picture; EDF must improve the quality of reactor outage preparation by safeguarding its internal processes.

With regard to environmental protection, the summer of 2018 was marked by two cases of water table pollution, one by tritium, the other by hydrocarbons.

With regard to radiation protection, 2018 continues in line with the preceding years: collective dosimetry is controlled but there are difficulties in obtaining satisfactory levels of radiological cleanliness during reactor outages and deficiencies in the control of access to areas with high dosimetric risks.

Tricastin site

The Tricastin nuclear site, situated in the Drôme and Vaucluse *départements*, is a vast industrial site accommodating the largest concentration of nuclear and chemical facilities in France. It harbours a large number of installations, with a nuclear power plant comprising four 900 MWe reactors, nuclear fuel cycle facilities, and the BCOT (Operational Hot Unit) which fulfils maintenance and storage functions. It is situated on the right bank of the Donzère-Mondragon Canal (a diversion channel of the river Rhône) between Valence and Avignon. It occupies a surface area of 800 hectares covering three municipalities, namely Saint-Paul-Trois-Châteaux and Pierrelatte in the Drôme *département*, and Bollène in the Vaucluse *département*.

Tricastin nuclear power plant

The Tricastin NPP comprises four 900 MWe pressurised water reactors: reactors 1 and 2 were commissioned in 1980 and constitute BNI 87, while reactors 3 and 4, commissioned in 1981, constitute BNI 88.

ASN considers that the overall performance of the Tricastin NPP with regard to nuclear safety and environmental protection is in line with ASN's general assessment of EDF plant performance. ASN considers that the radiation protection performance, however, is below the national average.

In 2016 and 2017, ASN obliged shutdowns of all or part of the facility, due firstly to the question of carbon segregation in the steam generators, and secondly to the deficiency in the earthquake resistance of the embankment protecting the Tricastin NPP against flooding. ASN observes that the management of these outages and the simultaneous restarting of the Tricastin reactors was a real challenge which EDF managed capably on the whole, with no noteworthy significant events.

With regard to nuclear safety, although the NPP's performance was satisfactory until the end of the summer, with areas showing progress (compliance with the operating technical specifications, the configuring of systems, processing alarms in the control room, etc.), ASN nevertheless noted weaknesses in operating quality in the autumn, with the reporting of twelve significant safety-related events in September and October 2018. ASN notes that the Tricastin NPP still has weaknesses in the area of periodic tests. With regard to maintenance, ASN notes that despite the busy industrial programme for 2018, the scheduled refuelling and maintenance outages were capably managed on the whole.

ASN considers that the environmental protection performance of the Tricastin NPP is mixed, despite being in line with the general assessment of the EDF plants. ASN notes persistent weaknesses in the radioactive effluent treatment systems and the question of liquid effluent containment. Waste management, can also be improved.

With regard to radiation protection, at the end of a tightened inspection ASN noted shortcomings in the management of contaminated workers, particularly when skin contaminations were concerned. ASN noted above all that this issue is not adequately followed-up in the NPP's integrated management system.

In June 2019, the Tricastin NPP reactor 1 will be the first in the French fleet of 900 MWe reactors operated by EDF to undergo its fourth 10-yearly outage, which is a stage of the 4th periodic safety review. ASN will be particularly attentive to this 10-yearly outage and will deploy a specific oversight plan.

Nuclear fuel cycle installations

The Tricastin fuel cycle installations mainly cover the upstream activities of the fuel cycle and, as of the end of 2018, they are operated by a single licensee, Orano Cycle.

The site comprises:

- **the TU5 facility** (BNI 155) for converting uranyl nitrate $UO_2(NO_3)_2$ resulting from the reprocessing of spent fuels into triuranium octoxide (U_3O_8);
- **the W plant** (ICPE within the perimeter of the BNI) for converting depleted UF_6 into U_3O_8;
- **the former Comurhex** facility (BNI 105) for converting uranium tetrafluoride (UF_4) into uranium hexafluoride (UF_6);
- **the Georges Besse I plant** (BNI 93) for the enrichment of UF_6 by gaseous diffusion;
- **the Georges Besse II plant** (BNI 168) for centrifuge enrichment of UF_6;
- **the uranium storage areas** at Tricastin (BNIs 178 and 179) for storing uranium in the form of oxides or UF_6;
- **the maintenance**, effluent treatment and waste packaging facilities (formerly Socatri) (BNI 138);
- **the Atlas** process samples analysis and environmental monitoring laboratory (BNI 176);
- a Defence BNI (DBNI) which more particularly operates the nuclear materials storage areas, virtually all of which are for civil uses.

In the light of its on-site inspections carried out in 2018, ASN considers that the level of safety of the Orano Cycle facilities on the Tricastin site has improved, particularly thanks to the gradual shutdown of the oldest facilities, the commissioning of facilities with reassessed safety standards and the completion of the works stemming from the lessons learned from the Fukushima NPP accident.

The in-depth inspection conducted by ASN on the site in 2018, comprising in particular several exercises and in-situation scenarios, revealed the emergency management organisation and means – which are shared – to be adequate for emergency situation management, whatever the accident-stricken facility. ASN moreover considers that the presence of a local emergency response force, its organisation, the means at its disposal and the quality of its action constitute an asset in the emergency organisation of the Orano Cycle platform at Tricastin, given the chemical and nuclear accident risks involved in the operation of its facilities.

In the light of the other inspections carried out in 2018 on the platform and at site central management, ASN considers that Orano Cycle must improve the follow-up of its commitments made with ASN and monitor its service providers more closely. The radioactive substance transport operations, which are now organised centrally, are managed satisfactorily.

Orano Cycle uranium chemistry plants TU5 and W

BNI 155, called TU5, can handle up to 2,000 tonnes of uranium per year, which enables all the uranyl nitrate ($UO_2(NO_3)_2$) from the Orano Cycle plant in La Hague to be processed for conversion into U_3O_8 (a stable solid compound that can guarantee storage of the uranium under safer conditions than in liquid or gaseous form). Once converted, the uranium from reprocessing is placed in storage on the Tricastin site. The W plant situated within the perimeter of BNI 155 can process the depleted UF_6 from the Georges Besse 2 plant, to stabilise it as U_3O_8.

ASN considers that the facilities situated within the perimeter of BNI 155 are operated with a satisfactory level of safety.

For the TU5 plant, 2018 saw the implementation of the commitments made further to the periodic safety review of the facility. The progress with these commitments and the organization put in place to track them regularly have been verified by ASN and found to be satisfactory.

After completing its tests, the new UF_6 emission unit (EM3) of the W plant was commissioned in mid-2018 and is now in the reliability-enhancement phase. This new unit provides better containment in the event of UF_6 leakage and better resistance to internal hazards (fire, explosion, etc.) and external hazards (earthquake). The old unit was shut down within the deadlines set by ASN (30 June 2018). The ASN resolution setting the requirements applicable to the W plant was modified in May 2018 to regulate operation of the EM3 unit.

More generally, the licensee must continue to improve operating rigour and more specifically the detection and management of deviations. ASN remains attentive to the maintaining of the required rigour in operating and maintenance actions, the management of detected anomalies and the effectiveness of the corrective actions put in place.

Putting in place a sole licensee

With a view to simplifying the legal organisation of the Areva Group, a process to merge the Areva subsidiaries present on the Tricastin site was initiated in 2012, so that Areva NC could become the sole licensee of all the site BNIs. This process was completed for the Comurhex BNI in 2013. The process to change the licensee from Socatri, Eurodif and *Société d'Enrichissement du Tricastin* (SET) was completed in 2018.
Orano Cycle, formerly Areva NC, is therefore now the sole licensee of all the cycle facilities on the site.

In addition, further to the waste management deficiencies detected in 2017, an unannounced inspection on this subject was carried out in March 2018. This inspection confirmed recurrent shortcomings in the implementation of the requirements relative to waste management. At the end of this latter inspection, ASN asked Orano Cycle to put in place a complementary plan, combined with inspection and monitoring measures, with the aim of lastingly reinforcing compliance with the rules for waste identification, management and storage. In 2019, ASN will check that this plan has been implemented and enables the required standard of conformity to be reached.

Orano Cycle uranium fluorination plants

Pursuant to the ASN requirement, the oldest fluorination facilities were shut down definitively before 31 December 2017. The shut down facilities have since been emptied of the majority of their hazardous substances and are now in the decommissioning preparation phase.

In February 2014, Orano Cycle submitted a decommissioning file for BNI 105 (formerly Comurhex), which underwent a public inquiry in 2017 and its examination by ASN continued in 2018. The main issues associated with the decommissioning of BNI 105 are linked to the risks of dissemination of radioactive substances, exposure to ionising radiation and criticality, due to the residual uranium-bearing substances present in certain items of equipment.

Under the effect of the hot summer temperatures, two drums of uranium-bearing materials stored in this facility developed leaks, leading in the case of one drum to the dispersion of contamination outside the storage building, with no consequences outside the site. This event was rated level 1 on the INES scale. ASN has asked for the creation of a containment chamber to store the drums pending their repackaging, and the renovation of the floor surfaces to achieve a satisfactory level of containment. More generally ASN expects the licensee, in 2019, to reinforce the containment of its old facilities and the means dedicated to their monitoring.

The tests of the new production units of the Comurhex 2 project, grouping the facilities for converting uranium tetrafluoride (UF_4) into uranium hexafluoride (UF_6), continued in 2018 with the introduction of UF_4 into the plant systems in autumn. Orano Cycle had difficulties in validating the operation of certain equipment items due either to processes which turned out to be ill-suited or to construction defects.

The inspections carried out in 2018 showed that the validation processes prior to the commissioning of new facilities were satisfactory on the whole but should be applied with greater rigour. ASN also noted a lack of rigour in the first operating activities.

The licensee must apply greater rigour in the operation of its facilities, both old and new. It must also, as of 2019, improve the containment of the old facilities until the radioactive substances stored in them have been definitively removed.

Georges Besse I enrichment plant

The Eurodif uranium enrichment facility (BNI 93) consisted essentially of a plant for separating uranium isotopes by the gaseous diffusion process.

After shutting down production at this plant in May 2012, the licensee – Eurodif production – carried out, from 2013 to 2016, the Eurodif «Prisme» process of «intensive rinsing operations followed by venting», which consisted in performing repeated rinsing of the gaseous diffusions circuits with chlorine trifluoride (ClF_3), a toxic and dangerous substance, which allowed the extraction of virtually all the residual uranium deposited in the diffusion barriers. These operations are now finished.

The licensee submitted its application for final shutdown and decommissioning of the facility in March 2015. The examination of this file continued in 2018.

The decommissioning challenges concern the volume of Very-Low-Level (VLL) waste produced (which includes 160,000 tonnes of VLL metallic waste) and the decommissioning duration, which must be as short as possible (currently estimated at 30 years), considering the best scientific and technical knowledge available at the time and under economically acceptable conditions.

Further to the Eurodif plant final shutdown and decommissioning preparation operations, which have been under way since 2017, ASN authorised, in August 2018, entry of the shut down facilities into a monitored standby phase which is to last until the start of the first decommissioning operations, planned for 2028. ASN ascertained beforehand, essentially through various inspections, that the facilities were in a safe state. It verified more specifically the prior removal of the operational waste.

ASN will be attentive to the maintaining of rigour in facility monitoring and of a safety culture that is appropriate for the specific shutdown situation of the facilities.

The main residual risk in the facility now is associated with the UF_6 containers in the storage yards, which are still within the facility perimeter. These yards should ultimately be attached to the Tricastin uranium storage areas (BNI 178).

Georges Besse II enrichment plant

The Georges Besse II plant (BNI 168), operated by *Société d'Enrichissement du Tricastin* (SET) until 2018, is the site's new enrichment facility since the shutdown of Eurodif. It uses the centrifuge process to separate uranium isotopes.

The standard of safety of the plant's facilities in 2018 was satisfactory. The technologies used in the facility enable high targets for safety, radiation protection and environmental protection to be achieved.

ASN had identified two subjects requiring particular attention in 2017: the fact that the water-presence detectors in the sampling plant ovens were not connected to the instrumentation & control system, an anomaly that was not detected during either the commissioning test or the periodic tests, and the process for assessing physical modifications to the facility, deemed insufficient during an inspection. In 2018 ASN verified that these subjects had been correctly addressed.

The licensee Orano Cycle has demonstrated vigilance with regard to minor deviations. It was thus capable of dealing competently, as soon as it was detected, with a significant safety event rated level 1 on the INES scale concerning insufficient UF_6 solidification times following the taking of liquid samples.

In 2019, the licensee must be particularly careful in defining the items and activities important to protection and their associated requirements in its subcontracted activity specifications. It must also ensure that the operating contingencies which are not covered by handling procedures form the subject of «hold points» involving the service responsible for safety.

Maintenance, effluent treatment and waste packaging facilities (formerly Socatri)

ASN considers that the level of operational safety of the Socatri facilities (BNI 138) was satisfactory in 2018.

Orano Cycle continued implementation of the significant safety improvements prescribed by ASN or for which it had made commitments further to the last periodic safety review of the facility. Nevertheless, improvements in fire-risk prevention are still required.

Alongside this, the licensee conducted tightened inspections of the retention structures in operation, as prescribed by ASN in April 2017. All the retention structures identified as noncompliant by these inspections have been rendered compliant.

Examination of the BNI substantial modification file, involving more specifically the creation of «Trident», a facility for processing the site's waste, was completed with Decree 2019-113 of 19 February 2019. The development work on this facility started in 2018, after receiving authorisation from ASN. Its commissioning will be subject to another ASN authorisation.

Tricastin uranium-bearing material storage yards

Following the delicensing of part of the Pierrelatte Defence BNI by decision of the Prime Minister, BNI 178 – Tricastin uranium-bearing materials storage yards – has been created. This installation groups the uranium storage areas and the new emergency management premises of the Tricastin platform. ASN registered this installation in December 2016 and has ascertained, with the Defence Nuclear Safety Authority (ASND), the continuity of oversight of the nuclear safety of this installation. The installation baseline requirements are currently being upgraded to be in conformity with the regulatory texts applicable to BNIs.

The results of the ASN inspections conducted since the BNI was registered are satisfactory. Two deviations relative to the availability of communication means in the event of an emergency were noted and are currently being addressed.

In 2017, Orano Cycle filed an application with the Minister responsible for Nuclear Safety to integrate the storage areas currently situated in BNI 93 (Eurodif, Georges Besse I) – which are intended to remain in operation – into this BNI.

P35 facility

Following on from the delicensing process of the Pierrelatte DBNI by decision of the Prime Minister, the «P35» facility, BNI 179, has been created. This facility comprises ten uranium storage buildings.

ASN registered this facility in January 2018 and has ascertained, with ASND, the continuity of oversight of the nuclear safety of these storage areas. The installation baseline requirements are currently being overhauled to ensure conformity with the regulatory texts applicable to BNIs.

The first inspection conducted by ASN in 2018 revealed no anomalies.

Alongside this, under the project to group together the Tricastin site storage areas within a single BNI – the Tricastin uranium-bearing material storage areas BNI, Areva – now called Orano Cycle – filed an application with the Minister responsible for Nuclear Safety in late 2017 to merge BNIs 178 and 179.

Tricastin Analysis Laboratories (Atlas)

Atlas (BNI 176) was authorised by Decree 2015-1210 of 30 September 2015 and commissioned in May 2017. The facility represents a significant improvement in safety compared with the old laboratories it replaces.

Two of the three UF_6 analysis and sampling benches were commissioned in February 2018 following validation of the prior test results. Commissioning of the last bench, which will finalise the complete commissioning of the facility, is planned for 2019.

During its inspections ASN noted shortcomings in the traceability of proof of conformity of the facilities with the safety requirements and in the traceability of deviations. It thus revealed the fact that the fire hatches of the facility did not undergo a systematic verification of conformity during acceptance of the facility. At the request of ASN, a fire hatch verification campaign was carried out and the noncompliant hatches were rendered compliant in 2018.

ASN also considers that the licensee must improve the management of the waste storage areas and the associated traceability, the management of fire loads, the monitoring of service providers and the tracking of its personnel training courses.

New uranium storage facility project

In February 2015, Orano Cycle informed ASN that it wanted to create a new BNI intended for storage on the Tricastin site of uranium-bearing materials resulting from fuel reprocessing. Orano Cycle has undertaken actions to optimise the site's existing storage areas in order to push back the date they are filled to capacity from 2019 to 2021, and in November 2017 it filed an application for authorisation to create new storage buildings. In 2018, ASN informed the Minister responsible for Nuclear Safety that the content of the creation authorisation application was sufficient for its examination to continue in 2019.

Tricastin Operational Hot Unit (BCOT)

The BCOT constitutes BNI 157. Operated by EDF, it is intended for the maintenance and storage of equipment and tooling, fuel elements excluded, coming from contaminated systems and equipment of the nuclear power reactors.

ASN considers that the level of safety of the BCOT is on the whole satisfactory.

In 2018, the BCOT continued the cutting up of the used control rod guide tubes from the pressurised water reactors operated by EDF. The operations should be completed in 2020 at the latest.

The examination of the periodic safety review report led ASN to prescribe several improvement measures, particularly concerning worker radiation protection.

In a letter dated 22 June 2017, EDF declared the final shutdown of the BCOT by 30 June 2020 at the latest. The storage and maintenance operations shall be now carried out on the Saint-Dizier maintenance base (Bamas). Transfer of the activities and the start of tooling disassembly began in 2018.

Romans-sur-Isère site

Framatome operates two basic nuclear installations on its Romans-sur-Isère site in the Drôme *département*, namely the research reactor fuel fabrication unit (BNI 63) and the pressurised water reactor nuclear fuel fabrication Unit (BNI 98), and an Installation Classified for Protection of the Environment (ICPE) called the «cavities» facility which manufactures specific components such as the «cavities» or «LHC collimators» for CERN.

Framatome nuclear fuel fabrication plants

The fabrication of fuel for electricity generating reactors involves the transformation of UF_6 into uranium oxide powder. The pellets fabricated from this powder in Framatome's Romans-sur-Isère plant, called «FBFC» (BNI 98), are placed in zirconium metal clads to constitute the fuel rods, then brought together to form assemblies for use in the NPP reactors. In the case of experimental reactors, the fuels used are more varied, with some of them using, for example, highly-enriched uranium in metal form. These fuels are also fabricated in the Romans-sur-Isère plant, formerly called «Cerca» (BNI 63).

Framatome maintained its efforts with regard to rigour of operation in 2018, and implemented an ambitious works programme within its two facilities.

The site continued to increase its personnel numbers in the following areas in 2018: safety, project management, regulatory inspections and service provider monitoring.

During 2018, ASN checked the fulfilment of the commitments made following the periodic safety reviews of the two BNIs (BNIs 98 and 63), which involved additional safety studies or work to reinforce the buildings (fire-risk management, anti-seismic reinforcements, improved containment).

The improvement in safety management and operating rigour is confirmed. These improvements must nevertheless continue, notably through the systematic checking of activities. In effect, 4 events linked to prevention of the criticality risk were reported in 2018 and rated level 1 on the INES scale, and 3 of them gave rise to reactive inspections by ASN.

With regard to radiation protection, the situation has improved but further progress can be made in certain areas. The dosimetric risks nevertheless remain moderate in these facilities which do not use reprocessed uranium.

With regard to environmental protection, the site must further improve its control of the waste management routes, particularly with regard to the distinction between radioactive waste and conventional waste.

In view of the site's significant improvements in safety management, organisation and operating rigour, ASN decided in May 2018 to lift the tightened monitoring constraint which had been placed on the site in 2014.

The other industrial and research facilities

High Flux Reactor of the Laue-Langevin Institute

The Laue Langevin Institute (ILL) international research organisation accommodates a 58 MWth heavy-water High-Flux neutron Reactor (HFR) which produces high-intensity thermal neutron beams for fundamental research, particularly in the areas of solid-state physics, neutron physics and molecular biology.

The HFR, which constitutes BNI 67, accommodates the European Molecular Biology Laboratory (EMBL), an international research laboratory, within its perimeter. Employing some 500 persons, this BNI occupies a surface area of 12 ha situated between the rivers Isère and Drac, just upstream of their confluence, near the CEA centre of Grenoble.

ASN considers the HFR safety management to be fairly satisfactory but it has observed deviations in the operating organization during inspections, which have led it to demand improvement measures in certain areas.

The works to set up «hardened safety core» safeguard systems to integrate the lessons learned from the Fukushima NPP accident were completed in the first half of 2018, which is positive.

The setting up of an Integrated Management System (IMS) for quality and safety that meets the requirements of the Order of 7 February 2012 continued in 2018. This system aims to improve the licensee's control of the activities and the state of the facilities.

ASN has noted in particular the ILL's substantial work on its new deviation management process. ASN expected the ILL to improve the tracking and performance of the inspections and periodic tests specified in the general operating rules, and it observed this in 2018. ASN nevertheless considers that the ILL must continue to put in place the other processes of its IMS. It must also associate deployment of this system with training and awareness-raising measures for its teams. Lastly, it must improve worker oversight and monitoring. ASN also expects improvements in the process for managing physical modifications to the facility, as the shortcomings it noted had led it, in February 2018, to serve formal notice on the ILL to comply with the regulations in effect on this subject.

Furthermore, during 2018 ASN observed shortcomings in the tracking of ILL commitments made in the context of the inspection follow-ups and the significant event reports. The effectiveness and the durability of the corrective actions defined in response to deviations, events or ASN findings, must be improved.

Lastly, ASN has asked the licensee to reinforce its organisation for controlling the fire risk. The licensee has set up an action plan.

Alongside this, ASN has conducted a preliminary analysis of the periodic safety review report submitted by the ILL in November 2017. ASN notes the work of the licensee, particularly on the conformity check of Equipment Important to the Protection of interests (EIP) with regard to safety and on the updating of the safety baseline requirements. Nonetheless, a number of shortcomings have been identified, especially regarding the analysis of conformity of the facility with the regulatory requirements, in particular for the hazard risks (fire, aircraft crash, etc.). ASN has therefore asked the licensee to supplement the file so that its examination can be continued.

Ionisos irradiator

The company Ionisos operates an industrial irradiator in Dagneux, situated in the Ain *département*. This irradiator, which constitutes BNI 68, uses the radiation from cobalt-60 sources for purposes such as sterilising medical equipment (syringes, dressings, prostheses) and polymerising plastic materials.

The facility displayed a satisfactory level of safety in 2018.

Ionisos must nevertheless improve its analyses of deviations and events, and the communication of information to ASN.

CERN accelerators and research centre (Geneva)

Following the signing of an international agreement between France, Switzerland and CERN on 15 November 2010, ASN and the OFSP (Swiss Federal Office of Public Health) – the Swiss radiation protection oversight body – are contributing to the verification of the safety and radiation protection requirements applied by CERN. The joint actions concern transport, waste and radiation protection.

Three joint inspections by the French and Swiss Authorities were held in 2018, focusing on the commissioning of the Medicis facility, the management of inter-site transport of radioactive substances and CERN's fire management organisation. These inspections found the practices on the whole to be satisfactory.

