AUTORITÉ
DE SÛRETÉ
NUCLÉAIRE

ABSTRACTS

ASN REPORT

on the state of nuclear safety and radiation protection in France in 2019

The French Nuclear Safety Authority presents its report on the state of nuclear safety and radiation protection in France in 2019.

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 FRENCH NUCLEAR SAFETY AUTHORITY

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 the citizens and regarded internationally as a benchmark for good practice.

ABSTRACTS – ASN REPORT ON THE STATE OF NUCLEAR SAFETY AND RADIATION PROTECTION IN FRANCE IN 2019

ROLES

Regulating

ASN contributes to drafting regulations, by submitting its opinion to the Government 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 (BNIs), such as creation and decommissioning. ASN also 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 responsable for ensuring compliance with the rules and requirements applicable to the facilities and activities within its field of competence. Since the Energy Transition for Green Growth Act of 17 August 2015, ASN's roles now include protecting ionising 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 enforcement and penalty powers (formal notice, administrative fines, daily penalty payments, ability to carry out seizure, take samples or require payment of a deposit, etc.). The administrative fine is the competence of the Sanctions Committee within the ASN, which complies with the principle of the separation of the examination and sentencing functions.

Informing

ASN reports on its activities to Parliament. It informs the public and the 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. It supports 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 and its foreign counterparts of the situation. ASN assists the Government. More particularly, it sends the competent Authorities its recommendations regarding the civil security measures to be taken.

Regulation and monitoring of diversified activities and facilities

Nuclear power plants, radioactive waste management, fabrication and reprocessing of nuclear fuel, radioactive material packages, medical facilities, research laboratories, industrial activities, etc. ASN monitors and regulates an extremely varied range of activities and facilities.

This regulation covers:

- 57 nuclear reactors(*) producing 70% of the electricity consumed in France, as well as the Flamanville EPR reactor under construction;
- about 90 other facilities participating in civil research activities, radioactive waste management activities or "fuel cycle" activities;
- more than thirty or so facilities which have been finally shut down or are being decommissioned;
- several thousand facilities or activities using sources of ionising radiation for medical, industrial or research purposes;
- several hundred thousand shipments of radioactive substances performed annually in France.

THE SUPPORT OF EXPERTS

When drawing up its decisions and regulations, 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 its eight advisory committees of experts, who come from a variety of scientific and technical backgrounds.

** As at 3 March 2020.*

OPERATIONS

The Commission

The Commission defines ASN's general policy regarding nuclear safety and radiation protection. It consists of five Commissioners, including the ASN Chairman, appointed for a term of 6 years(*).

Bernard DOROSZCZUK Chairman	Philippe CHAUMET-RIFFAUD Commissioner	Sylvie CADET-MERCIER(*) Commissioner	Lydie ÉVRARD(*) Commissioner	Jean-Luc LACHAUME(*) Commissioner
from 13 November 2018 to 12 November 2024	from 10 December 2014 to 9 December 2020	from 21 December 2016 to 9 December 2023	from 10 March 2017 to 9 December 2023	from 21 December 2018 to 9 December 2026
APPOINTED BY the President of the Republic			APPOINTED BY the President of the Senate	APPOINTED BY the President of the National Assembly

** Pursuant to Act 2017-55 of 20 January 2017 constituting the general statutes of Independent Administrative Authorities and Independent Public Authorities, which stipulates renewal of half of the ASN Commission, except for its Chairman, every three years, Decree 2019-190 of 14 March 2019 (codifying the provisions applicable to BNIs, the transport of radioactive substances and transparency in the nuclear field) sets out the relevant interim provisions and modified the duration of the mandates of the three Commissioners.*

Impartiality

The Commissioners perform their duties in complete impartiality and receive no instructions from either the Government or 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 also terminate the duties of any member of the Commission in the event of serious breach of his or her obligations.

Competencies

The Commission takes decisions and issues opinions, which are published in ASN's *Official Bulletin*. The Commission defines ASN's oversight policy. The Chairman appoints the ASN inspectors. 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 competent committees of the National Assembly and of the Senate and to the Parliamentary Office for the Assessment of Scientific and Technological Choices.
The Commission defines ASN's external relations policy at national and international level.

The departments

ASN comprises departments placed under the authority of its Chairman. The 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 regional 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 divisions assist the Prefect of the *département*(*) who is in charge of protecting the general public, and supervise, the operations to safeguard the facility affected by the accident.

** Administrative region headed by a Prefect.*

KEY FIGURES IN 2019

PERSONNEL

521 staff members

of which

321 inspectors

84% management

ASN ACTIONS

1,817 **inspections**
representing 4,274 days of inspection

23,420 **inspection follow-up letters**
available on *asn.fr*
as at 31 December 2019

22 **meetings**
of Advisory Committees of experts

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

1,585 **individual licenses**
issued for facilities and activities

BUDGET

€63.97 MILLION

total budget for ASN (programme 181)

€83.4 MILLION

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

INFORMATION

More than **1,200**

answers to queries from the public and stakeholders

18

press conferences

75

information notices

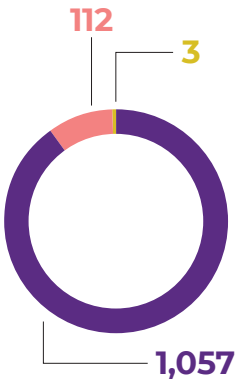
8

emergency exercises

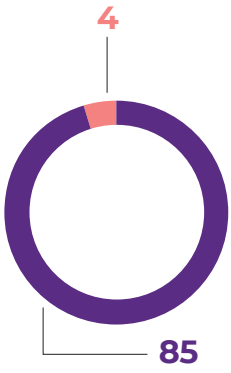
KEY FIGURES IN 2019

NUMBER OF SIGNIFICANT EVENTS RATED ON THE INES SCALE(*)

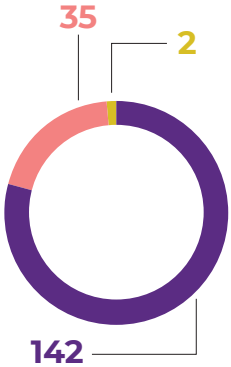
1,172
events in the BNIs



89
events in the transport of radioactive substances



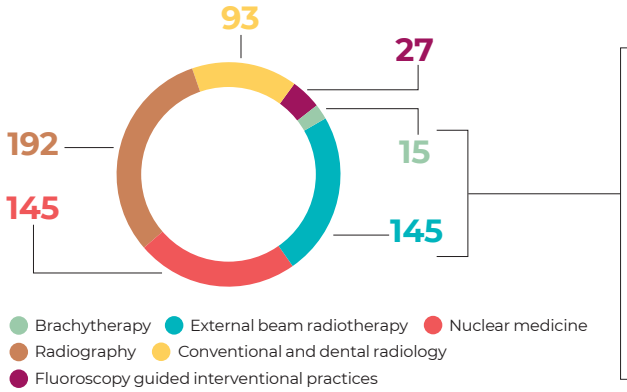
179
events in small-scale nuclear facilities (medical and industrial)



Level 0 Level 1 Level 2

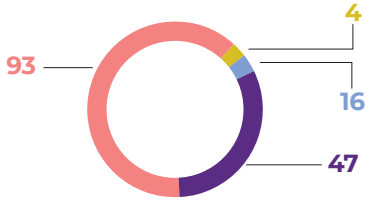
NUMBER OF SIGNIFICANT EVENTS IN THE MEDICAL FIELD(*)

617
significant events per area of exposure



Brachytherapy External beam radiotherapy Nuclear medicine
Radiography Conventional and dental radiology
Fluoroscopy guided interventional practices

160
significant events in external beam radiotherapy and brachytherapy
according to the classification on the ASN-SFRO scale



Out of scale Level 1
Level 0 Level 2

** The INES scale (International Nuclear and Radiological Event Scale) was developed by IAEA to explain to the public the importance of an event in terms of safety or radiation protection. This scale applies to events occurring in BNIs and events with potential or actual consequences for the radiation protection of the public and workers. It does not apply to events with an impact on the radiation protection of patients, and the criteria normally used to rate events (notably the dose received) are not applicable in this case.*

As it was pertinent to be able to inform the public of radiotherapy events, ASN –in close collaboration with the French Society for Radiotherapy and Oncology– developed a scale specific to radiotherapy events (ASN-SFRO scale).

These two scales cover a relatively wide range of radiation protection events, with the exception of imaging events.

ASN ORGANISATION CHART

on 3 March 2020

COMMISSION

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

Chairman
Bernard Doroszczuk

Head of Private Office
Laurent Felber

GENERAL DIRECTORATE

Professional ethics
Alain Dorison

Deputy Directors General
Julien Collet
Daniel Delalande
Anne-Cécile Rigail

Director General
Olivier Gupta

Chief inspector
Christophe Quintin

Director of Private Office
Bastien Poubeau

DEPARTMENTS

Nuclear Power Plants Department
Rémy Catteau

Nuclear Pressure Equipment Department
Corinne Silvestri

Waste, Research Facilities and Fuel Cycle Department
Christophe Kassiotis

Transport and Sources Department
Fabien Féron

Ionising Radiation and Health Department
Carole Rousse

Environment and Emergency Department
Olivier Rivière

Legal Affairs Department
Olivia Lahaye

Information, Communication and Digital Usages Department
Céline Acharian

International Relations Department
Luc Chanial

Office of Administration
Brigitte Rouède

Management and Expertise Office
Adeline Clos

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: Olivier Morzelle
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

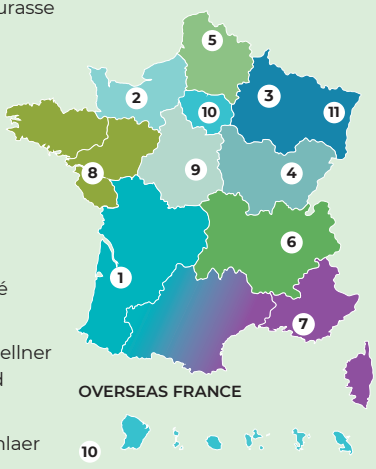
7 Marseille Division
Regional representative: Corinne Tourasse
Regional head: Bastien Lauras

8 Nantes Division
Regional representative: Annick Bonneville
Regional head: Émilie Jambu

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



For BNI oversight only, the Caen and Orléans divisions hold responsibility for the Brittany and Île-de-France regions respectively.

Competence
Independence
Rigour
Transparency

asn.fr

info@asn.fr

You can also follow ASN on the social networks

SUMMARY

ADVICE TO THE READER

- **FIND THE FULL REPORT**
  on the state of nuclear safety and radiation protection in France in 2019 on *asn.fr*

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

A commitment to quality and rigour is demanded from everyone

Montrouge, 3 March 2020

In a context where the level of safety in nuclear facilities has remained on the whole satisfactory, 2019 was marked by increased awareness on the part of the nuclear licensees of the challenges that face them as a group. The need to reinforce the quality of the work done and professional rigorousness in terms of safety has been broadly taken on board, which is essential if progress is to be made. The increase in inspections cannot be considered an appropriate response. As those with prime responsibility for safety, it is therefore up to the licensees to address these challenges.

In the medical field, the radiation protection of patients undergoing diagnostic or therapeutic procedures involving ionising radiation has been maintained at a high level. The number of significant radiation protection events reported by the health professionals remained very low in 2019 when compared with the number of procedures carried out on the patients every year and the complexity of some of these procedures. However, particular attention must be maintained, owing to the extremely sophisticated technical nature of some medical procedures and the chain of professionals involved.

Professional competence and rigour at the heart of the nuclear industry's recovery

At the end of 2018, ASN underlined the need for re-engagement by the nuclear industry in order to maintain the key industrial skills vital to the quality of the work done and the safety of the facilities.

In 2019, in response to a request from the Government and further to the conclusions of the *Building the Flamanville EPR* report by Jean-Martin Folz, EDF presented an action plan "*to restore the level of quality, rigour and excellence which underpinned the construction of the French NPP fleet*".

ASN considers that the orientations of the plan are a step in the right direction. Quality and professional rigour are key aspects in ensuring the safety of the facilities. They must be applied both in the performance of the activities and in their oversight by the licensees, who hold prime responsibility for safety.

ASN considers that the commitment to quality and rigour in running projects must be restated, not only for new constructions, but also for legacy waste recovery and packaging projects, decommissioning, or major maintenance works. The nuclear industry must more precisely define the conditions for implementation of this action plan, notably in terms of reinforcing the safety culture and a rigorous professional attitude.

Continued operation of the 900 MWe reactors: an EDF goal still to be achieved

With the support of the IRSN, ASN continued to examine the fourth periodic safety review of the 900 MWe reactors, in order to define the generic conditions for their continued operation, in other words those that are applicable to all these reactors. The main goals of this review concern the management of installation conformity, more particularly ageing management, as well as the facility's greater robustness to natural hazards and the mitigation of the radiological consequences in the event of an accident, notably with core melt. These goals were defined in the light of the safety objectives set for the third generation reactors, in particular the EPR.

For the fourth periodic safety review, EDF proposed installation modifications in order to achieve these goals, for example to improve the safety of the spent fuel pool, or to reduce the risk of containment basemat melt-through with the resulting contamination of the soil and groundwater in the event of an accident with core melt. ASN will issue a resolution on the generic part of the periodic safety review of these reactors at the end of 2020, to regulate their continued operation.

ASN considers that implementation of the modifications proposed by EDF leads to significant safety improvements for the facilities and contributes to achieving the goals of the periodic safety review. However, at this stage of the examination, ASN considers that these modifications alone are unable to meet all the targets set. In the absence of any additional proposals from the licensee during the course of 2020, ASN will prescribe additional modifications.

In 2019, Tricastin reactor 1 was the first to carry out its fourth ten-yearly outage. EDF set up a specific organisation and extensively mobilised its national engineering division to provide the site with support, before and during the outage, so that the modifications to be deployed could be fully assimilated. This organisation enabled the work to be carried out satisfactorily. ASN underlines the fact that over the next few years several reactor ten-yearly outages will be performed at the same time and queries EDF's ability to implement such an organisation simultaneously on the sites concerned.

Questions about the operational intervention conditions

During its inspections, ASN placed greater emphasis on controlling the implementation of the operational measures planned by the licensees to deal with undesirable events in a nuclear facility. In this respect, ASN conducted exercises simulating an outbreak of fire, internal flooding, loss of containment of hazardous products, or an accident situation. For certain exercises, ASN observed that the actions required in these situations were not feasible or that the intervention times were longer than those planned by the licensee.

These findings mean that the licensee must ensure that the actions required by the operating documents are actually operationally feasible and take corrective measures where applicable.

More generally, the growing complexity of the rules to be followed and of the operational measures to be taken, demands extra vigilance on the part of all the players.

The eight EPR containment penetration welds to be repaired

The Flamanville EPR reactor is a pressurised water reactor, providing a significantly higher level of safety than the reactors currently in operation. The EPR in particular offers greater protection against external hazards and more effective means of mitigating the consequences of accidents with core melt.

Numerous deviations from the expected quality were found in the construction and manufacture of the EPR equipment, primarily due to a loss of experience and a lack of professional rigour, notably in the use of special processes (welding, forging, heat treatment, non-destructive testing, etc.). These problems also revealed shortcomings in the oversight exercised by the licensee.

With regard to the deviations in the design and production of welds on the main steam letdown lines, ASN stated as early as 2018 that preference should be given to repairing all the welds. At the end of 2018, EDF however proposed an approach to justify maintaining certain welds as they were (the eight containment penetration welds). Given the nature and the particular high number of deviations which occurred in the design and production of these welds, and given that their repair is technically feasible, ASN informed EDF in June 2019 that their repair prior to commissioning of the reactor was the baseline solution.

Irregularities which should cause everyone to re-examine their activities

ASN has established an action plan to deal with the risk of fraud. The first conclusions have been reached after a campaign of fraud-targeted inspections and the analysis of fraud reports sent by whistle blowers.

The risk of fraud exists, but the number of confirmed cases at this stage is very low when compared with the volume of activities. The first findings mainly concern irregularities in the implementation of special processes (identity fraud among welders or inspectors), in internal controls at the suppliers (falsification of test results) or in the monitoring of activities (declaration of monitoring work not actually performed). Not all of these irregularities were detected by the licensee's monitoring activities.

In most cases, the analyses by the licensees and the investigations carried out by ASN further to these findings, revealed no safety risks. The manufacturers and licensees must remain vigilant, including with regard to their own personnel, and question the underlying root causes of this type of behaviour.

A new step in the consultation process for the management of radioactive materials and waste

As co-sponsor, alongside the Ministry for Energy, ASN was heavily involved in the public debate held in 2019 to prepare the next version of the French National Radioactive Material and Waste Management Plan. The conclusions of the public debate underlined the major importance of the management of high and intermediate level, long-lived waste, the need to take greater account of certain aspects (transport, environmental assessment, decommissioning issues and interaction with energy policy) as well as the central nature of the governance of the national radioactive materials and waste management system. The joint decision by the Ministry for Ecological and Inclusive Transition and the ASN Chairman, specifying how the lessons learned from the public debate are to be addressed, was published in February 2020. ASN will continue its involvement to ensure safe management of the waste and materials and will work to make an effective contribution to high-quality consultation with the stakeholders.

The permanent need to anticipate the nuclear safety and radiation protection challenges of new projects

ASN seeks to anticipate the safety challenges associated with the facilities it regulates, in particular on the basis of forward-looking analysis carried out within the framework of the National Radioactive Materials and Waste Management Plan and the guidelines of the multi-year energy programme.

In this context, ASN issued its opinion on the safety options dossier of the EDF project for a centralised storage pool, sufficiently early on so its safety requirements could be integrated into the project.

Faced with the prospect of final shutdown of the two reactors of the Fessenheim NPP, and then of several other reactors, planned under the multi-year energy programme, ASN will be attentive to ensuring that the steps taken by the licensee enable decommissioning to be carried out as rapidly as possible. ASN will aim to optimise its examination processes and learn all relevant lessons from the decommissioning of the Fessenheim NPP, for the benefit of subsequent decommissioning work.

Finally, with regard to the potential construction of new reactors, ASN issued its opinion on the safety options of the "EPR New Model" reactor project and its "EPR 2" evolution, taking account of the lessons learned from the Flamanville EPR and the reactors in operation. This opinion identifies the subjects which would need to be examined in greater depth, or the choices that would have to be justified for a possible reactor creation authorisation application, for example, the adoption of a break preclusion approach.

Vigilance to be maintained owing to the complexity of some medical procedures and the chain of professionals involved

In 2019, the number of significant radiation protection events reported to ASN in the medical field did not change significantly and remains low when compared with the number of procedures performed and the complexity of some of them. The most important challenges from the radiation protection viewpoint concern:

- for workers: fluoroscopy-guided interventional practices and nuclear medicine, where the dose limits are exceeded, notably for the hands and eyes;
- for patients: fluoroscopy-guided interventional practices, owing to the duration of certain procedures, external beam radiotherapy, notably owing to wrong-side errors

and, finally, nuclear medicine, with radiopharmaceutical administration errors;
- for the public and the environment: nuclear medicine, with radioactive source losses, leaks from pipes and radioactive effluent containment systems.

Concerning external beam radiotherapy, the number of significant radiation protection event reports stabilised in 2019. Three events were rated at level 2 on the ASN-SFRO scale (5 in 2018). The security of access to high-level sealed sources needs to be improved in brachytherapy units and will remain a priority inspection topic. The occurrence of two events in which the source remained blocked in a projector recalls the importance of staff training in the emergency measures to be taken in such a situation.

The deployment of new therapies in nuclear medicine, with high activity levels being administered to the patients, requires particular attention with regard to radioactive effluent management. In addition, personnel training efforts must be maintained and the coordination of preventive measures during work by outside contractors must be improved.

With regard to fluoroscopy-guided interventional practices, too few of the premises where they are carried out actually fully meet the regulatory requirements, although the situation is however better in the interventional radiology units. Insufficient training of the professionals in patient radiation protection and a shortfall in application of the principle of optimisation of procedures are recurring findings during the inspections. There is insufficient exploitation of the collection of the doses received by the patients during procedures in order to optimise practices. Patient follow-up –as defined by the French National Authority for Health– if the skin exposure limit is exceeded, is not very satisfactory, particularly in the operating theatres.

Similarly, in the field of external beam radiotherapy, this monitoring is also considered to be insufficient. It led ASN to request that a follow-up study be conducted by professionals on patients affected by a level 2 significant radiation protection event.

Proposals to reinforce the management of a nuclear post-accident situation

On the basis of the lessons learned from the Fukushima NPP accident and the emergency exercises, the Steering Committee for the management of the post-accident phase of a nuclear accident (Codirpa) headed by ASN, proposed a number of changes to post-accident doctrine to the Prime Minister. They primarily aim to simplify the post-accident zoning used as the basis for the population protection measures. More specifically, new criteria were proposed to define the population evacuation perimeter.

The Codirpa also drew up a public guide and created a joint Anccli/ASN/IRSN website to raise awareness of post-accident situations. This site enables elected officials, health professionals, associations, education personnel and economic players to access documents and information for preparing or managing life in a region contaminated by a nuclear accident.

New exchange framework to reinforce cross-border cooperation

ASN took the initiative of setting up a new framework of exchanges to reinforce the sharing of experience on specific subjects with its counterparts in neighbouring countries: Germany, Belgium, Luxembourg and Switzerland. In November 2019, it therefore organised the first inter-regional seminar devoted to cross-inspections, consultation with the stakeholders, emergency preparedness and response and maintaining the skill levels of the nuclear safety regulators. This format for sharing, which is broader than a bilateral meeting and more focused than a multilateral framework, showed the added value to be gained from examining these subjects in greater depth and formulating common proposals to reinforce international cooperation.

Olivier GUPTA – Director General

EDITORIAL BY THE DIRECTOR GENERAL

Efficient oversight and regulation in an unprecedented context

Montrouge, 3 March 2020

With the problems encountered on the EPR construction site, questions concerning the continued operation of the reactors and the structural shortfall in key skills in certain areas, the period through which the nuclear industry is passing at the moment could be referred to as "tense". It is therefore perfectly legitimate to question ASN's actions, the effectiveness of its oversight and regulation and the future actions it intends to take in this unprecedented context. These actions are underpinned by four guidelines and are supported by a human resources policy appropriate to the situation.

Restoring the focus on licensee prime responsibility

When a sector is in difficulty, attention often turns towards the State or the competent Authorities. In this context, there could also be the temptation by the regulator to seek to regulate even further. However, we do not believe that the problems being experienced by the nuclear industry can be overcome by more regulation. Nor do we believe that the problem of fraud can be resolved solely by more inspections.

ASN does not hesitate to use the full range of inspection, enforcement and sanction resources at its disposal: examples of this are the reinforced surveillance in 2019 of the operating Flamanville NPP, or the new inspections deployed to prevent fraud.

In terms of nuclear safety and radiation protection however, a situation in which a licensee could "shelter behind" ASN on a long-term basis is unacceptable: the aim is always for the licensees concerned to themselves assume their prime responsibility for the protection of people and the environment in a fully satisfactory manner. And it is for this that they are accountable to ASN.

It is thus our firm conviction that the means for turning the nuclear sector around lie primarily in the hands of the industry itself.

Improving nuclear safety and radiation protection through dialogue

ASN is open to proposals from licensees and professionals, who have prime responsibility for nuclear safety and radiation protection. These proposals must be based on technical arguments that will be subsequently examined by ASN, in most cases with the assistance of the IRSN. This is what we call an in-depth technical dialogue. The quality and sincerity of this dialogue constitutes one of the pillars on which safety and indeed progress in the field of safety are built.

ASN observes nuclear activities performed in the field, notably during inspections, including by questioning the various parties involved: licensees, contractors on the worksites, care personnel in hospitals and so on. These observations are the basis of ASN's annual evaluation of the nuclear safety and radiation protection situation for the main licensees and the various activity sectors.

ASN dialogues with the other stakeholders, as was the case in 2019 for the consultation on the fourth periodic safety reviews of the 900 MWe reactors and the public debate on the National Radioactive Materials and Waste Management Plan.

Listening, observing, dialoguing: this is what enables us to fully assess a situation and accurately calibrate our requirements and our oversight actions.

A clear definition of priorities

When carrying out its duties, ASN seeks to tailor its oversight actions to help the licensees and professionals focus their resources, which are by their very nature limited, on the essential nuclear safety and radiation protection issues.

In the interest of effectiveness and in order to achieve tangible progress on subjects with major implications, it is important to clearly define the priorities: this entails implementation of the principle of proportionality, on which there is an international consensus, also called the graded approach. The position statement issued by ASN and ASND in 2019 regarding CEA's waste management and decommissioning strategy was a means of validating CEA's priorities in this field. In 2020, we will be doing the same for Orano.

In the same way, it is important to clearly define oversight priorities, which must be targeted in order to address specific issues. ASN has taken initiatives in this area, for example the oversight of reactor outages. After conducting an experiment in 2019, we will be adapting this oversight in 2020, involving fewer systematic prior examinations of files and more field inspections, while increasing the responsibility of the licensee.

In small-scale nuclear facilities, this graded approach also led to the overhaul of the regulatory regimes and the reorientation of some of our inspections, so that our requirements and our inspections are more proportionate to the risks presented by the activities.

Using our powers of regulation, enforcement and sanction, whenever necessary

ASN has considerable regulatory, enforcement and sanction powers and is responsible for using them with discernment.

We do of course sometimes strongly express our disagreement, as was the case this year with regard to the steam line welds on the EPR reactor. We also sometimes issue enforcement measures, such as formal notices, including in the medical sector. In total, the number of cases in which we resort to enforcement measures remains small, an indication of both the good intentions of the licensees and the strength of ASN: it is able to impose most of its positions without having to use these instruments.

In addition to the existing arsenal, the legislator has provided ASN with an additional sanction tool, the administrative fine. Its utilisation requires the creation of a Sanctions Committee, which will be set up in 2020.

A level of skills commensurate with ASN's roles

One pre-condition for being able to exercise efficient and credible oversight is to maintain the ASN personnel's level of skill and accumulated experience in the field of risks and nuclear matters. ASN must therefore have personnel with the skills enabling them to rigorously carry out their investigation and inspection duties with the necessary degree of expertise, more specifically in relation to those available at its technical support organisation, the IRSN.

In a context of State reforms, the handover from one generation to the next and the need to maintain the attractiveness of the jobs it offers, ASN has taken steps, both quantitative and qualitative, to ensure that it can call on personnel with cutting-edge skills, who will devote a sufficiently large part of their career to the regulation and oversight of nuclear safety and radiation protection, because of the recognition that their technical experience is valued.

***

The ASN teams were extensively called on in 2019 and were up to the challenge. I thank them and I thank our partners, especially the IRSN, and the members of the groups advising ASN or collaborating in its work.

The ASN teams are aware of the confidence placed in them, notably by the representative bodies of the Republic. They also know that much will be expected of them in 2020, given the scale of the challenges ahead. Through their individual commitment, they will all do everything they can to be worthy of this trust and these responsibilities.

ASN ASSESSMENTS

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 (NPPs) in operation

ASN considers that the operating rigour of the EDF NPPs regressed in 2019.

The number of significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES) has been increasing steadily for several years. It has increased by more than 30% since 2017. Three significant events were rated level 2 in 2019. Two of them reveal inappropriate actions and decisions on the part of the operators and the crossing of organisational defence lines. Furthermore, as in the previous years, the verification procedures undertaken by EDF regularly reveal deficiencies in the design, installation or maintenance of equipment, calling into question their ability to fulfil their functions in all the situations considered in the nuclear safety case. These deficiencies often concern several reactors, given the similarities in the design and operation of the EDF NPPs.

The situation scenarios the EDF teams have to address during the ASN inspections show that the operational documentation is not always adapted to the reality on the ground and can contain errors, inaccuracies, and even instructions that are impossible to carry out. Analysis of the significant events moreover reveals situations in which groups of people eventually cease to be aware of the safety implications of their actions, sometimes even becoming used to non-compliant situations. ASN considers that EDF must give fresh meaning to the activities in order to federate the operators around the real safety issues.

Improvements in fire risk prevention were nevertheless observed. ASN also notes that EDF places greater importance on the conformity of its installations, which is essential for nuclear safety.

Continued operation of the reactors

The far-reaching modifications EDF plans making to the facilities and the methods of operational management within the framework of the reactor periodic safety reviews will significantly improve the safety of the facilities. EDF is deploying considerable engineering resources for these reviews. ASN notes however that these national engineering teams have reached the maximum of their capacity.

In 2019, EDF performed the first of its 4th ten-yearly outages on one of the reactors at the Tricastin NPP. EDF deployed significant resources for this ten-yearly outage which went reasonably satisfactorily. ASN wonders whether EDF has the capacity to deploy such resources in the future for the other reactors, particularly when several 4th ten-yearly outages take place concurrently.

The conformity of the facilities

As in 2018, ASN noted that, in comparison with previous years, EDF placed greater emphasis on rapidly restoring the conformity of its facility after detecting a deviation, which is satisfactory. However, as in previous years, ASN considers that the actual conformity of the facilities with the rules applicable to them needs to be significantly improved. The year 2019 was again characterised by the detection of deviations affecting equipment that call into question their ability to fulfil their function in an accident situation. Some of these deviations date back to the construction of the reactors, others have been created when implementing modifications to the facilities, including recently, or result from ageing or insufficient maintenance of the facilities. In 2019, a number of pumping stations were found to be in sub-standard condition and, once again, deviations affecting the emergency diesel generator sets were discovered. Several deviations were also linked to the manufacture of components of items important to safety. This was the case in particular with defective electrical components, which led to a significant event rated level 2 on the INES scale affecting reactor 2 of the Penly NPP. EDF must continue the targeted inspection actions it has been gradually deploying over the last few years, but must also widen their scope.

ASN notes that the necessary spare parts are not always available in sufficient quantities. In these situations, ASN is particularly attentive to the effectiveness, the efficiency and the durability of the compensatory measures implemented by EDF pending correction of the anomaly.

In order to combat the risk of fraud, EDF has adapted its inspection practices, in particular by making greater use of unannounced or cross-inspections. ASN considers that EDF must nevertheless step up its actions in order to prevent abnormalities within its own organisations.

Maintenance

As a general rule, most of the NPPs are adequately organised to successfully carry out large-scale maintenance operations.

In a context of a high maintenance workloads, due in particular to the continued operation of the reactors and the "*Grand Carénage*" major overhaul programme, ASN has in the past regularly drawn EDF's attention to the persistence of an excessively large number of maintenance quality deficiencies. Over the last few years EDF has put in place action plans to reduce their occurrence. However, ASN finds that these have not been sufficiently effective. EDF must therefore learn from this and increase its professional rigour in maintenance operations.

Several of these maintenance quality deficiencies result from operators losing sight of the fact that their actions contribute to safety, or from applying the maintenance procedures incorrectly or even applying inappropriate procedures. The operators still have to deal with constraints linked to work organisation, such as insufficient preparation for certain activities, unplanned scheduling changes and problems with worksite coordination.

ASN in 2019 has again noted very high levels of fouling in certain internal structures of the Steam Generators (SG) of several reactors, which could impair their operating safety. These fouling levels are the result of maintenance that was insufficient to guarantee satisfactory cleanness.

Further deterioration associated with the ageing of certain items of equipment, particularly SG internal structures, was also detected in 2019. ASN considers that EDF must therefore adapt the level of stringency of its in-service monitoring and look ahead to the development of repair processes.

ASN regularly notes EDF's difficulty in ensuring appropriate and proportional monitoring of subcontracted activities, whether the activities are performed on site or at the suppliers of goods and services. This being said, in 2019 ASN saw an improvement in the technical oversight of subcontracted operations and service provider monitoring, particularly through the use of computer aids recently deployed in the NPPs.

Operation

ASN observes organisational weaknesses on some sites and losses of know-how. These difficulties are increased on the sites which have had to carry out a ten-yearly outage due to the fact that these outages involve deploying substantial resources and lead to significant changes in the facilities and their baseline operating requirements.

In 2019, the ASN inspections highlighted the need for closer monitoring of the activities of operational control operators. At several NPPS the average time taken to detect a breach of the operational management rules is too long. Despite this, the operators seem to know the reactor operational control rules, even though they have undergone relatively frequent changes over the last few years. ASN therefore considers that the analysis of these deviations must focus on their root causes and that EDF must be particularly attentive to the verification of the actions of the operational control teams.

As in 2018, EDF encountered difficulties during the post-outage reactor restarts. Furthermore, the majority of the sites need to improve the scheduling and performance of the periodic tests and the analysis of their results. 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 inspections ASN carried out in 2019 in the area of operational management in the event of an accident placed the operators in simulated accident situations. Although the operators showed that they knew the technical actions to carry out, ASN's inspections revealed that in some cases these actions cannot be accomplished within the required times, or even cannot be carried out at all due to the configuration of the facilities. In other cases, the instructions did not take into account the actual status of the facility. EDF initiated an action plan in mid-2019, and its first effects can already be seen.

In recent years, EDF has reinforced its organisation for controlling hazard-related risks, such as the organisation put into place to detect and eliminate the risk of objects falling in the event of an earthquake. However, ASN regularly observes that the steps taken by EDF to prevent hazards and mitigate their consequences need to be further improved. This is the case in particular with the provisions for explosion risks, for which some maintenance and inspection actions are not implemented satisfactorily.

As in 2018, the ASN inspections focusing on the organisation and emergency resources confirmed that the organisation, preparedness and management principles for emergency situations covered by an on-site emergency plan have been correctly assimilated.

The analyses conducted by the sites further to significant events are generally appropriate and the identification of organisational causes is getting better. However, these analyses often result only in corrective actions that are limited to one-off awareness-raising measures targeting the employees, services or companies identified as being the cause of the deviation.

Protection of the environment

EDF's organisation for controlling the detrimental effects and impact of the NPPs on the environment needs to be improved on most sites. ASN considers that the licensee needs to raise its level of vigilance on these topics. EDF must more specifically improve the integration of the regulatory provisions relating to pollution prevention, particularly regarding the containment of hazardous liquid substances. Despite some occasional weaknesses, EDF has shown a good level of control over its process for managing effluent discharges. With regard to waste management, ASN observes the continuing improvements in EDF's organisation, but remains vigilant regarding the various sites' compliance with regulations.

Worker radiation protection and occupational safety

ASN notes an overall deterioration in the way radiation protection is taken into account in the NPPs. The significant events analyses often show in particular an inadequate perception of the radiological risks. ASN has nevertheless noted improvements in the implementation of means of cordoning off worksites.

A fatal accident resulting from worksite organisation and handling problems occurred in 2019. EDF has taken actions to mitigate the main risks for workers further to inspections by the ASN labour inspectors. Certain occupational risk situations are nevertheless still worrying and must be significantly improved. They concern the risks linked to work equipment and more particularly to lifting gear, the explosion and fire risks and electrical risks.

Individual NPP assessments

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

- in the area of nuclear safety: Fessenheim, Saint-Alban and, to a lesser extent, Blayais;
- in the area of environmental protection: Fessenheim, Saint-Alban and Saint-Laurent-des-Eaux;
- in the area of radiation protection: Saint-Alban.

Other sites on the contrary are under-performing in at least one of these three areas:

- in the area of nuclear safety: Flamanville, Golfech and Gravelines;
- in the area of environmental protection: Flamanville, Cruas, Dampierre-en-Burly;
- in the area of radiation protection: Flamanville, Dampierre-en-Burly and Tricastin.

The Flamanville EPR reactor under construction

ASN considers that, in view of the lack of rigour observed in the performance and monitoring of certain welding operations, EDF must extend the scale of the verifications performed to demonstrate the satisfactory condition of the facility. Beyond these verifications, ASN considers that the organisation put into place to prepare for operation of the Flamanville EPR reactor is on the whole satisfactory.

The deviations found on the main steam letdown pipes revealed a lack of control over the welding operations and a breakdown in EDF monitoring of its contractors. ASN therefore asked that the review of the quality of the Flamanville EPR reactor equipment be extended to include a broader scope of equipment and subcontractors, while adapting the depth of the review according to the implications. EDF still has to supplement this procedure. EDF must moreover be careful to ensure that the necessary repairs and worksite completion are carried out giving priority to the quality of workmanship and professional rigour.

In 2019, ASN observed improvements in equipment qualification and traceability of the startup tests. EDF must nevertheless further develop its practices concerning the demonstration of startup test representativeness.

NPPs being decommissioned and waste management facilities

ASN considers that the level of safety of the facilities being decommissioned and of waste management is on the whole satisfactory, but that the risk of worker exposure to ionising radiation, the main issue during decommissioning, must be better controlled.

With EDF facilities undergoing decommissioning from which the fuel has already been removed, nuclear safety consists in controlling the containment of the radioactive substances. Most of these substances are situated in the currently contained reactor pressure vessels which are not undergoing any decommissioning operations that could put the substances back into suspension (with the exception of Chooz A and Superphénix).

The issues that EDF has to address concern worker radiation protection and waste management. With regard to these points, in 2019, EDF continued to have difficulties in controlling the risk associated with the presence of alpha-emitting radionuclides, more particularly in the Chooz A facility. Furthermore, EDF is confronted with the problem of asbestos, which requires the suspension of work in order to establish appropriate protective measures and remove the asbestos.

As a general rule, the ongoing decommissioning operations are falling behind schedule and the major operations, which concern reactor core decommissioning, have been postponed. Managing time lines in complete safety therefore remains a major issue for EDF. ASN considers that EDF must reinforce the coordination of the Fessenheim NPP decommissioning project in order to have an overall view of the project integrating all its interactions. It also considers that EDF must improve its organisation to establish and validate fundamental decisions for the decommissioning scenario based on proven and formalised hypotheses.

Orano Cycle

ASN considers that the level of safety in the facilities operated by Orano Cycle remained at a generally satisfactory level in 2019, in a context where the group's new organisation was being put in place.

The facilities operated by Orano Cycle are located on the sites of La Hague, Tricastin and Marcoule. They present significant safety risks, but of different types, both chemical and radiological. The organisation of the Orano group is mainly decentralised, which leads to differences in practices between each site.

The Orano group has put in place a central organisation, which has improved the quality of its periodic safety reviews, particularly through its ability to report on the conformity of its facilities. The Tricastin and La Hague sites, which feature numerous Basic Nuclear Installations (BNIs), have set up dedicated organisations that enable the periodic safety reviews of the various BNIs to be conducted continuously, which improves the rigour of the reviews. Orano must nevertheless continue these improvement initiatives, particularly with regard to civil engineering where it must redouble its efforts concerning its auxiliary facilities which are not assigned to production. Orano must improve the centralised tracking of the required actions identified during these reviews in order to take them through to completion.

Orano Cycle has set up an organization to manage the effects of ageing of its La Hague facilities. The principle of the methodology deployed is acceptable. ASN observes that its deployment has improved compared with 2018. The actions to implement must be tracked more formally. Orano's organisation must be improved and be underpinned more by procedures than individual skills. Within the framework of the periodic safety reviews of the Tricastin and Marcoule facilities, ASN will check that Orano capitalises on the progress it has made in this area.

Progress remains to be made in Orano's monitoring of its service providers. ASN has observed several deviations in the execution of the periodic inspections and tests performed by outside contractors and in the way they take into account the safety requirements when carrying out new work projects.

Orano Cycle has nevertheless made progress in the implementation of its periodic inspections and tests at La Hague.

Risk control

Orano has improved its operational control teams' compliance with the instructions concerning the containment of radioactive substances at La Hague.

Compliance with radiation protection instructions in the Orano plants has also improved on the whole. Despite this, monitoring devices are not always available at the entrance to and exit from radiological areas.

Post-Fukushima

Orano Cycle has demonstrated determination in its management of the stress tests further to the Fukushima NPP accident. In 2019, Orano completed the construction of virtually all the complementary resources resulting from this exercise. These include, for example, new means designed to help cope with extreme situations in its facilities, particularly water make-up resources and new emergency response buildings that are robust to extreme hazards.

Emergency management

Orano has a robust emergency management organisation and provides its emergency response teams with appropriate training. The exercises conducted by Orano Cycle on the La Hague site in 2019 were sufficiently diverse to ensure adequate training of these teams.

Legacy waste retrieval and packaging, decommissioning and waste management

Large quantities of legacy waste at the La Hague site are not stored in accordance with current requirements and present major safety risks. The retrieval and packaging of this legacy waste govern decommissioning progress in the definitively shut down plants. ASN observes delays in Orano's waste retrieval and packaging projects, which are often complex, leading Orano to announce the pushing back –sometimes by several decades– of deadlines to which it was committed. ASN considers that the control of the retrieval and packaging projects must be improved. Thus, in 2019, ASN initiated a procedure to monitor the management of these projects, assisted by the DGEC (General Directorate for Energy and Climate). This procedure has led ASN to ask Orano to make fundamental improvements to the management of these projects and the organisation underpinning their management, in order to better meet the deadlines to which Orano has committed itself and which are prescribed in ASN resolutions or decrees. This procedure will be continued in 2020.

Furthermore, shortcomings in waste management have given rise to several significant event notifications, particularly with regard to criticality prevention. Orano must improve its waste storage conditions and monitor more systematically the drums of waste produced.

CEA

ASN considers that the safety of the facilities operated by the CEA (Alternative Energies and Atomic Energy Commission) remains on the whole satisfactory, despite a worrying budgetary situation. The safety issues concern firstly the continued operation of the facilities, designed to old safety standards, secondly the decommissioning of the definitively shut down facilities and the retrieval and packaging of legacy waste, and lastly the management of its radioactive waste and materials with no identified use.

Safety organisation and management

ASN observes that the organisation of the CEA is constantly changing. These organisational changes aim to improve the efficiency of the CEA structures, clarify roles and ensure greater involvement of the decision-making levels. ASN considers that the CEA must remain attentive to ensuring that all the safety aspects are properly taken into account at all levels of the organisation and are led by people who have the necessary resources, skills and authority. It urges the CEA to rapidly propose a strategic view of the changes under way.

ASN considers that the implementation of "major safety commitments," managed at the highest level and enabling the most important nuclear safety and radiation protection issues to be monitored, is on the whole satisfactory. It will be necessary to ensure that the reduction in resources allocated to the CEA does not affect the meeting of other commitments, particularly those governed by ASN requirements.

Facilities in operation and undergoing decommissioning

Faced with the ageing of the CEA's facilities in operation and the uncertainty of the projects to replace some of them, in 2019 the CEA developed a medium-term strategy for the utilisation of its experimental civil nuclear research facilities and its waste and material management facilities. The first conclusions reveal the need to streamline and optimise the existing facilities, as well as carry out substantial renovation work and perhaps build new facilities. ASN considers that this prioritisation is legitimate from the safety aspect and that the CEA must draw clear action plans from it and formalise precisely the options it has taken (abandoning or optimisation of operation, work to undertake, etc.).

In 2019, ASN and ASND (Defence Nuclear Safety Authority) underlined the CEA's relevant in-depth review (see Notable events) of its decommissioning strategy, its prioritisation of operations and human resources, the effectiveness of its organization, and the appropriateness of the financial resources devoted to these operations. The new organisation for decommissioning implemented in 2017 also represents a significant step forward. This progress will have to be confirmed in the medium-term by meeting the deadlines for the highest priority projects. The CEA must remain attentive to the non-redundant facilities whose unavailability could undermine the process as a whole, to the allocated financial resources, to the feasibility of the work completion deadlines and to work progress.

The conformity of the facilities

ASN observes that the CEA has embraced the periodic safety review process for its facilities by implementing a cross-cutting organisation dedicated to these activities on each site. The check of conformity, particularly with the regulatory provisions, and the action plans defined by the CEA are showing distinct improvements (efforts to be exhaustive, conclusions on conformity with the regulations or not, implementation schedules, distinguishing compliance actions from improvement actions), even if further improvements are still necessary regarding the extent of the checks on certain equipment items and the management of activities important to protection. The reassessment of control of the risks and adverse effects of each facility is also better grasped and well documented. Improvements are however required in the reassessment of the seismic and climatic risks (wind, tornadoes); the studies submitted do not allow a satisfactory assessment of the conformity of several facilities –particularly of their baseline requirements– with respect to the regulations. The CEA must be vigilant as to the proper execution of the works identified in the reassessments. ASN effectively observes that the CEA sometimes makes commitments without being able to ensure that the human or financial resources are actually available.

Management of deviations

The management of deviations within the facilities is on the whole satisfactory. Nevertheless, their analysis should be taken to further by analysing all the deviations, from the significant events down to low-level events. On the whole, the number of significant events in 2019 was stable in relation to 2018. No significant event exceeded level 1 on the INES scale. The analysis of their causes regularly reveals a technical deficiency (related to ageing or obsolescence) or an organisational or human cause (related to incorrect transposition of safety requirements in the operational documentation or to activity planning). Lastly, ASN underlines the quality of the experience feedback sheets produced by the central services for the centres and the nuclear facilities. It encourages the CEA to take steps to ensure that the measures defined in these sheets are effectively applied in the BNIs.

Management of modifications

For many years now the CEA has applied a modification management system that gives satisfaction, particularly through the quality of the files submitted to ASN when applying for authorisations for noteworthy modifications. ASN also observes that the modifications implemented on site do effectively correspond to the information provided by the CEA in its authorisation applications.

Maintenance and periodic inspections and tests

The maintenance work and the scheduling of the periodic inspections and tests, their performance and their monitoring within the CEA facilities are on the whole satisfactory. ASN does however still observe disparities between the facilities in these two areas. In addition, the traceability of the inspections performed must be further improved. ASN also expects the CEA to implement an ageing and obsolescence strategy that is harmonised for all its facilities. At present, for the facilities as a whole, ageing is often only managed through the periodic inspections and tests.

Outside contractors

ASN observes that the CEA's monitoring of outside contractors has been stepped up over the last few years, particularly by following monitoring plans and appointing CEA personnel to specifically monitor the subcontracted activities. ASN does nevertheless note that when maintenance is carried out by outside contractors whose services are governed by contracts signed with the centres and monitored by the support services, the monitoring is not always appropriate. This is because these monitoring plans are not individualised. The balance between the number of CEA employees in charge of monitoring and the number of work interventions performed can be improved, as can the appropriateness of the monitoring plans for the services they concern. ASN also notes the need for the CEA to tighten the monitoring of the chain of outside contractors, particularly their service providers' subcontractors. Lastly, there are still disparities in the quality of monitoring between the facilities operated by the CEA.

Risk control, emergency management and integration of the lessons learned from Fukushima

ASN observes significant delays in the construction of the emergency management buildings, designed to take account of the lessons learned from Fukushima, for the Cadarache, Marcoule and Saclay centres. In 2019, ASN thus gave the CEA formal notice to submit the design basis justifications for the future emergency management buildings of the Saclay centre.

The CEA's emergency organisation and resources have to be significantly improved to catch up on the lateness in meeting the current requirements. The national organisation in particular needs to be reinforced, paying very close attention to the coordination between the national level, the sites and the facilities. Coordination between the local security force and the facilities of the CEA centres is improving, particularly as regards keeping the intervention plans and instructions up to date.

ASN also considers that the CEA must continue its efforts to improve protection against the fire risk. The management of the technical devices (fire doors and fire dampers, fire detection systems, etc.) must be improved and fire loads limited, particularly when worksites are in progress. The now identified shortcomings in the lightning protection of the buildings must also be remedied within short time frames.

Personnel radiation protection

Radiation protection is satisfactorily taken into account in the various CEA centres, with the exception of the Fontenay-aux-Roses site, where shortcomings have been observed in the organisation and technical provisions in place. For all the centres, the identification of items and activities important to protection, the management of measuring instrument ageing and the monitoring of outside contractors (dealing with deviations, traceability and application of the ALARA principle) need to be improved.

Protection of the environment

CEA's organisation for controlling the adverse effects and the impact of the facilities on the environment is satisfactory, particularly with regard to the management of gaseous and liquid effluents. The management of non-radioactive liquid effluents however must be improved, as much in the quality of their analyses as in their management, and concerning storm water in particular. In view of the number of facilities in final shutdown status and undergoing decommissioning, the CEA has to engage in the substantial task of reviewing the impact studies and proposing discharge limits that are consistent with their operation. With regard to waste management, ASN expects on the part of the CEA improvements in zoning, in the cordoning-off of work areas, in collection areas and in the radioactive waste inventories.

Individual facility assessments

The ASN assessments of each centre and each nuclear facility are detailed in the Regional Overview in this report.

The Jules Horowitz research reactor (JHR), currently under construction at Cadarache

The JHR reactor, which was authorised in 2009, is currently under construction. The worksite contingencies, such as the management of safety-related deviations, are handled satisfactorily. In view of the extension of the construction work and the time required to commission the reactor, the CEA must respond to issues of project management, maintaining its technical skills over time and the conservation of already manufactured and possibly installed equipment items before they are commissioned. ASN considers that the change of organisation implemented in the second half of 2019 is on the whole satisfactory.

Andra

The French National Agency for Radioactive Waste Management (Andra) is the only licensee of radioactive waste disposal BNIs in France. ASN considers that the operation of Andra's waste disposal BNIs is satisfactory. ASN notes that the low-level long-lived waste disposal project made no progress during the 2016-2018 period, and that consequently the deadlines of the PNGMDR (National Radioactive Material and Waste Management Plan) on this subject have not been met.

Operation of Andra's existing facilities

ASN considers that safety and radiation protection in the facilities operated by Andra are satisfactory.

ASN observes a significant drop in the number of significant events reported between 2018 and 2019. It has doubts regarding Andra's reporting of events.

Alongside this, ASN considers that Andra must better integrate certain principles of the safety approach, particularly to take better account of defence in depth in the classification of certain items or activities as being important to protection.

Organisation dedicated to the *Cigéo* project creation authorisation file

Andra has set up a dedicated organisation for the preparation of the *Cigéo* project creation authorisation file, the submittal of which is planned for the end of 2020. ASN observes that this organisation is complex, which can have an impact on

the management of priorities. It does nevertheless give the project team a level of visibility that is appropriate for the issues and enables the subjects to be addressed with a high standard of technical proficiency. As regards taking organisational and human aspects into account, ASN considers that Andra's organisation, which is based on outsourcing, could present weaknesses.

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

ASN ASSESSMENTS **BY AREA OF ACTIVITY**

THE MEDICAL SECTOR

In radiotherapy, the safety fundamentals are in place (equipment verifications, medical staff training, quality and risk management policy). The quality initiatives are making progress. The prospective risk analyses however remain relatively theoretical and are insufficiently deployed prior to organisational or technical changes. ASN is reducing its inspection frequencies, but given the diversity of situations encountered, the centres displaying vulnerabilities or particular risks will continue to be subject to particular scrutiny and more frequent monitoring in 2020.

With regard to treatment safety, the situation **in brachytherapy** is comparable with that of external-beam radiotherapy. The radiation protection of medical staff and the management of high-activity sealed sources are considered satisfactory on the whole. This level must however be maintained through continuous training. In the current context, increased attention must be given to securing access to these sources, to prevent any unauthorised access.

In nuclear medicine, the radiation protection of patients and medical staff is satisfactory. The training efforts must be maintained in this sector as well. Moreover, the coordination of prevention measures when outside companies intervene (for machine maintenance, upkeep of the premises, etc.) must be improved. One of the radiation protection challenges is also to ensure good management of radioactive effluents, which is all the more important given that therapies administering high activities to patients are going to increase in number, leading to an increase in the discharged radioactivity.

In the area of **fluoroscopy-guided interventional practices**, ASN considers that the measures it has been recommending for several years to improve the radiation protection of patients and professionals have still not been sufficiently implemented, particularly for surgical procedures performed in operating theatres. The inspections frequently reveal deviations from the regulations, as much in the radiation protection of patients as in that of medical staff, and ASN is regularly notified of events concerning interventional practitioners who have exceeded the dose limits for the extremities. The radiation protection situation is however significantly better in the departments that have been using these technologies for a long time, such as the imaging departments performing interventional cardiology and neurology activities. Substantial awareness-raising in all the professionals is necessary to help the medical, paramedical and administrative staff of the medical centres gain a better perception of the risks, particularly for the professionals working in operating theatres.

In ASN's opinion, the continuous training of the medical staff and the involvement of the medical physicist probably constitute the two key points to guarantee control of the doses delivered to patients during interventional procedures.

The growing number of diagnostic examinations performed using **CT scanners** –computed tomography scanners– contributes very substantially to the collective dose received by the public, as medical imaging is the leading source of artificial exposure of the population to ionising radiation.

The medical justification of these procedures is still not sufficiently operational, due to the highly insufficient training of the prescribing physicians, not to mention the lack of availability of other diagnostic methods –Magnetic resonance imaging (MRI), ultrasonography. In July 2018, ASN published a second plan of action for controlling ionising radiation doses delivered to persons during medical imaging. This plan aims to reinforce the application of justification of the procedures and 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 depending on the companies, even though worker dosimetric 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 licensees when this activity is performed in a bunker in accordance with the applicable regulations, ASN is still concerned by the observed shortcomings in the signalling of the operations area during on-site work and notes a deterioration in the situation compared with 2018. More generally, ASN considers that the ordering customers should favour industrial radiography services provided in bunkers and not on site. Lastly, the content of operator training should better integrate the lessons learned from the significant radiation protection events.

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 satisfactory on the whole. 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 notable improvements concern the conditions of waste and effluent storage, particularly the setting up of pre-disposal checking procedures; nevertheless, further progress must be made, particularly in preparation for the recovery of unused "legacy" sealed radioactive sources. 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 still not systematic enough.

With regard to the **veterinary uses of ionising radiation**, ASN can see the result of the 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 2019, the safety of transport of radioactive substances was on the whole satisfactory. Although a number of transport operations –mainly by road– did suffer incidents, these must be put into perspective with the 770,000 transport operations carried out each year. The incidents led neither to dispersion of the package content into the environment, nor to significant exposure of persons, with the exception of one event concerning the overexposure of a driver transporting radiopharmaceutical products (dose of nearly 28 mSv (millisieverts) received over 12 consecutive months).

The number of significant events relating to the transport of radioactive substances on the public highway remains stables (85 events reported to ASN in 2019). These were essentially:

- material non-conformities affecting a package. They 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 rigour in day-to-day operations.

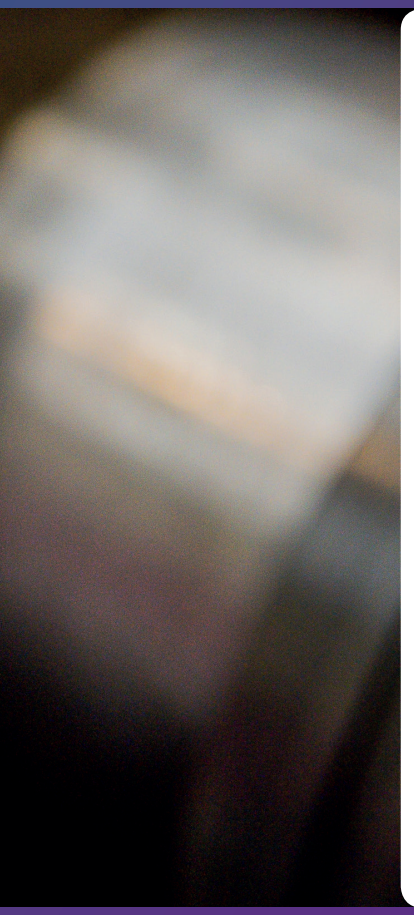
With regard to transport operations involved in the fuel cycle and, more generally, for BNIs, ASN considers that the consignors must further improve how they demonstrate that the contents actually loaded into the packaging comply with the specifications of the approval certificates and the corresponding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

For transport operations involving packages that no longer require ASN approval, progress is observed with respect to the previous years, along with better application of the recommendations given in ASN Guide No. 7 (volume 3). The improvements still to be made generally concern the description of the authorised contents by type of package, the demonstration that there is no loss or dispersion of the radioactive content under normal transport conditions, and that is impossible to exceed the applicable dose rate 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 knowledge of the regulations applicable to these transport operations and the arrangements made by certain hospitals or nuclear medicine centres for the shipment and reception 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.


AUTORITÉ DE SÛRETÉ NUCLÉAIRE
asn

NOTABLE EVENTS 2019



FLAMANVILLE EPR REACTOR

Non-conformity of main secondary system welds

A significant number of deviations have been detected in the welds made on the pipes making up the main secondary systems of the Flamanville EPR reactor. These deviations led to the presence of flaws which were only belatedly detected and to mechanical properties below those initially anticipated. These deviations stem resulted from insufficient qualification of the processes, a lack of expertise in their implementation and shortcomings in EDF's monitoring of its contractors.

Some of these welds are subject to a "break preclusion" approach, which assumes mechanical properties and a level of manufacturing quality that are particularly high.

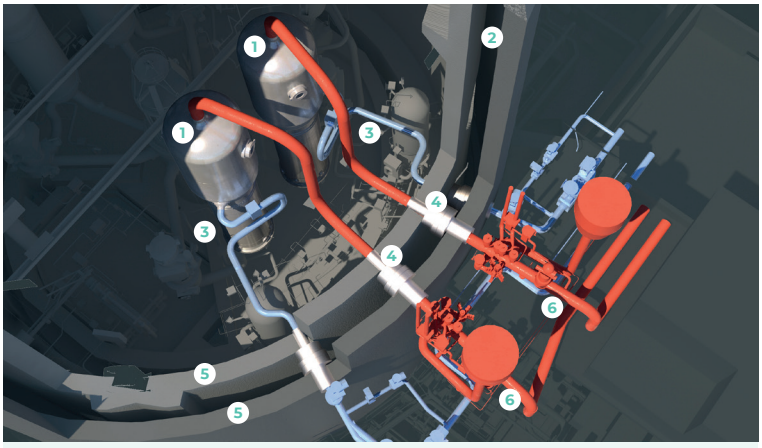
As early as 2018, ASN considered that preference should be given to repairing all the welds. EDF began to repair the main secondary systems welds, using procedures which depended on the systems concerned and the nature of the deviations.

Main steam line welds on the containment penetrations

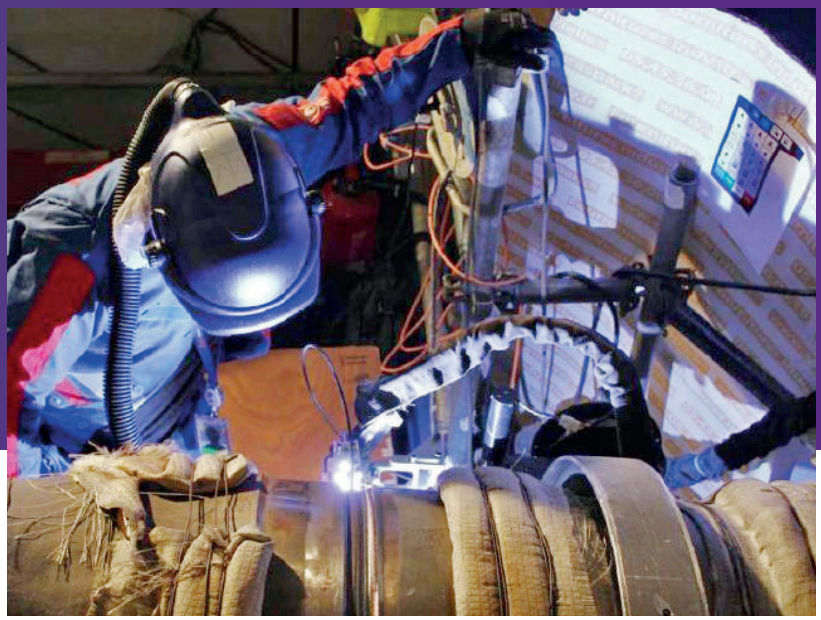
Eight main steam line welds (VVP system) are located in the annulus between the two containment walls of the reactor building and are hard to access. EDF had hoped to be able to keep these break-preclusion welds as-is, relying on a test programme and increased in-service monitoring.

After examining the EDF file and consulting its Advisory Committee for Nuclear Pressure Equipment, ASN considered that the nature and the particularly high number of the deviations which had occurred during design and manufacture represented a major obstacle to keeping these welds as-is. In June 2019, ASN therefore indicated that repair before commissioning of the reactor remained the baseline solution.

Three repair solutions were then studied by EDF, for which ASN submitted its preliminary analysis of the risks and sensitive points. In October 2019, EDF's priority scenario was repair of the pipe from the inside, which requires the development of special intervention means. Qualification of the processes is ongoing, with EDF envisaging the end of the repair works in the second half of 2021.



1 Steam generators 2 Annulus 3 Feedwater flow control system
4 Penetrations 5 Double containment 6 Steam letdown systems (VVP)



Implementation of the orbital TIG process (weld on the main secondary system)

The other main steam line welds

In 2018, EDF decided to repair the other welds on the main steam lines. More than 50 welds are to be repaired, with the high level of quality required by the break preclusion approach.

Qualification of the welding processes and verification of the performance of the non-destructive testing means are in progress. The repair work is scheduled to start in 2020.

Steam generators feedwater system welds

In 2018, EDF began to repair the welds on the steam generators feedwater flow control system (ARE system). Six welds have been repaired.

In 2018, ASN also asked EDF to review the quality of the equipment in the Flamanville EPR reactor. In so doing, EDF revealed new deviations concerning the steam generators feedwater supply system. These deviations are currently being characterised in order to define how best to handle them. The review will continue in 2020.

IN BRIEF

Preparation for the operations to repair the eight penetration welds requires prior qualification of the welding processes, the non-destructive tests and the tools needed, notably for the pipe cutting and clamping phases, as well as for the heat treatment of the welds. Qualification of the welding process was started in 2019 and will continue in 2020.

For each weld, EDF and Framatome are thus producing a table to assess its compliance with the requirements of the technical baseline, including that associated with the break preclusion hypotheses. The organisation approved and mandated by ASN to evaluate the compliance of these welds examines their documentation and the corresponding table and evaluates whether the prerequisites for initiating their repair have been met. At the same time, ASN checks that all the actions taken by EDF, the manufacturer Framatome and the organisation result in a weld performance process that is robust.

REGULATION NEWS

Protecting NPPs from heat waves and earthquakes

In 2019, France experienced several heat wave episodes, plus the earthquake at Le Teil on 11 November 2019. The nuclear reactor safety cases take account of this type of natural hazard.

Operation of nuclear reactors during heat waves

The temperatures that nuclear reactors are required to deal with, as specified in the safety case, are regularly reassessed, notably during the periodic safety reviews. These reassessments take account of climate change.