In 2018, ASN and the OFSP also finalised the examination of the safety files submitted by CERN to demonstrate the safety of the new facilities, particularly the Medicis facility designed to produce radioisotopes for medical research purposes.

Installations undergoing decommissioning

Superphénix reactor and the fuel storage facility

The Superphénix fast neutron reactor (BNI 91), a 1,200 MWe sodium-cooled industrial prototype, is situated at Creys-Malville in the Isère *département*. It was definitively shut down in 1997. The reactor has been unloaded and the majority of the sodium has been neutralised in concrete. Superphénix is associated with another BNI, the APEC fuel storage facility (BNI 141). The APEC essentially comprises a pool containing the fuel unloaded from the reactor pressure vessel and the area for storing the soda concrete packages resulting from neutralisation of the sodium from Superphénix.

ASN considers that the safety of Superphénix decommissioning operations and of APEC operation is on the whole satisfactory.

ASN has authorised the commencement of the second Superphénix decommissioning phase, which consists in opening the reactor pressure vessel to dismantle its internal components both *in situ* and in dedicated facilities constructed in the reactor building, by direct or remote manipulation, depending on the activation of the structures.

Following two failures of equipment important to the protection of the facilities, one of them rated a significant event of level 1 on the INES scale, EDF had difficulties in procuring certain items of equipment which had become obsolete. ASN has asked the licensee to establish an action plan for the management of obsolescence.

With regard to emergency situation management and further to ASN's discovery of functional deficiencies, the site reinforced its organisation in 2018. To test its effectiveness, ASN organised a further unannounced night-time exercise. This exercise showed the situation to be satisfactory. These improvements were confirmed during a significant event involving loss of the site electrical power sources which occurred on 14 December 2018 and was rated level 1 on the INES scale.

Lastly, further to deviations in the monitoring of subcontracted activities and the management of waste, observed by ASN during inspections in 2017, the licensee took measures in 2018 to clarify and reinforce the site's organisation in these areas.

Siloette, Siloé, LAMA reactors and effluents and solid waste treatment station – CEA Centre

The CEA Grenoble centre (Isère *département*) was inaugurated in January 1959. Activities associated with the development of nuclear reactors were carried out there before being gradually transferred to other CEA centres in the 1980's. The Grenoble centre now carries out research and development in the areas of renewable energies, health and microtechnology. In 2002, the CEA Grenoble centre began a site delicensing process.

The site accommodated six nuclear installations which have gradually stopped their activities and are now in the decommissioning phase with a view to delicensing. Delicensing of the Siloette reactor was declared in 2007, that of the Mélusine reactor in 2011, of the Siloé reactor in January 2015 and of the LAMA in August 2017.

The last BNIs on the site are those relating to the Effluents and solid Waste Treatment Station and decay storage (STED) (BNIs 36 and 79). All the buildings have been dismantled, in accordance with their decommissioning decree.

The technical discussions between ASN and CEA concerning the radiological and chemical remediation of the soil of the STED continued in 2018. All the operations that can be technically achieved at a reasonably acceptable cost have been carried out. In view of the presence of residual chemical and radiological marking, ASN will make delicensing of the STED dependent on the implementation of active institutional controls.

SICN plant in Veurey-Voroize

The former nuclear fuel fabrication plant in Veurey-Voroize (Isère *département*), operated by *Société Industrielle de Combustible Nucléaire* (SICN, Orano Group) comprises two nuclear installations, BNIs 65 and 90. The fuel fabrication activities were definitively stopped in the early 2000's. The decommissioning operations were authorised by Decrees 2006-191 and 2006-190 of 15 February 2006, and the decommissioning work has now been completed.

The site nevertheless displays residual contamination of the soil and groundwater, the impact of which is compatible with the envisaged future use (industrial). ASN has therefore asked the licensee to submit, as a prerequisite to delicensing, an application for the implementation of active institutional controls designed to restrict the use of the soil and groundwater and to guarantee that the land usage remains compatible with the state of the site. The SICN submitted this file to the Isère Prefect's office in March 2014, and the delicensing application file for the two BNIs to ASN. It will not be possible to declare this delicensing until these active institutional controls have been effectively put into place by the Prefect of the Isère *département*, following the examination procedure, which includes a public inquiry, in 2019. The Local Information Committee was also consulted about the institutional controls project and the delicencing file, and gave its opinion on them in December 2018.

Labour inspection in the nuclear power plants of the Auvergne-Rhône-Alpes region

Twenty eight labour inspections were carried out during 2018, along with twenty five days of presence in the region's nuclear power plants for meetings, discussions with employees and staff representatives, and participation at the meetings of the committees for health, safety and working conditions.
The inspections are divided between inspections conducted on the sites of maintenance work carried out during the reactor outages and thematic inspections (electrical risk, explosive atmosphere, asbestos risk). Lastly, inspections were also carried out further to serious workplace accidents.

Broadly speaking, what emerges from 2018 is:

- raised awareness and the implementation of an action plan to improve control of the risk associated with explosive atmospheres in the EDF facilities with the need to keep better track of the compliance of its facilities with the requirements of the labour code (electrical risk, ATEX explosion risk);
- the need for EDF to be more involved in the oversight of conformity of the collective protective means intended to limit contamination dispersion;
- the need, more generally, to continue the radiation protection efforts;
- the need for real-time updating of the work-related documents during the works so that the collective andindividual protection requirements are consistent with the states of the work site and the associated risks.

Bourgogne Franche-Comté region

The Dijon division regulates nuclear safety, radiation protection and the transport of radioactive substances in the 8 *départements* of the Bourgogne-Franche-Comté region.

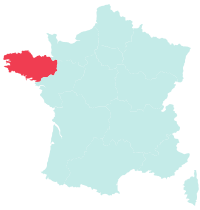
THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- small-scale nuclear activities in the medical sector:
  - 8 external-beam radiotherapy departments;
  - 4 brachytherapy departments;
  - 14 nuclear medicine departments;
  - 36 centres performing fluoroscopy-guided interventional procedures;
  - 52 computed tomography scanners;
  - about 800 medical radiology devices;
  - about 2,000 dental radiology devices;
- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - about 200 veterinary practices, 3 of them equipped with scanners;
  - about 400 industrial and research establishments, including 28 companies exercising an industrial radiography activity;
  - 162 users of devices for detecting lead in paint;
  - 2 accelerators;
- activities linked to the transport of radioactive substances;
- approved laboratories and organisations:
  - 3 organisations approved for radiation protection controls, with 4 agencies;
  - 5 organisations approved for radon monitoring and 1 laboratory approved for measuring radioactivity in the environment.

In 2018, ASN carried out 53 inspections in the Bourgogne-Franche-Comté region in small-scale nuclear activities and 5 inspections relative to the transport of radioactive substances.

Among the significant events reported and analysed to draw lessons from them, 7 events concerning radiotherapy or brachytherapy patients were rated level 1 on the ASN-SFRO scale, while 2 events concerning the theft or loss of a radioactive source were rated level 1 on the INES scale.

ASN also devoted particular attention to the Framatome manufacturing plants situated in the Bourgogne-Franche-Comté region. The steps taken by ASN in this respect are described in chapter 10.



Bretagne region

The Nantes division regulates radiation protection and the transport of radioactive substances in the 4 *départements* of the Bretagne region. The Caen division regulates the nuclear safety of the Monts d'Arrée NPP (Brennilis), currently undergoing decommissioning.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- the Monts d'Arrée NPP, undergoing decommissioning;

- small-scale nuclear activities in the medical sector:
  - 8 external-beam radiotherapy departments;
  - 5 brachytherapy departments;
  - 11 nuclear medicine departments;
  - 37 centres performing fluoroscopy-guided interventional procedures;
  - 54 computed tomography scanners;
  - some 2,500 medical and dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - 1 cyclotron;
  - 20 industrial radiography companies;
  - about 450 licences for industrial and research equipment, including 325 users of devices to detect lead in paint;

- activities linked to the transport of radioactive substances;

- approved laboratories and organisations:
  - 6 radiation protection technical control agencies;
  - 7 radon screening agencies;
  - 4 head offices of laboratories approved for taking environmental radioactivity measurements.

In 2018, ASN carried out 49 inspections, comprising 2 inspections in the Monts d'Arrée NPP undergoing decommissioning and 47 in small-scale nuclear activities including 2 relating to the transport of radioactive substances.

Among the 37 significant events reported and analysed to draw lessons from them, 12 events concerned radiotherapy patients and 6 of these were rated level 1 on the ASN-SFRO scale and 1 was rated level 2. One event concerning a brachytherapy patient was rated level 2 on the ASN-SFRO scale.

ASN drew up two violation reports in the exercise of its oversight duties.

The Brennilis NPP

The Brennilis NPP is situated in the Finistère *département*, on the Monts d'Arrée site 55 km north of Quimper. Baptised EL4-D, this installation (BNI 162) was an industrial electricity production prototype (70 MWe) moderated with heavy water and cooled with carbon dioxide, and it was definitively shut down in 1985. The Decree of 27 July 2011 authorized part of the decommissioning operations, with the exception of decommissioning of the reactor block. The Decree of 16 November 2016 extended the time frame for the decommissioning operations, particularly those concerning:

- decommissioning of the heat exchangers;
- clean-out and demolition of the effluent treatment station.

These operations were to be completed before 28 July 2018.

BRETAGNE

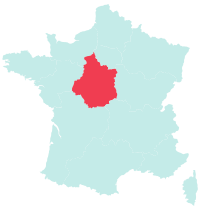
During 2018, EDF continued decommissioning of the Effluent Treatment Station (STE). The basement demolition work, which began in August 2016, was completed in early 2018 due to various work site contingencies. EDF then started the operations to remove the polluted soil situated beneath the STE, in accordance with the soil management plan approved by ASN in April 2018. The partial decommissioning operations were not yet completed on 28 July 2018.

Moreover, in accordance with the amending Decree of 16 November 2016, EDF submitted the complete decommissioning file for the reactor in July 2018. This file is currently being examined by ASN.

Alongside this, EDF finalised the worksite teardown operations for the reactor containment heat exchanger decommissioning site after the fire that occurred in September 2015. ASN considers that the licensee conducted this work in compliance with the safety and radiation protection requirements.

In 2018, the licensee also started arrangements and the work to render secure the reactor building with a view to preparing the operations to take samples from the reactor block. These sampling operations were subject to the prior consent of ASN through a resolution of 21 August 2017. EDF has submitted an application file which is currently being examined by ASN.

ASN considers that the licensee shows rigour and transparency in its handling of the malfunctions and deviations that occur on its site. The management of waste, particularly in the storage areas situated within the reactor containment, and compliance with regulatory requirements need to be improved.



Centre-Val de Loire region

The Orléans division regulates nuclear safety, radiation protection and the transport of radioactive substances in the 6 *départements* of the Centre-Val de Loire region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- BNIs:
  - the Belleville-sur-Loire NPP (2 reactors of 1,300 MWe);
  - the Dampierre-en-Burly NPP (4 reactors of 900 MWe);
  - the Saint-Laurent-des-Eaux site: the NPP in operation (2 reactors of 900 MWe), and the 2 French Gas-Cooled Reactors (GCR) undergoing decommissioning and the irradiated graphite sleeve storage silos;
  - the Chinon site: the NPP in operation (4 reactors of 900 MWe), the 3 French GCRs undergoing decommissioning, the Irradiated Material Facility (AMI) and the Inter-Regional Fuel Warehouse (MIR);
- small-scale nuclear activities in the medical sector:
  - 8 external-beam radiotherapy departments;
  - 3 brachytherapy departments;
  - 10 nuclear medicine departments;
  - 35 centres performing fluoroscopy-guided interventional procedures;
  - 38 computed tomography scanners;
  - some 2,700 medical and dental radiology devices;
- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - 10 industrial radiography companies;
  - about 330 industrial, veterinary and research radiography devices;
- activities linked to the transport of radioactive substances.

In 2018, ASN carried out 145 nuclear safety and radiation protection inspections: 101 inspections of the nuclear installations of the EDF sites of Belleville-sur-Loire, Chinon, Dampierre-en-Burly and Saint-Laurent-des-Eaux, and 44 inspections in small-scale nuclear activities in the Centre-Val de Loire region.

ASN carried out 67 days of labour inspections in the nuclear power plants.

In 2018, 11 significant events rated level 1 on the INES scale were reported by the licensees of the EDF nuclear installations in the Centre-Val de Loire region, to which can be added 7 general events rated level 1 on the INES scale which concerned some of the region's NPPs. In small-scale nuclear activities, one event rated level 1 on the INES scale was reported in 2018, while 3 events concerning radiotherapy patients were rated level 1 on the ASN-SFRO scale.

ASN inspectors issued three violation reports in the exercise of their oversight duties

Belleville-sur-Loire nuclear power plant

The Belleville-sur-Loire NPP is situated in the north-east of the Cher *département*, on the left bank of the river Loire, at the crossroads of four *départements* (Cher, Nièvre, Yonne and Loiret) and two administrative regions (Bourgogne-Franche-Comté and Centre-Val de Loire). The NPP comprises two reactors of 1,300 MWe, which were commissioned in 1987 and 1988 and constitute BNIs 127 and 128 respectively.

ASN considers that the performance of the Belleville-sur-Loire NPP is on the whole in line with the general assessment of EDF in the areas of radiation protection and the environment. The performance with regard to safety remains below average, despite the notable improvements made in 2018 and which remain to be consolidated.

In the area of safety, there are still numerous significant events resulting from a lack of rigour in operational control of the facility and ASN observes only slight progress in this respect, despite the alerts of the previous years. To give an example, EDF reported a significant event rated

level 1 on the INES scale due to late detection of a reactor control rod cluster position which was outside the limits set by the installation's safety baseline requirements. ASN nevertheless observed a distinct improvement in the general state of the installations and the detection of anomalies in 2018. It is nonetheless necessary to ensure that these changes in culture are integrated by all the departments and maintained over the long term. Consequently, ASN has decided to maintain the site under tightened surveillance. This situation is likely to change during 2019 depending on the robustness and durability of the actions put in place by the licensee to improve its operating management results. ASN shall specially monitor the improvement plan implemented by the licensee on this subject in 2019.

In the area of radiation protection, ASN underlines the significant efforts made by the site, even though control of the risk of contamination dispersion during reactor outage periods can be improved.

The environmental performance of the Belleville-sur-Loire NPP is comparable with the national average and can be further improved. ASN does however wish to underline the fact that significant improvement work was carried out in 2018, such as the reconditioning of several facilities which could have presented risks for the environment (including the demineralisation station).

Dampierre-en-Burly nuclear power plant

The Dampierre-en-Burly NPP is situated on the right bank of the Loire river, in the Loiret *département*, about 10 km downstream of the town of Gien and 45 km upstream of Orléans. It comprises four 900 MWe nuclear reactors which were commissioned in 1980 and 1981. Reactors 1 and 2 constitute BNI 84, and reactors 3 and 4 BNI 85. The site accommodates one of the regional bases of the FARN (Nuclear Rapid Intervention Force), the special emergency response force created by EDF in 2011 following the Fukushima NPP accident. Its role is to intervene in pre-accident or accident situations, on any nuclear power plant in France, by providing additional human resources and emergency equipment.

ASN considers that the nuclear safety performance of the Dampierre-en-Burly NPP is on the whole in line with the general assessment of the EDF plants. This being said, its environmental and radiation protection performance are below the national average.

With regard to safety, the results are satisfactory, with a good level of involvement of the independent safety organisation. However, several significant events resulting from a lack of rigour in the management, operation and monitoring of the installations reveal shortcomings in the implementation of practices to enhance worker reliability. This has led the licensee to implement *ad hoc* corrective actions which ASN will monitor with particular attention in 2019. With regard to the maintenance of the installations, ASN considers that improvements can be made in service provider monitoring, spare parts management and the maintenance activities. An increase in the number of maintenance non-qualities on equipment important to safety was effectively observed in 2018. By way of example, EDF reported a significant event rated level 1 on the INES scale on account of late detection of a non-quality in maintenance work performed on the valve of a pipe passing through the reactor containment. Lastly, ASN considers that the site must further improve its management of fire-related risks.

With regard to radiation protection, the site's performance is still below the norm. The findings from ASN inspections and the increase in the number of significant radiation protection events reported in 2018 show that the radiation protection fundamentals are insufficiently taken into account on the worksites (radiological cleanliness, worksite surveillance, non-compliance with optimisation approach, etc.). However, since summer 2018 the licensee has become aware of its weaknesses in this area and has put in place a new action plan – more robust than the one presented in 2017 – to regain control in this area. This situation shall be specifically monitored by ASN in 2019.

With regard to the environment, in the light of the inspections carried out in 2018, ASN considers that the site must make further improvements. This is because although the gaseous and liquid effluent discharges remain within the maximum permitted values, ASN has observed numerous nonconformities, particularly concerning pollution control and prevention and waste management.

Chinon site

Situated in the municipality of Avoine in the Indre-et-Loire *département*, on the left bank of the river Loire, the Chinon site accommodates various nuclear installations, some in operation, others shut down or undergoing decommissioning. On the south side of the site, the Chinon B nuclear power plant comprises four in-service 900 MWe reactors, the first two constituting BNI 107 were commissioned in 1982-1983, while the second two constituting BNI 132 were commissioned in 1986-1987. To the north, the three old graphite-moderated Gas-Cooled Reactors designated Chinon A1, A2 and A3, are currently being decommissioned. The site also accommodates the AMI (Irradiated Materials Facility), designed for the expert assessment of activated or contaminated materials, whose activities have now been entirely transferred to a new laboratory – the LIDEC – and the MIR (Inter-Regional fresh fuel Warehouse).

Chinon NPP

Reactors B1, B2, B3 and B4 in operation

ASN considers that the safety and environmental protection performance of the Chinon NPP on the whole is in line with ASN's general assessment of EDF, and that the radiation protection performance is above the national average.

ASN considers that the site is maintaining a satisfactory level with regard to nuclear safety. It underlines improvements in the overall upkeep of the worksites and the completeness of the documents examined during various inspections. Progress is required in the preparation of the risk analyses and in the performance of the system configuring and periodic test activities, which have been the cause of several significant events. Furthermore, the NPP's organisation for detecting deviations and justifying their remediation time frames is not sufficiently robust and must be improved. Lastly, the site must improve its management of the risks relating to fire, explosion and lightning in order to ensure the conformity of its installations with the associated regulations.

The radiation protection performance of the Chinon site is satisfactory, as witnessed by good results in terms of dosimetry and radiological cleanliness. The radiation protection rules are generally well integrated at the preparation stage and during the performance of work in controlled areas, despite the detection of a few deviations.

Although comparable with the national average, the environmental performance of the Chinon site can be improved on the whole. Although the maximum discharge values for gaseous and liquid effluents are respected and the number of environment-related significant events is low, numerous regulatory deviations concerning catering for the legionella and amoeba risks and waste management were noted.

Reactors A1, A2 and A3 undergoing decommissioning

The graphite-moderated Gas-Cooled Reactor (GCR) series comprises six reactors, including the Chinon A1, A2 and A3. These first-generation reactors used natural uranium as the fuel and graphite as the moderator. They were cooled by gas. This plant series includes "integrated" reactors, whose heat exchangers are situated under the reactor core inside the vessel, and "non-integrated" reactors, whose heat exchangers are situated on either side of the reactor vessel. The Chinon A1, A2 and A3 reactors are "non-integrated" GCR reactors. They were shut down in 1973, 1985 and 1990 respectively.

Reactors A1 and A2 were partially decommissioned and transformed into storage facilities for their own equipment (Chinon A1 D and Chinon A2 D). These operations were authorised by the Decrees of 11 October 1982 and 7 February 1991 respectively. Chinon A1 D is partially decommissioned at present and has been set up as a museum since 1986. Chinon A2 D is also partially decommissioned and houses Groupe Intra, which operates robotised machines for interventions on accident-stricken nuclear installations.

Complete decommissioning of the Chinon A3 reactor was authorised by the Decree of 18 May 2010, with a decommissioning «under water» scenario.

In March 2016, EDF announced a complete change of decommissioning strategy for its definitively shut down reactors. In this new strategy, the planned decommissioning scenario for all the reactor pressure vessels involves decommissioning «in air» and the Chinon A2 reactor pressure vessel would be decommissioned first. This new strategy is currently being examined by ASN.

The operations to decommission the exchangers (first step in decommissioning of the facility) on the Chinon A3 reactor began several years ago. After an interruption of several months due to the presence of asbestos, decommissioning of the heat exchangers of the south premises of Chinon A3 was completed in June 2018. Regarding decommissioning of the heat exchangers of the north premises, the parts containing asbestos had to be cleaned before starting the operations in 2018.

ASN considers that the level of safety of the Chinon nuclear installations undergoing decommissioning (Chinon A1, A2 and A3) is generally satisfactory. The inspections carried out in 2018 revealed satisfactory control of reactor containment and compliance with EDF's commitments concerning nuclear waste management. Significant improvements have been made in waste monitoring and management. The removal of a large quantity of waste packages resulting from the decommissioning operations is a positive point in this respect.

Nuclear fuel cycle installations

Inter-Regional fresh fuel Warehouse

Commissioned in 1978, the Chinon Inter-Regional Warehouse (MIR) is a facility for storing fresh fuel assemblies pending their utilisation in the EDF reactors. It constitutes BNI 99, and along with the Bugey MIR, it contributes to the management of flows of fuel assembly supplies for the reactors.

After making several additional information requests between 2015 and 2017, ASN notified EDF in 2018 of the admissibility of the periodic safety review report submitted in 2015 and will continue its examination in 2019.

The facility was emptied of all the fuel assemblies in 2018 to allow the replacement of the handling crane and the «removal» of the levelling slab. With a view to performance of this work, ASN authorised the downgrading of areas of potential nuclear waste production on the facility into conventional waste areas, and the temporary modification of the general operating rules.

Research facilities undergoing decommissioning

Irradiated Materials Facility

The Irradiated Material Facility (AMI), which was declared and commissioned in 1964, is situated on the Chinon nuclear site and operated by EDF. This facility (BNI 94) has stopped operating and is waiting to undergo decommissioning. It was intended essentially for performing examinations and expert assessments on activated or contaminated materials from pressurised water reactors.

The analysis and expert assessment activities were entirely transferred in 2015 to a new facility on the site, the Lidec (Ceidre integrated laboratory).

With decommissioning of the facility in view, the activities in the AMI are now essentially monitoring and decommissioning preparation operations. The year 2018 was chiefly taken by the continuation of the treatment and removal of legacy waste and various unused equipment items, along with standard operating and monitoring operations and preparation for the future decommissioning activities.

ASN inspection in the AMI irradiated materials facility - June 2018

The decommissioning file underwent a public inquiry and consultations in 2017. Based on this, ASN continued its examination and drew up a draft decommissioning decree.

ASN considers that the management of waste treatment operations and the monitoring of outside contractors are satisfactory. In a context where the facility's activities involve numerous specific work projects, ASN will be attentive to the management of the facility developments and the announced schedules.