A heat wave has three main consequences for the operation of nuclear reactors.

Operation of safety systems during a heat wave

In a heat wave, ventilation and air-conditioning systems are needed to guarantee the operation of the safety systems of the nuclear reactors.

During the heat waves of 2003 and 2006, EDF reinforced the ventilation and air-conditioning capacity of the premises containing the safety systems. These systems, which are required in the event of a heat wave, undergo preventive servicing, inspection and maintenance work. The general operating rules for the reactors indicate the steps to be taken should this equipment fail. This entails taking special measures, or even shutting down the reactor, as necessary.

In addition, EDF sets out special operating rules which, between April and October of each year, adapt the level of deployment of the internal organisations on the basis of the weather forecasts.

Reactor cooling and waste management in the event of drought or low water levels

Nuclear reactors must be permanently cooled in order to remain safe. Water is thus taken for this purpose from a watercourse or from the sea.

A period of drought can lead to a drop in the level and discharge of a watercourse. The licensee must permanently ensure that these remain sufficient to cool the safety systems. These parameters are specific to each NPP.

The discharge of the watercourse also affects the dispersal of liquid effluents from the nuclear reactors. For each NPP, ASN sets a minimum watercourse discharge value at which effluent discharges are possible.

Below this discharge rate (low water situation), effluent discharges are prohibited and the licensee has to store the effluents produced.

Controlling thermal discharges

The water intake from watercourses or the sea to cool the reactor is generally speaking discharged at a higher temperature, either directly, or after cooling in the cooling towers, enabling some of the heat to be dissipated into the atmosphere.

In the case of NPPs using a watercourse, ASN has for each site defined the conditions for discharge of the water used for cooling. In order to protect the environment, the ecosystem in particular, limit values are set for the heating of the watercourse as a result of operation of the NPP, as well as for the temperature of the water downstream of the plant. If these limit values are exceeded, the licensee shall reduce the power of the reactor or shut it down. Since 2006, ASN has incorporated measures into the regulations covering NPP discharges, to ensure advance definition of the operations of NPPs in exceptional climatic conditions leading to significant warming of the watercourse. These special provisions are however only applicable if the security of the electricity grid is at stake. Temporary relaxation of the limit values for the thermal discharges may also be authorised by ASN, at EDF's request, if needed by the electricity grid, as was the case during the heat waves of 2003 and 2006. In this case, environmental monitoring is reinforced.

During the heat waves of 2019, EDF had to shut down several reactors and reduce the power of some others.

Cruas-Meysse NPP

Designing NPPs to deal with the earthquake risk

Earthquakes form part of the natural risks that nuclear facilities must be able to withstand. Seismic protection measures are designed into the facilities and reviewed every ten years during the periodic safety reviews, to take account of changing knowledge.

In France, the characterisation of the seismic risk that each Basic Nuclear Installation (BNI) must be able to withstand is based on a deterministic approach, detailed in basic safety rule 2001-01. This rule is supplemented by ASN Guide 2/01 which defines the design provisions for the seismic protection of civil engineering structures.

The hazard characterisation method consists in:

- firstly, determining the "Maximum Historically Probable Earthquake" (MHPE) which corresponds to a return period of about 1,000 years. This level of earthquake can be considered as the most intense level "in human memory" identified in the region concerned;
- then defining the "Safe Shutdown Earthquake" (SSE) which corresponds to an increase in the magnitude of the MHPE of 0.5 on the Richter scale. Furthermore, the SSE is positioned by convention as close as possible to the nuclear site within the seismotectonic zone to which it belongs.

The SSE therefore integrates margins with respect to the historical earthquake recorded in the region in question: it is more intense and is positioned as close as possible to the nuclear site. On some sites, the consideration of paleoseismicity[1] data can supplement the movements associated with the SSEs.

Every 10 years, during their periodic safety reviews of its facilities, EDF reassess the earthquake intensity to be considered in the safety case. This reassessment is made in the light of developments in historical knowledge and any earthquakes that have occurred since the last review. As a result, EDF regularly reinforces parts of its facilities.

Without waiting for the periodic safety review, ASN may also ask that any event compromising the hypotheses used in the design of a facility be taken into consideration.

ASN therefore asked EDF to determine whether the Le Teil earthquake of 11 November 2019, once it was characterised, required a reassessment of the MHPE and thus the SSE for the Cruas and Tricastin NPPs. If so, EDF must determine whether this reassessment will oblige it to reinforce its installations. ASN will review the entire process and issue a position statement on this subject.

After the Fukushima NPP accident, ASN also asked EDF to check the robustness of its NPPs to an even higher earthquake level, the "Hardened Safety Core Earthquake" (HSCE), for which the main safety functions must continue to be guaranteed. The ground movements (accelerations) corresponding to the HSCE must be greater than those of the SSE plus 50%, and greater than those of earthquakes with a return period of 20,000 years. To meet this requirement, EDF has defined a "hardened safety core" of equipment (such as the ultimate backup diesel generator sets) that can withstand the HSCE and which is currently being deployed on its reactors.

IN BRIEF

The concept of the "hardened safety core" aims to create structures and equipment capable of withstanding events and of performing functions essential for the safety of the facilities and for management of an emergency on the site.

1. A paleoseismicity study consists in excavating trenches through the surface trace of an active fault in order to identify earthquakes which have in the past affected the region in question.

REGULATION NEWS

Fourth ten-yearly outage of EDF reactors: the first one at Tricastin

In 2019, EDF initiated its program of fourth ten-yearly outages for its 900 MWe reactors. Tricastin reactor 1 was thus shut down from 1 June to 23 December 2019.

This ten-yearly outage is one of the steps of its fourth periodic safety review. This periodic safety review is particularly important because the initial hypothesis used in the design of some of the reactor equipment was 40 years of operation. Extending its operation beyond this period means that these design studies must be updated or some equipment replaced. This periodic safety review is also an opportunity to complete the incorporation of the changes arising from the ASN requirements issued following the stress tests performed in the wake of the accident that struck the Fukushima Daiichi NPP.

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.

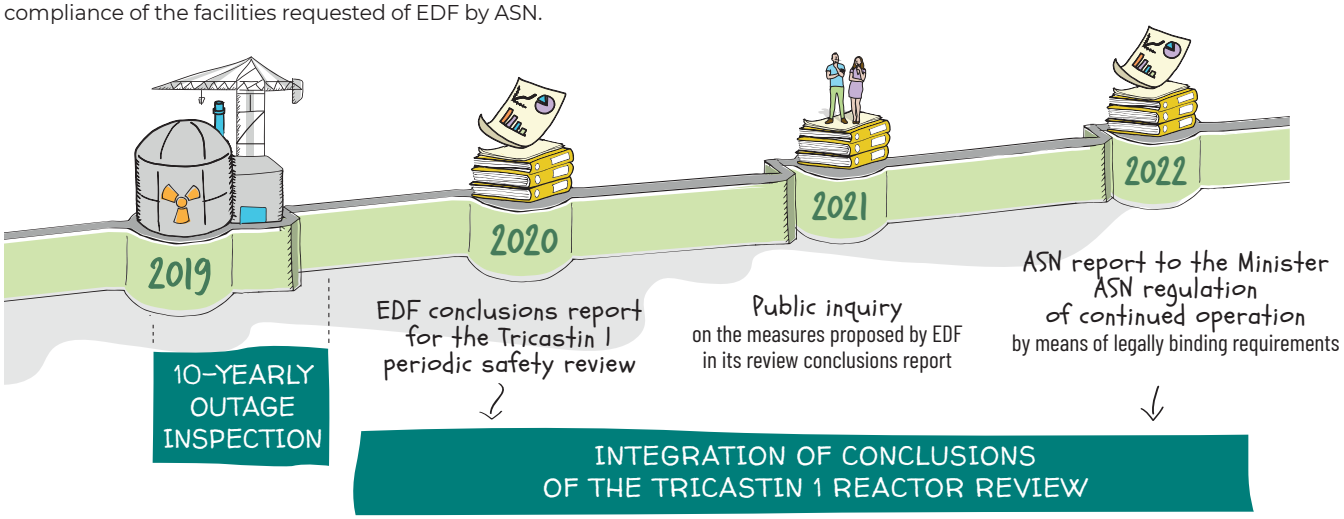
During the ten-yearly outage at Tricastin NPP reactor 1, EDF carried out tightened inspections on the compliance of equipment important for safety and ten-yearly tests on the reactor coolant system and the containment. These inspections participate in the closer attention to the compliance of the facilities requested of EDF by ASN.

EDF also made changes to its facility to improve safety. For example, EDF installed a new fuel pool cooling system and a system to remove heat from the containment in the event of an accident with fuel melt. These changes help bring the safety objectives closer in line with those of the third generation reactors.

ASN has implemented a specific inspection programme before, during and after the ten-yearly outage, entailing about ten more inspections than a conventional ten-yearly outage.

ASN considers that the performance of this ten-yearly outage was on the whole satisfactorily. It will issue a position statement on the continued operation of Tricastin reactor 1 after the public inquiry to be held in 2021, as required by law.

EDF mobilised significant human resources to prepare for and carry out this ten-yearly outage. 5,000 personnel took part in this. This effort will need to be sustained for the long-term, as of 2020 for the fourth ten-yearly outages of Bugey NPP reactors 2 and 4 and until 2030 for that of the last reactor of the Chinon NPP.



JOINT POSITION OF ASN AND ASND

CEA decommissioning and materials and waste management strategy

In France, nearly 40 CEA civil and defence nuclear facilities have been finally shut down or are being decommissioned. The ageing design of these facilities did not take account of decommissioning or radioactive waste management in accordance with current safety requirements.

Given the number and complexity of the operations to be carried out for all the nuclear facilities to be decommissioned, CEA defined priorities, based primarily on an analysis of the potential hazards, in order to mitigate the risks presented by these facilities. The highest priority operations concern some individual facilities in the Marcoule Defence Basic Nuclear Installation (DBNI), as well as the Basic Nuclear Installations (BNI) in Saclay (BNI 72) and Cadarache (BNI 56). An accident in one of these facilities could lead to unacceptable nuclear safety and radiation protection consequences.

In their opinion of 27 May 2019, ASN and the Defence Nuclear Safety Authority (ASND) confirmed the general adequacy, with constant resource levels, of the prioritisation defined by CEA, given the resources allocated by the State and the significant number of nuclear facilities being decommissioned, entailing considerable investment (creation or preliminary renovation of means for the recovery, packaging and storage of radioactive materials and waste, as well as the corresponding transportation), so that the legacy waste could be correctly managed. However, even if there are no unexpected events or delays in the projects considered by CEA to have priority, the mitigation of the risks presented by these ageing facilities will not be effective before ten or so years at best. ASN and ASND have concerns in particular about the planned human and financial resources for dealing with all of the most important situations entailing safety implications or environmental hazards over the coming 10 years. A specific investment effort, as well as the creation of engineering units and the reinforcement of the safety teams dedicated to these projects would seem to be necessary.

If these projects are to progress, they will require an increase in CEA's oversight and coordination capacity allied with rigorous and transparent State monitoring of CEA's actions, in terms of cost, time and effectiveness.

With regard to the facilities of lower priority, and owing to the limits of its human and financial resources, CEA is looking at a "two-stage" decommissioning of each facility. First of all, most of the hazard potential will be removed. Secondly, following a potentially lengthy period of interruption, the decommissioning operations will be completed on the facilities.

The resulting surveillance, upkeep and operations needed to maintain a sufficient level of safety in these facilities, once the hazard potential has been removed, possibly for decades up until delicensing, will significantly increase the final cost of the decommissioning of all the CEA facilities. **Moreover, the priority decommissioning of facilities with significant safety implications will, for those facilities for which decommissioning is postponed, lead to the modification of the regulatory requirements already issued.**

The public must be regularly informed of the progress of the programme as a whole.

IN BRIEF

CEA operated these facilities, some of them since the 1950s, in a context where *"pressing national and international needs forced it to take the necessary steps to enable France to maintain its position in the field of atomic energy research."*

PUBLIC DEBATE

National Radioactive Materials and Waste Management Plan

Planning Act 2006-739 of 28 June 2006 on the sustainable management of radioactive materials and waste stipulated the drafting of a National Radioactive Materials and Waste Management Plan (PNGMDR) every 3 years.

The PNGMDR is prepared by the General Directorate for Energy and Climate (DGEC) at the Ministry for Ecological and Solidarity-based Transition and by ASN, on the basis of the work done by a pluralistic working group in particular comprising radioactive waste producers, licensees of management facilities for these wastes, evaluation and control authorities and environmental protection associations.

In concrete terms, the PNGMDR gives a detailed inventory of radioactive materials 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 requirements and the studies to be conducted in the coming years. There are 83 such studies, each with one or more coordinators and a completion deadline.

A similar pluralistic drafting approach will be applied for the 5th edition of the PNGMDR which was preceded, for the first time, by a public debate. Indeed, 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 public participation in the drafting of this next plan. The CNDP decided to organise a public debate on the plan.

Together with the Special Public Debates Commission (CPDP), ASN and the DGEC draw up a "Programme manager file", which presented the main aspects of the PNGMDR and identified the main challenges as related to the drafting of the next plan:

- the challenges of reusing stored radioactive materials;
- spent fuel storage capacity;
- the scale of the volumes of very low level (VLL) waste expected from decommissioning;
- management of the diversity of low level, long-lived waste (LLW-LL);
- the creation and operation of a deep geological disposal facility.

Furthermore, ahead of the debate, the CPDP produced a "clarifying the controversies" dossier, which aims to provide the non-specialist public with the various arguments put forward by the experts and institutional organisations concerning questions arising from the plan.

ASN and the DGEC took part in the debate in order to present the issues and answer questions from the public. The institutional representatives (nuclear licensees, associations, Local Information Committees, experts) were often present in large numbers. ASN, as did the CPDP, observed that participation by the general public was low. The participative platform received 86 questions, 442 opinions, 62 individual stakeholder presentations and 22 contributions. Of the 86 questions received, 69 were sent to ASN and the DGEC, who provided answers.

ASN notes the diversity of the subjects of concern for the debate's participants. More particularly, a large number of questions concerned the *Cigéo* project, the effective reuse of radioactive substances qualified as materials or the coverage of the costs if these materials were finally to be considered as waste, along with the management of VLL waste. These topics were already identified as being among the five issues of the debate in the Programme Manager File. Other subjects were raised by the public, such as the reprocessing of spent fuels, the separation-transmutation of radionuclides, the governance of radioactive materials and waste management, the environmental and health impacts of waste management, transports, or resorting to the use of nuclear energy.

The CNDP and the CPDP presented their conclusions following this debate in a report and a summary transmitted on 25 November 2019. For each of the topics identified by ASN and the DGEC, the CPDP concludes that the debate was able to clarify the various options and their implications. Other subjects were also raised during the public debate. For instance, the management of particular waste categories, such as those resulting from the conversion of uranium, legacy waste and mining waste, transportation, health, the economy and regional impacts, were subjects which received particular attention from the public. Elsewhere, the duration of the plan, set by law at three years, was felt to be too short and inconsistent with the nature of the issues and with the durations of the other plans related to it.

Public debate meeting on the PNGMDR in Tours – 2019

ASN considers that the debate was able to explain certain technical controversies, clarify the expectations of the public and nuclear stakeholders and inform the Programme Managers with a view to the drafting of the next PNGMDR. On 21 February 2020, the Minister for Ecological and Solidarity-based Transition and ASN communicated how they envisage following up the debate:

- transparency and the monitoring of the conditions for reuse of radioactive materials will be reinforced and characterisation of the issues involved in the reprocessing of spent fuels will be continued;
- measures to anticipate the saturation of spent fuel storage capacity and the characterisation of the challenges of dry storage, will be looked at in greater depth;
- the orientations of the previous plan concerning the management of VLL waste, notably the study of reuse solutions and the search for additional disposal solutions, will be confirmed;
- management methods tailored to the diversity of LLW-LL waste will be examined;
- cross-cutting issues in which the public expressed an interest, such as health and environmental impacts, regional issues, modes of transport and economic aspects, will be developed further in the forthcoming plan;
- the definition of the conditions for the implementation of *Cigéo* will be specified and research and development on management alternatives will be continued;
- the interaction between the PNGMDR and other management policies, such as the multi-year energy programme, will be reinforced;
- the PNGMDR will refocus on strategic orientations.

ASN opinions on radioactive materials and waste management solutions will be issued on the basis of these orientations.

The drafting of the 5th plan and its environmental assessment and public consultation will take place in 2020 and early 2021. The plan will then be made public and transmitted to the Parliamentary Office for the Evaluation of Scientific and Technological Choices for its opinion.

IN BRIEF

The debate was held from 17 April to 25 September 2019, using a variety of procedures:

- **6 general subjects meetings in large cities;**
- **14 thematic meetings in the regions concerned;**
- **2 discussion sessions debating an ethical approach to the management of radioactive materials and waste;**
- **a round-table on the question of trust and mistrust felt by the public with respect to the decisions taken or envisaged;**
- **information and debate stands in several towns around France;**
- **an on-line participative platform enabling people to express an opinion, submit comments on those already expressed, submit questions to the prime contractor and, for artificial persons, submit an individual stakeholder's presentation and contributions document.**

In parallel with these participation methods open to all, the CPDP set up some innovative systems:

- **a "mirror group" comprising 14 people drawn by lots drafted a joint contribution on the topic "What did we inherit and what will we leave to our children?";**
- **a "tomorrow's specialists workshop" brought together students from different backgrounds to explore how radioactive waste management can be informed by different disciplines.**

MANAGEMENT ORIENTATIONS

Spent nuclear fuel storage capacity

ASN underlines the need for France to acquire spent fuel storage capacity and the need to start preparations for these projects without delay. In 2019, it issued its opinion on the safety options of the centralised spent fuel pool presented by EDF.

The "nuclear fuel cycle" encompasses the fabrication of the nuclear fuel used in the reactors of the power plants, its storage and its reprocessing after irradiation. ASN monitors the overall consistency of the industrial choices made concerning fuel management which could have an impact on safety.

This monitoring covers:

- the changes or problems that could be anticipated over the next decade in the facilities and transport operations involved, on the subject of which ASN issues a statement every 10 years on "fuel cycle consistency";
- the prospects, for the coming century, in terms of the management of radioactive materials and waste, for which ASN and the DGEC periodically update the National Radioactive Materials and Waste Management Plan (PNGMDR).

Identified needs

As early as 2010, ASN had identified the need for new spent fuel storage capacity by about 2030. Given the current volumes, this need can be primarily explained by the fact that, once used, the fuels resulting from a first reprocessing, called MOX, are not then again reprocessed.

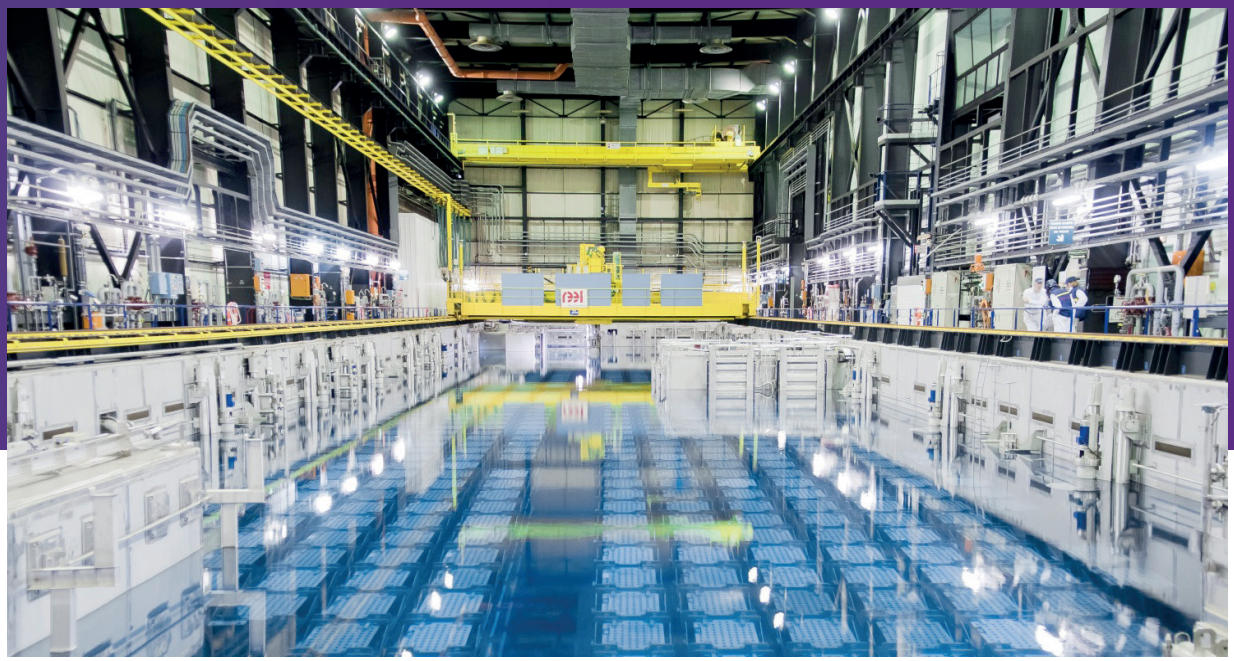
This need having been confirmed by the PNGMDR 2016-2018, the Government instructed EDF to submit applications to extend this capacity[1], more specifically an authorisation application to be submitted by EDF at the end of 2020.

An EDF project, an ASN analysis

In 2017, EDF asked ASN for its opinion on the safety options for a spent fuels centralised storage pool project. Its purpose is to store 10,000 tHM (tonnes heavy metal) in two storage ponds. In this dossier, EDF did not define a site for the location of the facility. ASN issued its opinion on this project on 23 July 2019 and considers that the general safety objectives and the design options adopted are satisfactory.

Additional demonstrations will however be required, notably concerning the design and the control of manufacturing, in order to guarantee the long-term leaktightness of the pool, as well as the contingencies selected regarding external hazards, more particularly airplane crashes, once the site of the facility has been chosen.

1. *Article 10 de of the Order of 23 February 2017 setting out the provisions of the PNGMDR requires EDF to transmit* "a creation authorisation application for a new spent fuel storage facility, or a substantial modification application, if this is an extension of an existing facility, to the Ministry responsible for nuclear safety, before 31 December 2020".



Spent fuel pool at La Hague

Anticipating confirmed needs

The public debate on the PNGMDR held in 2019 confirmed the need for new spent fuel storage capacity by about 2030 and the consistency of the choice of "wet" storage with the reprocessing strategy. This choice would also be compatible with direct disposal of the fuels.

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

ASN thus considers that it is important for EDF to continue its project to create new centralised storage capacity, without delay.

For the longer term, given the foreseeable shutdown of the 900 MWe reactors, which are the oldest and today the only ones using MOX fuel:

- either new storage capacity is required, well in excess of the current and planned volume;
- or MOX fuel must be usable in reactors other than the 900 MWe.

The time-frame required for the study and implementation of these options is about ten years. ASN therefore asks the industrial players to start examining these two options without delay.

IN BRIEF

MOX (mixed oxide) fuel is a nuclear fuel based on a mixture of oxides of uranium and plutonium. Its use in nuclear power generating reactors began abroad in the 1970s. It has been used in France since 1987. In 2017, of the 58 French reactors, 22 of EDF's 900 MWe nuclear reactors were using this fuel. 24 reactors are authorised to use it. In France, MOX fuel uses only civil plutonium, extracted from spent fuel.

REGULATORY NEWS

2019 was marked by considerable activity in terms of standards.

More specifically, Decree 2019-190 of 14 March 2019 published in the *Journal Officiel* (*Official Gazette*) of 16 March 2019, codifies the provisions applicable to Basic Nuclear Installations (BNIs), the transport of radioactive substances and transparency in the nuclear field. This Decree led to a wide-ranging consultation with the stakeholders and the public between September 2017 and January 2018. The High Council for the Prevention of Technological Risks (CSPRT) and then ASN issued their opinions on 13 March and 21 June 2018 respectively. It entered into force on 1 April 2019.

In addition, a number of Orders and ASN resolutions resulting from the Decrees[1] transposing Council Directive 2013/59/Euratom of 5 December 2013 laying down Basic Standards for the protection of health against the dangers arising from exposure to ionising radiation were published in 2019.

Finally, international news was marked by the revision of the regulation for the transport of radioactive materials from the International Atomic Energy Agency (IAEA).

1. National news

1.1 Acts

• Act 2019-773 of 24 July 2019 creating the French Office for Biodiversity and Hunting, modifying the duties of the hunting federations and reinforcing environmental policing

Articles 4, 6 and 22 of this Act modify the provisions of the "common core of the environmental policies" (resulting from the overhaul of these policies by Ordinance 2012-34 of 11 January 2012) on the basis of the experience acquired since 2012 and resulting from the adaptations to the procedural framework within which the personnel responsible for monitoring carry out their administrative and judicial policing duties with the aim of reinforcing the policing powers of these personnel and improving the efficiency of the monitoring services.

The ASN inspectors may use the new prerogatives created by the 24 July 2019 Act because, since Ordinance 2016-128 of 10 February 2016 introducing various nuclear provisions, the nuclear safety inspectors and radiation protection inspectors carry out their monitoring duties within the framework of the procedural rules of the "common core of environmental policies" set out by the provisions of Articles L.171-1 et seq. of the Environment Code.

For example, in the criminal field, the ASN inspectors can now, when authorised by the Public Prosecutor's office and for the purpose of technical or scientific examinations, ask qualified persons or ask any person, any establishment or any private or public organisation, for information relevant to the investigation, including data taken from a computer system or from processing of nominative data, without professional confidentiality being raised as a cause for non-compliance, if there is no legitimate reason. Furthermore, when authorised by the Public Prosecutor's office, the names and first names of the persons appearing in the copies of the citations, except for those of the offender, could be deleted when this information is liable to endanger the life or physical safety of these persons or of their family.

During the administrative inspections they carry out, the inspectors may, as was already the case in judicial police investigations, take samples or have them taken for the purposes of analysis or testing. The new provisions enable ASN to take steps (penalty payments for example) to guarantee complete performance of the enforcement measures intended to oblige the party responsible for an activity to regularise their situation and submit a notification or application for authorisation or registration.

• Act 2019-1147 of 8 November 2019 concerning energy and the climate

Article 1 of this Act more specifically modifies the date of achieving the target of a 50% share of electricity production from nuclear sources, pushing it back from 2025 to 2035. The Decree on the multi-year energy programme, which should appear in 2020, will notably detail the procedures and arrangements for achieving this target.

Article 31 of this Act modifies Article L.122-1 of the Environment Code. Under the terms of this Environment Code, as amended, "the environmental Authority" and the "authority in charge of case by case examination" to determine whether the project is subject to the environmental assessment, are separate.

V bis (new) of Article L.122-1 of the Environment Code specifies that this "*authority in charge of the case by case examination and the environmental authority should not find themselves in a position giving rise to a conflict of interest.*"

However, nothing is modified for the BNIs. Since Act 2018-727 of 10 August 2018 (ESSOC Act), pursuant to the second paragraph of IV of Article L.122-1, ASN is the authority in charge of determining whether the noteworthy modification projects liable to have a significant negative impact on the environment, shall be subject to an environmental assessment.

Furthermore, in order to secure the plans and programmes subject to systematic or case by case environmental assessment, a new Article L.191-1 of the Environment Code (created by the 8 November 2019 Act) gives the administrative judge the option, when he or she finds that an illegality affecting one of these acts is liable to be regularised and provided that he or she has found that the other means are unfounded, to stay the proceedings in order to enable the administrative authority to conduct this regularisation, in order to avoid pronouncing it null and void.

1. Decree 2018-434 of 4 June 2018 introducing various nuclear provisions and Decree 2018-437 of 4 June 2018 concerning the protection of workers against hazards arising from ionising radiation.

1.2 Decrees and Orders

1.2.1 Radiation protection

TEXTS ISSUED PURSUANT TO THE PUBLIC HEALTH CODE

Radon

• **The purpose of the Order of 20 February 2019 concerning health information and recommendations to be issued to the population in order to prevent the effects of exposure to radon in buildings** is to act as a tool for the institutional stakeholders in charge of carrying out measures to raise awareness of the radon risk. As a priority, it concerns elected officials and inhabitants in municipalities with a significant radon potential, as identified in the Order of 27 June 2018 identifying the zones with radon potential in France. The information about the origin and health effects of radon is supplemented by recommendations on the steps to be taken according to the level of exposure measured in the home. ASN is one of the authorities designated by the Minister in charge of radiation protection to disseminate this health information and these recommendations to the public.

• **The Order of 26 February 2019 concerning the methods for managing radon in certain buildings open to the public and for dissemination of information to those persons frequenting these facilities** supplements the regulations for the management of situations in which the radon reference level, set at 300 Bq/m^3 (becquerels per cubic metre) is exceeded in buildings open to the public (ERPs). It more specifically clarifies the steps to be taken in manner that is gradual and appropriate to the situation encountered. The Order also defines the contents of the display of the radon concentration at the entrance to the buildings open to the public concerned, so that the public frequenting the buildings are made aware of this information.

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 (ARS) to ensure that these waters comply with the regulation quality references and entail no risk to the health of consumers. **The Order of 11 January 2019 modifying the Order of 5 July 2016 concerning the conditions for the approval of laboratories to take samples and conduct analyses to check the health quality of the waters and the Order of 19 October 2017 concerning the analysis methods used for health** checks of waters more specifically aims to share the approval procedure for laboratories measuring radioactivity in the EDCH and in natural mineral waters for the purposes of the health check. This approval, issued by the Minister in charge of health has, since 1 April 2019, been dependent on first of all obtaining national environmental radioactivity monitoring network approval, issued by ASN and mentioned in Article R.1333-25 of the Public Health Code.

TEXTS ISSUED PURSUANT TO THE LABOUR CODE

• **The Order of 26 June 2019 concerning individual monitoring of worker exposure to ionising radiation** sets out the procedures and conditions for implementation of the provisions of Article R.4451-64 to R.4451-72 of the Labour Code, more specifically:

- the implementation of individual dosimetric monitoring of workers exposed to a risk caused by ionising radiation;
- reporting to the ionising radiation exposure monitoring information system (Siseri);
- communication to Siseri of the individual dosimetric monitoring results;
- access to the individual dosimetric monitoring results and possible correction by the occupational physician;
- accreditation of the dosimetry organisations, the medical biology laboratories and the occupational health departments tasked with individual monitoring of worker exposure to ionising radiation set out in Article R.4451-65 of the Labour Code.

The Order will enter into force on 1 July 2020. On that date, the Order of 17 July 2013 concerning the individual medical monitoring form and the dosimetric monitoring of workers exposed to ionising radiation and the Order of 21 June 2013 concerning the conditions for issue of the certificate and for approval of organisations responsible for individual monitoring of worker exposure to ionising radiation will be repealed.

TEXTS ISSUED PURSUANT TO THE LABOUR CODE AND THE PUBLIC HEALTH CODE

• **The Order of 18 December 2019 concerning the training of the Radiation Protection Expert-Officer and the certification of training organisations and radiation protection organisations** defines the duties of the radiation protection advisor mentioned in Articles R.4451-126 of the Labour Code and R.1333-18 of the Public Health Code, whether they are a Radiation Protection Expert-Officer or a Radiation Protection Organisation.