Saint-Laurent-des-Eaux site

The Saint-Laurent-des-Eaux site, situated on the banks of the river Loire in the municipality of Saint-Laurent-Nouan in the Loir-et-Cher *département*, comprises various nuclear installations, some of them in operation and others undergoing decommissioning. The Saint-Laurent-des-Eaux NPP comprises two operating reactors, B1 and B2, which were commissioned in 1980 and 1981 and constitute BNI 100. The site also features two old gas-cooled nuclear reactors, A1 and A2, currently in the decommissioning phase, and two silos for storing the graphite sleeves from the operation of reactors A1 and A2.

Saint-Laurent-des-Eaux NPP

Reactors B1 and B2 in operation

ASN considers that the performance of the Saint-Laurent-des-Eaux NPP is on the whole in line with the general assessment of EDF in the areas of safety, environment and radiation protection.

With regard to nuclear safety, ASN considers that the site has regressed with respect to the previous years. ASN nevertheless underlines the good general upkeep of the worksites, the satisfactory condition of the components and equipment of the inspected systems, and a high-quality independent safety organisation. This being said, shortcomings in operating rigour and operational control management of the facilities were observed in 2018. Numerous events highlight, for example, deficiencies in the management of operating contingencies and poor monitoring of procedures. The NPP's organisation for characterising deviations and justifying their remediation time frames is not sufficiently robust and must be improved, as must experience feedback management.

Generally speaking, Saint-Laurent-des-Eaux shows satisfactory radiation protection performance, although it came down in 2018. Despite the involvement of the personnel responsible for radiation protection, the traceability and monitoring of dosimetry optimisation actions on high-risk work sites can in particular be improved. Several significant radiation protection events moreover reveal failures of workers to comply with requirements.

The site's organisation to meet the regulatory requirements with regard to the environment can be further improved in a number of aspects. The dedicated department demonstrates resolve to make improvements and progress, supported by an active independent environment organisation. Good practices are observed during the inspections on the various themes addressed. Nevertheless, deficiencies in deviation detection have again been observed in this area. In 2019, ASN will ensure that the site works actively on the reviews of the conformity of its facilities with the regulatory framework.

Reactors A1 and A2 undergoing decommissioning

The former Saint-Laurent-des-Eaux NPP constitutes a Basic Nuclear Installation comprising two «integrated» Gas-Cooled Reactors, Saint-Laurent-des-Eaux reactors A1 and A2. Their final shutdown was pronounced in 1990 and 1992 respectively. Complete decommissioning of the installation was authorised by the Decree of 18 May 2010.

In March 2016, EDF announced a complete change of decommissioning strategy for its definitively shut down reactors.

Pending decommissioning of the reactor pressure vessels, other operations are performed outside the pressure vessel or to prepare for its decommissioning. Some worksites presenting a risk of contamination by alpha radionuclides (emptying tanks, characterising sludge, removing the source term from the Saint-Laurent-des-Eaux A2 pool) had been suspended in 2016 following the discovery of confirmed cases of internal contamination of personnel working on these sites. In 2017, EDF initiated an operating rigour plan which stepped up worker training and monitoring. The worksites were resumed in 2017. ASN has checked the measures defined in the plan and observed improvements in the management of the worksites involving an «alpha» contamination risk.

The liquid and solid waste removal operations continued as part of the decommissioning of the Saint-Laurent-des-Eaux A reactors. Research is still in progress to create a new legacy waste characterisation chamber and to define a storage solution to bring together «legacy waste with projected disposal route» and «legacy waste without disposal routes».

ASN considers that the level of safety of the Saint-Laurent-des-Eaux A reactors is satisfactory. To give an example, the organisation of the aids put in place to monitor waste management and the periodic checks of the installations are satisfactory.

Saint-Laurent-des-Eaux silos

The facility, authorised by Decree of 14 June 1971, consists of two silos whose purpose is the storage of irradiated graphite sleeves (Low-Level Long-Lived Waste - LLW-LL) coming from the operation of Saint-Laurent-des-Eaux A Gas-Cooled Reactors. Static containment of this waste is ensured by the concrete bunker structures of the silos, which are sealed by a steel lining. In 2010, EDF installed a geotechnical containment around the silos, reinforcing the control of the risk of dissemination of radioactive substances, which is the main risk presented by the installation.

Operation of this BNI (BNI 74) is limited to surveillance and maintenance measures (inspections and radiological monitoring of the silos, checking there is no water ingress, checking the relative humidity, the dose rates in the vicinity

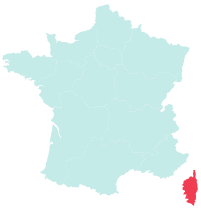
of the silos, the activity of the water table, and monitoring the condition of civil engineering structures). These actions are on the whole carried out satisfactorily.

In the context of its new decommissioning strategy for the GCR, EDF has announced its decision to start removing the graphite sleeves from the silos without waiting for the graphite waste disposal route to become available. To this end, EDF envisages creating a new graphite sleeve storage facility on the Saint-Laurent-des-Eaux site.

EDF presented the progress of the silo emptying and storage facility studies to ASN in 2018. Complementary studies are in progress to consolidate the scenario and find technical optimisations. EDF plans submitting, at the end of 2020, the application file for authorisation to create a new storage BNI, and the decommissioning file which will take into account the operations to empty, clean-out and demolish the existing silos.

Labour inspection in the nuclear power plants of the Centre-Val de Loire region.

Specific inspections were conducted within the four NPPs of the Centre-Val de Loire region on the themes of fire and personnel evacuation and sheltering in the event of incidents or accidents. These inspections served to check, among other things, compliance with the obligations associated with the utilisation of work places on account of the fire risk. Fire remains a subject of concern that is constantly on the nuclear power plants' agenda, and for which ASN expects significant improvements.



Corse
Collectivity

The Marseille division regulates radiation protection and the transport of radioactive substances in the Corse collectivity.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- small-scale nuclear activities in the medical sector:
  - 2 external-beam radiotherapy departments;
  - 2 nuclear medicine departments;
  - 9 centres performing fluoroscopy-guided interventional procedures;
  - 8 computed tomography scanners;
  - some 330 medical and dental radiology devices;
- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - some 40 veterinary surgeons using diagnostic radiology devices;
  - about 40 industrial and research establishments, including 25 users of devices for detecting lead in paint;
- activities linked to the transport of radioactive substances.

ASN carried out 4 inspections in Corse in 2018: 1 in the medical sector, 1 in the industrial sector and 2 in the transport of radioactive substances.

Overseas *départements* and regions

The regulation of radiation protection and the transport of radioactive substances in the 6 overseas *départements* and regions (Guadeloupe, Martinique, Guyane, La Réunion, Mayotte, Saint-Pierre-et-Miquelon) is ensured by the Paris division.

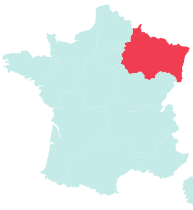
The Paris division also acts as expert to the competent authorities of Nouvelle-Calédonie and French Polynésie.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- small-scale nuclear activities in the medical sector:
  - 4 external-beam radiotherapy departments;
  - 3 brachytherapy departments;
  - 4 nuclear medicine departments;
  - 26 centres performing fluoroscopy-guided interventional procedures;
  - about 35 centres in possession of at least one Computed Tomography (CT) scanner;
  - about 100 medical radiology centres;
  - about 1,000 dental radiology devices;
- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - more than 70 users of veterinary radiology devices;
  - 2 industrial radiography companies using gamma radiography devices;
  - 1 cyclotron;
- activities linked to the transport of radioactive substances.

23 inspections were carried out in the small-scale nuclear activities sector in the French Overseas *départements* and regions in 2018. Two on-site inspection campaigns were carried out by the ASN Paris Division.

One event concerning radiotherapy patients was rated level 1 on the ASN-SFRO scale in 2018.



Grand Est region

The Châlons-en-Champagne and Strasbourg divisions are jointly responsible for regulating nuclear safety, radiation protection and the transport of radioactive substances in the 10 *départements* of the Grand Est region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- BNIs:
  - the Cattenom NPP (4 reactors of 1,300 MWe);
  - the Chooz B NPP (2 reactors of 1,450 MWe);
  - the Chooz A NPP (currently being decommissioned);
  - the Fessenheim NPP (2 reactors of 900 MWe);
  - the Nogent-sur-Seine NPP (2 reactors of 1,300 MWe);
  - the CSA storage centre for short-lived low- and intermediate-level radioactive waste located in Soulaines-Dhuys in the Aube *département*;
- the *Cigéo* geological disposal project for long-lived high- and intermediate-level radioactive waste;
- small-scale nuclear activities in the medical sector:
  - 15 external-beam radiotherapy departments;
  - 5 brachytherapy departments;
  - 20 nuclear medicine departments;
  - 83 computed tomography scanners;
  - about 80 centres carrying out fluoroscopy-guided interventional procedures;
  - some 2,100 medical and dental radiology devices;
- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - about 85 veterinary clinics;
  - about 500 licensed industrial activities, with more than half of the licenses being for possession of devices to detect lead in paint;
  - about 50 research laboratories situated mainly in the universities of the region;
- activities linked to the transport of radioactive substances;
- 5 head offices of organisations approved in radiation protection.

In 2018, ASN conducted 181 inspections, of which 71 were in the NPPs, 5 in radioactive waste disposal facilities, 87 in the small-scale nuclear activities sector, 11 in the transport of radioactive substances and 7 concerning approved organisations or approved laboratories.

ASN also carried out 17 days of labour inspections in the NPPs.

During 2018, 16 significant events reported by nuclear installation licensees in the Grand Est region were rated level 1 on the INES scale. In the small-scale nuclear activities sector, 4 significant events were rated level 1 on the ASN-SFRO, and 5 were rated level 1 on the INES scale.

Cattenom nuclear power plant

The Cattenom NPP is situated on the left bank of the river Moselle, 5 km from the town of Thionville and 10 km from Luxembourg and Germany.

The site comprises four pressurised water reactors each with a unit power of 1,300 MWe, commissioned between 1986 and 1991 and producing each year about 37 TWh, that is to say 7% of EDF's national electricity production. Reactors 1, 2, 3 and 4 constitute BNIs 124, 125, 126 and 137 respectively.

ASN considers that the performance of the Cattenom site with regard to nuclear safety, radiation protection and protection of the environment is in line with the general assessment of the EDF plants, with an improvement in

radiation protection but a persistent shortfall in maintenance and operating operations.

The year 2018 was thus marked by several events associated with maintenance non-qualities, leading to unscheduled shutdowns or replacements of parts. Some of these events are linked to modifications made in 2016 during the third 10-yearly outage of reactor 1, highlighting some one-off shortcomings in their integration; others confirm the need to reinforce the verification of the technical actions of the operators or the monitoring of service providers. Nevertheless, the site's ability to manage incidental events, once clearly identified, remains satisfactory.

An action plan to improve the way operating activities are carried out was put in place in late 2017. ASN notes a reduction in the number of events caused by a lack of vigilance, but considers that the action plan has not yet brought adequate results in the preparation and deployment phases, where control and rigour can be improved.

ASN considers that the efforts undertaken to achieve conformity in environmental aspects must be extended to a reinforcement of the environmental protection culture, to better prevent accidental spillages, inspection equipment downtimes and the crossing of pre-alarm thresholds.

The finely-tuned coordination of the biocide treatments of the cooling towers in 2018 enabled the chemical and micro-organism discharge values to be kept within permissible limits, but the need to perform treatments, including during cold periods – which is a local particularity – could necessitate the adaptation of the prescriptive framework governing discharges.

Lastly, the positive dynamics in radiation protection management observed in 2017 were confirmed in 2018 in a context of more sustained activity: the efforts made with regard to radiological cleanliness and dosimetric optimisation must be continued.

Chooz nuclear power plant

The Chooz NPP operated by EDF is situated in the municipality of Chooz, 60 km north of Charleville-Mézières, in the Ardennes *département*. The site comprises reactor A (BNI 163), operated from 1967 to 1991, for which the final shutdown and decommissioning operations were authorised by Decree 2007-1395 of 27 September 2007, and two reactors each with a power rating of 1,450 MWe (BNIs 139 and 144) commissioned in 2000.

Reactors B1 and B2 in operation

ASN considers that the performance of the Chooz B NPP with regard to nuclear safety, radiation protection and environmental protection is, on the whole, in line with the general assessment of EDF plant performance.

With regard to nuclear safety, ASN observes improvements in reactor operation but considers that the required level of rigour has not yet been reached; the licensee must not reduce its efforts in this area. The significant events, which remain numerous, also underline shortcomings in activity preparation and operator training. The quality of the operational documentation and its updating is moreover considered a weak point for the operational control and maintenance activities alike. In this latter respect, care must be taken to ensure that equipment modifications or changes in maintenance requirements are duly integrated.

With regard to radiation protection, ASN considers the site's performance satisfactory on the whole. Dosimetry and radiological cleanliness were well managed during the reactor outages. The site must nevertheless maintain its vigilance to ensure compliance with the basic radiation protection actions.

Lastly, ASN considers that the sites organisation for environmental protection is satisfactory on the whole. Certain events nevertheless revealed uncontrolled discharges of cooling fluids and occasional failures in equipment involved in the monitoring of liquid and gaseous discharges.

Reactor A undergoing decommissioning

The decommissioning work on the reactor A pressure vessel continued in 2018, including in particular the commissioning of the packaging facility for waste resulting from the underwater cutting up of the reactor pressure vessel and the cutting up of its closure head.

The decommissioning work on the equipment still present in the nuclear auxiliaries cavern bunkers was interrupted during the year. This work, chiefly carried out by remote operation, nevertheless involves manual interventions which were poorly evaluated in the initial work file and necessitated reviewing of the radiation protection measures.

With regard to the environment and nuclear safety, ASN considers that the decommissioning operations have been carried out satisfactorily.

No event occurred in the area of radiation protection in 2018. The licensee must nevertheless remain vigilant with regard to the risk of contamination by alpha particles in the monitoring of its service providers.

Fessenheim nuclear power plant

The Fessenheim NPP comprises two pressurised water reactors, each with a power rating of 900 MWe, which produce the equivalent of the electricity consumption of the Alsace region (about 12 TWh per year). It is situated 1.5 km from the German border and about 30 km from Switzerland. The two reactors, which constitute BNI 75, were commissioned in 1977.

ASN considers that the nuclear safety performance of the Fessenheim site, as in the previous years, stands out positively with respect to the average for the nuclear fleet. The site remains at good level for environmental protection. Lastly, with regard to radiation protection, the site is in line with the general assessment of the EDF plants.

The operating safety of the reactors remained highly satisfactory in 2018. The return of reactor 2 to service after lifting the test certificate of its steam generator went well and did not lead to a drop in the performance of the site with respect to 2017, whereas only one reactor was operated that year. The licensee must however improve its preparation for work operations and the periodic tests.

The volume of maintenance work was very low in 2018 as there was no scheduled reactor outage, but the effort to maintain the facilities in good condition remains visible. Particular attention shall be paid to the implementation of the maintenance programmes and maintaining the facilities in good condition in 2019 in view of the future final shutdown of the site (see box). It should be noted that this uncertain context has had no impacts at present, from ASN's viewpoint, on the social climate and the involvement of the personnel.

The number of significant events relating to the environment remains low, confirming the overall positive judgement expressed by ASN in the preceding years. Nevertheless, the fact that the two events reported were detected during the preparation or performance of ASN inspections calls for a reinforcement of the site's ability to detect deviations, particularly concerning the auxiliary equipment items which are outside the scope of the periodic tests and preventive maintenance programmes.

Lastly, in a context of a low maintenance workload, no major radiation protection events occurred in 2018.

Prospect of final shutdown of the Fessenheim site

Following the announcement of further delays in the Flamanville EPR construction worksite, the shutting down of the Fessenheim NPP, initially planned for the end of 2018 was pushed back to 2019, then to 2020, leading to the scheduling of two new refuelling and maintenance outages in 2019.

The principle of decorrelating the shutdown of the Fessenheim NPP and commissioning of the Flamanville EPR, in accordance with the Government's demand, and EDF's confirmation that there is no prospect of operating reactors 1 and 2 beyond their fourth periodic safety reviews, which reach their respective terms in September 2020 and August 2022, now set an operating limit on the reactors.

ASN has noted these factors and in late 2018 started the updating of the prescriptions applicable to the site, particular regarding the «hardened safety core» provisions defined further to the lessons learned from the Fukushima NPP accident, in order to adapt them to the particular case of a site that is shut down and waiting for decommissioning.

ASN nevertheless observes that at the end of 2018 the site still has no firm industrial schedule for its end of operation and has not yet been the subject of a final shutdown notification in accordance with the procedure provided for in Article L. 593-26 of the Environment Code.

ASN considers that the persistent uncertainty in this file, already marked by numerous schedule changes, is unsatisfactory, and it also notes that it particularly affects the life of the site in several respects:

- the rescheduling of the periodic maintenance operations for equipment items whose withdrawal from service had been planned, then postponed, necessitates a particular effort for planning and the examination of arrangements that might possibly be necessary, particularly those that require a technical assessment or an authorisation;
- the preparation of the decommissioning file and of those pre-decommissioning operations which can be started as soon as production stops, cannot remain subject to the vagaries of an unstable schedule. ASN nevertheless observes that the site has already started to remove the spent fuel assemblies in order to achieve a situation presenting the lowest possible risk as early as possible;
- the social climate of the site and the employees' commitment, which have been satisfactory until now, must be safeguarded. This implies in particular having a clear schedule for the reduction in personnel numbers concomitantly with the shutdown, and individual visibility of personnel transfers.

ASN reminds EDF that is must declare final shutdown of the reactors as soon as possible in order to best prepare their decommissioning. EDF has sent ASN a preliminary guideline notice for the fourth periodic safety review of the Fessenheim NPP with a view to final shutdown, and a preliminary decommissioning plan. The final shutdown notification shall be accompanied by an updated decommissioning plan; the decommissioning file must be transmitted no later than two years after the notification.

Nogent-sur-Seine nuclear power plant

Operated by EDF and situated in the municipality of Nogent-sur-Seine in the Aube *département*, 70 km north-west of Troyes, the Nogent-sur-Seine NPP comprises two pressurised water reactors, each of 1,300 MWe, commissioned in 1987 and 1988. Reactor 1 constitutes BNI 139 and reactor 2 BNI 140.

ASN considers that the radiation protection performance of the Nogent-sur-Seine site is on the whole in line with the general assessment of EDF, while its performance in nuclear safety and radiation protection is below average.

With regard to nuclear safety, ASN considers that operating rigour has regressed, particularly on account of deficiencies in the preparation of operating activities.

As far as maintenance is concerned, ASN considers that the progress in the work monitoring is insufficient, particularly when implementing equipment modifications. ASN also notes shortcomings in the analysis of the fitness of equipment to be returned to service following the maintenance operations. Progress is also expected in the integration of the regulatory requirements regarding prevention of the fire risk.

With regard to radiation protection, ASN considers that the site has undertaken to correct the malfunctions observed in the preceding years. More specifically, significant improvements have been made in the preparation of maintenance worksites involving radiological risks and the organisation for dealing with contaminated personnel. Vigilance must moreover be maintained in the detection and processing of deviations in this area.

Regarding environmental protection, ASN considers that the site must further improve its performance, particularly in the internal management of effluents, which reveals shortcomings in the environmental culture of the workers or in the implementation of the procedures. ASN has observed progress in the management of conventional waste but remains attentive to compliance with the regulatory provisions concerning the management of radioactive waste.

Soulaines-Dhuys waste disposal centre

Commissioned in January 1992, the Aube radioactive waste repository (CSA) took over from the Manche disposal centre which ceased its activities in July 1994, and benefited from the experience acquired with the Manche centre. This disposal facility, which constitutes BNI 149, has a capacity of one million cubic metres of Low and Intermediate Level Short-Lived Waste (LL/ILW-SL). The operations authorised in the facility include waste packaging either by injection of mortar into metal chambers of 5 or 10 m^3, or by compaction in 200L drums. At the end of 2018, the volume of waste in the repository totalled some 335,175 m^3, that is to say about 33.5% of the authorised capacity. According to the estimates made by Andra in 2016 in the concluding report on the CSA periodic safety review, the CSA could be completely filled by 2062 rather than 2042 as initially forecast, this new estimate being based on better knowledge of the future waste and the waste delivery schedules.

ASN considers, in line with the previous years, that the CSA is operated under satisfactory conditions of safety and radiation protection.

Labour inspection in the nuclear power plants of the Grand Est region

ASN performed 9 inspections and took part in 7 meetings or surveys on the four sites and continued its oversight actions in the area of occupational safety, particularly during reactor outages.
The management of occupational safety remains broadly satisfactory on all the sites. ASN nevertheless observes, as in the preceding years, some shortcomings in the application of prevention measures and performance of risk analyses by the licensee and its service providers. On the subject more specifically of the electrical risk, ASN has again, in the course of specific inspections, observed shortcomings in the meeting of regulatory obligations.
On the Cattenom site, strict occupational safety management has been observed, with only a few isolated deviations being noted. Reinforcement of prevention of the asbestos risk, the need for which was highlighted by a few minor events, is covered by a dedicated organisation to limit the risk of accidental exposure.
On the Fessenheim site, some cases of exceeding maximum permitted daily working times, which can form the subject of a waiver for safety reasons, underline the need to adopt a suitable organisation to limit their occurrence and duration.

ASN inspectors at the Aube waste repository (CSA) – December 2018

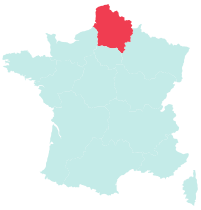
In 2018, ASN authorised the partial commissioning of the package inspection facility which gives the CSA more effective means of checking the quality of the received packages. Complete commissioning of this facility, planned for early 2019, will require another authorisation.

The technical analysis of the CSA's periodic safety review report, intended in particular to assess the safety of the facility according to the planned development of its activities over the next ten years, continued in 2018.

Deep geological waste repository project

After examining the safety options file for the *Cigéo* deep geological waste repository, ASN issued its opinion on 11 January 2018.

Alongside this, ASN considers that the scientific experiments and work conducted by Andra in the underground laboratory at Bure continued in 2018 with a good standard of quality, comparable with that of the preceding years.



Hauts-de-France region

The Lille division regulates nuclear safety, radiation protection and the transport of radioactive substances in the 5 *départements* of the Hauts-de-France region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- BNIs:
  - the Gravelines NPP (6 reactors of 900 MWe) operated by EDF;
  - Somanu (*Société de maintenance nucléaire*) operated by Framatome in Maubeuge (Nord *département*) - classified BNI until 28 May 2018, then ICPE;

- small-scale nuclear activities in the medical sector:
  - 18 external-beam radiotherapy departments;
  - 3 brachytherapy departments;
  - 27 nuclear medicine departments;
  - 92 centres performing fluoroscopy-guided interventional procedures;
  - 126 computed tomography scanners;
  - some 4,600 medical and dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - 600 industrial and research establishments, including 29 companies exercising an industrial radiography activity, 3 particle accelerators of which 2 are cyclotrons, 38 laboratories situated mainly in the universities of the region, 19 companies using gamma ray densitometers and 280 users of devices for detecting lead in paint;
  - 340 veterinary surgeries or clinics practising diagnostic radiology;

- activities linked to the transport of radioactive substances;

- organisations approved by ASN:
  - 4 agencies of approved organisations in the area of small-scale nuclear activities.

In 2018, ASN's carried out 111 inspections in the Hauts-de-France region, of which 21 were in the Gravelines NPP, 85 in small-scale nuclear activities and 5 in the transport of radioactive substances.

ASN also carried out 12 labour inspection operations in the Gravelines NPP.

During 2018, 5 significant events rated level 1 on the INES scale were notified by the Gravelines NPP.

In small-scale nuclear activities, 4 events were rated level 1 on the INES scale, while 9 events concerning radiotherapy and brachytherapy treatments were rated level 1 on the ASN-SFRO scale and 1 concerning radiotherapy treatment was rated level 2 on the ASN-SFRO scale.

ASN drew up one violation report in the exercise of its oversight duties.

Gravelines nuclear power plant

The Gravelines NPP, operated by EDF, is located in the Nord *département* on the shores of the North Sea, 21 km east of Calais and 15 km west of Dunkerque. The site is situated 30 km from Belgium and 60 km from the United Kingdom. This NPP comprises six 900 MWe pressurised water reactors, representing a total power of 5,400 MWe. Reactors 1 and 2 constitute BNI 96, reactors 3 and 4 BNI 97 and reactors 5 and 6 BNI 122.

ASN considers that the nuclear safety and radiation protection performance of the Gravelines NPP is in line with its general assessment of EDF performance. Improvements in operating rigour were observed in 2018.

With regard to nuclear safety, the Gravelines NPP made progress in 2018 in the areas of reactor control and compliance with procedures. The site must nevertheless remain vigilant with regard to system configuring and enhancing the reliability of practices.

Concerning maintenance, 2018 saw the performance of its third 10-yearly outage of reactor 6 (the last reactor on the site to undergo this outage). Alongside this, the condition of certain facilities (particularly the pumping stations which display recurrent corrosion problems) and more generally the condition of the premises need to be improved. The involvement of all the members of personnel is necessary to detect and report deviations.

With regard to environmental protection, ASN considers that the performance of the Gravelines NPP is below the average for the EDF plants; it must in particular ensure better control of the site's wastewater treatment. In 2018, ASN adapted the prescriptions relative to the conditions of sampling and discharging of effluents from the Gravelines NPP into the environment, more specifically to allow the performance of pumping tests in the groundwater table before installing the ultimate water back-up system.

With regard to radiation protection, ASN continues to note shortcomings in the access control of some areas presenting risks of radiological exposure. Progress is also expected in the detection and handling of deviations in this area.

In the area of transport, the Gravelines NPP must be attentive to compliance with package tie-down rules during on-site transport operations.

The key event in 2018 relating to ASN inspections on this site was an in-depth inspection conducted from 14 to 18 May by a team of ten inspectors from all over France and coordinated by the ASN Inspector-in-Chief. This inspection was attended by two observers from the Belgian nuclear regulator (AFCN and BelV) and three members of the Gravelines CLI, in addition to the participating technical experts from IRSN. A film of this inspection can be viewed on *asn.fr*.

In-depth inspection by ASN at the Gravelines NPP – May 2018.

The *Société de maintenance nucléaire* in Maubeuge

Société de maintenance nucléaire (Somanu) is situated in the industrial zone of Grévaux-les-Guides in the locality of Maubeuge in the Nord *département*. The facility ensures the repair, maintenance and expert assessment of equipment and activities stemming primarily from nuclear reactors, excluding fuel elements. Somanu constituted BNI 143.

After reviewing the quantities of radioactive substances handled by Somanu, the Ministry for Ecological and Inclusive Transition and ASN have acknowledged that the BNI now comes under the system of Installations Classified for Protection of the Environment (ICPE) and is consequently now outside the scope of ASN oversight.

Labour inspection in the Gravelines nuclear power plant

Twelve labour inspection operations were carried out in the Gravelines NPP during 2018. The inspections were divided between inspections conducted on the maintenance worksites, carried out during the reactor outages, and thematic inspections (work at height, electrical conformity, lifting). Meetings were also organised with senior management, employes and personnel representatives.
With regard to health and safety, ASN remains attentive to the training of operators working at height and to the precautions to be taken when lifting loads. Unlike 2017, there were no serious work accidents.

Île-de-France region

The Paris division regulates radiation protection and the transport of radioactive substances in the 8 *départements* of the Île-de-France region. The Orléans division regulates nuclear safety in the basic nuclear installations of this region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- Basic Nuclear Installations regulated by the Orléans division:
  - the CEA Saclay centre, including in particular the experimental reactors Osiris and Orphée;
  - the UPRA (Artificial Radionuclide Production Plant) operated by CIS bio international in Saclay;
  - the CEA Fontenay-aux-Roses centre;

- small-scale nuclear activities in the medical sector regulated by the Paris division:
  - 26 external-beam radiotherapy departments;
  - 14 brachytherapy departments;
  - 40 *in-vivo* nuclear medicine departments and 16 *in-vitro* (medical biology) nuclear medicine departments;
  - 153 centres performing fluoroscopy-guided interventional procedures;
  - more than 200 centres in possession of at least one Computed Tomography (CT) scanner;
  - about 850 medical radiology centres;
  - about 8,000 dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors under the oversight of the Paris division:
  - about 650 users of veterinary radiology devices;
  - 9 industrial radiography companies using gamma radiography devices;
  - about 160 licenses concerning research activities involving unsealed radioactive sources;

- activities linked to the transport of radioactive substances;

- organisations approved by ASN:
  - 12 organisations approved for radiation protection controls.

ASN carried out 202 inspections in the Île-de-France region in 2018, of which 42 were in the field of nuclear safety, 151 in small-scale nuclear activities and 9 in the transport of radioactive substances.

Four Safety-related Significant Events (ESS) notified in Île-de-France and concerning BNIs were rated level 1 on the INES scale. In the small-scale nuclear activities, 3 Significant Events relating to Radiation protection (ESR) were rated level 1 on the INES scale, while 10 events concerning radiotherapy patients were rated level 1 on the ASN-SFRO scale.

ASN drew up two violation in the exercise of its oversight duties.

Saclay site

CEA Saclay Centre

The Saclay centre, covering an area of 223 hectares, is located about 20 km south-west of Paris, in the Essonne *département*. Some 6,000 people work there. Since 2005, this centre has been primarily devoted to physical sciences, fundamental research and applied research. The applications concern physics, metallurgy, electronics, biology, climatology, simulation, chemistry and the environment. The main aim of applied nuclear research is to optimise the operation of the French NPPs and their safety. Eight BNIs are located in this centre. It also houses an office of the French national institute for nuclear science and technology (training institute) and

two industrial firms: Technicatome, which designs nuclear reactors for naval propulsion, and CIS bio international, which produces radiopharmaceuticals for nuclear medicine.

The industrial and research facilities

Osiris and ISIS reactors – CEA Centre

The Osiris pool-type reactor has an authorised power of 70 megawatts thermal (MWth). It was primarily intended for technological irradiation of structural materials and fuels for various power reactor technologies. Another of its functions was to produce radionuclides for medical uses.

Its critical mock-up, the ISIS reactor with a power of 700 kWth, is essentially used for training purposes today. These two reactors, which constitute BNI 40, were authorised by a Decree dated 8 June 1965.

Given the old design of this facility by comparison with the best available techniques for protection against external hazards and for containment of materials in the event of an accident, the Osiris reactor was shut down at the end of 2015. CEA intends to continue with operation of the ISIS reactor until March 2019. In October 2018, the CEA submitted its decommissioning file for complete installation – the Osiris reactor and the ISIS reactor.

Since the Osiris reactor was shut down, the operations to remove the radioactive substances and hazardous materials and the decommissioning preparation operations are under way, with an organisation that is adapted to this new reactor status. Spent fuel removals continued in 2018, and two major decommissioning preparation operations were authorised by ASN resolutions. Improvements in the fire protection of the installation are moreover currently being implemented.

The inspections carried out by ASN in 2018 found the management of radioactive sources and the monitoring of outside contractors to be satisfactory. Management of the decommissioning preparation operations was also found to be satisfactory, but schedule slippages were observed. Alongside this, the deadlines for updating the baseline requirements must be better respected so that the rules applicable to the facility reflect its actual condition.

Orphée reactor – CEA Centre

The Orphée reactor (BNI 101), a neutron source reactor, is a pool-type research reactor with a licensed power of 14 MWth. The highly compact core is located in a tank of heavy water acting as moderator. Creation of the reactor was authorised by a Decree of 8 March 1978 and its first divergence took place in 1980. It is equipped with nine horizontal channels tangential to the core, allowing the use of 19 neutron beams. These beams are used for conducting experiments in areas such as physics, biology and physical chemistry. The reactor also has ten vertical channels allowing the introduction of samples to irradiate for the manufacture of radionuclides or the production of special materials. The neutron radiography facility is intended for the performance of non-destructive test on certain components.

The CEA has scheduled shutdown of the Orphée reactor for the end of 2019. The decommissioning file, expected before the end of 2019, shall be examined by ASN.

ASN considers that the level of safety of the Orphée reactor is on the whole satisfactory. The licensee's organisation in other respects is appropriate. The commitments made by the licensee are correctly implemented, particularly those further to the last periodic safety review.

The rigour of operation of the cooling towers must nevertheless be improved. Similarly, ASN has observed a number of deviations in radiation protection, particularly concerning the placarding of radiological zoning and contamination control measures.

Spent Fuel Testing Laboratory (LECI) – CEA Centre

The LECI was built and commissioned in November 1959. The CEA declared it as a basic nuclear installation on 8 January 1968. An extension was authorised in 2000. The LECI (BNI 50) is an expert assessment aid for the nuclear licensees. Its role is to study the properties of materials used in the nuclear sector, whether irradiated or not.

This facility must meet the same safety requirements as the fuel cycle nuclear installations, but the safety approach is proportional to the risks and drawbacks it presents.

Further to the last periodic safety review, ASN issued a resolution of 30 November 2016 (amended on 26 June 2017) regulating the continued operation of the facility through technical prescriptions relating in particular to the improvement plan that CEA had undertaken to implement. Some of CEA's commitments have not been fulfilled within the deadlines. ASN shall be particularly attentive to compliance with the assigned deadlines for the reinforcement work to ensure the earthquake resistance of the building 625 (end of 1st quarter 2021).

The inspections carried out in 2018 revealed operation of the facility to be satisfactory. More specifically, radiation protection and criticality were found to be well managed.

Nevertheless, ASN notes an increase in the number of incident notifications in 2018 and shall be attentive to the lessons learned from them.

Poséidon irradiator – CEA Centre

Authorised in 1972, the Poséidon facility (BNI 77) is an irradiator comprising a storage pool for cobalt-60 sources, partially surmounted by an irradiation bunker. The BNI moreover includes another bunkered irradiator baptised Pagure, and the Vulcain accelerator.

This facility is used for studies and qualification services for the equipment installed in the nuclear reactors, notably thanks to an immersible chamber, as well as for the radiosterilisation of medical products.

The main risk in the facility is that of exposure to ionising radiation due to the presence of very high-level sealed sources.

In 2017 and 2018, CEA carried out modifications on the facility to eliminate the common mode failure risk on the cabled Pagure and Vulcain channels, and improved control of access to the Poséidon and Pagure bunkers. ASN examined the management of these modifications during an inspection in 2018, and found it to be satisfactory.

Alongside this, ASN considers that the BNI 77 is operated satisfactorily with regard to radiation protection, particularly as regards worker dosimetric monitoring. The organisation for the in-service monitoring of pressure equipment, however, must be improved.

Solid waste and liquid effluent treatment facilities

The CEA operates diverse facilities: laboratories associated with fuel cycle research as well research reactors. CEA also carries out numerous decommissioning operations. Consequently, it produces diverse types of waste. The CEA has specific processing, packaging and storage facilities for the management of this waste.

Solid radioactive waste management zone – CEA Centre

The solid radioactive waste management zone (BNI 72) was authorized by Decree of 14 June 1971. Managed by the CEA, this facility processes, packages and stores the high, intermediate and low-level waste from the Saclay centre installations. It also stores legacy materials and waste (spent fuels, sealed sources, scintillating liquids, ion-exchange resins, technological waste, etc.) pending disposal.

For several years now the CEA has been having difficulties in meeting the requirements set by ASN and the commitments it made following the periodic safety review of 2009 or the inspection follow-ups.

In 2017, in view of the delays in the removal from storage operations, the CEA requested a change in the deadlines prescribed in ASN resolution 2010-DC-0194 of 22 July 2010, particularly the pushing back of facility final shutdown deadline to 31 December 2022 so that the BNI can continue to be used for the management of radioactive waste from the Saclay BNIs. ASN will be attentive to the justification for the new time frames requested for completion of the removal from storage operations. It will more particularly set the conditions for continued operation of the facility further to the examination of the periodic safety review (for which the report was submitted in 2017), which is conducted constistently with the examination of the decommissioning file transmitted in 2015 and supplemented in 2017.

In the light of the inspections carried out in 2018, ASN considers that the level of safety of the facility is acceptable. The removal from storage operations are proceeding under suitably safe conditions, despite the divergences from schedule. The year was nevertheless marked by several significant events concerning loss of integrity of drums of waste, reflecting the need to better control their storage conditions.

Lastly, and more broadly, in view of the scheduled final shutdown and decommissioning of BNI 72, ASN shall be attentive to the proposed organisation and the means committed by the CEA for the future treatment of the solid waste from the Saclay site..

Liquid effluents management zone – CEA Centre

The liquid effluents management zone constitutes BNI 35. Declared by the CEA by letter of 27 May 1964, this installation is dedicated to the treatment of radioactive liquid effluents. The CEA was authorised by a Decree of 8 January 2004 to create an extension in the BNI, called «Stella», for the purpose of treating and packaging low-level aqueous effluents from the Saclay centre. These effluents are concentrated by evaporation then immobilised in a cementitious matrix in order to produce packages acceptable by Andra's above-ground waste disposal centres.

The concentration process was put into service in 2010, but the appearance of cracks in the first packages led ASN to limit the packaging operations. The CEA has thus only packaged some of the effluents from one of the installation's tanks that contains 40 m^3 of concentrates. The CEA has made progress since the early stages in defining its packaging solution for all the effluents from the installation. Thus, in June 2018, Andra authorised the packaging of these concentrates in accordance with the 12H package approval. The CEA must now ask ASN for authorisation to manufacture these packages.

Complementary investigations concerning the stability of the structure of the low-level liquid effluents storage room (room 97) have led the CEA to suspend, since 2016, the acceptance of effluents from other BNIs. ASN considers that the CEA must clarify its management strategy for the liquid effluents produced on the Saclay site, particularly regarding the future of premises 97 and the management of the effluents produced by BNI 35 itself.

In addition, the Decree of 8 January 2004 authorising the creation of Stella also stipulated that the CEA must remove the legacy waste stored in the eight MA500 tanks and the HA4 tank of BNI 35 within ten years. Due to the technical difficulties encountered in the recovery and packaging of this waste, the CEA was unable to meet the various prescribed deadlines and requested a deadline extension. As at the end of 2018, tank HA4 and 7 of the MA500 are empty. The operations to prepare for the emptying of the last MA500 tank have begun.

The CEA has scheduled several legacy effluent recovery operations and submittal of the associated files in 2019.

In view of the inspections performed in 2018, ASN underlines the proficiency of monitoring of barrier integrity and of operational management for accidents. Furthermore, the licensee rapidly found an alternative solution to remedy the unavailability of the facility's boiler pending its replacement at the end of 2018.

The emergency organisation and means, however, can be improved, and the fire risks study carried out for the periodic safety review must be supplemented.

Facilities undergoing decommissioning at the CEA Saclay centre

The decommissioning operations performed on the Saclay site concern two finally shut down BNIs (BNIs 18 and 49) and three BNIs in operation (BNIs 35, 40 and 72), parts of which have ceased activity and in which operations in preparation for decommissioning are being carried out. They also concern two ICPEs – Installations Classified for Protection of the Environment (EL2 and EL3), previously classified as BNIs but which have not been completely decommissioned due to the lack of a disposal route for the low-level long-lived waste. Their downgrading from BNI to ICPE status in the 1980's, in compliance with the regulations of that time, could not be done today.

More generally, the CEA's decommissioning and waste management strategy is subject to examination by ASN.

Ulysse reactor – CEA Centre

Ulysse was the first French university reactor. The installation, which constitutes BNI 18, underwent final shutdown in 2007 and has contained no fuel since 2008. The BNI decommissioning decree was published on 21 August 2014 and provides for a decommissioning duration of five years. This installation presents limited safety risks.

Further to the authorisation granted by ASN in early 2017, cutting up of the reactor block concrete block – the last step of the nuclear worksites – began in July 2017. The first phase of cutting up the «conventional» part of the reactor block was completed in April 2018. The second phase corresponding to cutting up of the «nuclear» part is in progress and will end in early 2019, before the final clean-out step.

The removal of about one hundred concrete blocks resulting from the first cutting-up phase is planned for the first half of 2019. ASN will ensure beforehand that the planned clean-out criteria have been satisfied.

High level Activity Laboratory – CEA Centre

The High level Activity Laboratory (LHA) comprises several laboratories intended for research work or the production of various radionuclides. It constitutes BNI 49. On completion of the decommissioning and clean-out work authorised by Decree of 18 September 2008, only two laboratories – currently in operation – should ultimately remain under the ICPE system. These two laboratories are the laboratory for the chemical and radiological characterisation of effluents and waste, and the packaging and storage facility for the retrieval of unused sources.

The decommissioning of the TOTEM shielded chain in cell No. 10, and the clean-out of cell Nos. 11 and 15 continued in 2018.

Despite the progress of the clean-out and decommissioning operations, the accumulated delays have prevented the CEA from meeting the deadline of 21 September 2018 set by the decree authorising LHA decommissioning. The discovery of pollution in certain intercell yards in 2017 also led to changes in the operations to be carried out. The licensee must therefore draw up a decommissioning decree modification file. ASN will be attentive to the justification of the deadline and the conditions of safety of the future operations.

ASN considers that the level of safety of BNI 49 undergoing decommissioning must be improved. 2018 was marked by significant events associated with the fire risk. For example, CEA reported one event rated level 1 on the INES scale for malfunctions of the automatic fire detection system which led the licensee to suspend the work in progress in the premises concerned.

The inspections of the facility confirmed improvements in the management of the waste storage areas. ASN nevertheless notes deficiencies in the monitoring of operations performed by outside contractors, and in the management of deviations and tracking of the performance of inspections and periodic tests. ASN shall be attentive to the performance of corrective actions in these areas..

Artificial Radionuclide Production Plant

UPRA (Artificial Radionuclide Production Plant) – BNI 29 – was commissioned in 1964 on the Saclay site by the CEA, which in 1990 created the CIS bio international subsidiary, the current licensee. In the early 2000s, this subsidiary was bought up by several companies specialising in nuclear medicine. In 2017, the parent company of CIS bio international acquired Mallinckrodt Nuclear Medecine LCC, now forming the Curium group, which owns three production sites (in the United States, France, and the Netherlands).

The Curium group is an important player on the French and international market for the production and development of radiopharmaceutical products. The products are mainly used for the purposes of medical diagnoses, but also for therapeutic uses. Another role of BNI 29 until the end of 2019 is also to retrieve disused sealed radioactive sources which were used for radiotherapy and industrial irradiation.

ASN considers that the safety performance of CIS bio international must still be significantly improved. It is true that ASN noted the licensee's efforts in 2018 to make its organisation and its operating processes more efficient, but the results are still insufficient.

As in the preceding years, the large number of significant events, the causes of which always include organisational and human deficiencies, reflects a poor culture of operating safety and reveals a lack of commitment of management to take organisational and human factors properly into account. Compliance with the requirements of the operating rules and the monitoring of activities must be improved, particularly

Assessment of the CEA Saclay centre

The CEA centres of Saclay and Fontenay-aux-Roses were grouped together in a single centre (CEA Paris-Saclay) in 2017. A new organisation was also implemented in 2017 in order to improve the management of the decommissioning projects, with the creation of the Department of facilities undergoing clean-out and decommissioning. During the period of consolidation of these new organisations, ASN has been vigilant with regard to the maintained control of safety and radiation protection in the Saclay BNIs. ASN considers that safety of operation of the CEA Saclay centre's BNIs is satisfactory. The organisation of transport movements, which represent large quantities of highly diverse types of packages and contents, is also efficient.
The CEA nevertheless still has difficulties in fulfilling technical requirements within the deadlines set by ASN. The decommissioning and legacy waste recovery and packaging operations are falling behind schedule. ASN considers that the progress of the decommissioning projects is one of the major safety challenges for the shut down installations and that the management of the waste from the decommissioning operations is crucial for the smooth running of the decommissioning programmes.
The inspections conducted by ASN in 2018 have shown the CEA's need for increased vigilance in the management of the fire risk within the BNIs. This concerns equally well the demonstration of control of the risks as the performance of periodic checks that guarantee correct operation of the equipment involved in fire protection.
The revising of the On-site Emergency Plan (PUI) was still not finished in 2018. Its updating will provide a renewed estimate of the risk that the Saclay nuclear installations represent given the risk reduction resulting from the shutdown of the Osiris reactor. On completion of the examination and approval of the On-site Emergency Plan, ASN will be able to assess the possibility of setting up buildings open to the public in large numbers near the CEA site.
Further to the Fukushima NPP accident, ASN had initiated stress tests on the nuclear installations. More particularly, the CEA's emergency management means were examined for the Saclay centre. In 2015 ASN prescribed the creation of new emergency management means, notably the construction or reinforcement of «hardened safety core» emergency centres capable of withstanding extreme conditions. Faced with the confirmed lateness in the deployment of the new emergency management buildings, the compensatory measures proposed by the CEA will have to be operational rapidly.
A national emergency exercise was organised in December 2018. Its purpose was to test the emergency response mechanisms planned by the public authorities and the licensee should an accident occur in a BNI. This exercise was held over two days. The first day focusing primarily on «nuclear safety» was organised around an accident scenario which was unknown to the participants and concerned BNI 101 (Orphée reactor) and led to the mobilisation of the emergency organisation (departmental operations centre of the Essone *département* Prefect's Office, the IRSN emergency technical centre, strategic management and command post of the CEA Saclay centre and the CEA emergency coordination centre). ASN considers that this exercise identified several weaknesses in the CEA's emergency organisation which will have to be corrected.
The second day, in which «civil protection» was the prime focus, enabled the Essonne Prefect's office, with the support of the regional players, to prepare the implementation of population protection measures.

the management of inspections and periodic tests, the handling of deviations and the tracking of maintenance operations. To give an example, CIS bio international reported a significant event rated level 1 on the INES scale for deficiencies in the management and traceability of inspections and periodic tests.