This Order will enter into force on 1 July 2020 with interim provisions until 1 July 2021. It repeals the Order of 6 December 2013 concerning the training of the Radiation Protection Expert-Officer and the certification of training organisations, as well as the Order of 24 November 2009 ratifying ASN resolution 2009-DC-0147 of 16 July 2009 setting out the conditions for the performance of the duties of a Radiation Protection Expert-Officer from outside the facility as of 1 July 2021.

1.2.2 Basic Nuclear Installations

• **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 of 17 August 2015, by Ordinance 2016-128 of 10 February 2016 comprising various nuclear provisions and, concerning ASN, by Act 2017-55 of 20 January 2017 introducing the general status of independent administrative authorities and independent public authorities, entails modifications to the regulatory provisions in force.

After Decree 2016-846 of 28 June 2016 specified the provisions concerning the conditions for the modification and decommissioning of BNIs and rules regarding subcontracting, Decree 2019-190 of 14 March 2019 specified the provisions concerning Local Information Committees (CLI), the renewal of the ASN Commission, the ASN Sanctions Commission, third-party expertise and the transposition of the Industrial Emissions Directive (IED) and Seveso Directive to BNIs.

On this occasion, the Minister responsible for nuclear safety decided to codify all the regulatory provisions in force.

• **The Order of 7 February 2012 setting the general rules concerning BNIs ("BNI Order")**

Work to revise this Order began in 2019 and will continue in 2020 on the basis of feedback from more than 6 years of implementation of the Order. In 2019, ASN began to analyse the observations and proposed changes from the licensees. All the stakeholders will then be consulted on the draft modifying Order.

1.2.3 The security of radioactive sources

• **The Order of 29 November 2019 concerning the protection of ionising radiation sources and batches of category A, B, C and D radioactive sources against malicious acts** was published in the *Journal Officiel* (*Official Gazette*) on 11 December 2019. This Order clarifies the measures to be taken to protect ionising radiation sources or batches of radioactive sources against malicious acts, both in the facilities and during transport operations. This Order, to which ASN made an active contribution and which entered into force on 1 January 2020:

- is part of the Government's national security strategy, in particular to counter radiological threats;

Codification and updating of the decrees concerning BNIs and transparency in the nuclear field

Decree 2019-190 of 14 March 2019 constitutes the regulatory part of the Environment Code more specifically concerning ASN, BNIs, the transport of radioactive substances and the system of inspection and sanctions with respect to these installations and activities.

The Decree codifies and updates the following decrees:

- **Decree 2007-830 of 11 May 2007, amended, concerning the BNI nomenclature;**
- **Decree 2007-831 of 11 May 2007 setting the procedures for appointing and qualifying nuclear safety inspectors;**
- **Decree 2007-1368 of 19 September 2007 concerning the secondment of certain civil servants to ASN on a part-time basis;**
- **Decree 2007-1557 of 2 November 2007 amended, relative to Basic Nuclear Installations and to the oversight of the transport of radioactive substances in terms of nuclear safety;**
- **Decree 2007-1572 of 6 November 2007 concerning technical inquiries into accidents or incidents concerning a nuclear activity;**
- **Decree 2008-251 of 12 March 2008, amended, concerning BNI Local Information Committees (CLI);**
- **Decree 2008-1108 of 29 October 2008 concerning the composition of the High Committee for Transparency and Information on Nuclear Security (HCTISN);**
- **Decree 2010-277 of 16 March 2010 concerning the HCTISN.**

The Decree also modifies the regulatory procedures relating to BNIs currently governed by the Decree of 2 November 2007 referred to as the "BNI Procedures" Decree, more specifically so that they are brought into line with the new regulatory requirements concerning the environmental assessment of projects, resulting from the Ordinance of 3 August 2016 and its implementing Decree of 11 August 2016 which transpose Directive 2011/92/EU of the European Parliament and the Council of 13 December 2011 concerning the assessment of the environmental impact of certain public and private projects, as modified by Directive 2014/52/EU of the European Parliament and the Council of 16 April 2014.

Furthermore, the Decree:

- **supplements the provisions relating to the CLIs pursuant to Article 123 of the Energy Transition for Green Growth Act (TECV) of 17 August 2015, notably with the aim of including foreign members in the CLIs concerned if the BNI site is located in a border *département*;**
- **defines the conditions of renewal of half of the ASN Commission, other than its chairperson, every three years, pursuant to Act 2017-55 of 20 January 2017 introducing the general status of the independent administrative authorities and the independent public authorities;**
- **defines the functioning of the ASN Sanction Committee instituted by Ordinance 2016-128 of 10 February 2016 introducing various provisions concerning nuclear activities and detailing the procedures giving rise to administrative fines;**
- **clarifies the System applicable to BNIs containing equipment or installations subject to Directive 2010/75/EU of 24 November 2010 relating to industrial emissions (referred to as the "IED Directive"), as well as the System of BNIs subject to Directive 2012/18/EU of 4 July 2012 concerning the control of the hazards linked to major accidents involving substances (referred to as the "SEVESO 3 Directive") pursuant to the above-mentioned Ordinance 2016-128 of 10 February 2016 containing various nuclear-related provisions.**

- is based on recommendations issued by the IAEA, which are already in effect in other countries, notably in Europe;
- adopts a graded approach, with the organisational or technical arrangements being reinforced proportionately to the danger represented by the source(s) to be protected;
- comprises interim provisions of up to two years, enabling the facilities or carriers concerned to define, plan and then implement these new requirements.

1.3 ASN Resolutions

1.3.1 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.

ASN resolution 2019-DC-0667 of 18 April 2019 concerning the methods for evaluating ionising radiation doses delivered to patients during a radiology procedure, fluoroscopy-guided interventional or nuclear medicine practices, and the updating of the corresponding Diagnostic Reference Levels (DRLs)
This resolution updates and clarifies the methods for evaluating the ionising radiation doses delivered to patients during medical imaging procedures, in order to help control these doses. It updates the Diagnostic Reference Levels (DRLs) for dental and conventional radiology, computed tomography and nuclear medicine procedures. For the first time, DRLs have also been defined for certain fluoroscopy-guided interventional practices.

It specifies how the data are collected, confirms the need to analyse the dosimetry values collected, in order to optimise the doses delivered to the patients and recalls the obligation to send the data thus collected and analysed to the Institute for Radiation Protection and Nuclear Safety (IRSN). When the DRLs are exceeded, with the exception of justified special situations, the party performing the procedures takes the necessary action to reinforce optimisation.

ASN resolution 2019-DC-0669 of 11 June 2019 modifying ASN resolution 2017-DC-0585 of 14 March 2017 concerning continuing training in the radiation protection of persons exposed to ionising radiation for medical purposes
This resolution of 11 June 2019 primarily modifies the conditions for the entry into force of the resolution of 14 March 2017 (Article 15), by requiring the application:
- of the professional guides within 6 months following their approval;
- as of the day following the publication of the approval Order, in the absence of an approved professional guide, of the articles of the resolution concerning the pedagogical objectives and the methods of training for each profession or field of activity concerned, the skills of the trainers and the training organisations.

1.3.2 Basic Nuclear Installations

ASN resolution 2017-DC-0616 of 30 November 2017 concerning noteworthy modifications to BNIs
This resolution came into force in full on 1 July 2019. Noteworthy modifications include the changes made by the licensee:
- to the systems, structures and components of the installation, their authorised operating conditions, the elements which led to its authorisation or its commissioning authorisation or, as applicable, its decommissioning conditions;
- and liable to affect public health and safety or the protection of nature and the environment.

This resolution specifies the criteria for distinguishing the noteworthy modifications requiring ASN authorisation from those simply requiring notification to it. It also defines the requirements applicable to the management of noteworthy modifications, more particularly the internal check procedures to be implemented by the licensees.

The ASN resolution confirms the responsibility of the licensees for managing noteworthy modifications to their facilities, while ensuring that they are supported by an appropriate organisation, and reinforces the overall consistency of the system by making ASN's oversight more proportionate to the specific implications of each modification.

This resolution also repeals:
- ASN resolution 2008-DC-0106 of 11 July 2008 concerning the procedures for the implementation of internal authorisation systems in Basic Nuclear Installations (as at 1 January 2018);
- ASN resolution 2013-DC-0352 of 18 June 2013 concerning public access to modification project files specified in Article L.593-15 of the Environment Code (as at 1 January 2018);
- ASN resolution 2014-DC-0420 of 13 February 2014 concerning physical modifications to BNIs (as at 1 July 2019).

1.4 ASN guides

For a period of one month between 29 November and 29 December 2019, ASN submitted its draft guide on "Policy for the management of risks and detrimental effects of BNIs and the licensee integrated management system" as provided for by the Environment Code, to a public consultation.

The draft guide expresses the relevant ASN recommendations. These recommendations concern all BNIs, whether in the design, construction, commissioning, operation, final shutdown, decommissioning phases or, for radioactive waste disposal facilities, in the closure or surveillance phase.

This draft guide is part of the ASN work to integrate into the French regulatory framework a number of positions adopted by WENRA (Western European Nuclear Regulators Association), in particular the "reference levels" for the existing reactors.

The observations received will be analysed by ASN and written up in a report, which will more particularly indicate the steps to be taken to subsequent to the consultation.

1.5 The professional guides approved by ASN

With regard to Nuclear Pressure Equipment (ESPN), ASN has approved the following professional guides:
ASN resolution CODEP-CLG-2019-003685 of 22 January 2019, issued to implement the provisions of b of IV of Article 10 of the Order of 10 November 1999 concerning monitoring of the operation of the main primary system and main secondary systems of pressurised water reactors, approving the AFCEN professional guide reference RS.17.022 revision B for the design and manufacture of the main pressurised parts intended for the nuclear pressure equipment of the main primary and main secondary systems.
ASN resolution CODEP-CLG-2019003687 of 22 January 2019, implementing the provisions of the modified Order of 30 December 2015 concerning ESPN and certain safety accessories designed to protect it, approving the four professional guides:
a. **AFCEN Guide reference RS.18.003 revision A** concerning the compliance evaluation requirements and procedures for a permanent assembly of an ESPN installation subject to 4.1.a of Appendix V of the Order of 30 December 2015;
b. **AFCEN Guide reference RS.18.004 revision C** concerning the compliance evaluation of the protection against the allowable limits being exceeded at installation of an ESPN;
c. **AFCEN Guide reference RS.16.009 revision B** concerning the repairs and modifications of ESPN subject to points 1 to 4 of Appendix V of the Order of 30 December 2015;
d. **AFCEN Guide reference RS.18.006 revision A** concerning the requirements applicable to the repairs and modifications of ESPN subject to points 1 to 4 of Appendix V of the Order of 30 December 2015 and the procurement of the parts intended for it.

ASN, the French Nuclear Safety Authority, has eleven 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 2019, the ASN regional divisions totalled 230 employees, including 176 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. The divisions 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 (NPPs).

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 emergency situation preparedness, they help draw up the emergency plans established by the Prefects and take part in the periodic exercises.

The ASN regional divisions contribute to the mission of informing the public. 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 to inform the public and cross-border relations are addressed in chapters 5 and 6 respectively of the full ASN report.

IMPORTANT

Oversight of small-scale nuclear activities (medical, research and industry, transport) is presented in chapters 7, 8, 9 of the full ASN report, available on *asn.fr*

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 Nuclear Power Plants (NPPs) operated by EDF:
  - Bugey (4 reactors of 900 MWe),
  - Saint-Alban (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 on the Tricastin industrial platform;
- the Operational Hot Unit (BCOT) at Tricastin, operated by EDF;
- The High Flux Reactor (RHF) 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 irradiator in Dagneux;
- the nuclear fuel fabrication plant and pelletising unit of SICN in Veurey-Voroize;
- the French Alternative Energies and Atomic Energy Commission (CEA) reactors and plants in Grenoble, 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 120 centres carrying out fluoroscopy-guided interventional procedures,
  - about 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,
  - about 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;
- ASN-approved laboratories and organisations:
  - 3 organisations and 8 agencies approved for radiation protection controls.

In 2019, ASN carried out 328 inspections in the Auvergne-Rhône-Alpes region, comprising 98 inspections in the Bugey, Saint-Alban, Cruas-Meysse and Tricastin nuclear power plants, 89 inspections in plants and installations undergoing decommissioning, 127 inspections in small-scale nuclear activities and 14 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 (CHSCT).

In the exercise of its oversight duties, ASN drew up one violation report and gave one nuclear activity manager formal notice to comply with the regulations. In 2019, ASN was notified of 36 significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES scale), of which 33 occurred in BNIs and 3 in small-scale nuclear activities.

BUGEY SITE

The Bugey industrial site comprises various facilities, including the Bugey NPP operated by EDF on the municipality of Saint-Vulbas in the Ain *département*, 35 km east of Lyon. It comprises four Pressurised Water Reactors (PWR), 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 also accommodates Bugey 1, a graphite-moderated Gas-Cooled Reactor (GCR) commissioned in 1972, shut down in 1994 and currently undergoing decommissioning, and the Activated waste packaging and interim storage facility (Iceda) and the Inter-Regional Warehouse (MIR) for fuel storage.

Lastly, the site accommodates one of the regional bases of the Nuclear Rapid Action Force (FARN), the special nuclear rapid intervention force created by EDF in 2011 further to the Fukushima Daiichi NPP accident in Japan. Its role is to intervene in pre-accident or accident situations, on any Nuclear Power Plant (NPP) in France, by providing additional human resources and emergency equipment.

Bugey nuclear power plant

Reactors 2, 3, 4 and 5 in operation

ASN considers that the performance of the Bugey NPP with regard to nuclear safety, radiation protection and environmental protection is in line with the general assessment of EDF plant performance. The NPP maintains a high level of proficiency in its operating and maintenance activities. ASN has nevertheless noted weaknesses in the area of environmental protection.

With regard to nuclear safety, the results obtained by the Bugey NPP in 2019 must be improved, particularly regarding reactor management and the performance of periodic tests. There was also an increase in the number of reactor trips. The licensee must remain vigilant in its preparation and performance of operational control operations further to unforeseen events. Lastly, ASN noted shortcomings in the identification and handling of deviations.

With regard to environmental protection, ASN considers that the performance of the Bugey NPP, while remaining within the average for the plants operated by EDF, reveals some disparities. ASN notes a persistent weakness in the prevention of risks of leaks from buried structures (pipes and conduits) carrying radioactive and chemical fluids. ASN moreover considers that the modifications of equipment linked to environmental protection must be analysed and monitored with the same rigour as equipment associated with nuclear safety.

With regard to radiation protection, ASN notes that the dosimetric results were satisfactory.

With regard to occupational safety, despite the mobilisation of the risk prevention officers with regard to the vital risks, accidents or noteworthy near-accidents occurred in 2019, underlining the site's weaknesses, particularly regarding compliance with rules for personal protective equipment against electrical risks, compliance work on lifting equipment and on the boric acid handling stations. Although the accident indicator figures are improving, EDF must nevertheless continue the efforts requested by ASN in the application of worksite safety rules, in the context of the fourth ten-yearly outages.

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.

In March 2016, in view of the technical difficulties encountered, 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" rather than "under water" as initially envisaged.

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.

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 of people and the environment, the production quality file, the start-up tests, waste management and the operating documents. EDF submitted its reply to ASN's requests at the end of 2018. The last finishing work and the pre-commissioning tests continued in 2019.

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 worksite. ASN nevertheless observed, as in 2018, that the test programme was significantly behind schedule. EDF now envisages commissioning the facility in 2020.

ASN has moreover continued its examination of the application file for approval of the packaging of intermediate-level long-lived waste (ILW-LL) in packages in the Iceda facility, submitted

by EDF in November 2015 and supplemented in May 2016 at the request of ASN. ASN was unable to give its approval on the basis of the examination of the file as it stood. Further studies were 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 and it is currently being examined.

Inter-Regional Warehouse

The Inter-Regional Warehouse (MIR) (BNI 102) on the Bugey site operated by EDF is a storage facility for fresh nuclear fuel intended for the NPP fleet in service.

The level of safety of the MIR was satisfactory in 2019. The periodic safety review of the facility is in progress, as are the stress tests requested by ASN following the Fukushima Daiichi NPP accident.

Saint-Alban nuclear power plant

The Saint-Alban 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 PWRs commissioned in 1986 and 1987. Reactor 1 constitutes BNI 119 and reactor 2 BNI 120.

ASN considers that the performance of the Saint-Alban NPP with regard to nuclear safety, environmental protection and radiation protection is well positioned in comparison with the general standard of EDF plant performance.

With regard to nuclear safety, ASN notes that in 2019 the Saint-Alban NPP maintained its good results, in keeping with the last few years. ASN notes in particular that the vigilance applied in the fight against fire outbreaks continued to bear fruit in 2019.

Concerning maintenance, ASN considers that on the whole EDF successfully managed the maintenance outage of reactor 2, which was the only maintenance outage scheduled in 2019. This outage was marked by a technical difficulty in disconnecting two control rod clusters when opening the reactor vessel closure head, an unforeseen event that was managed satisfactorily. The site must be more rigorous in its monitoring of the sensitive areas of small-diameter pipes.

ASN considers that the environmental protection performance of the Saint-Alban NPP is in line with the general assessment of the EDF plants. The organisation defined and implemented by EDF to meet the regulatory requirements concerning the monitoring of discharges and the environment seems satisfactory on the whole.

With regard to worker radiation protection, ASN notes that the operational results were satisfactory.

The results concerning health and safety at work are also satisfactory. ASN notes that no serious accidents occurred during the reactor 2 maintenance outage. During this outage, ASN noted difficulties in organising the worksites and more specifically in taking into account the occupational risks at the work station in situations with tight schedules.

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 PWRs of 900 MWe each. Reactors 1 and 2 constitute BNI 111 and reactors 3 and 4 constitute BNI 112.

ASN considers that the performance of the Cruas-Meysse NPP is on the whole in line with the general assessment of EDF in the areas of nuclear safety and radiation protection. The site's performance in environmental protection and waste management, however, is below average.

With regard to nuclear safety, ASN considers that the Cruas-Meysse NPP is maintaining its level of performance. ASN notes in particular that the work started in 2018 on the management of deviations is bearing fruit. ASN considers that the action plan implemented by EDF meets the requirements and expects the results in this area to be consolidated in 2020. Progress has also been made in the prevention of reactor trips.

The year 2019 was also marked by the occurrence of an earthquake on 11 November 2019 on the municipality of Teil in the Ardèche *département* (see Notable events). The tremors recorded by the site's acceleration measurement system reached what are referred to as "inspection" thresholds. Reaching these thresholds led EDF to shut down reactors 2, 3 and 4 –which were in service– in order to perform inspections and tests to check that the equipment and facilities had not suffered any damage. The investigation programme and its results were submitted to ASN, which authorised their return to service. The retrospective analysis of the acceleration values recorded on the day of the earthquake shows that they were significantly below the acceleration values taken into account in the design of the nuclear power plant.

In the area of maintenance and management of the works relating to the reactor outages, ASN considers that EDF has made progress in the quality of outage preparation and the handling of unforeseen events that occur during the outages.

In the area of radiation protection, ASN takes positive note of the steps taken by the licensee, although radiological cleanliness and control of the contamination risk during reactor outages must be further improved.

With regard to protection of the environment, ASN has again noted shortcomings in waste management. In effect, despite the actions taken in this area in response to the requests issued

by ASN in 2018, the year 2019 was marked by the removal of potentially pathogenic waste to a treatment facility without prior verification. During its inspections, ASN found that the waste areas concerned were not operated in accordance with the rules in force and asked EDF to stop using them until they were made compliant. With regard to environmental protection, the monitoring and treatment of the water table pollution by tritium and hydrocarbons, which occurred in summer 2018, continued in 2019.

The inspections conducted by the ASN labour inspectors in 2019 confirmed the work done by the licensee in the prevention of vital risks, the development of new protected processes for the workers and the general upkeep of worksites. The accidents or near-accidents that occurred were the subject of analyses and quality action plans, and the efforts made must be maintained, particularly for the organisational application of accident prevention in the field.

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 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*. The site harbours a large number of installations, with a NPP comprising four 900 MWe reactors, nuclear fuel cycle facilities, and the BCOT (Operational Hot Unit) which fulfils maintenance and storage functions.

Tricastin nuclear power plant

The Tricastin NPP comprises four 900 MWe Pressurised Water Reactors (PWRs): 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.

With regard to nuclear safety, the NPP's performance is on the whole in line with ASN's general assessment of the EDF plants, but ASN nevertheless considers that it has deteriorated, with events such as the jamming of a spent fuel assembly when removing upper internal equipment from the reactor 2 pressure vessel, and the occurrence of multiple events significant for safety during the reactor 1 restart phase at the end of its fourth ten-yearly outage, despite restarting having begun satisfactorily. More generally, over the year 2019, ASN observed shortcomings in the application of the operating technical specifications, in the implementation of reliability-enhancement practices, the monitoring in the control room, the configuring of systems and the integrity of the first barrier made up by the fuel assembly cladding.

The processing of alarms in the control room remained at a satisfactory level further to the steps taken in 2018. With regard to maintenance, ASN considers that the standard of management of scheduled maintenance and refuelling outages dropped in 2019. The Tricastin NPP reactor 1 was shut down from June to December 2019 for its fourth ten–yearly outage, fitting in as a stage of the fourth periodic safety review (see Noteworthy events). This is the first of EDF's 900 MWe reactors to reach this milestone.

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. While the licensee has taken measures to improve control of containment of liquid effluents, ASN nevertheless notes that a leak in a pipe carrying radioactive effluents led to tritium pollution of the groundwater of the water table within the site in November 2019. Along with this, ASN again notes a persistent weakness in the radioactive effluent treatment systems. Waste management has improved with respect to 2018, but further improvements can be made.

With regard to radiation protection, ASN observes that 2019 was marked by two cases of worker contamination leading to skin exposure of more than one quarter of the annual regulatory limit. Furthermore, several significant events reflect a lack of radiation protection culture in some workers. ASN therefore considers that the Tricastin NPP is below average on this subject and that the licensee must rapidly take fundamental actions to improve the radiation protection culture of the workers on the ground.

As far as worker safety is concerned, there are still problems with the regulatory compliance of the facilities, but there were no serious accidents in 2019. Thus, as in 2018, the electrical risk is still not suitably controlled, nor is the risk associated with work at height with, for example, noncompliant scaffolding.

THE NUCLEAR FUEL CYCLE FACILITIES

The Tricastin fuel cycle facilities mainly cover the upstream activities of the fuel cycle and since the end of 2018 they have been 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 BNI 155) for converting depleted UF_6 into U_3O_8;
- **the former Comurhex facility** (BNI 105) **and the Philippe Coste plant** (ICPE within the perimeter of 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** (BNI 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 Basic Nuclear Installation** (DBNI) which accommodates the nuclear materials storage areas in particular, virtually all of which are for civil uses.

Following the inspections it conducted in 2019, ASN considers that the level of safety of the Orano Cycle facilities on the Tricastin site has remained stable. The industrial commissioning of new facilities with reassessed safety standards nevertheless encountered several difficulties and some components will have to be replaced. In 2019, ASN authorised the application of a new version of the on-site emergency plan, adapted to the new site organisation, under the responsibility of Orano Cycle as sole licensee.

The unannounced inspections conducted by ASN simultaneously on BNIs 93, 105, 138, 155 and 168 in 2019 found the rigour of the patrol inspections to be quite satisfactory. ASN also conducted an inspection focusing on the waste management organisation of the Orano platform on the Tricastin site in 2019. ASN noted that this organisation needs to be better formalised and that the licensee must increase the rigour of the ultimate inspections of conventional waste leaving the site.

In 2020, ASN will ensure that Orano continues to deploy its action plans for monitoring outside contractors, the retention structures and the control of liquid discharges in order to improve and harmonise the practices of the platform's BNIs. ASN will also check that the internal inspection body is properly put in place, in accordance with the resolution of 30 November 2017 concerning noteworthy modifications of BNIs.

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 reprocessed uranium is stored on the Tricastin site. The W plant situated within the perimeter of BNI 155 can process the depleted UF_6 from the Georges Besse II 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, ASN continued to monitor the implementation of the commitments made further to the periodic safety review of the facility. The progress with these commitments and the organisational setup for tracking them are satisfactory.

To follow up ASN's waste management inspections of 2017 and 2018 which had revealed and then confirmed an unsatisfactory situation, a two-day unannounced inspection was carried out on this theme in July 2019. This inspection revealed a significantly improved situation, particularly with regard to the identification of the waste and the storage areas, the traceability and the condition of the waste storage areas, which are now less congested. More generally, the licensee must continue its efforts to increase its operational rigour, particularly through the detection and management of deviations.

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 2019, ASN completed its examination of the decommissioning file for BNI 105 (formerly Comurhex) submitted by Orano Cycle in February 2014 and which underwent a public inquiry in 2017. The decommissioning of BNI 105 is now authorised by Decree 2019-1368 of 16 December 2019. The main issues associated with decommissioning concern the risks of dissemination of radioactive substances, of exposure to ionising radiation and of criticality, on account of the residual uranium-bearing substances present in some items of equipment.

Furthermore, in 2019 ASN authorised and inspected work conducted within this facility on a storage area for drums of uranium-bearing materials with the aim of providing static and dynamic containment and suitable climate control, in order to prevent a repeat of the loss-of-containment event resulting from the pressure increase in the drums caused by the hot summer temperatures in 2018.

ASN also inspected the industrial commissioning of the majority of the units of the Philippe Coste plant, whose facilities are classified Seveso high threshold and replace those of BNI 105 (formerly Comurhex). Only the second fluorine production unit is still at the tests stage with a view to commissioning in 2020.

ASN has also checked the licensee's management of numerous significant design, construction and operating anomalies detected in this plant. ASN has more specifically monitored (1) the sealing defects in the crystallizing containers used to cool down and heat the UF_6 for its purification and transfer to the transport tanks, (2) widespread corrosion of the fluorine pipes, and (3) the gaseous discharge limit values which were exceeded several times.

ASN checked that in response to these anomalies the licensee had put in place appropriate operating instructions, technical modifications and tightened monitoring procedures for the equipment items concerned, pending their replacement or the implementation of lasting technical solutions.

Alongside this, the inspections conducted in the Philippe Coste plant in 2019 aimed in particular at ensuring that the licensee had remedied the shortcomings in rigour identified during the inspections in 2018. In 2020, ASN will be attentive firstly to the commissioning of new and replaced equipment and of the new fluorine production unit of the Philippe Coste plant, and secondly to the repackaging and processing of the uranium-bearing materials present in the BNI in preparation for the decommissioning of BNI 105.

Georges Besse I enrichment plant

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

After stopping production at this plant in May 2012, the licensee carried out, from 2013 to 2016, the Eurodif "Prisme" process of "intensive rinsing followed by venting", which consisted in performing repeated rinsing of the gaseous diffusion 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. Examination of the file continued in 2019 and the decree instructing Orano Cycle to proceed with the decommissioning of the Georges Besse 1 plant was published on 5 February 2020.

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

ASN has checked the operation of the facility for hydraulic containment and treatment of the alluvial water table situated beneath BNI 93 which has been polluted with perchloroethylene and trichloroethylene. This facility enables the water to be pumped out of the water table at one point, treated and then reinjected into the water table upstream of the pumping point, thereby containing and depolluting the water table. ASN has observed that since its commissioning in March 2014, the water table treatment facility has functioned very little due to several failures and substantial technical problems, including in particular a scaling phenomenon leading to the clogging of the facility's components. ASN has therefore asked Orano to propose technical solutions to allow sustained operation of the facility and treatment of the pollution.

In 2020, ASN shall endeavour to check the effective operation of the hydraulic containment and alluvial water table treatment facility. 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 yards (BNI 178).

Georges Besse II enrichment plant

The Georges Besse II plant (BNI 168), which was operated by *Société d'enrichissement du Tricastin* (SET) until 2018 and is now operated by Orano Cycle which has become the sole licensee on the Tricastin site, constitutes 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 2019 was satisfactory. The technologies utilised in the facility enable high standards of safety, radiation protection and environmental protection to be reached. ASN considers that the licensee is proactive in the detection of deviations from its baseline requirements and duly meets the commitments made to ASN.

In 2020, ASN will be attentive to the frequency of the patrol inspections and the completeness of the modification authorisation application files submitted by the licensee.

Maintenance, effluent treatment and waste packaging facilities

The effluent treatment and uranium recovery facility, constituting BNI 138 (formerly Socatri), ensures the treatment of liquid effluents and waste, as well as maintenance operations for various BNIs. ASN considers that in 2019 the licensee made efforts to improve the level of operational safety and the rigour of operation of this facility and that these efforts must be continued.

Decree 2019-113 of 19 February 2019 authorised substantial modifications to the BNI, in particular to create "Trident", a facility for treating the site's waste. ASN has inspected the fitting-out work for this facility. It is currently examining the commissioning authorisation.

In 2020, ASN will be attentive firstly to the Trident facility startup tests and secondly to the continuation of the licensee's actions to increase operating rigour.

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 facility groups the uranium storage areas and the new emergency management premises of the Tricastin platform. ASN registered this facility in December 2016 and ascertained, with the Defence Nuclear Safety Authority (ASND),

the continuity of oversight of the nuclear safety of this facility. The facility baseline requirements are currently being upgraded to be in conformity with the regulatory texts applicable to BNIs.

ASN notes that the storage yard facilities are well kept. The licensee must nevertheless still deal with several damaged legacy packages. Following its inspections in 2019, ASN asked the licensee to review the retention structure inspection practices, to improve the monitoring of the anomalies observed during the patrol inspections and to ascertain that all nuclear materials are correctly labelled in accordance with the regulations.

ASN is expecting the licensee to make progress with regard to the emergency management building and the equipment it contains. The facility baseline requirements must effectively be upgraded to guarantee operation of the emergency centre and mobile equipment.

P35 facility

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

ASN registered this facility in January 2018 and has ascertained, with ASND, that there will be continuity in the oversight of the nuclear safety of these storage areas.

ASN considers that safety of operation of the P35 storage facilities was on the whole satisfactory in 2019. However in 2019, following an inspection, ASN asked that the integration of all the defined requirements for equipment important to the protection of people and the environment be clarified. ASN had effectively noted in particular that the inspection frequencies had been reduced without a documented analysis.

New uranium storage facility project

In February 2015 Orano Cycle informed ASN of its wish to create a new BNI on the Tricastin site for the storage of uranium-bearing materials resulting from fuel reprocessing. Orano Cycle undertook work to optimise the existing storage facilities on the site in order to push back their saturation date from 2019 to 2021 and in November 2017 submitted a creation authorisation application for new storage buildings. In 2018, ASN informed the Minister responsible for nuclear safety that the content of the creation authorisation application was sufficient to enable its examination to continue in 2019. The public inquiry should be held in 2020.

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 have been functioning since February 2018 following validation of the preliminary test results. The start-up of the last bench, which will finalise the complete commissioning of the facility, was planned for 2019. However, substantial difficulties were encountered with the sealing of the bench. These difficulties led Orano Cycle to carry out sealing reinforcement operations under conditions that ASN, after inspection, considered inappropriate.

More generally, ASN considers that the licensee must continue its efforts to increase its operational rigour in this facility. The licensee must also improve its oversight of the teardown of worksites entrusted to outside contractors.