ASN also observed that, in view of the delays that have built up in recent years and despite the efforts made since the end of 2016, the licensee had difficulty in complying with the requirements resulting from the previous periodic safety review. By ASN resolution 2018-DC-0628 of 15 March 2018, ASN gave CIS bio international formal notice to comply with the unfulfilled requirements, setting deadlines of mid-2018 and end of 2018. ASN checked compliance with these new deadlines in inspections.

Alongside this, the application of new regulatory requirements is not adequately anticipated. This has more specifically led ASN to give CIS bio international, through resolution2018-DC-0629 of 15 March 2018, formal notice to draw up a waste management study and establish corresponding general operating rules that are in conformity with resolution 2015-DC-0508.

Lastly, complementary studies concerning the consequences of accident situations are currently being examined. The risks created by the installation shall be significantly reduced in the medium term. This reduction will be due to the stopping of the activity associated with disused high-level sealed sources and the production of iodine-131-based radiopharmaceuticals. These changes in operation, for which the deadline is the end of 2019, will be examined during the examination of the periodic safety review report submitted in the 2nd half of 2018.

More broadly speaking, ASN expects a lasting turnaround of CIS bio international. Operating rigour, the safety culture, the oversight of operations, the cross-functionality of the organisation, and compliance with the baseline requirements of the facility and ASN resolutions must all be improved.

CEA's Fontenay-aux-Roses centre

Created in 1946 as the CEA's first research centre, the Fontenay-aux-Roses site is continuing its transition from nuclear activities towards research activities in living sciences.

The Fontenay-aux-Roses centre comprises two BNIs, namely Procédé (BNI 165) and Support (BNI 166). BNI 165 accommodated the research and development activities on nuclear fuel reprocessing, transuranium elements, radioactive waste and the examination of irradiated fuels. These activities were stopped in the 1980s-1990s. BNI 166 is a facility for the characterisation, treatment, reconditioning and storage of legacy radioactive waste and waste from the decommissioning of BNI 165.

More generally, the CEA's decommissioning and waste management strategy is subject to examination by ASN.

Procédé and Support installations
– CEA Centre

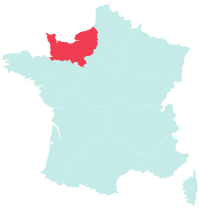
The decommissioning of these two installations which constitute BNI 165 and 166 respectively, was authorised by two Decrees of 30 June 2006. The initially planned duration for the decommissioning operations was about ten years. The CEA informed ASN that, due to strong presumptions of radioactive contamination beneath one of the buildings, to unforeseen difficulties and to a change in the overall decommissioning strategy of the CEA's civil centres, the decommissioning operations would extend beyond 2030, and in June 2015 it filed an application to change the prescribed decommissioning time frames.

ASN deemed that the first versions of these files were not admissible. In accordance with its commitments of 2017, in the 1st quarter of 2018 the CEA sent the new version of the files aiming to extend the decommissioning authorisation for the nuclear installations of the Fontenay-aux-Roses centre.

2018 witnessed slippages in the performance of the studies, in project scheduling and in the decommissioning operations schedule. Thus, the complements to the on-site emergency plan expected in 2017 were not submitted to ASN until the end of 2018 and will be examined in 2019.

Assessment of the CEA Fontenay-aux-Roses centre

ASN observes that the CEA once again has numerous difficulties in meeting the deadlines of projects that are fundamental for safety. ASN expects an improvement in the quality of the studies submitted by the CEA, which must be self-sufficient and include more detailed analyses.
Control of the fire risk remains a major issue. ASN registered improvements in 2018; the CEA provided elements demonstrating control of the fire risk at the end of the year.
Alongside this, equipment qualification compliance and discharge monitoring are satisfactory, but meeting commitments and control of containment must still be improved. Likewise, there is room for improvement in the detection of deviations and the monitoring of service providers. ASN never-theless notes the responsiveness of the personnel and good organisation of the various themes inspected, especially waste management.



Normandie region

The Caen division regulates nuclear safety, radiation protection and the transport of radioactive substances in the 5 *départements* of the Normandie region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- BNIs:
  - the NPPs of Flamanville (2 reactors of 1,300 MWe), Paluel (4 reactors of 1,300 MWe) and Penly (2 reactors of 1,300 MWe) operated by EDF;
  - the Flamanville 3 EPR reactor construction site;
  - the Orano Cycle spent nuclear fuel reprocessing plant at La Hague;
  - the Andra Manche repository;
  - the Ganil (National Large Heavy Ion Accelerator) in Caen;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - 8 external-beam radiotherapy departments (21 devices);
  - 1 proton therapy department;
  - 3 brachytherapy departments;
  - 11 nuclear medicine departments;
  - 35 centres performing fluoroscopy-guided interventional procedures;
  - 66 computed tomography scanners;
  - some 2,100 medical and dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - about 450 industrial and research establishments, including 18 companies exercising an industrial radiography activity;
  - 1 cyclotron;
  - about 21 laboratories situated mainly in the universities of the region;
  - 10 companies using gamma ray densitometers;
  - 150 users of devices for detecting lead in paint;
  - about 260 veterinary surgeries or clinics practising diagnostic radiology;

- activities linked to the transport of radioactive substances;

- ASN-approved laboratories and organisations, including:
  - 9 head offices of laboratories approved for taking environmental radioactivity measurements;
  - 3 head offices of organisations approved for radiation protection controls.

In 2018, ASN carried out 203 inspections in Normandie, comprising 62 inspections in the Nuclear Power Plants (NPP) of Flamanville, Paluel and Penly, 20 inspections on the construction site of the Flamanville 3 EPR reactor, 67 inspections on fuel cycle facilities, research facilities and facilities undergoing decommissioning, 46 inspections in small-scale nuclear activities and 8 in the transport of radioactive substances.

In addition to this, 46 days of labour inspection were carried out on the NPP sites and the Flamanville 3 worksite.

During 2018, 14 significant events rated level 1 on the INES scale were notified to ASN. In addition, 7 events rated level 1 on the ASN-SFRO scale were notified by the heads of radiotherapy departments in the Normandie region.

ASN drew up two violation reports in the exercise of its oversight duties.

Flamanville nuclear power plant

Operated by EDF and situated in the Manche *département* in the municipality of Flamanville, 25 km south-west of Cherbourg, the Flamanville NPP comprises two pressurised water reactors, each of 1,300 MWe commissioned in 1985 and 1986. Reactor 1 constitutes BNI 108 and reactor 2 BNI 109.

ASN considers that the performance of the Flamanville NPP with regard to nuclear safety, radiation protection and environmental protection is, on the whole, in line with the general assessment of EDF plant performance.

ASN nevertheless noted diverse shortcomings during its reactor outage inspection in 2018, which tend to indicate that safety management needs to be stepped up for outage monitoring. ASN considers that the quality of the authorisation application files must also be improved and their transmission better anticipated.

With regard to the 10-yearly outage of reactor 1, ASN considers that the preparation and tracking of the works and maintenance operations must be significantly improved. ASN considers that the licensee must also improve the monitoring of the reactor restarting process which enables it to ensure compliance with the safety baseline requirements. Lastly, ASN considers that the internal checks of the activities performed must be improved.

With regard to reactor operation and management, ASN considers that the site's performance is satisfactory on the whole, but the efforts made in the analysis of the periodic tests must be continued.

With regard to radiation protection, ASN considers that the organisation in place is satisfactory when the reactors are in operation. During the reactor outages, however, the management of access to limited-stay areas and the monitoring of limited-term contract or temporary personnel must be improved, as must the control of contaminated equipment storage conditions.

With regard to environmental protection, ASN considers that the organisation in place for the management of discharges and waste is satisfactory. The management of waste during reactor outages must however be further improved.

Paluel nuclear power plant

The Paluel NPP operated by EDF in the municipality of Paluel in the Seine-Maritime *département*, 30 km south-west of Dieppe, comprises four 1,300 MWe pressurised water reactors, commissioned between 1984 and 1986. Reactors 1, 2, 3 and 4 constitute BNIs 103, 104, 114 and 115 respectively.

The site accommodates one of the regional bases of the FARN, the special Nuclear Rapid Intervention Force created by EDF in 2011 further to the Fukushima NPP accident. Its role is to intervene in pre-accident or accident situations, on any nuclear power plant in France, by providing additional human resources and emergency equipment.

ASN considers that performance of the Paluel NPP with regard to nuclear safety and radiation protection is on the whole in line with the general assessment of EDF, and that its environmental protection performance is even more satisfactory.

With regard to reactor operation and management, ASN considers that the site's performance is satisfactory on the whole, even if the periodic tests must be scheduled with greater rigour, particularly during reactor outages. ASN considers that the management of fire detection inhibitions and the quality of the risk analyses during interventions must be improved. Lastly, ASN considers it necessary to continue improving the rigour in the preparation and monitoring of maintenance activities.

With regard to reactor 2, the 10-yearly outage which began in May 2015 ended in July 2018. ASN considers that the repair operations on the equipment impacted by the fall of the steam generator in 2016 were carried out satisfactorily. Reactor 2 is the first of the 1,300 MWe plant series on which EDF has replaced the steam generators. ASN considers that the requalification operations, which include the main primary system hydrostatic test, were carried out satisfactorily. Lastly, during restarting of the reactor after a shutdown of more than three years, ASN checked that the various material difficulties had been resolved.

As for reactor 3, ASN considers that its outage went well on the whole, even though it lasted longer than planned due to an unexpected finding in the reactor vessel head. ASN also notes that the development of corrosion on the equipment located outside the buildings needs to be better taken into account.

With regard to radiation protection, ASN considers that the organisation in place is satisfactory when the reactors are in operation. During reactor outages however, the management of entries into controlled areas and control of the contamination risk must be improved. Several significant events reflect a lack of radiation protection culture in some of the workers.

With regard to environmental protection, ASN considers that the organisation in place for the management of discharges and waste is satisfactory. The site made a significant effort in 2018 to improve the leak-tightness of its cooling units. The management of radioactive waste stored in the dedicated building, however, must be further improved.

Penly nuclear power plant

The Penly NPP operated by EDF in the Seine-Maritime *département* in the municipality of Penly, 15 km north-east of Dieppe, comprises two 1,300 MWe pressurised water reactors commissioned between 1990 and 1992. Reactor 1 constitutes BNI 136 and reactor 2 BNI 140.

ASN considers that the performance of the Penly NPP with regard to nuclear safety, radiation protection and environmental protection is, on the whole, in line with the general assessment of EDF plant performance. The licensee must nevertheless continue the efforts made in 2018 in safety management, particularly as regards the management of deviations.

With regard to operation and reactor management, ASN considers that the site's performance is satisfactory on the whole. ASN considers that particular attention must be paid to the preparation of operational management activities in order to reinforce the rigour during work on the equipment and during the periodic tests. The management of operational control procedures called out in the phases

ASN inspection at the Penly NPP on the earthquake theme – May 2017

of operational management of incidents or accidents must also be improved.

With regard to the refuelling outages of the two reactors, which were marked by technical contingencies necessitating prolonged repairs, ASN considers that the Penly NPP must improve work preparation and the verification and monitoring of maintenance activities.

In the area of radiation protection, ASN considers that continued improvement of the organisation in place is necessary. The way radiation exposure risks are taken into consideration is found to be highly variable, and ASN still detects numerous deviations during its worksite inspections. The licensee must also continue its ongoing efforts to improve the knowledge and radiological risk awareness of outside contractor personnel.

With regard to environmental protection, ASN considers that the organisation in place for the management of discharges and waste is satisfactory; the licensee made significant waste removal efforts in 2018. ASN also notes an increase in the number of failures of measuring equipment involved in monitoring discharges and the environment.

Flamanville 3 EPR reactor construction worksite

Following issuing of the creation authorisation Decree 2007-534 of 10 April 2007 and of the building permit, construction work on the Flamanville 3 reactor began in September 2007.

The electromechanical installation activities continued in 2018 with, among other things, the hydrostatic test of the nuclear steam supply system main primary system, continuation of assembly of the main secondary and auxiliary systems, modifications to the instrumentation and control of the installation and cable-pulling and electrical connection operations. Important starting test phases were carried out, including in particular the cold tests, the functional tests with reactor vessel open and the continuation of the hot test preliminary tests. ASN conducted a specific inspection of these operations and also checked the measures taken with regard to protection of the environment and preparation for reactor operation.

ASN considers that the organisation put in place for the start-up tests was on the whole satisfactory in 2018. Nevertheless, despite the improvements in EDF's organisation for the start-up tests, continued significant efforts must be made to achieve the prerequisite defined for the performance of the start-up tests and the associated supporting documents to prove the representativeness of these tests. ASN will continue its oversight action on these themes in 2019, particularly in the preparation for operation, the start-up tests and bringing the main secondary systems into compliance.

ASN inspected EDF's organisation for protection of the environment on the worksite, notably the management of the buried waste discovered on the site in 2017 and the integration of the new requirements associated with application of ASN resolutions 2018-DC-0639 and 2018-DC-0640 of 19 July 2018. ASN noted numerous events concerning the environment during 2018, demonstrating insufficient consideration of the risks for the environment when performing the start-up tests.

ASN continues its inspection of the organisation implemented by the teams responsible for future operation of the Flamanville 3 reactor, particularly concerning the preparation for operational control of the installation, control of the fire risk and protection of the environment. ASN considers that substantial work remains to be accomplished in this respect. In view of EDF's current schedule, ASN should conduct an in-depth inspection of this organisation in 2019.

Labour inspection in the nuclear power plants of the Normandie region

ASN conducted oversight actions concerning the conditions of health and safety during maintenance and construction operations and the management of subcontracting in the nuclear power plants.
ASN more specifically examined the conditions of occurrence of several workplace accidents, including one electric shock incident and the several-day isolation of a person who suffered a serious malaise. Inspections were carried out on several NPPs to check the compliance work on fuel handling machines in the reactor buildings and the taking into account of the explosion risk.

The electromechanical assembly operations continued in 2018 and were marked by two major points relating to the main steam pipes:

- continuation of the examination of the deviations relative to the failure to take into account the specific requirements of the break preclusion procedure prior to the manufacture and assembly of these equipment items;
- the discovery of welding defects not detected during the end-of-manufacture inspections.

These points form the subject of an in-depth examination by ASN, which is based on several inspections carried out in 2018 supporting the analysis of the root causes of the detected deviations and the verification of the implementation of appropriate corrective actions to repair the incriminated welds. In view of the significant shortcomings in EDF's monitoring of outside contractors, ASN has asked for a quality review to be performed on the equipment of the Flamanville EPR reactor. In addition to this, the procedure proposed by EDF for dealing with the anomalies detected in the welds of the main pipes of the steam systems is currently being examined. ASN will give its opinion on the acceptability of this procedure in 2019.

ASN ensures the labour inspection missions on the Flamanville 3 worksite. In 2018, ASN checked that outside contractors working on the site complied with the provisions relative to labour law. Observation of the applicable safety rules was checked regularly. ASN also responded to requests coming directly from employees, performed investigations further to workplace accidents and examined or co-examined requests for waivers to provisions of the labour regulations. Lastly, ASN conducted several oversight operations concerning the regulatory provisions governing the transnational secondment of workers.

Manche waste Disposal Facility

The Manche waste Disposal Facility (CSM), which entered service in 1969, was the first radioactive waste repository operated in France. 527,225 m^3 of waste packages are emplaced in it. The CSM stopped accepting waste in July 1994.

In application of Decree 2016-846 of 28 June 2016, the CSM, which is managed by Andra, is considered to be in the decommissioning phase (operations prior to its closure) until installation of the long-term cover has been finished. An ASN resolution shall specify the date of closure of the repository (entry into monitoring and surveillance phase) and the minimum duration of the CSM monitoring and surveillance phase.

ASN considers that the state and the operation of the facilities are satisfactory. Andra must nevertheless continue its efforts to reinforce the stability of the cover and to eliminate the residual infiltrations of water into the repository at the edge of the membrane. More specifically, at the end of 2017, after examining the safety review guidance file, ASN formulated demands concerning the justification of the technical principles of deployment of the long-term cover and of the CSM memory system, and the updating of the impact study.

ASN considers that the organisation defined and implemented on the site to control the operations prior to closure of the facility, and to preserve the condition of the systems, equipment and buildings, is satisfactory. The licensee must nevertheless show greater rigour in the technical oversight of the activities.

National Large Heavy Ion Accelerator

The Ganil (National Large Heavy Ion Accelerator) economic interest group was authorised in 1980 to create an accelerator in Caen (BNI 113). This research facility produces, accelerates and distributes ion beams with various energy levels to study the structure of the atom. The high-energy beams produce strong fields of ionising radiation, activating the materials in contact, which then emit radiation even after the beams have stopped. Irradiation is therefore the main risk presented by the Ganil.

In 2017, the Ganil requested a change in the deadlines of six of the ten requirements of ASN resolution 2015-DC-0512 of 11 June 2015 relative to its first periodic safety review. Examination of this request continued in 2018. Alongside this, ASN noted that the studies and certain compliance work associated with the fire-detection and fire-fighting systems had been started. The licensee must ensure that this work is carried out in compliance with the regulations in effect.

"Exotic nuclei" are nuclei which do not exist naturally on Earth. They are created artificially in the Ganil for nuclear physics experiments on the origins and structure of matter. In order to be able to produce exotic nuclei, the Ganil was authorised in 2012 to build phase 1 of the Spiral 2 project. ASN issued the partial commissioning authorisation for this project at the end of 2014. During the examination of the complete commissioning authorisation application, ASN asked the licensee for additional information, which it provided and enabled the examination to continue.

The Ganil must continue its efforts in the monitoring of the compliance work and procedures relating to worker radiation protection, in the tracking of its commitments and ASN requests and requirements, and more generally in the updating of its integrated management system. The Ganil must also adapt its organisation in view of the commissioning of phase 1 of the Spiral 2 project.

La Hague site

The Orano site at La Hague is located on the north-west tip of the Cotentin peninsula, in the Manche *département*, 20 km west of Cherbourg and 6 km from Cap de La Hague. This site is situated about fifteen kilometres from the Channel Islands.

La Hague Orano Cycle reprocessing plants in operation

The La Hague plants for reprocessing fuel assemblies irradiated in the nuclear reactors are operated by Orano Cycle.

The various facilities of the UP3-A (BNI 116) and UP2-800 (BNI 117) plants and of the STE3 (BNI 118) effluent treatment station were commissioned from 1986 (reception and storage of spent fuel assemblies) to 2002 (R4 plutonium reprocessing facility), with most of the process facilities entering service in 1989-1990.

The Decrees of 10 January 2003 set the individual reprocessing capacity of each of the two plants at 1,000 tonnes per year, in terms of the quantities of uranium and plutonium contained in the fuel assemblies before burn-up (in the reactor), and limit the total capacity of the two plants to 1,700 tonnes per year. The limits and conditions for discharges and for water intake by the site are defined by two ASN resolutions of 22 December 2015.

Operations carried out in the plant

The reprocessing plants comprise several industrial units, each intended for a particular operation. Consequently there are facilities for the reception and storage of spent fuel assemblies, for their shearing and dissolution, for the chemical separation of fission products, uranium and plutonium, for the purification of uranium and plutonium, for treating the effluents and for packaging the waste.

The effluents and waste generated by the operation of the plants

The fission products and other transuranic elements resulting from reprocessing are concentrated, vitrified and packaged in Standard Vitrified Waste Packages (CSD-V). The pieces of assembly cladding are compacted and packaged in Standard Compacted Waste Packages (CSD-C). These reprocessing operations, which are detailed in chapter 11, involve chemical and mechanical processes which produce gaseous and liquid effluents and solid waste.

Oversight of the La Hague plants

On-site transport

Application of the general operating rules specific to the on-site transport of hazardous radioactive and non-radioactive substances is now operational on the La Hague site. The licensee has applied for an extension to the end-of-2018 deadline for the improvements in the transport systems demanded by ASN in its resolution of 3 May 2016, due to difficulties in implementing these improvements. This extension application is currently being examined by ASN.

Tracking the compliance notice concerning the Nuclear Pressure Equipment (NPE)

The La Hague site plants contain various nuclear pressure equipment items which can present a high risk for safety. The design, manufacture and maintenance of nuclear pressure equipment is governed by a specific regulation, the ESPN (French acronym for NPE) Order. Through ASN resolution 2015-DC-0510 of 26 May 2015, ASN gave the licensee formal notice to comply with the regulatory obligations for periodic inspection of the NPE in service. This compliance notice resolution contains deadlines extending over the period from 31 January 2016 to 31 July 2018.

For the 54 NPE items concerned by the compliance notice, the licensee has either carried out the required regulatory actions or submitted an equipment downgrading or shutdown notification, or applied for authorisation to waive the regulatory provisions by producing the necessary technical justifications. Their examination has led ASN to issue resolutions to authorise the waivers and set compensatory measures to guarantee a level of safety at least equivalent to that resulting from full accomplishment of the common law measures. In the light of these elements, ASN notified the licensee on 7 September 2018 that the provisions of its compliance resolution 2015-DC-0510 were satisfied

Additional requirements further to the stress tests

In 2018, ASN continued its inspections concerning the implementation of physical and organisational measures associated with the stress tests carried out further to the Fukushima Daicchi accident. In particular, the provisions relative to the emergency situation management premises prescribed by ASN resolution 2015-DC-0483 of 8 January 2015 were put in place within the required time frame. ASN will be particularly attentive in 2019 to the measures for managing the accident situations feared for legacy waste storage areas.

Examination of the safety review reports

In the context of the periodic safety review of BNI 117, ASN has verified the conformity check carried out by the licensee, and in particular the aspect concerning the ageing of the facilities. ASN notes that the methodological procedure adopted by the licensee for this periodic safety review is ambitious and rigorous. However, random sampling checks of its implementation have revealed deficiencies in traceability between the various steps of the method used for

the review and the conformity check. This weakness results in an insufficient level of control of the action plan and could be prejudicial to its implementation over the long term.

ASN analysed the admissibility of the periodic safety review report for BNI 118 submitted by Orano Cycle in November 2017. It considered it generally satisfactory with regard to the requirements of the Environment Code, but nevertheless requested additional information concerning the conformity check of the activities important to protection, and the examination of the protection measures with respect to fire, the tornado hazard, and the dimensioning of the emergency management resources. The safety review report is currently being examined.

Management of the condition of the evaporation concentration containers

ASN continued to verify implementation of the provisions of ASN resolution 2016-DC-0559 of 23 June 2016 relative to the fission product evaporators, issued further to the finding of a rate of corrosion exceeding that considered in their design.