In 2020, ASN will be extremely vigilant regarding the reconditioning of the third UF_6 analysis and sampling bench before any active tests are performed.

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.

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 now be carried out on the Saint-Dizier maintenance Base (Bamas). Activity transfer and tooling disassembly continued in 2019.

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

In 2019, ASN verified the modifications the BCOT made to its facility for cutting up the used RCC guide tubes of the pressurised water reactors operated by EDF.

In 2020, ASN will be attentive to the resumption of these operations and the last equipment removal operations.

ROMANS-SUR ISÈRE SITE

Framatome operates two BNIs on its Romans-sur-Isère site in the Drôme *département*, namely the research reactor fuel fabrication unit (BNI 63) and the PWR 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 the European Organization for Nuclear Research (CERN).

Framatome nuclear fuel fabrication plants

The fabrication of fuel for the nuclear power reactors necessitates transforming the 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).

In 2019, Framatome kept up an ambitious work programme within the two plants in order to meet the commitments made further to the periodic safety reviews. Investments have been made ("New Uranium Zone - NZU", new oxidation furnace CAPADOX), along with reinforcements of existing buildings (fire risk management, paraseismic reinforcements, improvement in material containment). The way in which the commitments are tracked and fulfilled is on the whole satisfactory.

The inspections conducted in 2019 confirmed satisfactory performance of the work and the putting in place of new organisational measures. An improvement was observed in the qualification process for new equipment important to the protection of people and the environment. The monitoring of service providers must nevertheless be further improved, particularly on the New Uranium Zone worksite. Several significant events relating to control of the criticality risk and rated level 1 on the International Nuclear and Radiological Event Scale (INES scale) were reported in 2019.

A storage bunker adjoined to a laboratory (L1) was commissioned in summer 2019. This arrangement represents a major improvement in safety, as it enables the mass of uranium in the laboratory to be limited to 600 grams, in accordance with the ASN resolution of 4 June 2019.

With regard to environmental protection, ASN considers that the Romans-sur-Isère site must further improve its control of the waste management routes, particularly by making a clear distinction between radioactive waste and conventional waste.

In 2020, ASN will be particularly attentive to the running of the New Uranium Zone worksite project, linked to the events of 2019. It will also closely monitor restarting of the Triga facility of BNI 63 and entry into service of the new waste treatment facility (Geode).

THE INDUSTRIAL AND RESEARCH FACILITIES

High Flux Reactor of the Laue-Langevin Institute

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

The RHF, 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 hectares situated between the rivers Isère and Drac, just upstream of their confluence, near the CEA Grenoble centre.

ASN considers that the safety of the RHF is managed relatively satisfactorily, but in 2019 it once again observed deviations concerning the operating organisation, particularly in the areas of waste management, environmental monitoring and periodic inspections.

ASN notes the substantial efforts the ILL has made in deploying its integrated quality and safety management system in order to meet the requirements of the BNI Order of 7 February 2012. During 2019, the licensee finished implementing all these processes and trained the personnel involved. The licensee had been given formal notice by ASN resolution of 6 February 2018 to modify its organization in order to comply with the regulatory provisions concerning physical modifications to its facilities. An inspection at the end of 2018 had revealed that the measures planned by ILL to comply with this notice had not been fully deployed and that they seemed not to have been made sufficiently known to the personnel. The ASN Director General's Office then had a meeting with ILL senior management so that the ILL could present immediate provisional measures and lasting measures to prevent recurrence of the observed deviations. During summer 2019, the ILL finished updating its modifications management process. The inspections carried out by ASN in 2019 enabled the compliance notice to be lifted in October 2019.

ASN tested the ILL's emergency organisation and resources during an inspection with an unannounced exercise outside working hours. ASN noted appropriate responsiveness, good knowledge of the facility and of the actions to take in an accident situation, and fluidity in the actions of the response teams.

The periodic safety review concluding report is currently being examined. The licensee's responsiveness and the quality of the information provided for the purpose of the examination are considered satisfactory. ASN carried out a tightened inspection focusing on the hypotheses and the conclusions of the ILL periodic safety review and the defining and implementation of its plan of action.

ASN will continue its examination of the safety review report in 2020 and will be attentive to the various action plans implemented by the ILL as a follow-up to the inspections of 2019 and lifting of the compliance notice.

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, prosthesis) and polymerising plastic materials.

The level of safety of the facility was found to be satisfactory in 2019. The ASN inspection focused specifically on the sealed source requalification operations carried out within the facility; these operations were conducted properly. An inspection targeting the periodic safety review was also carried out in 2019, and highlighted points requiring particular attention in the assimilation of the studies and conclusions of the safety review and the experience feedback analysis.

CERN accelerators and research centre

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.

Two joint visits by the Swiss and French Authorities took place in 2019 on the theme of fire prevention and radiation protection of workers. These visits revealed satisfactory practises.

FACILITIES 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 commencement of the second Superphénix decommissioning phase, which consists in opening the reactor pressure vessel to dismantle its internal components, in dedicated facilities constructed in the reactor building, by direct or remote manipulation. The safety and radiation protection measures implemented by EDF for these operations are on the whole satisfactory.

In December 2018 and June 2019, the site experienced a total loss of its electrical power supplies and the failure of one equipment important to the protection of the installations (emergency diesel generator set), which gave rise to two significant events rated level 1 on the INES scale. EDF reported difficulties in procuring certain obsolete items of equipment and long lead times for the replacement and repair of parts. ASN asked the licensee to perform a diagnosis covering the entire site and establish an action plan for managing equipment obsolescence. More generally, ASN notes that EDF was good about meeting its various commitments in 2019, but will remain attentive to the way defence in depth is taken into account and to the implementation of the plan addressing equipment obsolescence.

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 the effluents and Solid Waste Treatment Station and the decay storage facility (STED) (BNI 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 contamination, the licensee submitted a delicensing file along with a file for the establishing of active institutional controls in December 2019.

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) comprised two nuclear installations, BNI 65 and 90. The fuel fabrication activities were definitively stopped in the early 2000's. The decommissioning operations were authorised by Decrees 2006-190 and 2006-191 of 15 February 2006. The decommissioning work has been completed.

The site presents residual contamination of the soils and the groundwater. 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. 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.

A public inquiry concerning the request to implement active institutional controls was held in January 2019. The order instituting the institutional controls was issued by the Prefect of Isère in September 2019. Delicensing of BNI 65 and 90 was declared by two ASN resolutions, approved by Order of 12 December 2019.

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, 3 of which practice internal targeted radiotherapy,
  - 36 centres carrying out fluoroscopy-guided interventional procedures,
  - 53 computed tomography scanners for diagnostic purposes,
  - about 800 medical radiology devices,
  - about 2,000 dental radiology devices;
- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - about 300 veterinary practices, 3 of them equipped with scanners,
  - about 400 industrial and research centres, including 32 companies with an industrial radiography activity,
  - 1 industrial irradiator per radioactive source,
  - 1 computed tomography scanner dedicated to research,
  - 2 accelerators, one for industrial irradiation, the other for research and the production of drugs for medical imaging;
- activities linked to the transport of radioactive substances;
- ASN-approved laboratories and organisations:
  - 3 organisations approved for radiation protection controls,
  - 5 organisations approved for measuring radon,
  - 1 laboratory approved for taking environmental radioactivity measurements.

ASN conducted 74 inspections in small-scale nuclear activities in the Bourgogne-Franche-Comté region in 2019, comprising 28 inspections in the medical sector, 36 inspections in the industrial research and veterinary sectors, 2 inspections concerning radon exposure, 1 inspection in the area of polluted sites and soils, 2 inspections to monitor the activity of approved organisations and laboratories, and 5 inspections specific to the transport of radioactive substances.

One significant event rated level 1 on the INES scale was reported to ASN in 2019.

ASN inspectors issued one violation report in the exercise of their oversight duties.

ASN also devoted particular attention to the Framatome manufacturing plants situated in the Bourgogne-Franche-Comté region. The actions conducted by ASN in this context are described in chapter 10 of the full ASN report. ASN performed 8 inspections in these plants in Bourgogne-Franche-Comté in 2019.

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 (Brennilis), undergoing decommissioning;

- small-scale nuclear activities in the medical sector:
  - 10 external-beam radiotherapy departments,
  - 5 brachytherapy departments,
  - 10 nuclear medicine departments,
  - 39 centres using 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,
  - 15 industrial radiography companies, including 4 performing gamma radiography,
  - some 450 industrial and research equipment licenses;

- activities linked to the transport of radioactive substances;

- ASN-approved laboratories and organisations:
  - 8 agencies approved for radiation protection controls,
  - 18 organisations approved for measuring radon,
  - 4 head-offices of laboratories approved for taking environmental radioactivity measurements.

In 2019, ASN carried out 45 inspections, comprising 2 inspections at the Monts d'Arrée NPP undergoing decommissioning, 40 in small-scale nuclear activities and 3 in the transport of radioactive substances.

In 2019, 2 significant events in the medical sector were rated level 1 on the International Nuclear and Radiological Event Scale (INES scale). One event also concerned a worker in a non-nuclear activity and was rated level 2 on the INES scale.

ASN inspectors issued one violation report in the exercise of their oversight duties.

The Brennilis nuclear power plant

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 the decommissioning operations with the exception of those concerning 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;**
- **the clean-out and demolition of the effluent treatment station.**

In July 2018, EDF submitted an application file for the complete decommissioning of its installation. This file, which should enable decommissioning of the reactor block to be prescribed by decree, is currently being examined.

During 2019, EDF continued the preliminary work (preparation of access points and erection of scaffolding) and the safeguarding and removal of asbestos from the reactor containment in preparation for taking samples in the reactor block. These sampling operations were authorised by ASN by resolution CODEP-DRC-2019-039420 of 20 September 2019.

EDF also carried out preparatory tests in 2019 so that these sampling operations could be carried out at the beginning of 2020.

With regard to the decommissioning of the Effluent Treatment Station (STE), the basemat demolition operations that began in August 2016 took longer than expected and were completed in early 2018. The licensee then proceeded with the removal of the contaminated soils subjacent to the STE after approval of its soils management plan by ASN in April 2018. ASN conducted checks in the presence of all the parties after removal of the soils, the results of which will be known in 2020.

Furthermore, following the detection of a contaminated water leak in a room situated within the reactor containment in March 2017, EDF conducted investigations in 2019 to identify the origin of the leak and prepared the complementary investigations to be carried out prior to the reactor block decommissioning work. ASN considers that the licensee conducts its work in compliance with the safety and radiation protection requirements, but must improve its management of the time taken to perform the authorised operations.

In 2020, ASN will continue its examination of the complete decommissioning file and of the concluding report on the Brennilis installation periodic safety review submitted at the end of 2019.

Polluted sites and soils and mining sites

ASN backs up the Regional directorates for the environment, planning and housing (Dreal) on polluted sites and soils and on mining sites. With regard to the places in the public domain where uranium-bearing mining waste rock was reused, the ten areas in Bretagne concerned by the priority works have been treated (partial or complete removal of the mining waste rock).

The materials have been transferred to the former mining site of Prat-Mérien (Morbihan *département*). Five areas containing sludge and sediments radiologically contaminated by mine water from the former uranium mines have also been treated. The materials have been removed and transported to the Écarpière site (Loire-Atlantique *département*) for disposal.

Centre-Val de Loire region

The Orléans division regulates 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:

- Basic Nuclear Installations:
  - 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,
  - 11 nuclear medicine departments,
  - 32 centres using 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;

- ASN-approved laboratories and organisations:
  - 2 organisations approved for radiation protection controls,
  - 4 laboratories approved for taking environmental radioactivity measurements.

In 2019, ASN carried out 134 nuclear safety and radiation protection inspections: 106 inspections of the nuclear installations on the EDF sites of Belleville-sur-Loire, Chinon, Dampierre-en-Burly and Saint-Laurent-des-Eaux, and 28 inspections in small-scale nuclear activities in the Centre-Val de Loire region.

ASN also ensured 60 days of labour inspection in the Nuclear Power Plants (NPPs).

In 2019, 16 significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES scale) were reported by licensees of the EDF nuclear facilities in the Centre-Val de Loire region. In small-scale nuclear activities, 1 event concerning a brachytherapy patient was rated level 2 on the ASN-SFRO scale.

ASN inspectors issued one violation report 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 in line with the general assessment of EDF in the areas of radiation protection, the environment and nuclear safety.

The operational control of the installation has significantly improved compared with the preceding years, even if it is still below the level expected. The licensee has identified the few weaknesses that persist and is continuing to implement its action plan. More specifically, ASN considers that the licensee must make further progress in communication within and between the operational control teams, in the robust analysis of periodic test results and in monitoring the reactor parameters. By way of example, EDF reported a significant event rated level 1 on the INES scale due to two excursions from the operating envelope authorised by the installation's safety rules.

In addition to this, significant improvements can be made in fire risk management.

In the area of radiation protection, ASN finds that the situation is satisfactory and has remained so for several years. The service competent in radiation protection has made improvements in the traceability and monitoring of actions to optimise the dosimetry of worksites where there are major radiation risks.

Lifting tightened monitoring

In the light of the results of the tightened monitoring of the Belleville-sur-Loire NPP decided in September 2017, ASN observes that the condition of the installations and the practices with regard to safety have, broadly speaking, significantly improved. After the progress noted by ASN in 2018, the specific inspections carried out in 2019 revealed an improvement in the site's performance in the areas of deviation management and operating control of the installations.

Consequently, in January 2020 ASN decided to lift the tightened monitoring of the Belleville-sur-Loire NPP. ASN nevertheless insists on the need for the site to maintain this level of rigour so that the improvements observed since 2017 are sustained over the long term.

The environmental performance of the Belleville-sur-Loire NPP is satisfactory, even though the licensee must be particularly attentive to the management of on-site transport of hazardous materials, an area in which improvements are required in 2020.

With regard to labour inspection, inspections were carried out in the areas of health and safety at work, particularly during the maintenance outages. Inspections were carried out in particular in relation to the sealing work on the reactor containment wall. The observations addressed to the NPP and the subcontractor companies necessitated corrective actions which were checked during performance of the services. In addition, regular meetings took place with the bodies representing the personnel at meetings of the Committee for Health, Safety and Working Conditions (CHSCT) and when specifically requested by the personnel representatives, on subjects essentially addressing application of the Labour Laws.

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 Daiichi NPP accident. Its role is to intervene in pre-accident or accident situations, on any NPP in France, by providing additional human resources and emergency equipment.

ASN considers that the nuclear safety performance of the Dampierre-en-Burly NPP is in line with the general assessment of the EDF plants.

This being said, its environmental and radiation protection performance are below the national average. These assessments are exactly the same as those formulated for the year 2018.

With regard to safety, the results are on the whole satisfactory, with a good level of involvement of the independent safety organisation and the operational control teams in the significant events analyses. ASN does nevertheless observe an upsurge in organisational weaknesses between the operational control teams and the other services of the NPP which have been the cause of several significant events. Weaknesses in the monitoring actions in the control room are still observed regularly. ASN moreover again noted incomplete control of the fire risk on the site.

With regard to the maintenance of the facilities, ASN considers that the monitoring of outside contractors, application of

the maintenance baseline requirements and the physical conformity of the facilities with the applicable requirements must be improved. Several inspections and significant events also reveal maintenance errors following preventive and curative maintenance operations (on the emergency diesel generator sets in particular).

The site must make further improvements in radiation protection. Despite the plan of rigour deployed by the site in 2019, which brought some improvements, ASN regularly detects significant malfunctions in the control of radiological cleanliness and contamination dispersion on the sites. To give an example, recurrent deviations are noted in the monitoring and the working condition of the equipment for placing the systems under negative pressure to limit contamination dispersion.

Lastly ASN considers that the site must make further progress in environmental protection, particularly with waste management and the containment of liquids. ASN also regularly notes shortcomings in control of the risk of dispersion and proliferation of legionella in the tertiary circuit.

With regard to labour inspection, substantial work was carried out on the electrical risk, focusing in particular on management of the regulatory checks of electrical installations, authorisations and application of the lockout/tagout rules. Labour inspection also asked for complementary verifications on certain electrical systems. Improvement actions are expected of the licensee to ensure better control of the electrical risk. Following the occurrence of a serious handling and lifting-related accident, specific inspections were conducted to analyse the circumstances of the accident and check the corrective actions implemented by the licensee.

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 NPP 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 GCRs designated Chinon A1, A2 and A3, are currently being decommissioned. The site also accommodates the Irradiated Materials Facility (AMI), 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 nuclear power plant

Reactors B1, B2, B3 and B4 in operation

ASN considers that the performance of the Chinon NPP is in line with the general assessment of EDF in the areas of safety, radiation protection and the environment. Although this assessment is identical to that of 2018 in the areas of safety and the environment, the radiation protection performance in 2019 is poorer than that observed in 2018.

ASN considers that the NPP is maintaining a satisfactory level with regard to safety. Progress has been made in management of the alignment activities and performance of the periodic tests, both identified as weak points in the last few years. Continued progress is nevertheless required because these activities remain the cause of a large number of significant events. An improvement in the quality of the risk analyses and the traceability of maintenance operations was observed in 2019. In view of the deviations from regulations discovered during the inspections conducted in 2019, ASN considers that the licensee must significantly improve its management of risks related to fire and explosion.

The radiation protection performance of the Chinon NPP is satisfactory, leading to good results in terms of dosimetry and radiological cleanliness. The year 2019 was nevertheless marked by a rise in significant radiation protection events due to shortcomings in preventing contamination dispersion and a loss of robustness in the general organisation of the site in this respect.

Although comparable with the national average, the environmental performance of the Chinon NPP must be improved. Despite compliance with the discharge limits for gaseous and liquid effluents, and no observed exceeding of limits for legionella and amoebae in 2019, numerous deviations from regulations were noted concerning waste management (a finding already made in 2018) and the containment of hazardous substances. The licensee must take priority actions to address these deviations.

With regard to labour inspection, inspections were carried out in the areas of health and safety at work, particularly during the NPP maintenance outages. Thematic inspections were also carried out, particularly on management of the explosion risk. Improvements are expected of the licensee for the demonstration of control of conformity of facilities situated in identified explosion-risk areas.

Reactors A1, A2 and A3 undergoing decommissioning

The graphite-moderated GCRs series comprises six reactors, including Chinon A1, A2 and A3. These first-generation reactors used natural uranium as the fuel, graphite as the moderator and 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 –the Museum of the Atom– since 1986. Chinon A2 D is also partially decommissioned and houses GIE 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 has been examined by ASN.

ASN considers that the level of safety of the Chinon nuclear installations undergoing decommissioning (Chinon A1, A2 and A3) is satisfactory. The inspections conducted in 2019 revealed in particular that EDF's monitoring of outside contractors is well managed.

Decommissioning of the heat exchangers in the South hall of Chinon A3 ended in June 2018, with the removal of all the heat exchangers. Despite the measures taken as a result of experience feedback from the operations in the South hall, decommissioning of the heat exchangers in the North hall was interrupted due to the presence of asbestos. Restarting these operations in 2020 is under consideration.

THE NUCLEAR FUEL CYCLE FACILITIES

Inter-Regional fresh Fuel Warehouse

Commissioned in 1978, the Chinon Inter-Regional Fuel 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.

The facility was emptied of all the fuel assemblies in early 2018 to allow the replacement of the handling crane in 2019. ASN considers that the work went well and during an inspection it noted the good upkeep of the premises.

Nominal operation shall resume in early 2002 with the restarting of reception of fuel assemblies with updated baseline requirements, authorised by ASN.

RESEARCH FACILITIES UNDERGOING DECOMMISSIONING

Irradiated materials facility

The 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 a view to decommissioning the facility, the activities in the AMI are now essentially decommissioning preparation and monitoring operations. The year 2019 was chiefly marked 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 continued its examination of the decommissioning file and issued its opinion on the draft decommissioning decree in early 2020.

ASN considers that the management of the waste treatment operations, the performance of the periodic checks and tests and the monitoring of pressure equipment are satisfactory. Particular attention must be paid to the measures for controlling the fire risk. Shortcomings have been observed in the application of the operating rules and particular attention is required in the implementation of measures to prevent their recurrence.

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 GCRs, 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 nuclear power plant

Reactors B1 and B2 in operation

ASN considers that the performance of the Saint-Laurent-des-Eaux NPP is in line with the general assessment of the EDF plants in the areas of environment and safety, but underlines a drop in the rigour of operational control of the facilities. The radiation protection performance, however, is below the national average.

With regard to nuclear safety, ASN considers that the NPP has not improved its performance with respect to 2018 despite putting in place a "safety rigour plan". ASN nevertheless underlines the good overall upkeep of the worksites and satisfactory condition of the inspected equipment. This being said, shortcomings in operating rigour and operational control of the facilities were again observed in 2019. Numerous events highlight deficiencies in the management of changes of reactor state and in the application of the general operating rules. Shortcomings have been observed in the NPPs organisation for detecting deviations during maintenance work on the primary and secondary systems. Determined action regarding compliance with the facility operational control rules is expected of the licensee in 2020. ASN does however note that performance of the periodic tests is well managed.

Broadly speaking, the radiation protection performance of the Saint-Laurent-des-Eaux NPP dropped in 2019. Management of the storage areas must be improved and the containment rules must be more clearly defined and more closely monitored by EDF. Lastly, although its inspections identified several good practices, ASN considers that the site must consolidate its process for optimising doses prior to operations with radiation exposure risks.

The NPPs organisation to meet the environmental regulatory requirements is considered satisfactory. The various facilities inspected are well kept. An exercise simulating a hazardous substance discharge showed that the site was well organised, had a sound knowledge of the response actions and implemented them calmly. The management of retention structures showed some weaknesses however, with noncompliant equipment storage areas and undetected run-offs.

With regard to labour inspection, an in-depth inspection was conducted on the subject of fire, personnel evacuation and sheltering in the event of an incident or accident. Further to the labour inspection's observations, improvement actions are expected on the part of the licensee regarding the use and maintenance of the evacuation systems and the site's response organisation. Labour inspection will assess the measures taken in subsequent inspections. Particular attention must be focused on the audibility of the sirens inside the buildings.

Reactors A1 and A2 undergoing decommissioning

The former Saint-Laurent-des-Eaux NPP constitutes a BNI comprising two "integrated" GCRs, the Saint-Laurent-des-Eaux reactors A1 and A2. These first-generation reactors used natural uranium as the fuel, graphite as the moderator and were cooled by gas. Their final shutdown was declared 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.

ASN, which is examining the periodic safety review concluding report for Saint-Laurent-des-Eaux A submitted at the end of 2017, carried out a specific inspection in 2019. ASN noted that the organisation put in place by EDF for this safety review is satisfactory, but nevertheless observed that the justification for certain conformity analyses could be improved.

Work on the decommissioning sites continued in 2019, but several of them fell behind schedule due to organisational and technical difficulties, or issues related to the presence of asbestos. EDF also continued its efforts to remove the liquid and solid waste.

ASN considers that the level of safety of the Saint-Laurent-des-Eaux A reactors is satisfactory. ASN's inspections found that the overall upkeep of the premises and worksites was good. In addition, the organisation and tools in place for monitoring deviations and outside contractors are satisfactory. However Saint-Laurent-des-Eaux A must improve its organisation for the management of emergency situations in order to better integrate the particularities of installations undergoing decommissioning. ASN will also be attentive to the management of liquid waste, and more specifically to the solutions proposed by EDF further to the loss-of-containment event concerning two drums on a nuclear waste storage area in summer 2019.

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 coming from the operation of Saint-Laurent-des-Eaux A GCRs. 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 carried out satisfactorily on the whole.

In the context of its new decommissioning strategy for the GCRs, EDF announced in 2016 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 has postponed by one year –that is to say until the end of 2021– submission of the decommissioning file which will take into account the emptying, post-operational clean-out and demolition of the current existing.

Corse (Corsica) 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,
  - 7 centres performing fluoroscopy-guided interventional procedures,
  - 9 computed tomography scanners,
  - about 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,
  - some 40 industrial and research centres;
- activities linked to the transport of radioactive substances;
- ASN-approved laboratories and organisations:
  - 2 organisations approved for measuring radon.

In 2019, ASN carried out 5 inspections in Corse, of which 4 were in the medical sector and 1 in the industrial sector.

Overseas *départements* and regions

The regulation of radiation protection and the transport of radioactive substances in the 6 overseas *départements* and regions (Guadeloupe, Guyane, La Réunion, Martinique, 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 Polynesia.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- small-scale nuclear activities in the medical sector:
  - 4 external-beam radiotherapy departments,
  - 1 brachytherapy department,
  - 5 nuclear medicine departments,
  - 20 centres performing fluoroscopy-guided interventional procedures,
  - about 30 centres in possession of at least one computed tomography (CT) scanner,
  - about 100 medical radiology devices,
  - 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.

19 inspections were carried out in the small-scale nuclear activities sector in the French Overseas *départements* and regions in 2019. Three on-site inspection campaigns were carried out by the ASN Paris division.

In 2019, one event concerning workers was rated level 1 on the INES scale.

Grand Est region

The Châlons-en-Champagne and Strasbourg divisions jointly regulate 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:

- Basic Nuclear Installations:
  - the Cattenom NPP (4 reactors of 1,300 MWe),
  - the Chooz A NPP (currently being decommissioned),
  - the Chooz B NPP (2 reactors of 1,450 MWe),
  - the Fessenheim NPP (2 reactors of 900 MWe, of which 1 is in final shutdown status since 22 February 2020),
  - 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,
  - some 80 centres performing 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 250 industrial activities coming under the licensing system,
  - about 50 research laboratories situated primarily in the universities of the region;
- activities linked to the transport of radioactive substances;
- ASN-approved laboratories and organisations:
  - 5 organisations approved for radiation protection controls.

In 2019, ASN conducted 182 inspections in the Grand Est region, of which 71 were in the NPPs, 7 in radioactive waste disposal facilities, and on the site of the Chooz A NPP currently being decommissioned, 85 in the small-scale nuclear activities sector, 5 in the transport of radioactive substances and 14 concerning approved organisations or approved laboratories.

ASN also carried out 23 days of labour inspections in the NPPs.

During 2019, 18 significant events reported by nuclear installation licensees in the Grand Est region were rated level 1 on the International Nuclear and Radiological Event Scale (INES scale).

In small-scale nuclear activities, 3 significant events in the industrial sector 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.

It comprises four 1,300 MWe Pressurised Water Reactors (PWRs) commissioned between 1986 and 1991. Reactors 1, 2, 3 and 4 constitute BNIs 124, 125, 126 and 137 respectively. Along with the Paluel and Gravelines NPPs, it is one of the world's largest NPPs in terms of installed power.

ASN considers that, despite a relative improvement in 2018, the year 2019 was marked by a new deterioration in the Cattenom NPP's performance with regard to operation and maintenance, but nevertheless without the safety measurement indicators falling significantly below the average for the EDF plants.

The environmental protection results revealed satisfactory control in a context marked by a heatwave. Lastly, the radiation protection results remain contrasted despite the efforts made.

Several events highlighted a lack of rigour in the preparation or performance of reactor operating activities, and technical deviations or document anomalies were observed during work in the field. With regard to maintenance, 2019 was marked by a heavy schedule, with three reactors concerned by maintenance outages, two of which partially overlapped, mainly due to delays caused by unforeseen events during restarting. In this high industrial workload situation, weaknesses emerged in the performance of the technical actions in some maintenance activities (leading to maintenance errors) or in equipment requalifications. The ability to manage unforeseen events, and significant event reporting times and quality of analysis remain satisfactory.

The licensee took stock of the drop in performance and in late 2019 initiated an action plan to improve operating rigour.

With regard to the environment, 2019 was marked by the effects of the heatwave, with the water level of the River Moselle remaining very low for a long period. The site thus had to resort to operation by recirculating water from the adjacent Mirgenbach reservoir. Furthermore, substantial volumes of water were released from the Vieux-Pré reservoir into the River Moselle to compensate for the water intakes necessary for operation of the cooling towers. No accidental discharges were reported in 2019, but two events related to the control of discharges into water and the atmosphere were recorded.

With regard to radiation protection, 2019 was marked by deviations concerning compliance with the basic rules of access to classified areas and the control of contamination dispersion, in a context of intense activity linked to the reactor outages. This being said, the site's commitments made since 2017 to improve radiation protection have been widely met.

Lastly, regarding occupational safety, ASN has observed a drive on the theme of control of explosive atmosphere risks and this must be continued.

An inspection into the legality of the conditions of operation of foreign companies on the French territory was carried out jointly with the inspectors of the Regional unit supporting and monitoring the fight against illegal work (Uracti) of the Regional directorate for enterprises, competition, consumption, labour and employment (Direccte). This inspection detected irregularities concerning subcontractor companies during the provision of their services.

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 accommodates the Ardennes NPP, called Chooz A, comprising 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 the Chooz B NPP, comprising two 1,450 MWe reactors (BNI 139 and 144), commissioned in 2001.

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 that momentum driving progress has been maintained despite the context of intense activity on account of the ten-yearly outage of reactor 2. As far as operation of the reactors is concerned, particular attention must nevertheless be paid to the quality of the risk analyses relating to work interventions in periods of heightened activity.

In the area of maintenance, deficiencies in spare parts procurement were the cause of several significant events. The quality of the operational documentation can be further improved. Efforts must also be made in personnel training, particularly for activities that are complex or involve several specialities.

Alongside this, all the actions contributing to optimisation of worksite radiation protection, from the preliminary risk analysis through to compliance with instructions, must be improved. The licensee must moreover maintain its vigilance in the control of radiological cleanliness of the facilities and increase the rigour of individual behaviour.

ASN considers that the sites organisation for environmental protection is on the whole satisfactory. It notes in particular satisfactory and prompt management of the main events in this area.

Lastly, the oversight ensured through the labour inspections revealed no major nonconformities, but regularly highlighted shortcomings in the optimisation of occupational radiation protection.

Reactor A undergoing decommissioning

The reactor vessel decommissioning work continued in 2019, culminating in the packaging of the reactor vessel head and its shipping to the Aube disposal centre.

On a more general note, ASN considers that the licensee must make progress in the areas of radiation protection, the monitoring of service providers and the environment.

In the area of radiation protection, providing for the risk of alpha particle contamination is a major challenge for the site.

A surge in the cases of on-site contamination was observed in 2019. These findings were made in particular during labour inspection missions on the decommissioning worksites. The licensee must make particular efforts to improve the situation in this respect, and that also includes the monitoring of service providers.

With regard to the environment, ASN considers that the licensee must be particularly attentive to ensuring compliance with waste disposal routes.

Fessenheim nuclear power plant

The Fessenheim NPP comprises two PWRs, each with a unit power of 900 MWe. It is situated 1.5 km from the German border and about 30 km from Switzerland. The two reactors were commissioned in 1977 and will be definitively shut down in 2020.

ASN considers that the nuclear safety performance of the Fessenheim NPP remains satisfactory, as much in the operation of the reactors as in the implementation of the facility maintenance programmes; the facility is situated above the national average in the areas of safety and the environment, and in the average for radiation protection.

Thus, following a good year 2018, operation in 2019 revealed a number of events related to the reliability of maintenance interventions and operational control, but did not call into question the generally positive judgement of ASN. The good results in the number of reactor trips indicate the continued rigour of prevention actions in this respect. The site also displays excellent performance in the off-site and on-site transport of radioactive substances. The site's organisation for the deployment of the On-site Emergency Plan (PUI) is found to be robust, and the responsiveness of the response teams and the personnel in charge of deploying the local emergency resources was noted very positively during the ASN inspections.

ASN observed several events in 2019 that indicate a relative weakness in the site's management of the fire risk, such as with configuring the systems, monitoring the fire protection equipment, or the capacities of the response resources present on the site.

However, no deviations were observed with regard to fire permits, sectorisation or the fire loads, which appear to be well managed.

The maintenance programme for 2019 was rather particular, with two reactor shutdowns for maintenance outages, scheduled belatedly due to the postponement of the initially planned final shutdown date, and with worksites adapted to the context of the forthcoming closure. This programme was carried out satisfactorily. ASN noted the strong determination of the site to maintain the facilities in exemplary condition, with a good degree of involvement of the personnel and management in the maintenance and condition of the facilities.

With regard to environmental management, there were no events that called into question the generally positive judgement of the preceding years.

Lastly, in the area of radiation protection, 2019 witnessed a few events concerning accesses to classified areas and the control of the risk of contamination dispersion. This latter point reveals a potential weakness in the atypical decontamination activities, which will require particular vigilance in the context of the site's future activities. A few deviations were noted with respect to the fire regulations for worker safety, but the site's occupational safety performance remains satisfactory.

Preparation for final shutdown of the Fessenheim site

In September 2019, EDF transmitted the declaration of final shutdown of the Fessenheim NPP, which constitutes BNI 75, to the Minister responsible for nuclear safety and to ASN, in accordance with Article L. 593-26 of the Environment Code. Reactor 1 was shut down on 22 February 2020 and reactor 2 will be shut down on 30 June 2020. In accordance with the Environment Code, EDF enclosed with its shutdown declaration a decommissioning plan describing the planned decommissioning strategy for the NPP. EDF shall then have to submit a decommissioning file with the aim of obtaining a decree authorising it to start the decommissioning operations. This decommissioning file shall undergo a technical examination and a public inquiry.

There is already considerable international feedback on the decommissioning of PWR. In France, the Chooz A reactor in the Ardennes uses the same technology and is also undergoing decommissioning. For the Fessenheim NPP, EDF today plans for five years of decommissioning preparation, which will extend from final shutdown through to obtention of the decommissioning decree. These preparatory operations include in particular the removal of the fuel from the reactor core and removal of the spent fuel stored in the pools. Once the decommissioning decree has been issued, EDF estimates that the decommissioning operations will take 15 years to achieve the final status, followed by delicensing of the BNI.

Considered as a whole, the decommissioning plan submitted by EDF for the Fessenheim NPP is not sufficiently detailed for a facility that is so close to final shutdown. Consequently, in December 2019 ASN asked EDF to justify and further clarify its strategy, particularly regarding the decommissioning time frames and waste management. In this context, ASN observes that EDF plans sending the old steam generators –which are currently stored on site– to Sweden, for recycling in its Cyclife Sweden plant, whereas the conditions for this type of recycling have not yet been determined with regard to French Law.

Furthermore, EDF submitted a safety review guidance file for the Fessenheim reactors in June 2018. In effect, EDF must submit the safety review concluding report for the first reactor before 10 September 2020 and for the second reactor before 28 August 2022.

This guidance file serves to set the bounds of the conformity analyses and safety reassessments which are required for the periodic safety review. In December 2019, ASN also asked EDF for clarifications, particularly concerning the scope of the conformity review proposed by EDF, the justification for the methodologies used and the unforeseen events considered for the safety review. The safety review reports must enable ASN to ascertain that the safety of the facility will be maintained during the decommissioning preparation phases and decommissioning itself.

In November 2019, an in-depth inspection was carried out at the EDF's Department of dismantling projects and waste (DP2D), and on the Fessenheim site. ASN found project work packages that are insufficiently detailed and progress in the technical studies that is insufficient given the present stage of the decommissioning project.

EDF must reinforce the coordination of the Fessenheim decommissioning project in order to have an overall view of the project integrating all its interactions. It also considers that EDF must improve its organisation to establish and validate fundamental decisions for the decommissioning scenario based on proven and formalised hypotheses.

With regard to local operational aspects, the site has already started the planning and preparation of the reactor shutdown operations in 2020, and the management of the workforce and skills during the period prior to decommissioning. ASN has observed the maintaining of a highly satisfactory level of personnel involvement and considers that the management of the organisational and human challenges entailed by the prospective closure of the site, has been excellent.

Furthermore, a number of regulatory requirements, particularly those associated with the implementation of safety improvements further to the lessons learned from the Fukushima Daiichi accident, need to be adapted to the configuration of a site which will no longer be generating power but waiting for decommissioning. Consequently, ASN has started to amend certain requirements, particularly the requirement to build ultimate backup diesel generator sets and the designation of the resources required for the "hardened safety core".

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 PWRs, each of 1,300 MWe, commissioned in 1987 and 1988. Reactor 1 constitutes BNI 129 and reactor 2 BNI 130.

ASN considers that the performance of the Nogent-sur-Seine site with regard to nuclear safety, radiation protection and environmental protection is in line with the average for the plants operated by EDF.

As far as nuclear safety is concerned, the licensee must maintain its efforts to be rigorous in the operation of the reactors. ASN notes in particular that the restarting phase of reactor 1 was subject to an unusual number of events and observes that the operator vigilance, particularly in the control room, must be maintained, including in situations of increased activity. Particular attention must also be paid to the system configuring operations.

With regard to maintenance, ASN considers that the situation is generally satisfactory, in a context of intense activity linked to the ten-yearly outage of reactor 1. ASN notes the progress in monitoring work operations, but the monitoring is still not sufficiently relevant and appropriate for the facility modification activities. The licensee must also ensure rigorous traceability in the processing of anomalies observed on the equipment.

With regard to radiation protection, ASN considers that the licensee has managed to continue correcting the malfunctions in worker protection measures observed in the previous years. The loss of control of radiological cleanliness on a worksite with exposure risks during the ten-yearly outage of reactor 1 nevertheless underlines the need for vigilance in this area on the future similar worksites.

ASN notes a positive trend in environmental protection, but considers that the licensee must remain vigilant regarding the on-site management of effluents and the containment of liquid substances.

Lastly, the oversight ensured through the labour inspections revealed no major nonconformities: ASN focused particular attention on the conformity of the fuel handling machine during the ten-yearly outage of reactor 1, further to the corrections made by the licensee.

Aube waste disposal facility

Authorised by a Decree of 4 September 1989 and commissioned in January 1992, the Aube repository (CSA) took over from the Manche repository which ceased its activities in July 1994, while benefiting from the experience gained with the latter. This facility, situated in Soulaines-Dhuys, has a disposal capacity of one million cubic metres of low and intermediate level, short lived waste (LL/ILW-SL). It constitutes BNI 149. The operations authorised in the facility include the packaging of waste, either by injecting mortar into metal containers of 5 or 10 m³ volume, or by compacting 200-litre drums.

At the end of 2019, the volume of waste in the facility had reached about 345,000 m³, or 34.5% 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 that the CSA is operated under satisfactory conditions with regard to safety, radiation protection and environmental protect.

In 2019, with the authorisation of ASN, the CSA commissioned the package inspection facility which gives it more effective means of checking the quality of the received packages. The CSA has moreover started the construction of new waste disposal structures.

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 2019. ASN shall give its opinion on the conditions of operation of the CSA in 2020.

Deep geological disposal facility project

ASN considers that the scientific experiments and work conducted by Andra in the underground laboratory at Bure continued in 2019 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:

- one Basic Nuclear Installation:
  - the Gravelines NPP (6 reactors of 900 MWe) operated by EDF;

- small-scale nuclear activities in the medical sector:
  - 19 external-beam radiotherapy departments,
  - 3 brachytherapy departments,
  - 28 nuclear medicine departments,
  - 92 centres using 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:
  - 1 accelerator intended for the inspection of freight trains,
  - 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 and 19 companies using gamma ray densitometers,
  - 340 veterinary surgeries or clinics practising diagnostic radiology;

- activities linked to the transport of radioactive substances;

- ASN-approved laboratories and organisations:
  - 4 organisations approved for radiation protection controls.

In 2019, ASN's carried out 126 inspections in the Hauts-de-France region, of which 22 were in the Gravelines NPP, 96 in small-scale nuclear activities and 8 in the transport of radioactive substances.

ASN also carried out 41 labour inspection operations in the Gravelines NPP.

During 2019, 6 significant events rated level 1 on the INES scale were reported by the Gravelines NPP.

In small-scale nuclear activities, 5 events were rated level 1 on the INES scale.

Gravelines nuclear power plant

The Gravelines NPP operated by EDF is located in the Nord *département* on the shores of the North Sea, between Calais and Dunkerque. 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 radiation protection and environmental protection performance of the Gravelines NPP is, on the whole, in line with the general assessment of EDF plant performance, but its nuclear safety results are below the general average.

The improvement in nuclear safety performance perceived in 2018, especially during the in-depth inspection carried out from 14 to 18 May 2018, did not continue in 2019. ASN notes more specifically a downturn in the results concerning the reliability enhancement of practices. The licensee must also remain attentive to the availability of systems associated with the cooling function.

On the maintenance front, 2019 was marked by problems affecting the pumps and pipes carrying seawater. Furthermore, some items of equipment providing protection against external hazards display corrosion phenomena that could call into question their effectiveness. The licensee must respond to the recurrent problems of corrosion on the facilities.

As regards environmental protection, ASN considers that the Gravelines NPP must improve its management of the maintenance of the facilities for treating the radioactive effluents produced by the operation of the reactors.

With regard to radiation protection, ASN continues to find weaknesses in the control of access to certain areas presenting radiological exposure risks. Improvements are also expected in the monitoring of worksites involving internal contamination risks which were the cause of significant radiation protection events in 2019.

Forty-one labour inspection operations were carried out in the Gravelines NPP in 2019. The inspections are divided between inspections conducted on the maintenance worksites, particularly during reactor outages, and thematic inspections (exposure to chemical risks, lifting risks). Meetings were also organised with senior management, members of the Health, Safety and Working Conditions Committee (CHSCT) and personnel representatives. ASN requested the organisation of technical meetins on specific subjects, such as the risks involved in replacing the steam generators on reactor 5 or the site's organisation for the management of risks and safety at work. ASN effectively remains attentive to the training of operators working at height and to the precautions to be taken when lifting loads. No serious accidents occurred in 2019. The ASN labour inspector did however order a temporary work stoppage after observing a dangerous situation on the ultimate backup diesel generator set worksite.

Polluted sites and soils and mining sites

ASN continued its action and assisted the Dreal with safety recommendations concerning radiation protection for a clean-up project for the PCUK (*Produits Chimiques Ugine-Kuhlmann*) brownfield site, on which phosphogypsum residues are stored.

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 BNIs of this region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- Basic Nuclear Installations regulated by the Orléans division:
  - the CEA Saclay site, which belongs to the CEA Paris-Saclay centre,
  - the UPRA (Artificial Radionuclide Production Plant) operated by CIS bio international in Saclay,
  - the CEA Fontenay-aux-Roses site which belongs to the CEA Paris-Saclay centre;

- small-scale nuclear activities in the medical sector regulated by the Paris division:
  - 226 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 devices,
  - about 8,000 dental radiology devices;

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

- activities linked to the transport of radioactive substances;

- ASN-approved laboratories and organisations:
  - 9 bodies for radiation protection oversight.

ASN carried out 196 inspections in the Île-de-France region in 2019, of which 42 were in the field of nuclear safety, 148 in small-scale nuclear activities and 6 in the transport of radioactive substances.

Nine safety-related significant events were rated level 1 on the INES scale in Ile-de-France, 3 in the area of transport and 6 concerning BNIs.

CEA SACLAY SITE

The Saclay research centre, covering an area of 223 hectares, is located about 20 km south-west of Paris, in the Essonne *département*. About 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 and enhance the safety of the French Nuclear Power Plants (NPPs). The Saclay centre accommodates eight BNIs. Nearby are also located an office of the French National Institute for Nuclear science and Technology (INSTN) –a 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 MWth (megawatts thermal). 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 purposes.

Its critical mock-up, the ISIS reactor with a power of 700 kWth (kilowatts thermal), was essentially used for training purposes. These two reactors, which constitute BNI 40, were authorised by the Decree of 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. The ISIS reactor was definitively shut down in March 2019. In October 2018, the French Alternative Energies and Atomic Energy Commission (CEA) submitted its decommissioning file for the complete facility: the Osiris reactor and the ISIS reactor. The decommissioning file admissibility analysis carried out by ASN in 2019 revealed the need for a more detailed description of the operations planned for each stage of decommissioning, to better justify the envisaged initial state at the start of decommissioning, and to provide clarifications on the results of the impact study.

Since the Osiris reactor was shut down, the operations to remove the radioactive substances and hazardous materials and to prepare for decommissioning are under way, with an organisation that is adapted to this new reactor status. Removal of the spent fuels continued in 2019 and a new generator set was commissioned.

The inspections conducted by ASN in 2019 showed that the facility is operated under satisfactory conditions as regards the transport operations and the electrical equipment. However, the emergency organisation and operational management for accident situations must be improved, particularly through the updating of the operational documents and tightened monitoring of the training programmes. Management of the decommissioning preparation operations is satisfactory in the technical aspects, but some delays are observed. Management of baseline requirement updating deadlines needs to be improved.

Lastly, some of the significant events reveal organisational and human weaknesses, particularly in the relations with the centre's technical services. Consequently, the licensee must be vigilant regarding maintaining of operating rigour and the safety culture and in the analyses of periodic checks and tests results.

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 the 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 were 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, for its part, is intended for the performance of non-destructive tests on certain components.

The Orphée reactor was definitively shut down at the end of 2019. The licensee is preparing the decommissioning file for the facility.

Based on the inspections carried out in 2019, ASN considers that the level of safety of the Orphée reactor is on the whole satisfactory. Operation of the cooling towers has improved since 2018, when numerous deviations were observed. However, the fire risk control measures must be improved, as must emergency management preparedness. Lastly, the robustness of some of the nuclear pressure equipment management provisions must be increased.

Following reactor shutdown, the phase of decommissioning preparation pending issuing of the decommissioning decree shall be subject to particular scrutiny by ASN, notably the adaptation of the organisation and the personnel skills to manage new activities while maintaining the level of safety of the facility.

Spent fuel testing laboratory – *CEA Centre*

The Spent Fuel Testing Laboratory (LECI) – BNI 50 – was built and commissioned in November 1959. It was declared a Basic Nuclear Installation on 8 January 1968 by the CEA. An extension was authorised in 2000. The LECI 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 the 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. In particular, the demonstration of the behaviour of the structures with respect to the fire risk is behind schedule: a complementary study must be carried out to finalise the list of work to be carried out along with the corresponding deadlines. ASN shall be attentive to the proposed schedule and the CEA's firm commitment to meet it.

The reinforcement work to ensure the earthquake resistance of building 625 was authorized in February 2019. ASN shall be particularly attentive to the meeting of the deadlines for this work (end of the second quarter of 2021).

The inspections carried out by ASN in 2019 revealed operation of the facility to be satisfactory. More particularly, safety management was found to be well ensured. Improvements are however expected in the management of the periodic checks and tests with, among other things, the updating of the operating documents and a clearer definition of the criteria to be satisfied during the tests.

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 of personnel exposure to ionising radiation due to the presence of very high-activity sealed sources.

Examination of the periodic safety review report for the facility was completed with the publication of resolution CODEP-CLG-2019-048416 of 22 November 2019. The major themes addressed include the resistance of the building to seismic and climatic hazards (snow and wind in particular), and the ageing of the Poséidon storage pool.

In the light of the inspections carried out in 2019, ASN considers that the facility is operated satisfactorily and that the radioactive source renewal operations are properly managed. It underlines the steps taken by the CEA to clean out the premises by removing the items that are no longer used, thereby minimising the fire loads, and to improve the facility's equipment or put it back into service. Greater rigour is however required in filling out the operating documents.

SOLID WASTE AND LIQUID EFFLUENT TREATMENT FACILITIES

The CEA operates diverse facilities: laboratories associated with fuel cycle research as well research reactors. The 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 the Decree of 14 June 1971. Operated by the CEA, this facility processes, packages and stores the high, intermediate and low-level waste from the Saclay centre facilities. It also stores legacy materials and waste (spent fuels, sealed sources, scintillating liquids, ion-exchange resins, technological waste, etc.) pending disposal.

Considering the "Potential Source Term" (TSM)[1] currently present in the facility, BNI 72 is one of the priorities of the CEA's decommissioning strategy which has been examined by ASN, which stated its position on the so-defined priorities in May 2019 (see Notable events in the introduction to this chapter).

The commitments made further to the preceding safety review in 2009 aimed to guarantee an acceptable level of safety of the facility for the next ten years. They concerned in particular the removal of the majority of the potential source term from the facility and stopping the reception of new waste from the Saclay centre in order to concentrate the facility's resources on the retrieval and packaging of the legacy waste and on the decommissioning.

In 2017, in view of the delays in the removal from storage operations, the CEA requested that the deadlines prescribed in ASN resolution 2010-DC-0194 of 22 July 2010 for removal of the irradiated fuel from storage and removal of the waste stored in the "40 wells" area be pushed back by several years.

In order to be able to continue using the BNI for managing the radioactive waste from the Saclay BNIs, the CEA in 2017 asked for a change in the date of final shutdown of the facility, postponing it until the first of the following two terms was reached: either the effective date of the decommissioning decree or the date of 31 December 2022.

In the context of the periodic safety review, for which the report was submitted at the end of 2017, and the decommissioning file, ASN has examined the conditions of continued operation of BNI 72 with a view to its decommissioning. These two files have been examined jointly by ASN and IRSN, ASN having requested the latter's opinion. ASN shall be particularly vigilant with regard to rigorous application of the action plan proposed by the CEA, and meeting of the commitments made during the examination. Alongside this, the examination of the decommissioning file shall continue in 2020.

1. *The Potential Source Term (TSM is the French acronym for* "terme source mobilisable"*) corresponds to the quantity of radioactive activity that could be involved in an incident or accident.*

ASN considers that the safety of the facility is acceptable, while at the same time noting numerous delays in the operations to remove the fuel and waste from storage. ASN shall be particularly attentive to the monitoring of the intermediate deadlines and the CEA's commitments. ASN underlines the delay in the construction project for a new facility that is necessary for the retrieval and packaging of priority waste drums. ASN expects of the CEA both rigorous management of this project and compliance with the corresponding deadlines. ASN underlines that projects that contribute to reducing the potential source term within facilities constitute priorities for safety.

Floor and metal structure refurbishment work was carried out in various buildings of the BNI in 2019. ASN has observed during inspections that the management of the facility's sources is suitably organised, with internal instructions and procedures that allow satisfactory implementation of the regulatory provisions.

The year 2019 was nevertheless marked by several significant events concerning noncompliant use of the waste or package storage areas. These events reveal the lack of a questioning attitude on the part of the outside contractors, and a lack of monitoring on the part of the CEA. Lastly, ASN observes shortcomings in the ageing management of the facility and in particular a lack of preventive measures.

The 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 facility is dedicated to the treatment of radioactive liquid effluents. CEA was authorised by a Decree of 8 January 2004 to create "Stella", an extension in the BNI 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 French National Radioactive Waste Management Agency (Andra) 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 since made progress in defining its packaging solution for all the facility's effluents. Thus, in June 2018, Andra authorised the packaging of these concentrates in accordance with the 12H package approval. In April 2019, ASN received the CEA's request for authorisation to commission these packages and finalised its examination at the year end.

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. The majority of the low- and intermediate-level (LL and IL) radioactive effluents produced by the Saclay site production sources are now directed to the Marcoule Liquid Effluent Treatment Station (STEL), a Defence BNI.

In November 2018, in accordance with its commitment, the CEA submitted to ASN a file presenting the management strategy for the liquid radioactive effluents from the CEA Île-de-France and the overall strategy concerning BNI 35. In this file the CEA has set out deadlines for the cementation of the legacy concentrates stored on the site, which is a priority for the facility.

Alongside this, the situation of pit 99 containing old tanks of organic effluents, with the presence of contaminated sludge in the bottom of the tanks and the bottom of the pit, remains a major clean-out challenge. The clean-out and tank removal studies have been carried out, but ASN is still waiting for an authorisation application file to be submitted for these operations.

The Decree of 8 January 2004 authorising the creation of Stella also provided that the CEA must, within 10 years, remove the legacy effluents stored in the eight tanks called MA500 and in tank HA4 of BNI 35. Due to the technical difficulties encountered in their retrieval and packaging, these operations lasted longer than planned. The operations to empty the last MA500 tank have progressed significantly and the residual sludge in the bottom of the tanks must now be treated.

The inspections carried out by ASN on this facility in 2019 revealed proficiency and a robust organisation with regard to "instrumentation and control", and satisfactory implementation of maintenance. Shortcomings were however observed in the monitoring of ageing of civil engineering structures.

THE CEA SACLAY CENTRE FACILITIES UNDERGOING DECOMMISSIONING

The decommissioning operations performed on the Saclay site concern two finally shut down BNIs (BNI 18 and 49) and three BNIs in operation (BNI 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 Installations Classified for Protection of the Environment –ICPEs– (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.

Broadly speaking, the CEA's decommissioning and waste management strategy has been examined by ASN, which stated its position on the defined priorities in May 2019 (see Notable events in the introduction to this report).

Ulysse reactor *– CEA Centre*

Ulysse is the first French university reactor. The facility, which constitutes BNI 18, has been in final shutdown status since February 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 facility presents limited safety risks.

On 8 August 2019, the CEA announced the end of the decommissioning operations provided for in the decommissioning decree, with the completion of final post-operational clean-out. The facility therefore no longer has any areas regulated

Control of urbanisation around the Saclay site

The CEA – Saint-Aubin station project, on the route of the future line 18, is situated at the "*Le Christ de Saclay*" roundabout. This project is not compatible with the town-planning restrictions currently in effect.

At present, the control of urbanisation around Saclay is based on hazard zones resulting from studies that used hypotheses that are no longer relevant, given the changes in the Basic Nuclear Installations (BNIs) of the CEA and CIS bio international. ASN had therefore asked the CEA and CIS bio international to update these studies to assess the impacts of these BNIs on the line 18 project.

These updates, which take into account the shutdown of the Orphée reactor and removal of the iodine-131 from the CIS bio international facility, do not show any hazard zones reaching the station. The examination carried out by ASN confirms these results. In 2020, ASN will state its position on the effective reduction of the risks induced by the site's BNIs, which enable the provisions for controlling urbanisation to be revised.

on account of radiation protection, or areas where nuclear waste can be produced.

Some one hundred blocks of concrete resulting from the cutting-up phase of the "conventional" part of the reactor block are still present in the facility. Samples were taken from these blocks at the end of 2019 to check that the planned clean-out targets has been met. When the analysis results are received, which should be during the first half of 2020, and provided they are satisfactory, the last concrete blocks from the Ulysse reactor will be able to be removed.

In 2020, the CEA will start the procedures aiming to delicence the facility and withdraw it from the BNI System.

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.

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 being made in the operations to be carried out. Investigations into the radiological status of the soils were carried out during 2019, with results expected in 2020. The licensee must submit a decommissioning decree modification file. It must include the justification of the time required to complete the decommissioning operations authorised by the Decree of 18 September 28. Its submission is planned for mid-2021. ASN will be attentive to the progress of the studies planned prior to submission of the file.

Alongside this, the year 2019 saw the stopping of a large part of the decommissioning and clean-out operations, the safeguarding and teardown of the worksites, in relation with the CEA's decommissioning and waste management strategy examined by ASN.

ASN considers that the level of safety of BNI 49 undergoing decommissioning is satisfactory. The inspections of the facility confirmed the setting up of corrective measures further to the significant events in 2018 linked to the fire risk. They also confirmed the strong involvement of the licensee in the management of safety, particularly in the monitoring of worksites. In addition, the measures taken by the CEA for controlling detrimental effects were found to be satisfactory.

This being said, the monitoring of hazardous substances in the facility must be improved. Vigilance is also required with the proper characterisation of deviations and the tracking of the continuous improvements sheets.

Artificial Radionuclide Production Plant of CIS bio international

The UPRA constitutes BNI 29. It 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 2000's, this subsidiary was bought up by several companies specialising in nuclear medicine. In 2017, the parent company of CIS bio international acquired Mallinckrodt Nuclear Medicine 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. Until 2019, the role of BNI 29 was also to recover disused sealed sources which were used for radiotherapy and industrial irradiation. CIS bio international has made good progress with the removal of disused high-activity sealed sources that are stored in the facility. The group has moreover decided to stop its iodine-131-based productions on the Saclay site, which will significantly reduce the consequences of accident situations.

Assessment of the CEA Saclay site

ASN considers that the Basic Nuclear Installations (BNIs) of the Saclay centre are operated under satisfactory conditions of safety and observes that certain operations important to the protection of people and the environment have been completed. In August 2019, the The French Alternative Energies and Atomic Energy Commission (CEA) thus announced the end of the Ulysse reactor decommissioning operations. Removal of the irradiated fuel from the centre's reactors continued, contributing to the reduction in of the source term stored in the BNIs concerned.

Through its inspections, ASN has observed that the overall organisation in place for tracking discharges from the BNIs and monitoring the environment is satisfactory. The process for managing noteworthy BNI modifications is well documented, but recurrent schedule slippages are observed, delaying the implementation of physical modifications or updates of the operating baseline requirements.

ASN considers that the CEA must maintain its vigilance in the performance of the periodic checks and tests of its equipment, particular concerning compliance with deadlines and validation of the operations performed before the equipment is put back into service. It must also make sure of the operational availability of the means contributing to fire protection and the management of accident and emergency situations.

With regard to the emergency organisation and means, the CEA submitted an update of its On-site Emergency Plan (PUI) in the second quarter of 2019. Nevertheless, the CEA must ensure that the operational documents of the BNIs are updated without delay so that they correspond to the state of the facilities and check that the provisions set by ASN with regard to emergency situation preparedness and management are properly taken into account.

As in 2018, the CEA still has difficulties in fulfilling technical requirements within the deadlines set by ASN.

The decommissioning and waste recovery and packaging operations continue to fall behind schedule. ASN considers that the progress of the decommissioning projects is one of the major safety challenges for the shutdown installations and that the management of the waste from the decommissioning operations is crucial for the smooth running of the decommissioning programmes. The majority of the CEA Saclay centre BNIs are concerned, either directly or indirectly, by decommissioning or decommissioning preparation operations In view of the structural delays in the decommissioning preparation operations, ASN expects the CEA to make its implementation schedules for these operations more robust. ASN will be particularly vigilant in monitoring the progress of the decommissioning and waste retrieval and packaging projects, with the aim of ensuring control over the schedules.

Further to the Fukushima Daiichi NPP accident, ASN had initiated stress tests on the nuclear installations. More particularly, the emergency management means of the centres were examined for the Saclay centre. In 2016, 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. In view of the confirmed delays in the deployment of the new emergency management buildings, ASN gave the CEA formal notice in September 2019 to submit a file on the justification and sizing of its future emergency situation management premises before the end of 2019. In the letter accompanying its file, the CEA undertakes to submit a commissioning application for these premises in June 2020.

Broadly speaking, ASN considers that the safety of the facility improved in 2019. ASN notes in particular the efforts CIS bio international has made to makes its organisation and functioning more effective, and the culmination of large-scale projects and actions fostering safety.

The inspections have revealed an improvement in the management of the periodic checks and tests, in the monitoring of deviations and the identification of significant events, and more effective tracking of commitments, even if numerous schedule slippages are still observed. The organisation of radiation protection during work interventions is satisfactory, but greater rigour is nevertheless required in some them.

Further to the formal notice served in 2018 to comply with the requirements resulting from the preceding safety review, the efforts made by CIS bio international brought a satisfactory response to all these requirements. Two inspections in 2019 confirmed that these requirements had been met.

Numerous projects, studies and works undertaken by CIS bio international were finalised in 2019 or will be in early 2020. These projects help improve the safety of the facility. Broadly speaking, the time frames for completing the large-scale actions undertaken by CIS bio international –some of which are already underway for several years and are often difficult to implement– must be better controlled.

ASN nevertheless observes that there is considerable room for progress in several areas. The causes of the numerous significant events almost always include organisational and human deficiencies. Compliance with the requirements of the operating rules, the monitoring and management of activities must be improved, particularly as regards complying with the operating envelope and the management of liquid effluents. ASN's oversight reveals, with regard to safety, a lack of rigour and integration of experience feedback and highlights the need for a robust action plan relative to organisational and human factors.

To conclude, ASN expects CIS bio international to continue the ongoing improvement actions. Operating rigour, safety culture, consolidation of the workforce and skills, control of operations, the cross-disciplinary functioning of the organisation, compliance with the baseline requirements of the facility and control of the schedules are areas in which CIS bio international must particularly concentrate its improvement efforts.

THE CEA FONTENAY-AUX-ROSES SITE

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.

Broadly speaking, the CEA's decommissioning and waste management strategy has been examined by ASN, which stated its position on the so-defined priorities in May 2019 (see Notable events in the introduction to this report).

Procédé facility and Support facility

– CEA Centre

Decommissioning of these two facilities, Procédé and Support, which constitute BNI 165 and BNI 166 respectively, was authorised by two Decrees of 30 June 2006. The initial planned duration of 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 that the decommissioning plan would be modified. In June 2015, the CEA submitted an application to modify the prescribed deadlines for these decommissioning operations.

ASN deemed that the first versions of these decommissioning decree modification application files were not admissible. In accordance with the commitments made in 2017, the CEA submitted the revised versions of these files in 2018. The complementary studies announced in the files were submitted in the first quarter 2019.

In its examination of the periodic safety review reports received in 2017 and 2018, ASN identified that the CEA had to provide complementary information on the state of the soils, the decommissioning plan and the safety analysis report, particularly concerning the demonstration of control of the fire risks and seismic risks.

Assessment of the CEA Fontenay-aux-Roses site

On the basis of the inspections carried out in 2019, ASN finds that the monitoring of outside contractors is properly ensured on the CEA Fontenay-aux-Roses site and that the majority of the commitments and actions defined further to the inspections and significant events of the preceding years have been carried out.

However, there are weaknesses in the organisation and technical provisions for radiation protection within the BNIs of the Fontenay-aux-Roses site. ASN will monitor the deployment of the CEA's action plan to remedy the observed deviations. Furthermore, with regard to the fire risk, improvements are required in the control and monitoring of the fire loads.

Several significant events that occurred in 2019 highlighted problems of equipment ageing, in particular the malfunctioning of certain alarms that play a role in monitoring and maintaining the safety of the facilities.

In 2019, as in 2018, ASN observed slippages in the performance of the studies, in project scheduling and in the decommissioning operations schedule. ASN underlines in particular the delay in the projects for new equipment necessary for the decommissioning of the Fontenay-aux-Roses nuclear facilities. What ASN expects of the CEA is the implementation of decisive measures in 2020 to meet the deadlines for these various projects, especially those contributing to the reduction of the potential source term in the old facilities, which constitute priorities for safety.