The regular assessments of the results of the monitoring actions on these equipment items and of the regulatory inspections carried out by the licensee and communicated to ASN show that the thickness of evaporator 4120-23 in the T2 facility, identified as being the most affected by corrosion, is close to the minimum required thickness. Given the corrosion

The installations at La Hague

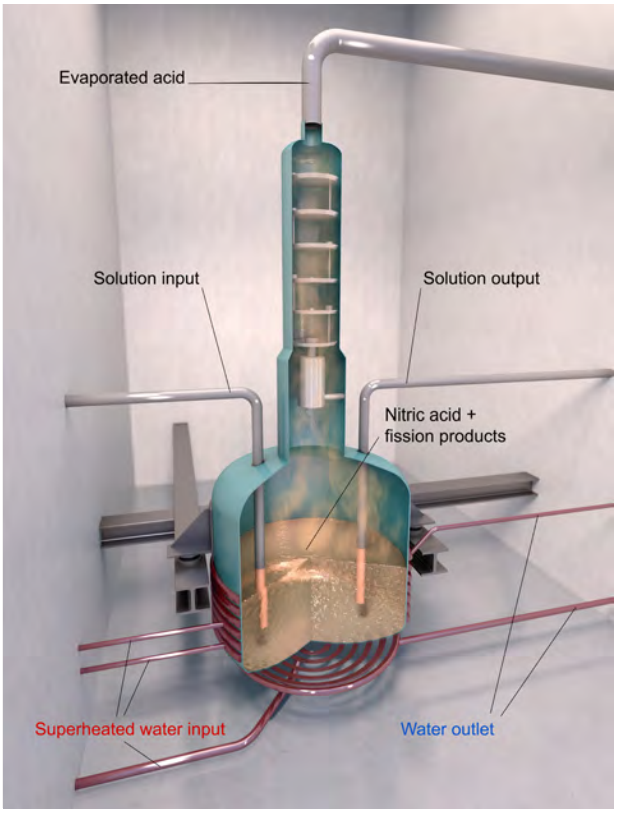
Shut down installations undergoing decommissioning:

- **BNI 80: Oxide High Activity facility (HAO)**
  - HAO/North: Facility for underwater unloading and spent fuel storage
  - HAO/South: Facility for shearing and dissolving of spent fuel elements
- **BNI 33: UP2-400 facility, first reprocessing unit**
  - HA/DE: Facility for separation of uranium and plutonium from fission products
  - HAPF/SPF (1 to 3): Facility for fission product concentration and storage
  - MAU: Facility for uranium and plutonium separation, uranium purification and storage in the form of uranyl nitrate
  - MAPu: Facility for purification, conversion to oxide and initial packaging of plutonium oxide
  - LCC: Central product quality control laboratory
  - ACR: Resins packaging facility
- **BNI 38: STE2 facility: Collection, treatment of effluents and storage of precipitation sludge, and AT1 facility, prototype installation currently being decommissioned**
- **BNI 47: ELAN II B facility, CEA research installation currently being decommissioned**

Installations in operation:

- **BNI 116: UP3-A plant**
  - T0: Facility for dry unloading of spent fuel elements
  - D and E pools: Pools for storage of spent fuel elements
  - T1: Facility for shearing of fuel elements, dissolving and clarification of solutions obtained
  - T2: Facility for separation of uranium, plutonium and fission products, and concentration/ storage of fission product solutions
  - T3/T5: Facilities for purification and storage of uranyl nitrate
  - T4: Facility for purification, conversion to oxide and packaging of plutonium
  - T7: Facility for vitrification of fission products
  - BSI: Facility for plutonium oxide storage
  - BC: Plant control room, reagent distribution facility and process control laboratories
  - ACC: Hull and end-piece compaction facilities
  - AD2: Technological waste packaging facility
  - ADT: Waste transit area
  - EDS: Solid waste storage area
  - D/E EDS: Storage/removal from storage of solid waste
  - ECC: Facilities for storage and recovery of technological waste and packaged structures
  - E/EV South-east: vitrified residues storage facility
  - E/EV/LH and E/EV/LH 2: Extension of vitrified residues storage capacity
- **BNI 117: UP2-800 facility**
  - NPH: Facility for underwater unloading and storage of spent fuel elements in pool
  - C pool: Pool for storage of spent fuel elements
  - R1: Fuel elements shearing, dissolving and resulting solutions clarification facility (including the URP: Plutonium Re-dissolution Facility)
  - R2: Uranium, plutonium and fission product separation, and fission product solution concentration facility (including the UCD: alpha waste centralised processing unit)
  - R4: Facility for purification, conversion to oxide and initial packaging of plutonium oxide
  - SPF (4, 5, 6): Facilities for storage of fission products
  - BST1: Facility for secondary packaging and storage of plutonium oxide
  - R7: Facility for vitrification of fission products
  - AML - AMEC: Packaging reception and maintenance facilities
- **BNI 118: STE3 facility: Effluent recovery and treatment and storage of bituminised waste packages**
  - D/E EB: Storage of alpha waste
  - MDS/B: mineralisation of solvent waste

Diagram of an evaporator and details of the half-tubes of the heating circuit



kinetics, this could lead the licensee to stop its operation around 2020.

Evaporator monitoring will remain a subject of particular attention for ASN until the new evaporators replacing the current ones are put into service.

In November 2016, ASN gave an opinion on the safety options presented by the licensee for new fission product evaporators. In November 2017, it authorised construction of the civil engineering structures of the new buildings that are to house the evaporators, and it inspected the construction worksites in 2018. ASN considers the monitoring of the service providers to be satisfactory. Orano Cycle must submit the application for authorisation to use these new evaporators to ASN in 2019.

La Hague Orano Cycle reprocessing plants undergoing decommissioning

UP2-400 irradiated fuel reprocessing plant

The former UP2-400 plant (BNI 33) was commissioned in 1966 and has been definitively shut down since 1 January 2004. Final shutdown also concerns the three BNIs associated with the UP2-400 plant: BNI 38 (STE2 installation and AT1 facility), BNI 47 (ELAN IIB facility) and BNI 80 (HAO facility). The ongoing operations in the four BNIs concern the retrieval and packaging of legacy waste and decommissioning.

Retrieval and packaging of legacy waste

Unlike the direct on-line packaging of the waste generated by the new UP2-800 and UP3-A plants at La Hague, most of the waste generated by the first UP2-400 plant was stored in bulk without permanent packaging. The operations to retrieve this waste are technically delicate and necessitate substantial means. They present major safety and radiation risks, which ASN monitors with particular attention.

The retrieval of the waste contained in the old storage facilities on the La Hague site is also a precondition for the decommissioning and clean-out of these storage facilities.

Over the years, retrieval of this waste has fallen considerably behind the initial schedule and continued to do so in recent years. ASN considers that any pushing back of deadlines must be justified by Orano Cycle and accompanied by compensatory measures that enable the risk to be reduced to the lowest level possible, because the buildings in which this legacy waste is stored are ageing and do not meet current safety standards. ASN considers in particular that Orano Cycle must retrieve the legacy waste produced by operation of the UP2-400 facility as quickly as possible, and more specifically the sludges stored in the STE2 silos, the waste from the HAO and 130 silos, and continue the processing of the fission product solutions stored in the SPF2 unit.

ASN has regulated all the legacy waste retrieval and packaging programmes at La Hague through prescriptions stipulated in resolution 2014-DC-0472 of 9 December 2014. This resolution defines priorities in terms of the safety of the legacy waste retrieval and packaging operations and sets milestones for each of the programmes concerned.

STE2

The scenario presented in 2010 concerning the retrieval and packaging of STE2 sludges is divided into three steps:
- retrieval of sludges stored in silos in STE2 (BNI 38);
- transfer and processing, initially by drying and compacting, in STE3 (BNI 118);
- packaging of the resulting pellets in «C5» packages for deep geological disposal.

Schematic diagram of retrieval and packaging of the waste from Silo 130

ASN authorised the first phase of work to retrieve the sludges from STE2 in 2015. During 2017, Orano Cycle submitted additional information relating to the first phase of the work and an authorisation application concerning the process for retrieving the sludges from STE2 and transferring them to STE3. This file is currently being examined.

The creation authorisation decree for the STE3 effluents treatment station was modified by the Decree of 29 January 2016 to allow the installation of the STE2 sludges treatment process.

Orano Cycle, however, has informed ASN that the process adopted for treating the sludges in STE3 could lead to difficulties in equipment operation and maintenance. It has also presented the alternative centrifuge treatment scenario that it intends implementing, which will lead to the production of drums for interim storage in the existing dedicated facility. Orano Cycle plans submitting a safety options file in 2019. The currently prescribed regulatory deadline for starting retrieval of the sludges will not be met.

Silo 130

Silo 130 is a reinforced concrete underground storage facility, with carbon steel liner, used for dry storage of solid waste from the reprocessing of Gas-Cooled Reactor (GCR) fuels, and the storage of technological waste and contaminated soils and rubble. The silo received waste of this type as from 1973, until the 1981 fire which forced the licensee to flood the waste. The leak-tightness of the silo thus filled with water is today only ensured by a single containment barrier consisting of a steel “skin”. Silo 130 is monitored by a network of piezometers situated nearby. The scenario for retrieving and packaging this waste comprises four stages:

- retrieval and packaging of the solid GCR waste;
- retrieval of the liquid effluents;
- retrieval and packaging of the residual GCR waste and the sludges from the bottom of the silo;
- retrieval and packaging of the soils and rubble.

Orano Cycle has built a retrieval unit above the pit containing the waste and a new building dedicated to the storing and packaging operations. ASN had set 1 July 2016 as the start date for all the waste retrieval operations. In the light of the justifications provided by Orano Cycle concerning the technical difficulties encountered, ASN pushed back the operations start date to 30 April 2018. Orano Cycle, however, did not meet this new regulatory deadline, even though the ventilation system of the retrieval and packaging facilities was actively connected in 2018 and the tests important to safety prior to entry of the facilities into active service were also started in 2018. After noting during an inspection that waste retrieval had effectively not yet started in April 2018, and taking account of the new technical and organisational difficulties encountered during the tests, ASN asked Orano Cycle to propose a realistic deadline for starting waste retrieval, explicitly defining the margins on the critical path and the margins for residual risks, with justifications. The examination of the authorisation applications concerning the first retrieval phases continued in 2018.

The old fission product solutions stored in the SPF2 unit of the UP2-400 plant

The licensee has chosen cold crucible vitrification for the packaging of the fission products resulting from the reprocessing of fuels from the Gas-Cooled Reactor series and containing molybdenum (UMo FP) in particular. The package thus produced is a Standard UMo Vitrified Waste Package (CSD-U).

Operational application of cold crucible vitrification was authorised by resolution of 20 June 2011. Unforeseeable problems were encountered during its development and implementation. Consequently, Orano Cycle was unable to meet the end-of-retrieval deadline set at 31 December 2017 by ASN resolution of 26 June 2012 and asked for this deadline to be pushed back until the end of 2019, on the basis of the CSD-U package production rate in 2018. This application is currently being reviewed by ASN.

The nuclear safety issues associated with Silo 130

Silo 130 was designed and built in compliance with the nuclear safety requirements in force in the 1960's. The structure of the Silo 130 civil engineering is today weakened by ageing and by the fire of 1981. Furthermore, the waste, which was initially stored dry, is now submerged in a large volume of water resulting from the extinguishing of the 1981 fire. The water is therefore in direct contact with the waste and can contribute to the corrosion of the carbon steel lining, which today is the sole containment barrier.
One of the major risks therefore concerns the dispersion of radioactive substances into the environment (infiltration of the contaminated water into the water table).
Another factor that can compromise the safety of Silo 130 is linked to the nature of the substances present in the waste, such as magnesium, which is pyrophoric. Hydrogen, a highly inflammable gas, can also be produced by the phenomena of radiolysis or corrosion (presence of water). These elements contribute to the fire and explosion risks.

Final shutdown and decommissioning operations

HAO facility

BNI 80 carried out the first stages of the reprocessing of spent nuclear fuels: reception, storage then shearing and dissolution. The dissolution solutions produced in BNI 80 were then transferred to the UP2-400 industrial plant in which the subsequent reprocessing operations took place.

BNI 80 comprises:
- HAO North, spent fuel unloading and storage site;
- HAO South, in which the shearing and dissolution operations were carried out;
- the «filtration» building, which accommodates the filtration system for the pool of the HAO South facility;
- the HAO silo, in which are stored the hulls and end-pieces (fragments of cladding and fuel end-pieces) in bulk, fines coming primarily from shearing, and resins and technological waste from the operation of the HAO facility between 1976 and 1997;
- the SOC (Organised Storage of Hulls) comprising three pools in which the drums containing the hulls and end-pieces are stored.

Decommissioning of the HAO facility was authorised by Decree of 31 July 2009. Orano Cycle encountered difficulties during the operations prior to decommissioning of cells 904 and 906 (difficulties in particular in achieving a radiological level in cell 906 compatible with semi-remote decommissioning operations, which led it to revise its decommissioning scenario. The new scenario will be presented to ASN in 2019.

The waste retrieval and packaging project currently under way in the HAO silo and the SOC, represents the first hold point in the decommissioning of the facility. Orano Cycle has expressed its difficulties in meeting the prescribed deadlines for retrieval of the waste contained in the HAO silo and the SOC. Pushing back the deadlines will make it necessary to modify the Decree of 31 July 2009. In 2018, the licensee continued the construction of the cell for the waste retrieved from the silo, and in late November 2018 it installed all the large equipment items.

Alongside this, BNI 80 had undergone a periodic safety review. Further to the examination of this review, ASN set additional requirements in a resolution of 4 January 2018.

UP2-400 plant, STE2 effluent treatment station and ÉLAN IIB facility

In July 2015, Orano Cycle submitted complete decommissioning files for BNIs 33 and 38. It also submitted the safety review reports for BNIs 33, 38 and 47. The examination of the reviews, conducted jointly with that of the decommissioning files, serves among other things to ascertain that the ageing management provisions are compatible with the decommissioning strategy envisaged by the licensee, in particular with the projected duration of the decommissioning project as a whole. The licensee must carry out additional studies of the earthquake resistance of the LCC (Central quality Control Laboratory). In 2018, Orano Cycle submitted updates to the decommissioning files for BNIs 33 And 38. The licensee continued carrying out the decommissioning operations authorised by the Decrees of 2013, notably in BNI 33. The decommissioning of BNI 33 is progressing satisfactorily, while that of BNI 38 is encountering difficulties, essentially due to the uncertainties about the radiological and chemical content of the cells. As far as BNI 47 is concerned, the results of the additional characterisations, prerequisites for the decommissioning operations, led Orano Cycle to start revising the decommissioning scenario, which will be presented to ASN in 2019. ASN nevertheless notes that Orano Cycle is endeavouring to establish action plans to control the schedule drifts.

Assessment of the La Hague site

ASN considers the results of Orano Cycle's activity at the La Hague site to be fairly satisfactory in the area of nuclear safety and satisfactory on the whole for worker radiation protection and environmental protection. ASN nevertheless notes that the licensee must improve the points developed below, particularly the management of maintenance and the periodic checks and the tracking of action plans.

Several inspections and events highlighted shortcomings in the periodic checks required by the General Operating Rules (RGE). ASN more specifically noted periodic checks that were not performed, and difficulties in demonstrating satisfactory training of the workers responsible for these checks.

In early 2018, the licensee subcontracted maintenance technical services, all trades combined, to an outside company for each of the three operational units of the plants in operation. These new contracts, called «multi-technique contracts», group together varied services which are themselves subcontracted in whole or in part. The ASN inspections showed that there were major implications in terms of skills and knowledge of the facilities for the chosen contractors.

Furthermore, the licensee must improve the robustness of its preventive maintenance policy for Equipment Important to Protection (EIP) and the control of its implementation. The preventive maintenance of the EIPs helps ensure the durability of their qualification, in the same way as the periodic checks and tests.

With regard to the monitoring of outside contractors, the licensee must reinforce its method of preparing the monitoring plans, taking into account the risks associated with subcontracted operations, and improve the skills and qualification of its monitoring personnel and their embracing of the specific provisions of the Order of 7 February 2012. These actions are all the more important given the implementation of these multi-technique contracts which require monitoring methods that are suited to the grouping of services.

ASN considers that Orano Cycle must continue the actions undertaken to improve the monitoring and managing of deviations and the associated lessons learned. Orano Cycle must better characterise the deviations, reduce their processing times, deepen the analysis of causes to develop preventive measures which are sometimes neglected in favour of curative actions. The actions plans drawn up further to the lessons learned from deviations or events reported to ASN must be implemented with greater rigour. ASN has observed delays in the implementation of actions associated with the control of handling operations.

ASN has noted lines for improvement with regard to the integration of Organisational and Human Factors (OHF) in the processes relating to organisational modifications and safety, implementation of the associated baseline requirements of the Orano group and decompartmentalisation of the departments in which the site's skills are situated. Orano Cycle must develop its resources and the professionalization of its network of OHF representatives in order to improve its abilities to assess early warning signs, deviations and events, and to deepen the analysis of the root and organisational causes of malfunctions. Orano Cycle must also ensure that the skills specific to this subject are better integrated in the preparation and monitoring of organisational changes.

During inspections on the fire theme, the inspectors noted problems with accessibility of buildings for the fire-fighting teams due to the presence of several major worksites and a lack of upkeep of certain secondary access points. Such situations can cause additional delays in response team interventions. On the other hand, progress was noted in compliance with the places specifically reserved for the emergency means, guaranteeing deployment of the response teams as close as possible to where they are needed.

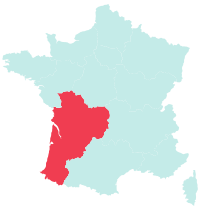
With regard to the periodic checks of the emergency means, ASN notes a widespread drift in the annual inspections of the site's fire extinguishers, indicating shortcomings in the licensee's organisation for tracking these checks.

Lastly, ASN carried out unannounced emergency situation simulations and finds that Orano Cycle must improve the coordination between its measures to control the fire risk and the measures to physically protect the nuclear materials.

In the context of the review of the analysis of risks associated with hazardous substances conducted by Orano Cycle in early 2018, ASN conducted an inspection to check *in situ* the operational nature of the safety barriers described by the licensee. ASN considers that significant improvements must be made regarding the prevention of major accidents involving hazardous substances. ASN has asked the licensee to significantly improve the non-radiological-risk culture of its teams and its means for checking risk prevention measures. The licensee must also carry out an in-depth assessment of the measures taken to prevent explosion risks and to protect the installations.

With regard to worker radiation protection, the organisation defined and implemented on the La Hague site and the results obtained are found to be satisfactory on the whole. Random sampling checks have nevertheless revealed deficiencies in cordoning off radiological zones, lateness in performing measuring instrument calibration checks and a lack of rigour in the updating of the radiation protection grids defining the radiological zoning of the installations (traceability of changes in the radiological zoning of the rooms). Furthermore, ASN has noted the increase in subcontracting of the radiation protection activity and the emergence of difficulties in recruiting and ramping up the skills of the service providers, points that will receive particular attention in 2019.

With regard to control of impacts and discharges, the organisation defined and implemented on the La Hague site and the results obtained are found to be satisfactory. ASN considers that Orano Cycle must be attentive to the rigour of management of the waste storage areas and continue its efforts to control the risks associated with the management of waste collection and packaging points.



Nouvelle-Aquitaine region

The Bordeaux division regulates nuclear safety, radiation protection and the transport of radioactive substances in the 12 *départements* of the Nouvelle-Aquitaine region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- BNIs:
  - the Blayais NPP (4 reactors of 900 MWe);
  - the Civaux NPP (2 reactors of 1,450 MWe);

- small-scale nuclear activities in the medical sector:
  - 19 external-beam radiotherapy departments;
  - 6 brachytherapy departments;
  - 24 nuclear medicine departments;
  - 91 centres performing fluoroscopy-guided interventional procedures;
  - 90 computed tomography scanners;
  - some 6,000 medical and dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - 679 industrial and research establishments, including 46 companies exercising an industrial radiography activity;
  - 1 cyclotron particle accelerator;
  - 67 laboratories situated mainly in the universities of the region;
  - 19 companies using gamma ray densitometers and 352 users of devices for detecting lead in paint;
  - 475 veterinary surgeries or clinics practising diagnostic radiology;

- activities linked to the transport of radioactive substances;

- ASN-approved laboratories and organisations:
  - 5 organisations approved for radiation protection technical controls.
  - 8 organisations approved for measuring radon;
  - 4 laboratories approved for taking environmental radioactivity measurements.

In 2018, ASN carried out 141 inspections in the Nouvelle-Aquitaine region, comprising 45 inspections in the Blayais and Civaux NPPs, 80 inspections in the small-scale nuclear activity sector, 6 inspections in the area of radioactive substance transport and 10 inspections of approved organisations and laboratories.

ASN also carried out 21 days of labour inspection at the Blayais NPP and 11 days at the Civaux NPP.

During 2018, 10 significant events rated level 1 on the INES scale were notified by the NPP licensees in the Nouvelle-Aquitaine region. In small-scale nuclear activities, 8 events concerning radiotherapy patients were rated level 1 on the ASN-SFRO scale and 1 was rated level 2.

Blayais nuclear power plant

Situated in the Gironde *département*, 50 km north of Bordeaux, the Blayais site accommodates the NPP operated by EDF. This NPP comprises four 900 MWe pressurised water reactors. Reactors 1 and 2 constitute BNI 86 and reactors 3 and 4 BNI 110.

ASN considers that the performance of the Blayais NPP with respect to its general assessment of EDF performance:
- is on the whole comparable with regard to nuclear safety;
- stands out positively with regard to radiation protection;
- is below average with regard to environmental protection.

With regard to safety, ASN notes that the reactor refuelling and maintenance outages went well. ASN nevertheless observes that the site has persistent difficulties in planning, preparing and performing the periodic tests required by the general operating rules. As in the preceding years, the quality

of the operational documentation constitutes a weak point for the smooth running of these tests, which introduces a risk of noncompliance with the procedures. Deficiencies in technical control and operational communication were also observed on several occasions.

As far as occupational radiation protection is concerned, ASN observes a significant drop in the number of significant event notifications compared with the preceding years. ASN notes that the licensee has met its targets with regard to collective dosimetry and radiological cleanliness of worksites. ASN does nevertheless note a few situations that reveal a lack of radiation protection culture in some workers and a lack of rigour in the management of radioactive sources.

With regard to protection of the environment, the licensee has identified the probable origin of the legacy presence of tritium in the captive water table situated beneath the power plant. The presence of tritium is in all likelihood due to leaks in the floors of the nuclear auxiliaries buildings of reactors 3 and 4. It nevertheless has no impact outside the site. ASN considers that the continuation of investigations and the implementation of repairs must be a priority for the site in 2019. ASN notes the substantial efforts made by the licensee to improve the management of its radioactive waste in accordance with the applicable rules, which the inspectors had found deficient early in the year.

Civaux nuclear power plant

The Civaux NPP is operated by EDF in the Vienne *département*, 30 km south of Poitiers in the Nouvelle-Aquitaine region. It comprises two 1,450 MWe pressurised water reactors. Reactors 1 and 2 constitute BNIs 158 and 159 respectively. The site accommodates one of the regional bases of the Nuclear Rapid Intervention Force (FARN) created by EDF in 2011.

ASN considers that the radiation protection and environmental protection performance of the Civaux NPP are on the whole in line with its general assessment of EDF performance, but that its nuclear safety performance falls short of this general assessment.

In the area of safety, ASN notes that during the maintenance outages of reactors 1 and 2 the licensee evidenced numerous shortcomings in the preparation, planning and performance of maintenance operations on equipment important for safety. These difficulties led to maintenance non-qualities, which the site has since corrected. ASN considers that the quality of maintenance has deteriorated with respect to the preceding years. EDF has not sufficiently learned the lessons from the maintenance outage of 2017. With regard to the operating activities, ASN considers that reactor operational management is on the whole carried out with rigour, but the site must still make further efforts in this area.

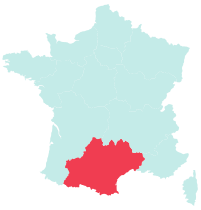
ASN considers that radiation protection must be taken into greater consideration in work preparation. ASN considers that the licensee must improve the optimisation of radiation doses received by the workers and improve the management of worker access to certain regulated areas in order to limit the risk of exposure to ionising radiation. It notes that radioactive sources are managed with rigour.

In the area of environmental protection, ASN considers that the licensee must improve its management strategy for accidental spillages of hazardous products on the site to prevent their transfer into the environment. It also considers that the licensee must improve its management of the microbiological risk and of radioactive waste on its facilities.

Labour inspection in the nuclear power plants of the Nouvelle-Aquitaine region

A tightened inspection at the Blayais NPP revealed a lack of command of the European regulations relative to the chemical risk. ASN will assess the measures taken by the licensee during 2019.
Specific investigations were carried out following workplace accidents and in response to specific requests concerning employees of outside companies. A tooling verification request was made on this occasion.

At the Civaux NPP, the labour inspectors made observations concerning compliance with the volumes of fresh air supplied in confined spaces, which led the licensee to postpone certain maintenance operations. A tightened inspection highlighted a lack of command of the European regulations relative to the chemical risk. ASN will assess the measures taken by the licensee during 2019. The labour inspectors noted that the inspection perimeter and the follow-up to observations made by an accredited organisation during the regulatory checks had to be improved, particularly in the electrical area. A request to have the electrical systems verified was made at the end of this inspection. Lastly, specific investigations were carried out following workplace accidents and in response to specific requests concerning employees of outside companies.



Occitanie region

The Bordeaux and Marseille divisions jointly regulate nuclear safety, radiation protection and the transport of radioactive substances in the 13 *départements* of the Occitanie region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- BNIs:
  - the Golfech NPP comprising 2 pressurised water reactors of 1,300 MWe;
  - the Melox MOX nuclear fuel production facility;
  - the CEA Marcoule research centre, which includes the civil BNIs Atalante and Phénix and the Diadem waste storage facility construction site;
  - the Centraco facility for processing low-activity waste;
  - the Gammatec industrial ioniser;
  - the Ecrin facility for storing waste on the Malvési site;

- small-scale nuclear activities in the medical sector:
  - 14 external-beam radiotherapy departments;
  - 6 brachytherapy departments;
  - 20 nuclear medicine departments;
  - 101 centres performing fluoroscopy-guided interventional procedures;
  - 118 computed tomography scanners;
  - some 5,000 medical and dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - about 500 industrial and research establishments, including 26 companies exercising an industrial radiography activity;
  - 4 cyclotron particle accelerators;
  - 79 laboratories situated mainly in the universities of the region;
  - about 300 users of devices for detecting lead in paint;
  - about 450 veterinary surgeries or clinics practising diagnostic radiology;

- activities linked to the transport of radioactive substances;

- activities linked to the transport of radioactive substances;
  - 3 head offices of laboratories approved for taking environmental radioactivity measurements;
  - 7 head offices of organisations approved for radiation protection controls.

In 2018, ASN carried out 124 inspections in the Occitanie region, comprising 40 inspections in BNIs, 68 inspections in small-scale nuclear activities, 8 in the transport of radioactive substances and 8 concerning organisations and laboratories approved by ASN.

ASN also carried out 12 days of labour inspection at the Golfech NPP.

During 2018, seven significant events rated level 1 on the INES scale were reported by nuclear installation licensees. In small-scale nuclear activities, 2 significant events rated level 1 on the INES scale were reported to ASN. Four events involving radiotherapy patients were rated level 4 on the ASN-SFRO scale.

ASN also drew up one violation report against a medical centre.

Golfech nuclear power plant

The Golfech NPP operated by EDF is located in the Tarn-et-Garonne *département*, 40 km west of Montauban. This NPP comprises two 1,300 MWe pressurised water reactors. Reactor 1 constitutes BNI 135 and reactor 2 BNI 142.

ASN considers that the environmental protection and radiation protection performance of the Golfech NPP are on the whole in line with its general assessment of EDF performance, but that its nuclear safety performance falls short of this general assessment.

Labour inspection in the Golfech nuclear power plant

With regard to labour inspection, the inspectors noted in 2018 that the inspection perimeter and the follow-up of the observations made by an accredited organisation during regulatory checks concerning the handling cranes in particular needed to be improved.
A tightened inspection highlighted a lack of command of the European regulations relative to the chemical risk. ASN will assess the measures taken by the licensee during 2019.

In the area of nuclear safety, ASN observes that the quality of operational control has deteriorated with respect to the preceding years, resulting in the reporting of numerous significant events for safety, 4 of which are rated level 1 on the INES scale. ASN notes that the staffing of the team in charge of operational control of reactor 2 was at the absolute minimum required on several occasions during the scheduled outage and that the conditions for ensuring serenity in the control room were deteriorated on both reactors. The scheduled outage of reactor 2 went well on the whole. The licensee took account of the lessons learned from the shutdowns of 2017. ASN nevertheless considers that the improvements in activity preparation must continue. Lastly, ASN considers that the Golfech licensee must continue to improve its capacity to detect, analyse and process the deviations affecting its installations.

With regard to environmental protection, ASN notes that the site must improve its management of hazardous substances, particularly the identification of substances and knowledge of their toxicity for the environment and for humans. ASN nevertheless underlines the site's progress in management of the microbiological risk and of waste.

With regard to occupational radiation protection, ASN notes deficiencies in the preparation and conducting of activities involving serious radiation risks. The site has persistent difficulties in meeting the dosimetric targets it sets itself.

Marcoule platform

The Marcoule nuclear platform is situated to the west of Orange in the Gard *département*. Its 6 civil installations are dedicated to research activities relating to the downstream part of the fuel cycle and the irradiation of materials, and to industrial activities concerning in particular the fabrication of MOX fuel, the processing of radioactive waste and the irradiation of materials. The majority of the site is occupied by defence nuclear installations.

CEA Marcoule centre

Created in 1955, the CEA Marcoule centre accommodates three civil installations: the Atalante laboratories (BNI 148), the Phénix reactor (BNI 71) and the Diadem storage facility (BNI 177).

Atalante facility – CEA Centre

The main purpose of the Atalante facility (BNI 148), created in the 1980s, is to conduct research and development on the recycling of nuclear fuel, the management of ultimate waste and the exploration of new concepts for fourth generation nuclear systems. Developments were made in 2017 to extend the research activities by accommodating the activities and equipment of the LEFCA (Laboratory for Research and Fabrication of Advanced nuclear Fuels), transferred from the CEA Cadarache centre.

In December 2016, the CEA submitted the facility's periodic safety review report to ASN. In 2018, ASN asked the CEA for additional information concerning in particular the protection of the facility against external hazards (lightning and flooding), control of the risk of loss of electrical power, and the methodology for radiological and chemical characterisation of the soils. The CEA provided additional information in 2018 and this is currently being examined.

ASN considers that the level of safety of Atalante is on the whole satisfactory. Shortcomings have nevertheless been noted in the provisions for monitoring outside contractors, particularly those performing periodic checks and tests on the facility. ASN moreover carried out a reactive inspection following an incident that occurred on 19 December 2018 involving the shattering of a bottle containing a radioactive liquid while being handled in a glove box, resulting in the injury of the worker performing the operation.

Phénix reactor – CEA Centre

The Phénix reactor is a demonstration fast breeder reactor cooled with liquid sodium. This reactor, with an electrical power rating of 250 MWe, was definitively shut down in 2009 and is currently being decommissioned.

The broad phases of its decommissioning are governed by Decree 2016-739 of 2 June 2016. ASN resolution 2016-DC-0564 of 7 July 2016 prescribes various decommissioning milestones and operations for the CEA.

The licensee is currently conducting actions to meet the ASN requirements and to fulfil the commitments it made further to the periodic safety review.

ASN considers that the level of nuclear safety and radiation protection of the Phénix reactor is on the whole satisfactory. Removal of irradiated fuels and the first decommissioning activities (removal of equipment, etc.) continued in 2018 under suitably safe conditions, but at a slower rate than planned as far as fuel removal is concerned. The

construction of the NOAH facility and the putting in place of the equipment that will be used to treat the sodium from Phénix and other CEA installations, also progressed in 2018. The commissioning file for this facility is to be received in 2019. Management of the modifications to the facility must moreover be improved.

Diadem facility – CEA Centre

The Diadem facility, currently under constructions, shall be dedicated to the storage of containers of radioactive waste emitting beta and gamma radiation, or waste rich in alpha emitters, pending construction of facilities for the disposal of long-lived waste, or low and intermediate-level short-lived wastes whose characteristics – especially the dose rate – means they cannot be accepted as-is by the Aube repository (CSA)

At the end of 2018, the CEA Informed ASN that certain construction operations were being put on hold for budgetary reasons.

ASN considers that worksite management is satisfactory. It underlines that this facility is to play a key role in the overall decommissioning and waste management strategy of the CEA, and considers that the CEA must rapidly resume the operations necessary for its commissioning.

Assessment of the CEA Marcoule centre

ASN considers that the level of nuclear safety and radiation protection of the CEA Marcoule centre is on the whole satisfactory. Regarding environmental protection, the centre's piezometers are currently being brought into conformity with the Order of 11 September 2003.
ASN considers that the management of on-site transport operations at the Marcoule centre is relatively satisfactory. Management of the on-site transport baseline rules must nevertheless be improved.
In the context of the stress tests carried out further to the Fukushima Daiichi accident, CEA Marcoule in 2018 submitted an update of its file relative to the planned work to reinforce the centre's emergency management building against the tornado risk. The ongoing examination of this file will endeavour to assess the impact of these reinforcements on the seismic resistance of the buildings and the demonstration of habitability and accessibility of the premises in the different potential accident situations.

Melox plant

Created in 1990 and operated by Orano Cycle, the Melox plant (BNI 151) produces MOX fuel which consists of a mix of uranium and plutonium oxides.

The licensee submitted its periodic safety review guidance file for the installation in 2018. The licensee had moreover taken all the necessary measures to meet its commitments and the requirements of ASN resolution 2014-DC-0440 of 15 July 2014, further to its previous periodic safety review.

ASN considers that the level of nuclear safety and radiation protection of the Melox plant remains satisfactory.

The containment barriers on which a large part of the safety case is based are effective and robust. The low-level events observed over the last two years concerning noncompliance with the rules of entry into and exit from specially identified areas within the plant, as much for personnel radiation protection as for safe management of radioactive waste, have come slightly down in number.

The major radiation risks in the plant are addressed with rigour, the licensee having undertaken in particular to conduct work over the long term to achieve significant dosimetric improvements as part of the work environment optimisation rendered necessary by the ageing of the plant.

The criticality risk, which is a major factor in this type of installations, suitably addressed by the licensee. With regard to this risk, low-level events did nevertheless occur in 2018, notably during maintenance operations in which operators have to work on the automated lines (referred to as «manual-slaved» control mode). Orano Cycle also informed ASN on 13 April 2018 of noncompliance with a criticality risk management rule prior to the introduction of a new motor into one of the glove boxes of the pelletizing facility. This event was rated level 1 on the INES scale because it concerned noncompliance with a safety-criticality rule.

With regard to the lessons learned from the Fukushima Daiichi accident, ASN is monitoring continuation of the construction of the new earthquake-resistant emergency command post.

Centraco plant

The Centraco plant, which constitutes BNI 160, was created in 1996 and is operated by Socodéi, a subsidiary of EDF. The purpose of the Centraco plant is to sort, decontaminate, reuse, treat and package – particularly by reducing their volume – waste and effluents with low levels of radioactivity. The waste resulting from the plant's processes is then routed to Andra's CSA repository.

The facility comprises:
- a melting unit melting a maximum of 3,500 tonnes of metallic waste per year;
- an incineration unit incinerating a maximum of 3,000 tonnes of solid waste and 2,000 tonnes of liquid waste per year;
- and interim storage areas.

The incineration and waste melting units functioned under suitably safe conditions without yet reaching their maximum processing capacity. The technical shutdown of the incineration unit for preventive maintenance was extended in anticipation of the preventive replacement of a ventilation filter in the last containment barrier.

Through its resolution 2014-DC-0446 of July 2014, ASN had prescribed additional analyses concerning the aircraft crash, lightning and earthquake hazards. These analyses were submitted to ASN in 2018 and are currently being examined.

ASN considers that the level of nuclear safety and radiation protection in the Centraco plant is on the whole satisfactory. ASN considers that the significant events reported by the licensee are dealt with competently.

The management of on-site transport operations within the Centraco plant is satisfactory. Improvements are nevertheless expected in the on-site transport rules and their oversight, particularly with regard to the formalising of requirements specific to on-site transport which do not stem from the conventional rules governing transport on the public highway.

Gammatec ioniser

The Gammatec ioniser, which constitutes BNI 170, is an industrial irradiator operated by the company Stéris since 2013. Gammatec treats products by ionisation (emission of gamma radiation) with the aim of sanitising (disinfecting) or sterilising materials or improving their performance. The installation consists of an industrial bunker and an experimental bunker. Both bunkers contain sealed sources of cobalt-60 which provide the radiation necessary for the facility's activity.

ASN considers that the level of nuclear safety and radiation protection of Gammatec remains satisfactory. The methods of managing deviations must nevertheless be better formalised in the integrated management system of the facility.

Écrin facility

The Écrin facility, BNI 175, is situated within the Malvési plant operated by Orano Cycle in the municipality of Narbonne in the Aude *département*. The Malvési plant transforms the concentrates from the uranium mines into uranium tetrafluoride, which represents the first step in the fabrication of a uranium-based nuclear fuel (excluding extraction of the ore). The transformation process produces liquid effluents containing nitrated sludges loaded with natural uranium, which are decanted and evaporated in lagoons in the facility.

Marcoule platform environmental protection

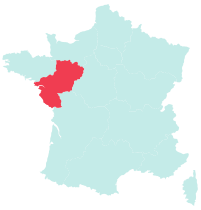
The management of waste and transfers of effluents from the civil installations, and monitoring of the environment are governed by ASN resolutions of 1 March 2016 setting out the requirements relative to the limits and conditions of liquid and gaseous effluent discharges from the Melox, Ata-lante, Centraco and Gammatec facilities. ASN considers this management and monitoring to be satisfactory.
In the context of decommissioning of the Phénix reactor, a similar draft resolution for the Phénix reactor was made available for consultation by the public, the Local Information Committee, the licensee and the Departmental Council for the environment and health and technological risks in 2018, and is currently being finalised. In appli-cation of these resolutions, the Marcoule site licensees must update the site's environmental impact study (which dates from 2012) by the end of 2019.

The entire Malvesi plant is subject to the system governing Seveso high-threshold ICPEs (installations Classified for Protection of the Environment).

The Écrin BNI is made up by the plant's two legacy sludge storage basins (B1 and B2), which stopped being used in the process in 2004 following failure of the basin B2 embankment. These two basins are classified as a BNI due to the presence of traces of artificial radionuclides resulting from the treatment of reprocessed uranium from the Marcoule site. The Écrin BNI was authorised by Decree of 20 July 2015 for the storage of radioactive waste for a period of thirty years with a volume of waste not exceeding 400,000 m^3 and total radiological activity of less than 120 terabecquerels.

The Écrin facility was commissioned by ASN resolution 2018-DC-0645 of 12 October 2018. This authorisation now enables the licensee to start the work defined in the authorisation decree, more specifically the creation of a vault to the south of basin B2 in which the materials removed from basins B5 and B6 can be stored. Once all these works are completed, a bituminous cover shall be put in place of the basins of the BNI. These works, which will span several years, should start in 2019.

Furthermore, in the French National Radioactive Material and Waste Management Plan (PNGMD), ASN asked Orano Cycle to study the various long-term disposal options for the waste contained in the Écrin facility. These studies are currently being examined.



Pays de la Loire region

The Nantes division regulates nuclear safety, radiation protection and the transport of radioactive substances in the 5 *départements* of the Pays de la Loire region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- BNIs:
  - the Ionisos irradiator in Sablé-sur-Sarthe;
  - the Ionisos irradiator in Pouzauges;

- small-scale nuclear activities in the medical sector:
  - 6 external-beam radiotherapy departments;
  - 4 brachytherapy units;
  - 11 nuclear medicine departments;
  - 40 centres performing fluoroscopy-guided interventional procedures;
  - 52 computed tomography scanners;
  - some 2,500 medical and dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - 1 cyclotron;
  - 34 industrial radiography companies, including 7 gamma radiography contractors;
  - about 400 licences for industrial and research equipment, including 220 users of devices to detect lead in paint;

- activities linked to the transport of radioactive substances;

- 5 radiation protection technical control agencies:
  - 1 radon screening agency;
  - 1 head office of laboratories approved for taking environmental radioactivity measurements.

In 2018, ASN carried out 54 inspections in small-scale nuclear activities and 4 inspections relative to the transport of radioactive substances.

Among the 24 significant events reported and analysed to draw lessons from them, 3 events concerned radiotherapy patients, one of which was rated level 1 on the ASN-SFRO scale, another level 2.

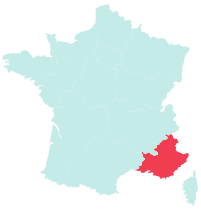
Ionisos irradiator

The company Ionisos operates two industrial ionisation installations on the sites of Pouzauges (Vendée *département*) and Sablé-sur-Sarthe (Sarthe *département*). These installations, constituting BNI 146 and 154 respectively, use high-activity cobalt-60 sealed radioactive sources.

The gamma radiation emitted is used to sterilise, destroy pathogenic germs or reinforce (by cross-linking) the technical properties of certain polymers, by exposing the products to ionise (single-use medical equipment, packaging, raw materials and finished productions for the pharmaceutical and cosmetic industries, packing films) for a pre-determined length of time.

The installation comprises a basin for underwater storage containing the radioactive sources and surmounted by a bunker in which the ionisation operations are performed, premises for storing the products before and after treatment, offices and technical rooms.

ASN considers that the Ionisos irradiators in the Pays de la Loire region are operated with due attention to nuclear safety and radiation protection. ASN continued its examination of the periodic safety review reports of the two irradiators in 2018.



Provence Alpes-Côte d'Azur region

The Marseille division regulates nuclear safety, radiation protection and the transport of nuclear substances in the 6 *départements* of the Provence-Alpes-Côte d'Azur (PACA) region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- BNIs:
  - the CEA Cadarache research Centre which counts 21 civil BNI's, including the Jules Horowitz Reactor currently under construction;
  - the ITER installation construction site, adjacent to the CEA Cadarache centre;
  - the Gammaster industrial ioniser;

- small-scale nuclear activities in the medical sector:
  - 12 external-beam radiotherapy departments;
  - 4 brachytherapy departments;
  - 17 nuclear medicine departments;
  - 106 centres performing fluoroscopy-guided interventional procedures;
  - 103 computed tomography scanners;
  - some 8,200 medical and dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - about 400 industrial and research establishments, including 21 companies exercising an industrial radiography activity;
  - 3 cyclotron particle accelerators;
  - 144 laboratories situated mainly in the universities of the region;
  - about 300 users of devices for detecting lead in paint;
  - about 300 veterinary surgeries or clinics practising diagnostic radiology;

- activities linked to the transport of radioactive substances;

- ASN-approved laboratories and organisations:
  - 2 laboratories approved for taking environmental radioactivity measurements;
  - 4 organisations approved for radiation protection controls.

In 2018, ASN carried out 107 inspections in the PACA region, comprising 45 inspections in BNIs, 53 inspections in small-scale nuclear activities, 6 in the transport of radioactive substances and 3 concerning organisations and laboratories approved by ASN.

During 2018, three significant events rated level 1 on the INES scale were reported by nuclear installation licensees. In small-scale nuclear activities, 2 significant events rated level 1 on the INES scale were reported to ASN. Five events involving radiotherapy patients were rated level 1 on the ASN-SFRO scale.

ASN drew up one violation report in the exercise of its oversight duties.

Cadarache site

CEA Cadarache centre

Created in 1959, the CEA Cadarache centre is situated in the municipality of Saint-Paul-lez-Durance in the Bouches-du-Rhône *département*, and covers a surface area of 1,600 hectares. This site focuses its activity primarily on nuclear energy and, as concerns its civil installations in operation, on research and development to support and optimise the existing reactors and the design of new-generation systems.

The following BNIs are located on the site:
- the Pégase-Cascad installation (BNI 22);
- the Cabri research reactor (BNI 24);
- the Rapsodie research reactor (BNI 25);
- the Solid Waste Treatment Station (STD - BNI 37-A);
- the Effluent Treatment Station (STE, BNI 37-B);

- the Plutonium technology facility (ATPu, BNI 32);
- the Masurca research reactor (BNI 39);
- the ÉOLE research reactor (BNI 42);
- the enriched Uranium Processing Facilities (ATUe, BNI 52);
- the Central Fissile Material Warehouse (MCMF, BNI 53);
- the Chemical Purification Laboratory (LPC, BNI 54);
- the High-Activity Laboratory LECA-STAR (BNI 55);
- the solid radioactive waste storage Area (BNI 56);
- the Phébus research reactor (BNI 92);
- the Minerve research reactor (BNI 95);
- the Laboratory for research and experimental fabrication of advanced nuclear fuels (Lefca, BNI 123);
- the Chicade laboratory (BNI 156);
- the Cedra storage facility (BNI 164);
- the Magenta storage warehouse (BNI 169);
- the Effluent advanced management and processing facility (Agate, BNI 171);
- the Jules Horowitz Reactor (RJH, BNI 172) under construction.

Ten installations at the Cadarache centre are in final shutdown status and either preparing or have started their decommissioning (7 of them have submitted or are going to submit their decommissioning file while 3 of them have received a decommissioning decree), 10 installations are in operation and one installation is under construction. The CEA Cadarache centre operates numerous installations which vary in their nature and their safety implications. ASN has moreover started or is continuing the examination of the periodic safety review guidance files or the conclusion reports for 16 of the 21 installations: Pégase-Cascad, Cabri, Rapsodie, STE, ATPu, ÉOLE, ATUe, MCMF, LPC, LECA-STAR, the Waste Storage Area, Phébus, Minerve, Chicade, Cedra and Magenta. It is noteworthy that 10 reports were submitted in 2017. In the examination of these reports, ASN is particularly attentive to the robustness of the action plans proposed and deployed. It ensures that the installations are in conformity with the applicable regulations and that the risks and adverse effects are effectively controlled.