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:

- Basic Nuclear Installations:
  - 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 (CSM),
  - the National Large Heavy Ion Accelerator (Ganil) in Caen;

- small-scale nuclear activities in the medical sector:
  - 8 external-beam radiotherapy departments (27 devices),
  - 1 proton therapy department,
  - 3 brachytherapy departments,
  - 12 nuclear medicine departments,
  - 50 centres using interventional procedures,
  - 70 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 centres, including 20 companies with an industrial radiography activity,
  - 5 particle accelerators, including 1 cyclotron,
  - 21 laboratories situated mainly in the universities of the region,
  - 5 companies using gamma ray densitometers,
  - about 260 veterinary surgeries or clinics practising diagnostic radiology, 1 equine research centre and 1 equine hospital centre;

- activities linked to the transport of radioactive substances;

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

In 2019, ASN carried out 200 inspections in Normandie, comprising 56 inspections in the Nuclear Power Plants (NPP) of Flamanville, Paluel and Penly, 14 inspections on the construction site of the Flamanville 3 EPR reactor, 72 inspections on fuel cycle facilities, research facilities and facilities undergoing decommissioning, 50 inspections in small-scale nuclear activities and 8 in the transport of radioactive substances.

In addition to this, 13 days of labour inspection were carried out on the NPP sites and the Flamanville 3 construction site.

In 2019, 1 significant event rated level 2 and 20 significant events rated level 1 on the INES scale were reported ASN. In addition, 2 events rated level 2 on the ASN-SFRO scale were reported by the heads of radiotherapy departments in the Normandie region.

ASN inspectors issued 2 violation reports in the exercise of their 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 in the areas of safety, radiation protection and environmental protection deteriorated in 2019 and is below the standard of the other EDF NPPs.

With regard to reactor operation and operational control, ASN considers that the site's performance has to be improved, particularly as regards control of the state and conformity of the facilities. The licensee must ensure that all the employees properly embrace the baseline requirements and improve the detection of deviations in the field.

With regard to the ten-yearly outage of reactor 2, ASN again considers that work preparation and monitoring of the maintenance operations must be improved. ASN still observes a large number of maintenance errors on equipment important to safety. Moreover, ASN considers that the licensee has not taken sufficient account of the lessons learned from the shutdown of reactor 1 for its first ten-yearly outage, particularly as concerns the preparation and performance of the primary cooling system hydrostatic test, the monitoring of outside contractors and management of foreign material exclusion from the systems.

Tightened monitoring

In 2019, ASN decided to place the Flamanville Nuclear Power Plant (NPP) under tightened monitoring further to the difficulties EDF has encountered with this NPP since mid-2018. Following the summoning of the NPP director, EDF submitted an action plan aiming to reinforce the control and monitoring of the operating activities. ASN will be particularly attentive to this action plan and will increase its oversight in 2020.

ASN considers that the performance of the NPP with regard to worker radiation protection is inadequate. Inappropriate operating conditions for workers have been observed several times during ASN inspections. The licensee also reported a large number of significant radiation protection events in 2019, including several cases of internal or external contamination. These events confirm the site's lack of proficiency in the fundamentals of radiation protection and the workers' lack of culture in this area.

With regard to environmental protection, ASN has observed that the licensee has an insufficient grasp of the waste management regulations. EDF must also improve its monitoring of the service providers who work in the area of environmental protection.

With regard to worker safety, ASN notes that several workplace accidents were caused by shortcomings in work preparation by EDF.

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 Nuclear Rapid Intervention Force (FARN) created by EDF in 2011 further to the Fukushima Daiichi 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, radiation protection and environmental protection is on the whole in line with the general assessment of EDF.

With regard to nuclear safety, ASN considers that the deviation management process implemented on the site is effective and that causes stemming from organisational and human factors are analysed in depth. The licensee must now focus on addressing the identified root causes, as a large number of significant events result from inappropriate responses by the workers, deficiencies in the knowledge of the baseline requirements, or operational documentation of sub-standard quality or readability.

As far as operation is concerned, ASN considers that the performance of the NPP has dropped slightly and it notes a lack of rigour in the operational control activities. On this subject, improvements are expected in the quality of the operational control documentation, in staff training, in activity preparation and in the monitoring of activities in the control room.

Performance concerning maintenance is satisfactory. However, at several inspections ASN has observed deficiencies in the performance of the conformity checks, chiefly concerning the ventilation system anchoring points. ASN therefore considers it necessary to continue to increase rigorousness in the preparation and checking of maintenance activities. The NPP must also improve the monitoring of work performed by outside contractors.

ASN considers that the NPP's performance in occupational radiation protection must be improved, particularly regarding compliance with the requirements for entering controlled areas and the radiation protection culture of the workers.

With regard to environmental protection, ASN considers that the licensee must tighten the monitoring of outside contractors, mainly at the wastewater treatment plant. ASN underlines the improvements the site has made in order to control discharges of gases that deplete the ozone layer.

In 2019, ASN revised the texts regulating water intakes and effluent discharges from the Paluel NPP through resolutions 2019-DC-0676 and 2019-DC-0677 of 9 July 2019.

With regard to labour inspection, the analysis of the fatal accident that occurred in 2019 reveals the need for far-reaching improvements in the coordination and implementation of worker protection measures.

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 and radiation protection is, on the whole, in line with the general assessment of EDF plant performance. The environmental protection performance, however, is considered to be below the EDF plant average.

With regard to nuclear safety, ASN considers the performance of the NPP to be satisfactory. However, ASN still observes shortcomings in the licensee's organisation for managing deviations, with numerous findings not being adequately characterised or traced.

As far as maintenance is concerned, the performance of the NPP remains stable. Nonetheless, at the end of 2019 the licensee notified ASN of a significant event rated level 2 on the INES scale concerning faults on electric cell components. This event revealed deficiencies in the planning of maintenance operations and the management of reactor state changes. An inspection will be organised on these themes in 2020.

Lastly, ASN considers that particular attention must be paid to the preparation of operational control activities in order to improve the quality of the documentation supporting operation of the facilities and the rigour with which the instructions are applied.

With regard to radiation protection, the forward-looking personnel radiological exposure targets were met during the reactor 2 outage. However, there are disparities in the way the radiation risks are taken into account. The practices witnessed by inspectors during worksite inspections and the increasing number of significant radiation protection events still reflect a lack of rigour. ASN underlines the need for outside contractors to be better informed of the radiological risk.

In the area of environmental protection, ASN observes significant progress in the managements of gases that deplete the ozone layer. Shortcomings have nevertheless been noted in the grasp of the regulations concerning waste management. ASN does however underline the quality of operation of the treatment plant.

The inspections relating to worker safety reveal shortcomings in the prevention of chemical risks in the facilities in operation, in the prevention of electrical risks, and in work at height on the construction sites, particularly that of the ultimate backup diesel-generator sets.

Flamanville 3 EPR reactor construction worksite

Following issuing of the Creation Authorisation Decree 2007-534 of 10 April 2007 and the building permit, the Flamanville 3 EPR reactor has been under construction since September 2007.

The end of assembly and finishing activities continued in 2019, in view of carrying out the overall tests of the facility. Important start-up test phases have also taken place, with the performance of the hot tests, which enable the functioning of the nuclear steam supply system and the associated auxiliary systems to be tested under the nominal temperature and pressure conditions. ASN conducted several inspections focusing specifically on these operations, including one 3-day tightened inspection on site. ASN underlines the mobilisation of resources and the marked improvement in EDF's organisation for the start-up tests. EDF must nevertheless supplement the demonstration of representativeness of the tests performed with respect to the test procedures, in particular through better command of the instrumentation and control configuration and tests carried out on a temporarily modified installation. Improvements are also expected in the utilisation of the accrued experience feedback and the implementation of the resulting corrective actions.

ASN also inspected the organisation implemented by EDF for the quality review of the EPR reactor equipment. This review was requested by ASN in 2018 due to serious shortcomings in EDF's monitoring of outside contractors. ASN considers that EDF must substantially supplement its complementary inspections programme, particularly as regards equipment other than pressure equipment. Greater rigour is also required in the implementation of this programme. This review has nevertheless already disclosed a number of deviations that EDF must address appropriately.

EDF must also ensure that a strategy is applied for the conservation, maintenance and testing of the equipment and structures present on the worksite until the reactor is commissioned.

ASN inspected EDF's organisation for the protection of the environment, in particular for the integration of ASN resolutions 2018-DC-0639 and 2018-DC-0640 of 19 July 2018 relative

to water intakes, effluent discharges and environmental monitoring and on the themes linked to the prevention of pollution, the control of non-radiological risks and the management of liquid containment. ASN notes numerous events concerning the environment during 2019 and considers that the way environmental risks are taken into account by the future licensee must be improved.

With regard to worker safety, ASN considers that the development of risks generated by the new activities, including the hot tests, was generally well managed by the existing organisation. Nevertheless, several serious workplace accidents occurred in 2019 as a result of breaches of basic rules.

Manche waste repository

The Manche waste repository (CSM), which was commissioned in 1969, was the first radioactive waste repository operated in France. 527,225 m³ of waste packages are emplaced in it. The CSM stopped accepting further waste in July 1994.

Examination of the periodic safety review guidance file had resulted in ASN formulating specific demands at the end of 2017, concerning the justification of the technical principles of deployment of the long-term cover, the CSM memory system and the updating of the impact study. In this context, ASN began the examination of the CSM periodic safety review file submitted by Andra in 2019.

ASN considers that the organisational set-up implemented for operating the facilities in 2019 is satisfactory. The licensee must however improve the the way the monitoring of outside contractors is organised in order to better identify those services that require monitoring and to clearly inform the contractors of the requirements relating to performance of the activities. It must also introduce robustness into deviation management, particularly with regard to meeting commitments and the associated deadlines. Lastly, the licensee must consolidate its integrated management system documents to ensure full consistency between the general operating rules and the various operating procedures.

National Large Heavy Ion Accelerator

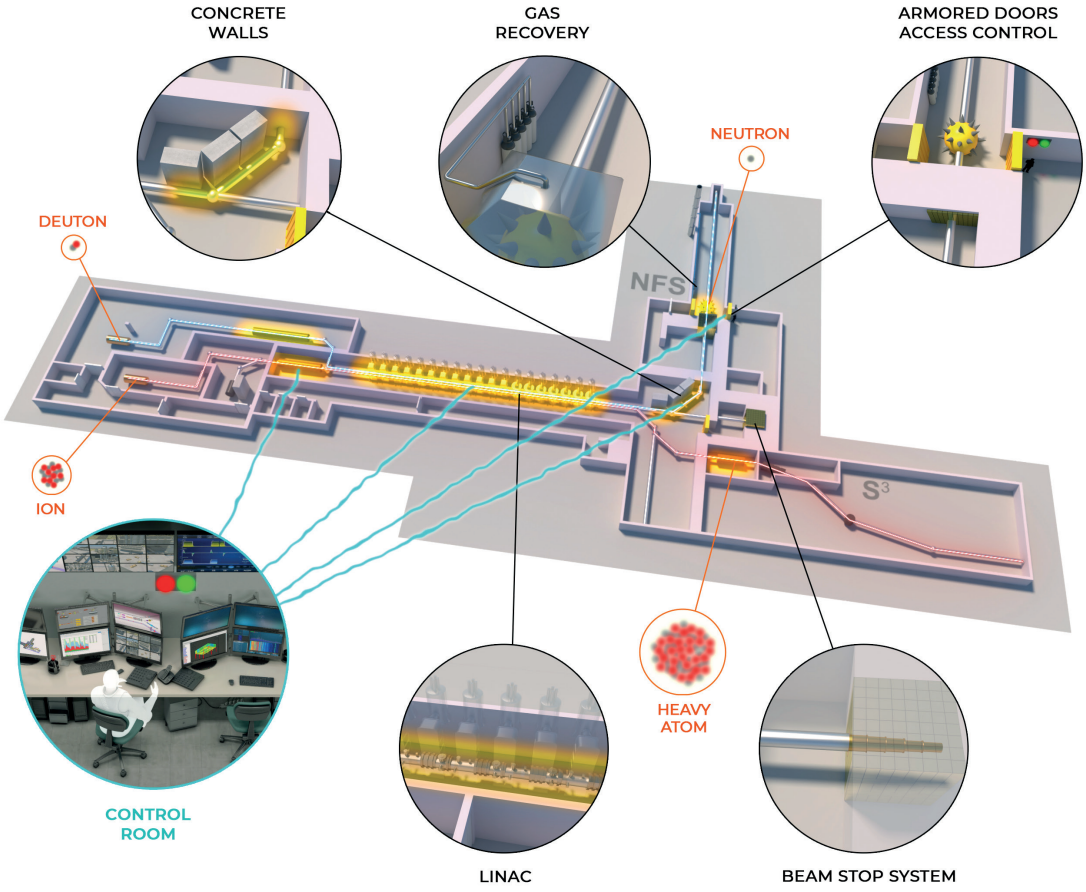
The National Large Heavy Ion Accelerator (Ganil) economic interest group was authorised in 1980 to create an ion accelerator in Caen (BNI 113). This research facility produces, accelerates and distributes ion beams with various energy levels to study the structure of the atom. The high-energy beams produce 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 Ganil.

"Exotic nuclei" are nuclei which do not exist naturally on Earth. They are created artificially in Ganil for nuclear physics experiments on the origins and structure of matter. In order to be able to produce exotic nuclei, Ganil was authorised in 2012 to build phase 1 of the SPIRAL 2 project, whose commissioning was authorised by ASN in 2019.

In accordance with the requirements of resolution 2015-DC-0512 of 11 June 2015 relative to its first periodic safety review, Ganil continued its compliance work on the fire-detection and fire-fighting devices, the management of radioactive waste and containment of the facilities. After analysing the difficulties encountered, ASN authorised Ganil to push back the deadlines for the compliance work provided for by six of the ten prescriptions of this periodic safety review. ASN notes an improvement in the management of projects linked to safety and will remain attentive to the meeting of deadlines, as much for Ganil's commitments as for the requirements laid down by ASN.

ASN considers that the organisation defined and implemented for the operation of the facilities in 2019 must be improved. The licensee must more specifically supplement its safety analysis report and incorporate all the modifications induced by the commissioning of phase 1 of the SPIRAL 2 facility. Ganil must also pursue its efforts with the updating of its integrated management system in order to improve the integration of changes in the regulatory baseline, especially in the area of radiation protection. Lastly, improvements are also expected in the completeness and quality of the files submitted to ASN.

Phase 1 of the SPIRAL 2 extension



Through resolution 2019-DC-0675 of 27 June 2019, ASN authorised the commissioning of phase 1 of the SPIRAL 2 extension of the National Large Heavy Ion Accelerator (Ganil). This resolution marks the end of an examination that lasted 10 years!

Situated in Caen, Ganil is an Economic Interest Group (GIE) comprising the IN2P3 (National Institute of Nuclear and Particle Physics) of the French National Centre for Scientific Research (CNRS) and the Sciences of matter department of the CEA. This Basic Nuclear Installation (BNI 113) was built in 1980. The scientists it has hosted since its commissioning in 1983 study the nuclei of exotic atoms (atoms which do not exist on Earth in the natural state) created by the interaction between a target and a beam of ions, whether radioactive or not, produced by a series of particle accelerators.

After entry into service of the SPIRAL 1 extension in 2001 (SPIRAL in French stands for "first-generation system for on-line production of radioactive ions") for the production of "light" exotic nuclei, Ganil applied to modify its facility in 2009 to install the SPIRAL2 extension in two phases in order to produce "heavy" radioactive ions.

In its first phase, SPIRAL 2 aims to give Ganil a new accelerator, the Linac, which will deliver, more specifically, very high intensity beams of heavy ions. The beam is then directed to the experiment rooms containing various experimentation devices: Neutrons For Science (NFS) and Super Separator Spectrometer (S3). The facility is also equipped with devices for stopping the beam, called "beam stops". Their function is to stop the beam of particles during the adjustment phases or in the accident or incident situations.

This new extension will make it possible to explore the nuclei of atoms which are not accessible with the current Ganil equipment. Subsequently, phase 2 of SPIRAL 2 will, through a dedicated production building, allow the creation of ion beams that are among the most intense in the world. This phase shall be built later and will form the subject of a new authorisation application.

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 La Hague.

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 water intake by the site are defined by ASN resolutions 2015-DC-0535 and 2015-DC-0536 of 22 December 2015.

Operations carried out in the plants

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.

When the spent fuel assemblies arrive at the plants in their transport packaging, they are unloaded either “under water” in a pool, or dry in a sealed shielded cell. The fuel assemblies are first stored in pools to cool them down.

The fuel assemblies are then sheared and dissolved in nitric acid to separate the fragments of metal cladding from the spent nuclear fuel. The fragments of cladding, insoluble in nitric acid, are removed from the dissolver, rinsed in acid and then water, and transferred to a compacting and packaging unit.

The nitric acid solution containing the dissolved radioactive substances is then processed to extract the uranium and plutonium from it, leaving the fission products and the other transuranium elements.

After purification, the uranium is concentrated and stored as uranyl nitrate $UO_2(NO_3)_2$. It will then be converted into a solid compound (U_3O_8) called “reprocessed uranium” in the TU5 facility on the Tricastin site.

After purification and concentration, the plutonium is precipitated by oxalic acid, dried, calcined into plutonium oxide, packaged in sealed containers and stored. The plutonium is then used for the fabrication of MOX fuels in the Orano Cycle plant (Melox) on the Marcoule site.

The effluents and waste produced by the operation of the plants

The fission products and other transuranium elements resulting from reprocessing are concentrated, vitrified and packaged in standard vitrified waste packages (CSD-V). The fragments of metal cladding are compacted and packaged in standard compacted waste packages (CSD-C).

Furthermore, the reprocessing operations described in the previous paragraph involve chemical and mechanical processes which produce gaseous and liquid effluents and solid waste.

The solid waste is packaged on site by either compaction or encapsulation in cement. The solid radioactive waste resulting from the reprocessing of the spent fuel assemblies from the French reactors is, depending on its composition, either sent to the Aube repository (CSA) or stored on the Orano Cycle La Hague site until a definitive disposal solution is found (particularly the CSD-V et CSD-C packages).

In accordance with Article L. 542-2 of the Environment Code, the radioactive waste resulting from the reprocessing of spent fuel assemblies originating from foreign countries is sent back to the owners. However, it is impossible to physically separate the waste according to the fuels from which it originates. In order to guarantee an equitable distribution of the waste resulting from the reprocessing of the fuels of its various customers, the licensee has proposed an accounting system that tracks the entries into and exits from the La Hague plant. This system, called Exper system, was approved by the Order of 2 October 2008 of the Minister responsible for energy.

The gaseous effluents are released mainly when the fuel assemblies are sheared and during the dissolution process. These gaseous effluents are treated by washing in a gas treatment unit. The residual radioactive gases, particularly krypton and tritium, are checked before being discharged into the atmosphere.

The liquid effluents are treated and generally recycled. Some radionuclides, such as iodine and tritium, are channelled –after being checked– to the sea discharge outfall. This outfall, like the other outfalls of the site, is subject to discharge limits. The other effluents are routed to the site’s packaging units (solid glass or bitumen matrix).

Management of the condition of the evaporation concentration containers

ASN continued its verification of 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 of these equipment items exceeding that considered in their design.

ASN conducted a five-day tightened inspection focusing on the non-destructive tests performed by the licensee on the evaporators of the T2 facility during its maintenance outage. ASN considers that these inspections were prepared and carried out under satisfactory conditions. Nevertheless, the results show that the thickness of the T2 facility evaporator 4120-23, identified as being the most affected by the corrosion, is close to the minimum thickness. Before restarting the facility, the licensee undertook to continue to reduce the utilisation of this evaporator and to conduct another measurement campaign in 2020.

ASN will be particularly attentive to the monitoring of these evaporators until the new replacement evaporators are commissioned.

"New Fission Products Concentration" project (NCPF)

ASN continued its examination of the NCPF project relative to the commissioning of new fission product evaporator concentrators to replace the old ones, the introduction of which began in August 2019 and ended in November 2019. An inspection was carried out in October 2019 on the construction worksites of the buildings for these six new evaporators. The organisation for managing this worksite was found to be rigorous. Another ASN inspection on these worksites is scheduled in 2020.

The installations at La Hague

SHUT DOWN INSTALLATIONS UNDERGOING DECOMMISSIONING:

- **BNI 80 – Oxide High Activity facility (HAO):**
  - **HAO/North:** facility for "under water" unloading and storage of spent fuel elements,
  - **HAO/South:** Facility for shearing and dissolving spent fuel elements;
- **BNI 33 – UP2-400 plant, first reprocessing unit:**
  - **HA/DE:** Facility for separating uranium and plutonium from fission products,
  - **HAPF/SPF (1 to 3):** Facility for fission product concentration and storage,
  - **MAU:** Facility for separating uranium and plutonium, uranium purification and storage as uranyl nitrate,
  - **MAPu:** Facility for purification, conversion to oxide and initial packaging of plutonium oxide,
  - **LCC:** Central product quality control laboratory,
  - **ACR:** Resin conditioning facility;
- **BNI 38 – STE2 facility: Effluent collection and treatment and storage of precipitation sludge, and AT1 facility, prototype facility currently being decommissioned;**
- **BNI 47 – ELAN IIB facility, research installation currently being decommissioned.**

INSTALLATIONS IN OPERATION:

- **BNI 116 – UP3-A plant:**
  - **T0:** Facility for dry unloading of spent fuel elements,
  - **Pools D and E:** Pools for storing spent fuel elements,
  - **T1:** Facility for shearing fuel elements, dissolving and clarification of the resulting solutions,
  - **T2:** Facility for separating uranium, plutonium and fission products and concentrating/storing 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:** Fission product vitrification facility,
  - **BSI:** Plutonium oxide storage facility,
  - **BC:** Plant control room, reagent distribution facility and process control laboratories,
  - **ACC:** Hull and end-piece compaction facility,
  - **AD2:** Technological waste packaging facility,
  - **ADT:** Waste transit area,
  - **EDS:** Sold waste storage area,
  - **D/E EDS:** Solid waste storage/removal from storage,
  - **ECC:** Facilities for storage and retrieval of technological waste and packaged structures,
  - **E/EV South-East:** Vitrified residues storage facility,
  - **E/EV/LH and E/EV/LH 2:** Vitrified residues storage facility extensions;
- **BNI 117 – UP2-800 plant:**
  - **NPH:** Facility for "under water" unloading and storage of spent fuel elements in pool,
  - **Pool C:** Spent fuel element storage pool,
  - **R1:** Facility for shearing and dissolving fuel elements and clarification of the resulting solutions (including the URP: Plutonium Redissolution Facility),
  - **R2:** Facility for separating uranium, plutonium and fission products and concentrating the fission product solutions (including the UCD: centralised alpha waste conditioning unit),
  - **SPF (4, 5, 6):** Fission product storage facilities,
  - **R4:** Facility for purification, conversion to oxide and initial packaging of plutonium oxide,
  - **BST1:** Facility for secondary packaging and storage of plutonium oxide,
  - **R7:** Fission products vitrification facility,
  - **AML-AMEC:** Packaging reception and maintenance facility;
- **BNI 118 – STE3 facility: Effluent collection and treatment and storage of bituminised waste packages:**
  - **D/E EB:** Storage of alpha waste,
  - **MDS/B:** Mineralisation of solvent waste.

Extension of the standard compacted waste package (CSD-C) storages areas

In April 2017, Orano Cycle submitted a substantial modification authorisation application file with the aim of extending the CSD-C package storage areas. The public inquiry was held from 5 June to 8 July. ASN is continuing the examination of this file.

FINAL SHUTDOWN AND DECOMMISSIONING OPERATIONS

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 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).

In 2019, ASN finalised the examination of the periodic safety review files for BNIs 33, 38 and 47. ASN resolution 2019-DC-0673 governing the continuation of their decommissioning was published on 25 June 2019.

ASN continued its examination of the partial decommissioning authorisation applications for BNIs 33 and 38 submitted in April 2018. The schedule push-backs requested by the licensee lead to decommissioning completion deadlines in 2046 and 2043 instead of 2035, the current deadline for the two BNIs. In early 2020, Orano must supplement firstly the decommissioning file for BNI 33 regarding the elimination of interactions between the MAPu facility and the BST1 facility in the event of an earthquake by demolishing the upper storeys of the MAPu, and secondly its dissertation in response to the opinion of the Environmental Authority, before starting the public inquiry.

ASN notes that the schedule push-backs requested are significant and largely due to the delays in legacy waste retrieval and packaging. Consequently, ASN will continue to monitor the management of these projects in 2020.

LEGACY WASTE RETRIEVAL AND PACKAGING OPERATIONS

Unlike the direct on-line packaging of waste, as is done with the waste produced in the new UP2-800 and UP3-A plants at La Hague, the majority of the waste produced by the first UP2-400 plant was stored in bulk without final packaging. The operations to retrieve this waste are complex and necessitate deployment of substantial means. They present major safety and radiation exposure risks, which ASN monitors with particular attention.

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

Retrieval and packaging of the STE2 sludges

The UP2-400 plant effluent treatment station, STE2, served to collect the effluents from the UP2-400 plant, treat them and store the precipitation sludges resulting from the treatment. The STE2 sludges are thus precipitates that fix the radiological activity contained in the effluents and they are stored in seven silos. A portion of the sludges has been encapsulated in bitumen and packaged in stainless steel drums in the STE3 facility. Following ASN's banning of bituminisation in 2008, Orano studied other packaging methods for the non-packaged or stored sludges.

The scenario for the retrieval and packaging of the STE2 sludges presented in 2010 was broken down into three steps:
- retrieval of the sludges stored in the silos of STE2 (BNI 38);
- transfer and treatment, initially envisaged by drying and compaction, in STE3 (BNI 118);
- packaging of the resulting pellets in "C5" packages for subsequent disposal in a deep geological repository.

ASN authorised the first phase of the work to retrieve the STE2 sludges in 2015 and the decree authorising the creation of the effluent treatment station STE3 was modified by the Decree of 29 January 2016, to allow the implementation of the STE2 sludge treatment process.

At the end of 2017 however, Orano Cycle informed ASN that the process chosen for treating the sludges in STE3 could lead to difficulties in equipment operation and maintenance. Orano Cycle proposed an alternative scenario using centrifugation and in August 2019 it submitted a Safety Options Dossier (DOS), which is however based on insufficiently substantiated hypotheses. An inspection held at the end of 2019 showed that the project was not sufficiently mature for ASN to be able to give an opinion on this DOS. The DOS must be revised, particularly in the fundamental options of the project concerning effluent treatment, discharges into the environment and control of the fire risk.

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 ensured only 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 sorting and packaging operations. The first lowering of the gripper into the

The safety issues associated with silo 130

Silo 130 was designed and built in accordance with the safety requirements in effect in the 1960's. Today, the civil engineering structure of silo 130 is weakened by ageing and by a fire that occurred in 1981. Furthermore, part of the waste that was initially stored dry is now submerged in a large volume of water that served to extinguish the 1981 fire. The water is therefore in direct contact with the waste and can contribute to corrosion of the carbon steel liner, which at present is the only containment barrier.

One of the major risks therefore concerns the dispersion of radioactive substances into the environment (infiltration of 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 phenomena of radiolysis or corrosion (presence of water). These elements contribute to the risks of fire and explosion.

pit with waste pick-up took place on 24 June 2019 and filling of the first drum began at the end of 2019. ASN inspected the future licensee's preparation of the waste retrieval facilities in 2019 and considers that the organisation implemented is satisfactory. ASN notes recurrent difficulties when starting the retrieval operations. Orano Cycle must ensure that these difficulties are resolved rapidly in order to ensure waste retrieval in accordance with the requirements of resolution 2010-DC-0190 of 29 June 2010, amended in November 2019.

HAO silo and SOC (Organised Storage of Hulls)

The Oxide High Activity facility (HAO – BNI 80) ensured the first steps of the spent nuclear fuel reprocessing process: 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, where the shearing and dissolution operations were carried out;
- the "filtration" building, which accommodates the filtration system for the HAO South pool;
- 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 Organised Storage of Hulls (SOC), comprising three pools in which the drums containing the hulls and end-pieces are stored.

In 2019, the licensee continued the operations prior to retrieval of the waste from the HAO silo (notably the construction of the future waste retrieval unit) and started the tests important to safety.

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

For the packaging of the fission products from the reprocessing of the GCR reactor fuels and containing molybdenum in particular (PF UMo), the licensee has opted for cold crucible vitrification. The package thus produced is a standard package of vitrified UMo waste (CSDU). Orano Cycle continued the retrieval of these solutions in 2019 and encountered various unforeseen technical difficulties linked to the use of the cold crucible. ASN will be attentive to the completion of retrieval of these solutions, planned for 2020.

Legacy waste retrieval and packaging project deadlines

ASN has regulated all the legacy waste retrieval and packaging programmes on the La Hague site by requirements set out in resolution 2014-DC-0472 of 9 December 2014. This resolution defines the priorities with regard to the safety of waste retrieval and packaging operations and sets milestones for each of the programmes concerned.

The retrieval of this waste has fallen significantly behind the initial schedule and has continued to do so over the last few years. ASN has examined the deadline push-backs requested by Orano Cycle and their justifications; it considers that the delays must be accompanied by compensatory measures to reduce the risk to as low a level as possible, because the buildings in which this legacy waste is stored do not meet current safety standards. ASN thus considers that the waste retrieval and packaging projects must be managed in exemplary fashion and have robust reference frameworks that allow the implementation of rapid retrieval solutions in order to minimise the risks as early as possible. On this account, ASN considers that Orano Cycle must make effective improvements in the management of the retrieval projects for the legacy waste produced by the operation of the UP2-400 plant, particularly those concerning the sludges stored in the STE2 silos, the waste in the HAO silo and that in silo 130.

In 2019, ASN examined the requests to push back the deadlines for recovery of the legacy fission products solutions stored in the SPF2 unit, the waste from silo 130, from silo HAO and from the SOC pools. ASN has pushed back the deadline for completion of retrieval of the legacy fission product solutions stored in the SPF2 unit until the end of December 2002 by resolution 2019-DC-0665 of 9 April 2019. The new deadline for starting retrieval of the waste from silo 130 is set at 29 February 2020 by resolution 2019-DC-0682 of 12 November 2019. Lastly, ASN postponed to June 2022 the deadline for starting retrieval of the waste from the HAO silo and the SOC pools.

In view of the difficulties with the waste retrieval and conditioning projects, ASN has started an exploratory approach for monitoring the progress of the legacy waste retrieval and decommissioning projects on the La Hague site, which included a licensee self-assessment and an in-depth inspection at the end of 2019. ASN observes that the licensee has defined a satisfactory project management methodology, but progress is required in the actual management of these projects in order to meet the time lines.

Assessment of the La Hague site

ASN considers that the performance of the Orano Cycle La Hague site in 2019 is satisfactory in the areas of nuclear safety, radiation protection and environmental protection.

With regard to nuclear safety, ASN notes an improvement –to be consolidated– in the management of the periodic checks and tests resulting from the integration of the lessons learned from the significant events reported in the last few years. ASN has nevertheless observed several cases where the time intervals between checks have been exceeded because organisational deficiencies have affected their integration in the tracking tool.

The licensee must also significantly improve its organisation for managing risks involving hazardous substances. During several inspections, ASN has observed shortcomings in the prevention of major accidents involving hazardous substances and a lack of means to control the conformity of the site's Installations Classified for Protection of the Environment (ICPEs).