Pégase-Cascad facility

– CEA Centre

The Pégase reactor was commissioned on the Cadarache site in 1964 and was operated for about ten years. The CEA was authorised by a Decree of 17 April 1980 to use the Pégase facility (BNI 22) for the storage of radioactive substances, in particular spent fuel elements in a pool.

This facility, which does not meet current safety requirements for storage facilities, has received no more radioactive substances for storage since 2008 and has removed a large part of its source term. The CEA has requested the pushing back of the ASN requirement that the facility be completely emptied of the stored radioactive substances before the end of 2018, and the compensatory conditions are currently being examined by ASN. Final shutdown of the facility is planned for the end of 2023 and the decommissioning file is to be received by the end of 2019.

The Cascad facility, authorised by a Decree of September 1989 modifying the Pégase facility and operated since 1990, is dedicated to the dry storage of spent fuel in wells. Unlike Pégase, for which ASN has prescribed removal of the stored substances as early as possible, the standard of safety of Cascad is satisfactory.

ASN opinion on the safety of the facility in 2018 is generally positive. The CEA must nevertheless clarify the schedule for certain removal operations concerning the radioactive substances currently stored in the Pégase pool.

Cabri research reactor

– CEA Centre

The Cabri reactor (BNI 24), created on 27 May 1964, is used for experimental programmes aiming at acquiring a deeper understanding of nuclear fuel behaviour in the event of a reactivity accident. The reactor has been equipped with a pressurised water loop since 2006 in order to study the behaviour of the fuel at high combustion rates in accident situations of increasing reactivity in a pressurised water reactor.

The year 2018 saw the first active tests of the CIP experimental programme (Cabri International Program) in the pressurised water loop of the renovated installation, which was authorised by ASN on 30 January 2018.

ASN considers that the level of safety of the Cabri reactor is satisfactory.

Rapsodie research reactor

– CEA Centre

The Rapsodie reactor (BNI 25) is the first sodium-cooled fast neutron reactor built in France. It operated from 1967 to 1978. A sealing defect in the reactor pressure vessel led to its final shutdown in 1983. Decommissioning operations were subsequently undertaken, but have been partially stopped further to a fatal accident in 1994 during the washing of of a sodium tank. At present the core has been unloaded, the fuel evacuated from the installation, the fluids and radioactive components have been removed and the reactor vessel is contained. The reactor pool has been emptied, partially cleaned out and decommissioned. In addition, the last sodium-containing waste was transferred at the end of 2018 to the Phénix installation (BNI 71) on the Marcoule site.

The decommissioning file for BNI 25 was submitted by the licensee at the end of 2014 and supplemented in 2016. It underwent a public inquiry from 5 June to 6 July 2018. ASN is continuing the examination of this file.

ASN considers that the level of safety of the Rapsodie in 2018 is satisfactory.

Solid waste treatment station

– CEA Centre

BNI 37 of CEA Cadarache historically comprised the Effluent Treatment Station (STE) and the Waste Treatment Station (STD), grouped into a single installation. As the CEA wishes to ensure continued operation of the STD and proceed with the final shutdown of the STE, BNI 37 was divided into two BNIs: 37-A (STD) and 37-B (STE) by ASN resolutions CODEP-DRC-2015-027232 and CODEP-DRC-2015-027225 of 9 July 2015. These records were made further to the Orders of 9 June 2015 defining of the perimeters of these two BNIs.

At present, the STD is the CEA's only civil BNI licensed for the packaging of LL/ILW-LL radioactive waste, called «low dose» and «intermediate dose» waste, before it is stored in the Cedra facility (BNI 164) pending transfer to a deep geological repository. The continued operation of the STD necessitates renovation work, which was prescribed in 2016, at the end of its second periodic safety review, by ASN Chairman's resolution CODEP-CLG-2016-015866 of 18 April 2016, the completion of which is planned for 2012. In the meantime, compensatory measures concerning the limiting of the quantities of radioactive substances in the facility and fire protection in particular, are applied.

The licensee reported one event rated level 1 on the INES scale concerning the fall of a package of intermediate-level waste in the facility on 25 October 2017. This fall was not detected and treated as a deviation from the installation's operating rules until July 2018. ASN conducted a reactive inspection concerning this event and noted firstly the fact the lack of any communication to ASN – for a period of 8 months – of information concerning what was a significant event, and secondly the fact that the report on the experience feedback on the suction-cup pick-up systems (used to handle these packages) transmitted by the licensee in response to a previous request of ASN, was particularly incomplete and did not mention the fall of the package in question.

ASN considers that the safety culture, the operating rigour, the control of subcontracted operations and the licensee's relations with its service providers on this facility must be significantly improved.

Active Effluents Treatment Station

– CEA Centre

The STE installation (BNI 37-B) has been shut down since 1 January 2014. Submission of the decommissioning file was prescribed for December 2019, in view in particular of the complexity of the installation and the time necessary for characterisation of the soils and the equipment before starting decommissioning.

ASN considers that the level of safety of BNI 37-B in 2018 is on the whole satisfactory. Nevertheless, the characterisation of the soils has revealed legacy radioactive markings which formed the subject of several significant event notifications during 2018. ASN remains particularly attentive to the way the CEA handles this new information concerning the state of the soils and the conduits, particularly in its management of storm water, due to the contamination of certain surfaces over which the storm water runs.

Plutonium Technology Facility (ATPu) and Chemical Purification Laboratory (LPC)

– CEA Centre

The ATPu (BNI 32) produced plutonium-based fuel elements intended for fast neutron or experimental reactors as from 1967, then, from 1987 until 1997, for Pressurised Water Reactors (PWR) using MOX fuel. The activities of the LPC (BNI 54) were associated with those of the ATPu: physical-chemical verifications and metallurgical examinations, treatment of effluents and contaminated waste. The two facilities were shut down in 2003 and are currently undergoing decommissioning.

The removal of the waste and materials from the facilities has proceeded satisfactorily. Alongside this, the takeover of the facilities by the CEA, the installation licensee since 1 January 2017 following the transfer of responsibility from Orano, is now satisfactory.

ASN considers that the level of safety and radiation protection of the facilities in 2018 is on the whole satisfactory. The monitoring of the fire loads must nevertheless be improved to ensure adequate protection against the fire risk.

Masurca research reactor

– CEA Centre

The Masurca reactor (BNI 39), whose construction was authorised by Decree of 14 December 1966, was intended for neutron studies, chiefly on the cores of fast neutron reactors, and the development of neutron measurement techniques. The reactor has not been functioning since 2007.

The CEA submitted the report of the periodic safety review of the installation in April 2015, the examination of which ended in March 2018 with the ASN Chairman's resolution CODEP-CLG-2018-019352 of 12 March 2018 which regulates the continued operation of the installation. Final shutdown of the installation was declared by the CEA on 31 December 2018.

The situation of the Masurca reactor in terms of nuclear safety and radiation protection in 2018 is satisfactory on the whole.

ÉOLE and Minerve research reactors
– CEA Centre

The experimental ÉOLE and Minerve reactors are very low-power (less than 1 kWe) critical mock-ups, used for neutron studies, in particular to evaluate the absorption of gamma rays or neutrons by materials.

The ÉOLE reactor (BNI 42), whose construction was authorised by the Decree of 23 June 1965, was mainly intended for neutron studies of moderated arrays, in particular those of Pressurised Water Reactors (PWR) and Boiling Water Reactors (BWR). The Minerve reactor (BNI 95), whose transfer from the Fontenay-aux-Roses studies centre to the Cadarache studies centre was authorised by Decree of 21 September 1977, is situated in the same hall as the ÉOLE reactor. Teaching and research activities were carried out on these mock-ups until their final shutdown on 31 December 2017.

The CEA submitted the decommissioning file for these installations in July 2018, and ASN is currently examining it. Pending decommissioning, operations in preparation for decommissioning, such as the removal of radioactive and hazardous substances, took place in 2018.

ASN considers that the level of nuclear safety and radiation protection of the ÉOLE and Minerve in 2018 is on the whole satisfactory. In September 2018, the licensee reported a significant event that occurred during the transport of radioactive substances between the two installations, rated level 1 on the INES scale due to noncompliance with two on-site transport rules.

The enriched Uranium Processing Facilities (ATUe) – CEA Centre

From 1963 to 1995, the ATUe (BNI 52) converted uranium hexafluoride from the enrichment plants into sinterable oxide, and ensured the chemical reprocessing of waste from the manufacture of fuel elements. Decommissioning of this facility was authorised by Decree in February 2006.

The licensee is seriously behind schedule in these decommissioning operations, mainly due to the poor assessment of the radiological condition of the installation prior to the first decommissioning operations. On this account, in 2010 the licensee requested a modification to its decree to take account of the true radiological condition of the installation; ASN has made several requests for additional information in this respect, and the modification request is still being examined.

In 2018, ASN authorised the CEA to proceed with the treatment of the radiologically marked soils situated within the perimeter of the installation.

ASN considers that the decommissioning of the ATUe is conducted in a relatively satisfactory manner.

Central Fissile Material Warehouse (MCMF)
– CEA Centre

Created in 1968, the MCMF (BNI 53) was a warehouse for storing enriched uranium and plutonium until its final shutdown and the removal of all its nuclear materials on 31 December 2017. The licensee submitted its decommissioning file in November 2018, and ASN is currently examining it.

High-activity laboratory LECA-STAR
– CEA Centre

The Active Fuel Examination Laboratory (LECA) and the Treatment, Clean-out and Reconditioning Station (STAR) – an extension of LECA, constitute expert assessment tools used by the CEA for the analysis of spent fuels. Commissioned in 1964, the LECA laboratory enables CEA to carry out destructive and non-destructive examinations of spent fuel from the nuclear power, research and naval propulsion sectors. As the facility is old, it was partially reinforced in the early 2010's to ensure its earthquake resistance. Nevertheless, its resistance to an earthquake of the «Safe Shutdown Earthquake» (SSE) level is not guaranteed today, and the CEA must propose ASN an acceptable strategy for the future of this facility. Commissioned in 1999, the STAR facility is an extension of the LECA laboratory, designed for the stabilisation and reconditioning of spent fuel.

The CEA gave ASN the periodic safety review reports for the LECA facility in June 2014 and for STAR in February 2018, and it is currently examining them.

ASN considers that the safety of BNI 55 was maintained at a satisfactory level in 2018. ASN notes a good level of involvement of senior management in the safety issues. Nonetheless, ASN remains attentive to ensuring that social, organisational and human factors are properly taken into account in the operation of the facility. The licensee reported a significant event rated level 1 on the INES scale, for under-estimation of the mass of fissile material contained in two fuel cladding samples transferred from CEA Cadarache to CEA Saclay.

Solid Radioactive Waste Storage Area
– CEA Centre

BNI 56, declared in January 1968 for the disposal of waste, is used for interim storage of legacy solid radioactive waste from the Cadarache centre. It comprises 3 pools, 6 pits, 5 trenches and hangars, which contain in particular Intermediate-Level Long-Lived Waste (ILW-LL) from the operation or decommissioning of CEA installations Major legacy waste retrieval and packaging work has been in progress for several years, and the CEA submitted the decommissioning file for the installation to ASN in June 2018.

ASN notes the lateness in the projects for retrieval and packaging of the waste stored in this facility. On account

of the safety and radiation risks, the retrieval solutions are technically complex to design and implement. The CEA must improve its project management.

ASN considers that the safety management of BNI 56 has significantly progressed over the last few years and has reached a satisfactory level. With regard to environmental protection, over and beyond the monitoring of the water table under the BNI, which is adequately ensured by the licensee, ASN remains attentive to the compliance work on the storm water management system, given the operating history and the radiological marking of certain areas of the facility.

Phébus research reactor

– CEA Centre

The Phébus reactor (BNI 92) is a pool experimental reactor with a power rating of 38 MWth which functioned from 1978 to 2007. Phébus was designed for the study of serious accidents affecting light water reactors and for defining operating procedures to prevent core melt-down or to mitigate its consequences.

The licensee submitted its decommissioning file to ASN in February 2018, and ASN is currently examining it, along with its periodic safety review report submitted in 2017. The initial schedule for removal of spent fuel elements, authorised in 2017, could not be met in 2018 due to the unavailability of the receiving facility (located on the CEA Marcoule site). ASN points out that decommissioning is governed by compliance with this milestone.

ASN's assessment of the Phébus installation is satisfactory on the whole for 2018. The formalisation of the methods of monitoring outside contractors must nevertheless be improved.

Laboratory for Research and Experimental Fabrication of Advanced nuclear Fuels (Lefca)

– CEA Centre

Commissioned in 1983, the Lefca (BNI 123), is a laboratory designed for conducting studies on plutonium, uranium, actinides and their compounds. The Lefca carries out studies aimed at understanding the behaviour of these materials in the reactor and at various stages in the fuel cycle. It also conducts research in the treatment, stabilisation and reconditioning of these materials. In 2018, the Lefca finalised the transfer of part of its research and development activities to the Atalante laboratories (BNI 148) of Marcoule.

ASN inspection in the Cedra facility – October 2018

The groundwater drainage system for preventing the risk of liquefaction of the soils in the event of an earthquake, the installation of which is required by ASN resolution 2010-DC-0173 of 5 January 2010, was put into service in January 2018. In addition, renovation work on the nuclear ventilation of the facility, made necessary due to the obsolescence of the controlling programmable controllers, is in progress and closely monitored by ASN.

Technical requirements have been laid down to govern continued operation of the installation through ASN Chairman's resolution CODEP-CLG-2018-034301 of 5 July 2018. Furthermore, at the end of 2018 the licensee declared that final shutdown of the installation would be effective no later than 31 December 2023.

Finally, ASN considers that the level of safety of the installation is on the whole satisfactory.

Chicade laboratory – CEA Centre

Since 1993, the Chicade facility (BNI 156) has been conducting research and development work on low and intermediate-level objects and waste, chiefly involving:

- the destructive and non-destructive characterisation of radioactive objects, waste sample packages and irradiating objects;
- the development and qualification of nuclear measurement systems;
- the development and implementation of chemical and radiochemical analysis methods;
- the expert assessment and inspection of waste packages packaged by the waste producers.

ASN considers that the operation of Chicade is on the whole satisfactory. The licensee reported several significant events relating to diffuse discharges of tritium to ASN in 2018, and ASN remains particularly attentive to the resolving of these diffuse discharges over the long term. The CEA must also learn the lessons from equipment failures, which are the cause of other significant events.

Cedra storage facility

– CEA Centre

Since 2006 the Cedra facility (BNI 164) processes ILW-LL waste and stores «low and medium dose» waste packages pending the creation of appropriate disposal routes.

The CEA submitted the facility's periodic safety review report to ASN in November 2017. ASN is currently examining this file, with particular attention to its exhaustiveness and the defining of the acceptance criteria applicable to the stored packages.

ASN considers that, after several years marked by failures to comply with the package acceptance and storage specifications, the management of the packages and the safety of the package reception, handling, storage and monitoring operations have improved and now reached a standard that is on the whole satisfactory. The CEA must nevertheless ensure the reliability of its suction-cup pick-up systems, which have caused significant events in this facility and others in recent years.

Assessment of the CEA Cadarache centre

ASN considers that the level of nuclear safety of the CEA Cadarache centre in 2018 is relatively satisfactory. ASN does however still note persistent disparities between the facilities of the centre, and had to use its enforcement powers further to the fall of a package in BNI 37-A, an event rated level 1 on the INES scale.
With regard to operation of the BNIs, ASN maintains its overall positive assessment of 2017 regarding the management of skills and training, compliance with the operating baseline requirements and, more broadly, the radiation protection measures taken by the centre's senior management. The management of nuclear safety is on the whole satisfactory, but the sharing of experience feedback and lessons learned between facilities must be improved. The results concerning the monitoring of service providers and subcontractors are mixed. The interfaces between the nuclear licensee and its service providers must be improved, particularly for the support facilities. In this respect, it would be beneficial to extend the good practices observed in some of the facilities of the centre to all them.
ASN considers moreover that the CEA must continue its efforts concerning protection against the fire risk, particularly in its control of the fire loads present in the facilities, the management of the periodic checks and tests, and compliance with the waste storage rules. Lastly, it was noted that only three facilities had a suitable lightning protection system. A compliance programme has been started.
ASN will be attentive to the correct performance of the work identified in the periodic safety reviews.
For the CEA, ASN observes that several projects concerning the renovation of facilities or the construction of new facilities were subsequently redefined or abandoned for budgetary reasons. In some cases, ASN may have to restrict the operating conditions, or even ask for the shutdown of certain old facilities.
The ASN resolutions of 11 July 2017 regulating discharges , transfers of effluents and monitoring of the environment of the civil installations of the Cadarache centre, referenced 2017-DC-0596 and 2017-DC-0597, are currently being deployed by the CEA which must finalise its assessment which aims at proving the conformity of the installations with these resolutions. The management of storm water before discharge must be improved in some of the older facilities.
With regard to the on-site transport of radioactive substances at the Cadarache centre, the licensee on the whole complies with its baseline requirements. The traceability of the checks carried out during these operations and the monitoring of service providers when this activity is subcontracted must nevertheless be improved.
The CEA must also revise is emergency situation management provisions to meet the requirements of ASN resolution 2017-DC-0592 of 13 June 2017. The main improvements expected concern the emergency management agreements made with the outside organisations, the emergency exercises, the teaching and training of the personnel involved in emergency management and turning lessons learned to good account.
With regard to the lessons learned from the Fukushima NPP accident, the CEA has entirely reviewed its draft project for an emergency centre that is resistance to extreme hazards due to project management difficulties, and has submitted a request to ASN for its entry into service to be pushed back. ASN thus modified the date initially prescribed for the commissioning of an operational emergency management centre that is robust to extreme hazards by resolution 2019-DC-0661 of 31 January 2019. ASN underlines that the compensatory measures proposed by the CEA pending the availability of an emergency centre that can withstand extreme hazards must be rapidly operational.
Major milestones were crossed in 2018 in the activities of decommissioning and retrieval and packaging of legacy radioactive waste and nuclear materials, notably with the completion of emptying of pools P1 and P2 of the storage area (BNI 56), and the completion of removal of the sodium-containing objects still present in the Rapsodie facility (BNI 25). ASN notes moreover that the waste and fuel removal milestones are correctly followed.

Magenta storage warehouse

– CEA Centre

The Magenta facility (BNI 169), which replaces the MCMF currently being decommissioned, has been dedicated since 2011 to the storage of non-irradiated fissile material and the non-destructive characterisation of the nuclear materials received. The removal of the material stored in the MCMF, which ended in December 2017, has lowered the activity levels in the facility. In 2018, the CEA submitted a file relating to the application for authorisation to commission new glove boxes, and it is currently being examined.

The safety of the facility is satisfactory. The CEA must nevertheless guarantee the maintaining of skills, in view of the significant personnel changes in the facility.

Effluent advanced management and processing facility (Agate) – CEA Centre

The Agate facility (BNI 171), commissioned in 2014 to replace BNI 37-B undergoing decommissioning, uses an evaporation process to concentrate radioactive liquid effluents containing mainly beta and gamma emitting radionuclides.

The Agate facility evaporator could not be used from 1 August 2017 to 8 October 2018 because deposits were discovered on the internal walls of the tank during its periodic inspection, causing interruption of the inspection. The CEA removed these deposits and put the evaporator back into service in 2018. This fortuitous discovery highlighted the need for the CEA to have buffer storage capacities for radioactive effluents in the facility and in the facilities that produce the effluents, the volumes of which increase significantly during periods when the evaporator is out of service.

ASN considers that the level of safety, radiation protection and environmental protection in the Agate facility is on the whole satisfactory.

Jules Horowitz Reactor project

– CEA Centre

The Jules Horowitz Reactor (RJH, BNI 172), under construction on the Cadarache since 2009, is a pressurised-water technological irradiation reactor designed to study the behaviour of materials under irradiation and of power reactor fuels. It will also allow the production of artificial radionuclides intended for nuclear medicine. Its power is limited to 100 MWth.

The construction work on the RJH installation continued in 2018, notably with the continuation of installation of the lining on the pools of the «reactor» and «nuclear annex» buildings, and the installation of the hot cell doors. In addition to this, the manufacture of the large equipment off the site is still in progress.

ASN considers that the CEA manages the RJH construction worksite satisfactorily. Management and correction of deviations are carried out with rigour and efficiency.

ASN is examining the CEA's request, addressed to the Minister responsible for nuclear safety, to push back by four years the planned facility commissioning deadline due to delays in the construction work. In 2019, the licensee must clarify its overall commissioning strategy for the facility.

ITER

The ITER installation (BNI 174), under construction on the Cadarache site since 2010 and adjacent to the CEA facilities, will be a fusion experimental reactor used for the scientific and technical demonstration of the control of thermonuclear fusion energy obtained by magnetic confinement of a deuterium-tritium plasma during long-duration experiments with a significant power level (500 MW developed for 400 s). This international project enjoys financial support from China, South Korea, India, Japan, Russia, the European Union and the United States, who make in-kind contributions by providing equipment for the project.

Owing to the delays in project progress and in some of the R&D work necessary for its design, ASN – through its resolution 2017-DC-0601 of 24 August 2017 – has regulated the new strategy for progressive commissioning of the installation through until 2035. The construction of the site's buildings continued in 2018, as did the manufacture of the equipment necessary for production of the first plasma, planned for 2025.

During 2018, ASN also took a favourable stance with regard to the licensee's planned modifications to the system for limiting the pressure in the vacuum chamber and the cooling system, which are major safety systems. The license must nevertheless submit additional safety studies and analyses focusing on the impact of these modifications and report on the progress of its action plan for controlling the hydrogen and dust explosion risk.

The inspections of the ITER Organisation carried out by ASN conclude that the safety requirements have been satisfactorily taken into account by the entire chain of outside contractors, as from the installation design stage. Improvements have been noted for the work packages under the responsibility of the European agency. The detection and processing of safety deviations must nevertheless be improved, paying attention to the quality of the analysis of causes. In effect, noncompliance with a defined requirement concerning a minimum wall thickness, which was not detected by the licensee or the chain of outside contractors, was revealed during an ASN inspection in December 2018.

Gammaster ioniser

Since 2008, the company Stéris has been operating an industrial irradiator called Gammaster situated in the municipality of Marseille. Gammaster treats products by ionisation (emission of gamma radiation) with the aim of sanitising (disinfecting) or sterilising materials or improving their performance. The facility is made up of an industrial bunker and houses sealed sources of cobalt-60 which provide the radiation necessary for its activity.

ASN considers that the standard of safety of Gammaster in 2018 remains satisfactory. The licensee must nevertheless continue its efforts regarding the management of maintenance operations.

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