ASN considers that the licensee must continue the efforts made in the monitoring of outside contractors, notably by improving the monitoring plan preparation methodology and the formalising of the monitoring documents. ASN notes that the licensee has initiated a plan of action in this respect and will be attentive to the deployment of new practices in 2020.

ASN considers that the licensee's fire risk organisation is satisfactory. Orano Cycle must nevertheless ensure that the fire response times given in its nuclear safety case are in line with those observed during exercises. Furthermore, the licensee must improve the prioritising of the fire-fighting teams' interventions. In 2020, ASN will remain attentive to the consistency between the intervention actions to accomplish and the human resources mobilised on the site.

With regard to radiation protection, ASN notes that the organisation of the La Hague site and the results obtained are satisfactory, particularly with respect to dosimetry optimisation during work interventions. Random checks have nevertheless revealed delays on the performance of radiation protection technical controls, and insufficient rigour in the keeping of the entry registers for limited-stay areas and prohibited areas, and in tracking the mobile radiation monitors.

ASN considers that the licensee's environmental protection organisation is satisfactory. Orano Cycle must nevertheless increase the rigour of waste management in the facilities, particularly with regard to storage conditions and radiological checks.

With regard to the management of the decommissioning and legacy waste retrieval and packaging projects, ASN considers that the organisation and project management must undergo fundamental improvements in order to meet the deadlines for the commitments made by Orano and transcribed in ASN requirements or decrees. ASN notes positively the integration of the lessons learned from the silo 130 project with the aim of improving the performance of the tests important to the safety for the HAO silo project and control of the fire risks in the project to retrieve the legacy waste from silo 115. The efforts must however be increased and widened. Orano must take all appropriate measures to allocate the necessary resources, whether internal or external, over the medium and long term in order to guarantee the effectiveness of its project management. Furthermore, ASN will ensure that Orano provides rigorous justification for the changes in scenario and durations of the associated operations, and will be attentive to the rigour of project management.

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:

- Basic Nuclear Installations:
  - 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,
  - 88 centres performing fluoroscopy-guided interventional procedures,
  - 89 computed tomography scanners,
  - some 6,000 medical and dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - about 700 industrial and research centres, including 50 companies with an industrial radiography activity,
  - 1 cyclotron particle accelerator,
  - 67 laboratories situated mainly in the universities of the region,
  - about 500 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 controls,
  - 8 organisations approved for measuring radon,
  - 4 laboratories approved for taking environmental radioactivity measurements.

In 2019, ASN carried out 143 inspections in the Nouvelle-Aquitaine region, comprising 40 inspections in the Blayais and Civaux NPPs, 89 inspections in the small-scale nuclear activity sector, 7 inspections in the area of radioactive substance transport and 7 inspections of approved organisations and laboratories.

ASN also carried out 17 days of labour inspection at the Blayais NPP and 4.5 days at the Civaux NPP.

During 2019, four significant events rated level 1 on the INES scale were reported by the NPP licensees of Nouvelle-Aquitaine. In small-scale nuclear activities, one significant radiation protection event rated level 1 on the INES scale was reported to ASN. One event involving radiotherapy patients was rated level 2 on the ASN-SFRO scale.

In the exercise of their oversight duties, the ASN inspectors issued one violation report to a firm performing industrial radiography in bunkers.

Blayais nuclear power plant

Situated in the Gironde department, 50 km north of Bordeaux, the Blayais NPP is 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 is in line with its general assessment of EDF performance for nuclear safety, and below it for radiation protection. The environmental protection performance, although comparable with the average for the nuclear fleet, must be improved.

As far as nuclear safety is concerned, ASN considers that the NPP is progressing in the area of maintenance and demonstrates proficiency in the work performed during the reactor outages. ASN does however still observe deficiencies in the quality of the operational documentation covering the preparation and performance of the activities. ASN considers that these deficiencies contribute to shortcomings in the following of procedures, which subsists in 2019 despite the implementation of an action plan on this subject. Deficiencies in monitoring in the control room, due in particular to the many demands made of the operators, have been noted in several significant events. Furthermore, in 2019 ASN observed a succession of events that could jeopardise the fuel cladding, which is the first radioactive substance containment barrier.

In the area of occupational radiation protection, ASN considers that the situation regarding various aspects related to the control of radiological cleanliness, the behaviour of the workers and the organisation of the worksites has deteriorated. In addition, ASN observes a lack of integration of the experience feedback over the year, illustrated in particular by a series of events during the last of the four reactor shutdowns in 2019.

As regards environmental protection, ASN considers that the licensee is being slow in providing lasting corrective solutions to the legacy pollution of the soils and groundwater detected in the last few years. It does however note that the investigations conducted by the site are moving forward. Furthermore, noncompliant non-radioactive liquid discharges occurred, linked to the difficulties the licensee is having with the upkeep of its wastewater networks.

With regard to labour inspection, ASN has monitored the conformity files of the heavy cranes, locally manufactured tooling and the ventilation of premises with specific pollution characteristics. The diagnostic and remediation times are deemed too long. In collaboration with the Regional Directorate for Enterprises, Competition, Consumption, Labour and Employment (Direccte), ASN has identified poor control of the asbestos risk. A verification of employee working times was also undertaken.

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 further to the accident at the Fukushima Daiichi NPP in Japan. 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 performance of the Civaux 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.

In the area of nuclear safety, with regard to the operating activities, ASN considers that the reactor control operations are on the whole conducted with rigour. Nevertheless, the licensee must remain attentive to the proper preparation and performance of delicate operational control actions when other activities carried out at the same time can necessitate the attention of the same operators. ASN considers that, on the whole, the licensee successfully accomplished the maintenance activities planned during the maintenance outage of reactor 2, the only outage in 2019. The licensee must further improve the quality of the maintenance operations in order to tackle under the best possible conditions the years to come, which will have higher outage and maintenance workloads, particularly with the ten-yearly outages which will be carried out in the context of the periodic safety review of the reactors.

Concerning worker radiation protection, ASN considers that the licensee has made progress in the implementation of prevention measures. ASN nevertheless considers that the site must improve the management of worker access to certain areas presenting a high level of exposure to ionising radiation.

In the area of environmental protection, ASN considers that the licensee must improve its strategy for managing an accidental discharge of hazardous substances in order to prevent their transfer into the environment. ASN's requirements have been prescribed by resolution 2019-DC-0666 of 18 April 2019. The material and organisational measures put in place by the licensee in this context shall be checked by ASN in 2020. ASN also considers that the licensee must improve the management of radioactive waste in its facilities.

With regard to labour inspection, specific investigations were conducted following the occurrence of workplace accidents, notably after accidental exposures to asbestos. ASN considers that the licensee took appropriate measures in response to the chemical risk in 2019, the lack of control of which had been underlined in inspections the year before.

Polluted sites and soils and mining sites

Pollution by radium-226 was revealed when earthworks were carried out on land belonging to the city of Bordeaux (wet docks sector). On a proposal from ASN, the Prefectoral Order of 1 June 2015 required the city of Bordeaux to carry out an in-depth study to characterise the origin and extent of the pollution and propose remediation solutions.

After analysing the information provided by the city of Bordeaux, ASN proposed to the Prefect of Gironde an order setting the perimeter and conditions of the intervention, the remediation objectives and the public information measures.

The order was signed on 14 June 2019 and the depollution work was carried out during the summer. During an inspection of the depollution worksite in July 2019, ASN verified compliance with the measures prescribed in the order concerning the conduct of the excavations and the removal of the contaminated rubble, and the regulatory requirements for the radiation protection of workers. ASN will decide in 2020, after an expert assessment by IRSN, whether the remediation objectives for the site have been achieved.

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:

- Basic Nuclear Installations:
  - 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 facility for storing Écrin waste on the Malvési site;

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

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - about 800 industrial and research centres, including 4 cyclotron particle accelerators, 26 companies exercising an industrial radiography activity and 79 laboratories situated mainly in the universities of the region,
  - about 450 veterinary surgeries or clinics practising diagnostic radiology;

- activities linked to the transport of radioactive substances;

- ASN-approved laboratories and organisations:
  - 3 laboratories approved for taking environmental radioactivity measurements,
  - 5 organisations approved for measuring radon,
  - 7 organisations approved for radiation protection controls.

In 2019, ASN carried out 115 inspections in the Occitanie region, comprising 50 inspections in BNIs, 47 inspections in small-scale nuclear activities, 8 in the transport of radioactive substances and 10 concerning organisations and laboratories approved by ASN.

ASN also carried out 7.5 days of labour inspection at the Golfech NPP.

During 2019, 1 significant event rated level 2 on the INES scale and 3 events rated level 1 were reported by nuclear installation licensees in Occitanie. In small-scale nuclear activities, 4 significant radiation protection events rated level 1 on the INES scale were reported to ASN.

In the exercise of their oversight duties, the ASN inspectors issued one violation report to a nuclear licensee and gave the Paul Sabatier University of Toulouse formal notice to remove its most intensely irradiating sources and nuclear waste within one year.

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 performance of the Golfech NPP is in line with its general assessment of EDF performance, but that its radiation protection performance falls short of this general assessment. The nuclear safety performance, for its part, is significantly below ASN's general assessment for the nuclear fleet. ASN considers that enhancing nuclear safety performance must be a priority for the licensee; it will monitor this closely in 2020.

In the area of nuclear safety, the quality of operating actions continued to deteriorate in 2019. ASN conducted a week-long in-depth inspection which highlighted a systemic lack of rigour. ASN considers that improving performance in this area must be an absolute priority for the licensee. The lack of rigour was also observed in the area of maintenance. ASN also considers that the opinion of the independent safety organisation is not sufficiently taken into consideration by the NPP's senior management. The year 2019 was marked by the reporting of numerous significant safety events. Eight events occurred during the scheduled outage of reactor 2, one of which was rated level 2 on the INES scale.

With regard to worker radiation protection, ASN considers that control of the radiological cleanliness of potentially contaminated premises must be improved rapidly. Deficiencies were again observed in the preparation and performance of activities presenting high radiation exposure risks.

With regard to environmental protection ASN considers that the licensee must make progress in the prevention of environmental releases, particularly in the detection of hazardous substance leaks and the control of equipment contributing to the containment of these substances on site.

In the area of labour inspection, ASN conducted specific investigations further to workplace accidents or notable situations, which led, for example, to a request to verify the electrical installations. ASN kept tracks on the conformity files of the heavy cranes and the ventilation of premises with specific pollution characteristics. In collaboration with the Regional Directorate for Enterprises, Competition, Consumption, Labour and Employment (Direccte), ASN identified poor control of the asbestos risk.

MARCOULE PLATFORM

The Marcoule nuclear platform is situated to the west of Orange in the Gard *département*. Its six 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 mixed oxyde fuel (MOX), 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 The French Alternative Energies and Atomic Energy Commission (CEA) Marcoule centre accommodates three civil installations: the Atalante laboratories (BNI 148), the Phénix NPP (BNI 71) and the Diadem storage facility (BNI 177).

Atalante facility – *CEA Centre*

The main purpose of the Atalante facility, created in the 1980s, is to conduct research and development concerning the recycling of nuclear fuels, the management of ultimate waste, 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. The conclusions of this report were examined by the Advisory Committee for Laboratories and Plants (GPU) on 19 June 2019. ASN considers that the performance of the periodic safety review of the facility and the resulting plan of action are relatively robust. The licensee must nevertheless improve its control of the fire risk.

ASN considers that the level of safety of Atalante is relatively satisfactory. The licensee must nevertheless make improvements in the performance of the periodic checks and tests, the monitoring of outside contractors and waste management. ASN moreover carried out an in-depth analysis of an event that occurred on 19 December 2018 which led to the shattering of a vial containing a radioactive liquid while being handled in a glove box. The event injured the person who was handling the vial. ASN asked the licensee to analyse the root causes of this incident, rated level 1 on the INES scale, focusing particular attention on the reagents that caused the explosion and the social, organisational and human factors behind the event. The premises concerned are padlocked pending the results of this analysis.

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 major decommissioning phases are regulated by Decree 2016-739 of 2 June 2016. ASN resolution 2016-DC-0564 of 7 July 2016 sets various decommissioning milestones and operations for the CEA.

In 2019, the licensee continued the actions to meet the ASN requirements and 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 relatively satisfactory. Improvements are more particularly required in the management of the fire risk, the monitoring of outside contractors, and the analysis of the organisational causes of significant events. Removal of the irradiated fuels and dismantling of equipment continued in 2019 under generally satisfactory conditions of safety, but at a slower rate than planned as far as fuel removal is concerned, due to technical incidents. Construction of the NOAH facility, which will treat the sodium from Phénix and other CEA installations, progressed in 2019 and the first operating tests were carried out. The commissioning file for this facility is to be submitted in 2020.

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).

After partial suspension of the construction work (apart from civil engineering work) in 2018 for budgetary reasons, the majority of the work packages resumed their activity in January 2019. Submission of the commissioning file for this facility is planned in 2020.

Assessment of the CEA Marcoule centre

ASN considers that the level of nuclear safety and radiation protection of the CEA Marcoule centre is relatively satisfactory. With regard to environmental protection, the licensee is deploying an action plan to bring the centre's piezometers into compliance with the Order of 11 September 2003.

ASN considers that the management of on-site transport operations at the Marcoule centre and the local emergency organisation are on the whole satisfactory.

In the context of the stress tests carried out further to the Fukushima Daiichi NPP accident, the CEA Marcoule centre 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. At the joint request of ASN and Defence Nuclear Safety Authority (ASND), an expert assessment of the seismic site effects specific to the Marcoule site is being carried out.

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 that the CEA must consider the operations necessary for its commissioning to be a priority. It is to be noted that a request to modify the creation authorisation decree will be necessary in order to change the package closure technology with the aim of reducing the fire risk in the facility.

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.

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 radiation exposure risks in the facility are addressed with rigour, and the licensee is continuing the work to improve dosimetry in the context of ageing facilities and the necessary optimisation of work stations. In 2019, the licensee deployed a major plan for preventive maintenance of equipment and increasing the reliability of the production facilities, which had a positive impact on the dosimetry in the medium term. In 2019, ASN also observed substantial research and development work on techniques for measuring and evaluating the dose at the lens of the eye and on lens-of-the-eye protection devices that are adapted to the facility, to take into account the lowering of the regulatory limit of exposure of the crystalline lens for workers to 20 mSv/year (millisieverts per year) as of 1 July 2023.

Prevention of the criticality risk in this facility is a major concern for the licensee and ASN, notably with the consideration of social, organisational and human factors in the operational aspects and in the maintenance operations.

With regard to integration of the lessons learned from the Fukushima Daiichi NPP accident, the improvements required by ASN are currently being implemented. Commissioning of the new emergency command post will take place later than initially planned due to technical and contractual difficulties with the prime contractor. On the basis of compensatory measures proposed by the licensee, ASN revised the commissioning deadline, pushing it back to September 2020 by ASN resolution 2019-DC0678 of 16 July 2019.

2019 was also marked by a failure to meet production targets in the Melox plant.

Centraco plant

The Centraco plant (BNI 160), was created in 1996 and is operated by Cyclife France, a 100% 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 Aube respository (CSA). 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
- storage areas.

ASN considers that the level of nuclear safety and radiation protection in the facility is on the whole satisfactory. The licensee must nevertheless comply with the provisions of ASN resolution 2017-DC-0592 of 13 June 2017 relative to the obligations of BNI licensees with regard to emergency situation preparedness and management and the content of the on-site emergency plan, and improve its in-service monitoring of pressure equipment.

In 2019, the licensee submitted a facility modification request to the competent administrations (ASN, the Minister responsible for nuclear safety and the Prefect of the Gard), with a view to widening the range of waste that can be treated by the facility. The examination of this request has revealed shortcomings concerning the nature of the waste treated and consideration of the flood risk, making it necessary to revise the project.

Gammatec ioniser

The Gammatec ioniser (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 sterilising them 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 remained satisfactory in 2019. The licensee must nevertheless improve the management of the facility's radioactive sources and of emergency situations, as much with regard to safety as to the security of the sources.

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. The entire Malvesi plant is subject to the system governing Seveso high-threshold 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 30 years with a volume of waste not exceeding 400,000 m^3 and total radiological activity of less than 120 TBq (terabecquerels).

Commissioning of the installation was authorised by ASN resolution 2018-DC-0645 of 12 October 2018, which enabled the licensee, in 2019, to start the work specified in the authorisation decree, such as the creation of a compartment to the south of basin B2, the end-purpose of which is to store materials coming from the emptying of basins B5 and B6. Once all this work is completed, a bituminous cover will be put in place over the BNI basins.

Furthermore, in the French National Radioactive Material and Waste Management Plan (PNGMDR), 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.

ASN considers that the level of nuclear safety and environmental protection of the Écrin facility is satisfactory. It considers that the anomalies affecting the west embankment of basin B1 were addressed appropriately.

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:

- Basic Nuclear Installations:
  - the Ionisos irradiator in Sablé-sur-Sarthe,
  - the Ionisos irradiator in Pouzauges;

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

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - 1 cyclotron,
  - 23 industrial radiography companies, including 7 gamma radiography contractors,
  - some 400 industrial and research equipment licenses;

- activities linked to the transport of radioactive substances;

- ASN-approved laboratories and organisations:
  - 6 agencies approved for radiation protection controls,
  - 13 organisations approved for measuring radon,
  - 1 head-office of laboratories approved for environmental radioactivity measurements.

In 2019, ASN carried out 56 on-site inspections comprising 1 in the Ionisos facility in Pouzauges, 48 inspections in small-scale nuclear activities and 7 inspections in the transport of radioactive substances.

In 2019, one significant event was rated level 2 on the INES scale (exposure of a worker) and one rated level 1.

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 be ionised (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 pool for underwater storage of the radioactive sources which is 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 2019.

Polluted sites and soils and mining sites

ASN assists the Regional Directorates for the Environment, Planning and Housing (Dreal) regarding polluted sites and soils and mining sites. With regard to the sites in public areas where uranium-bearing mining waste rock was reused, the 10 Pays de la Loire areas concerned by the priority works have been treated (partial or complete removal of the mining waste rock). The Écarpière site (Loire-Atlantique *département*) also received materials radiologically contaminated by mine water from the old uranium-bearing mines in Bretagne.

Provence Alpes-Côte d'Azur region

The Marseille division regulates nuclear safety, radiation protection and the transport of radioactive substances in the 6 *départements* of the Provence-Alpes-Côte d'Azur region.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISE:

- Basic Nuclear Installations:
  - the CEA Cadarache research centre which counts 21 civil BNIs, 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,
  - 106 computed tomography scanners,
  - some 8,200 medical and dental radiology devices;

- small-scale nuclear activities in the veterinary, industrial and research sectors:
  - about 800 industrial and research centres, including 3 cyclotron particle accelerators and 21 companies with an industrial radiography activity,
  - 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,
  - 8 organisations approved for measuring radon,
  - 5 organisations approved for radiation protection controls.

In 2019, ASN carried out 125 inspections in the PACA region, comprising 57 inspections in BNIs, 52 inspections in small-scale nuclear activities, 5 in the transport of radioactive substances and 11 concerning organisations and laboratories approved by ASN.

During 2019, three significant events rated level 1 on the INES scale were reported by nuclear installation licensees.

In small-scale nuclear activities, six significant events rated level 1 on the INES scale were reported to ASN.

In the exercise of their inspection duties, the ASN inspectors gave one BNI licensee formal notice to comply with the regulations concerning operating experience feedback and the designation of activities and equipment important to nuclear safety and their specified requirements.

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 Active Effluent Treatment Station (STE, BNI 37-B);
- the Plutonium Technology Facility (ATPu, INB 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.

At the Cadarache centre, 10 installations are in final shutdown status, 10 are in operation and one 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. When examining these reports, ASN is particularly attentive to the robustness of the proposed and deployed action plans. 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 French Alternative Energies and Atomic Energy Commission (CEA) was authorised by a Decree of 17 April 1980 to reuse 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[1]. The decommissioning file for the facility, whose final shutdown is planned for the end of 2023, was submitted in 2019. Some specific removal-from-storage operations shall be subject to ASN authorisation.

The CEA is effectively significantly behind schedule in the Pégase removal-from-storage operations, initially prescribed in ASN resolution CODEP-CLG-2017-006524 of 10 February 2017. Technical difficulties led the CEA to request the modification of these prescriptions to set 2035 as the deadline for completion of the removal-from-storage operations in Pégase. ASN is currently examining this request.

The Cascad facility, authorised by a Decree of 4 September 1989 modifying the Pégase facility and operated since 1990, is dedicated to the dry storage of irradiated fuel in wells.

ASN's assessment of nuclear safety and radiation protection in the Pégase and Cascad facilities in 2019 finds them to be relatively satisfactory. The CEA must nevertheless improve the monitoring of the action plan established further to the last periodic safety review of the facility.

Cabri research reactor – *CEA Centre*

The Cabri reactor (BNI 24), created on 27 May 1964, was designed for conducting experimental programmes aiming to achieve a better understanding of the behaviour of nuclear fuel 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. Since January 2018, the CEA has been conducting a programme of tests called "CIP" (Cabri International Program), which began in the early 2000's and necessitated substantial modification and safety upgrading work on the facility.

The year 2019 was devoted to the ten-yearly requalification of the reactor's pressurised water loop, in view of the next cycle of tests planned for 2020.

In 2019, ASN started the examination of a request to modify the creation authorisation decree for Cabri, submitted by the CEA with a view to having authorisation to irradiate electronic equipment in the Cabri reactor.

1. *The Potential Source Term (TSM is the French acronym for "*terme source mobilisable*") corresponds to the quantity of radioactive activity that could be involved in an incident or accident.*

ASN considers that the level of nuclear safety and radiation protection 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 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 and the waste containing sodium has been removed.

Examination of the decommissioning file of BNI 25, submitted by the licensee at the end of 2014 and supplemented in 2016, is in progress. The licensee is continuing the clean-out and decommissioning preparation work in parallel.

ASN considers that the level of safety of Rapsodie in 2019, particularly concerning waste management, is on the whole satisfactory. The licensee must nevertheless improve the monitoring of outside contractors and of the fire loads present in the facility.

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 the perimeters of these two BNIs.

At present, the STD is the CEA's only civil BNI licensed for the packaging of ILW-LL (intermediate-level, long-lived) radioactive waste before it is stored in the Cedra facility (BNI 164) pending transfer to a deep geological repository. This situation makes the STD an indispensable part of the CEA's decommissioning and waste management strategy. The continued operation and long-term durability 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. In the meantime, compensatory measures concerning more specifically the limiting of the quantities of radioactive substances in the facility and fire protection, are applied.

Following an event involving the falling of a package of moderately irradiating waste in the facility on 25 October 2017, which was not reported to ASN until July 2018 and led to an inspection, ASN gave the CEA formal notice through resolution CODEP-MRS-2019-011621 of 19 March 2019, to comply with the provisions of Articles 2.4.1 and 2.5.1 to 2.5.3 of the Order of 7 February 2012 respectively with regard to the preparation of operating experience feedback and the identification of activities important to protection for the operation of BNI 37-A. ASN also required the CEA, through resolution CODEP-MRS-2019-026031 of 23 July 2019, to submit to it:

- a review of the conditions of retrieval of the damaged package jammed in the well bottom;
- the guarantee that no damaged packages can have been stored in the Cedra facility;
- a regular report on the processes for detecting, examining and addressing all safety deviations in the facility and, where applicable, reporting them to ASN;
- a verification of compliance with the regulations concerning the use of subcontracting in BNI 37-A;
- an analysis of the root causes of this event, particularly regarding social, organisational and human factors;
- a third-party analysis of its organisation concerning the information and decision-making processes related to safety.

ASN conducted an inspection on 26 November 2019 to verify compliance with these requirements. ASN concluded that the CEA had taken proper account of the requirements of the compliance notice, subject to the provision of additional information concerning experience feedback on the use of a suction-cup pick-up system, which will be examined in 2020.

The CEA's action plan for improvement with regard to safety culture and operating rigour is found on the whole to be satisfactory. ASN expects a strong commitment from the CEA to take into account all the requirements of its resolutions, and the improvement actions stemming from its action plan, in order to improve the level of safety of BNI 37-A and the organisational processes at the CEA, in the short-term and lastingly, in order to ensure the rigour necessary for the operation of this type of BNI, which is pivotal to the CEA's decommissioning and waste management strategy.

ASN also continued the examination of the facility modification request submitted by the CEA with a view to improving the facility's resistance to external hazards. This ongoing examination has required ASN to make several additional information requests, more specifically to check the earthquake resistance of the renovated facility.

Active Effluents Treatment Station – *CEA Centre*

The STE (BNI 37-B) has been shut down since 1 January 2014. The CEA has requested the modification of a prescription in order to push back the deadline for submission of the decommissioning file for this facility, in view in of the complexity of the facility and the time required to characterise the soils and equipment before starting decommissioning. ASN is currently examining this postponement request.

ASN considers that the level of safety of BNI 37-B in 2019 is on the whole satisfactory. With regard to environmental protection, the results of the soil characterisation carried out for the preparation of the facility decommissioning file and

the data resulting from the monitoring of discharges led the licensee in 2018 and 2019 to report several significant events to ASN relative to the presence of artificial radionuclides in the networks and in the stormwater coming from the facility. The treatment of these contaminations and stormwater management are covered by a CEA action plan, for which ASN has issued additional information requests.

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 using mixed oxyde (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.

Removal of the waste and materials from the facilities continued in 2019. The decommissioning of the cryogenic waste processing unit of the LPC, as well as certain legacy waste repackaging and removal operations, have fallen behind schedule.

ASN considers that the level of nuclear safety and radiation protection of the facilities in 2019 is on the whole satisfactory. Improvements are still required in the monitoring of the facility's periodic checks and tests.

Masurca research reactor – *CEA Centre*

The Masurca reactor (BNI 39), whose construction was authorised by a 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 been shut down since 2007.

The licensee is preparing the installation decommissioning file, which must be submitted before the end of December 2020, following the declaration of final shutdown of the installation on 31 December 2018. Decommissioning preparation work, such as asbestos removal from the premises, is in progress.

The situation of the Masurca reactor in terms of nuclear safety and radiation protection in 2019 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 kilowatt) critical mock-ups that were 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 a Decree of 23 June 1965, was intended primarily for neutron studies of moderated arrays, in particular those of pressurised water reactors and boiling water reactors. The Minerve reactor (BNI 95), whose transfer from the Fontenay-aux-Roses studies centre to the Cadarache studies centre was authorised by a 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.

ASN continued the examination of the decommissioning files for these reactors in 2019. Pending decommissioning, operations in preparation for decommissioning, such as the removal of radioactive and hazardous substances, took place in 2019.

ASN considers that the level of nuclear safety and radiation protection of the ÉOLE and Minerve reactors in 2019 is on the whole satisfactory. ASN has nevertheless observed a drift in the schedule of certain decommissioning preparation operations, even though the licensee had given its commitment. In 2019, the licensee reported one significant event relative to the control of criticality.

The enriched Uranium Processing Facilities (ATUe) – *CEA Centre*

From 1963 to 1995, the ATUe (BNI 52) converted UF_6 (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 actual radiological condition of the installation, which led to several additional information requests. A new file must be submitted to provide clarifications on the characterisation of the final state and the planned steps to validate the in-depth clean-out of the facility. The only activities authorised today in the facility are the clean-out of the soils and the maintenance operations governed by periodic and regulatory checks.

The level of nuclear safety and radiation protection of the ATUe facilities in 2019 is on the whole satisfactory.

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. The decommissioning preparation operations, notably the chemical and radiological characterisations of the facility, continued in 2019.

High-activity laboratory LECA-STAR
– CEA Centre

The Active Fuel Examination Laboratory (LECA-BNI 55) 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 the 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.

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. With regard to the LECA facility, ASN submitted a draft resolution on continued operation for consultation by the public and the licensee at the end of 2019, which makes continued operation conditional on conducting work to improve control of the risks associated with earthquakes, fire, lightning and flooding, while at the same time limiting the potential source term of the facility in an accident situation.

Furthermore, as the LECA's resistance to the "safe shutdown earthquake" potential is not guaranteed today, the CEA proposed a strategy to ASN in 2019 to ensure the durability of this facility. ASN is currently examining this strategy.

ASN considers that the level of nuclear safety and radiation protection of BNI 55 in 2019 is on the whole satisfactory. ASN nevertheless remains vigilant with regard to the consideration of social, organisational and human factors in the operation of the facility.

Solid radioactive waste storage area
– CEA Centre

BNI 56, declared in January 1968 for the disposal of waste, is used for storing 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 continued in 2019, including the finalisation of the operations to retrieve low-level waste (LLW) from the cells of the F3 pit and measurement of the drums of bulk waste in the H4 hangar. ASN also continued examining the facility decommissioning file which was submitted in 2018, and asked the CEA for substantial amounts of additional information.

ASN considers that the level of nuclear safety and radiation protection of BNI 56 has progressed markedly over the last few years and has reached a satisfactory level. With regard to environmental protection, given the operating background and the radiological contamination of certain zones of the facility, ASN has asked the CEA to produce an action plan to ensure compliance with the stormwater management procedures in order to prevent the facility from causing any off-site pollution. In 2019, the CEA started taking steps to improve its stormwater management system, but further measures are still required.

Furthermore, BNI 56 is one of the priorities identified by the CEA in its new decommissioning and waste management strategy. ASN will therefore be attentive to the progress of the actions aiming to reduce as far as possible the risks and adverse effects that the facility presents for the environment.

Phébus research reactor *– CEA Centre*

The Phébus reactor (BNI 92) is a pool experimental reactor with a power rating of 38 megawatt thermal (MWth) (megawatt thermal) 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 it is currently being examined, jointly with its periodic safety review report submitted in 2017. Removal of the spent fuel from the reactor, which was one of the priorities of the decommissioning preparation operations, was completed in January 2019.

ASN considers that the nuclear safety and radiation protection of the Phébus installation for 2019 is on the whole satisfactory. It notes an improvement in the monitoring of outside contractors.

Laboratory for research and experimental fabrication of advanced nuclear fuels (Lefca) *– CEA Centre*

Commissioned in 1983, the Lefca (BNI 123) was a laboratory designed for conducting studies on plutonium, uranium, actinides and their compounds, which carried out studies aimed at understanding the behaviour of these materials in the reactor and in the various stages of the fuel cycle. In 2018, the Lefca finalised the transfer of part of its research and development equipment to the Atalante laboratories (BNI 148) of Marcoule.

The CEA sent the final shutdown declaration for the facility in April 2019 and submission of its decommissioning file is planned for 2021.

The electrical renovation work planned for after the last periodic safety review of the facility, further to which technical requirements were issued by ASN in resolution CODEP-CLG-2018-034301 of 5 July 2018 governing the continued operation of the facility, was carried out in 2019.

ASN considers that the level of nuclear safety and radiation protection of the facility is relatively satisfactory. Improvements are required in the monitoring of outside contractors and control of the fire risk.

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 level of nuclear safety and radiation protection of Chicade is on the whole satisfactory. With regard to environmental protection, the CEA has undertaken to review the impact study of its facility to take into account the gaseous discharges of tritium which were not provided for in its baseline requirements, and to submit a request to modify the facility creation decree once the ongoing examination of the facility's periodic safety review file is completed.

Cedra storage facility – *CEA Centre*

Since 2006, the Cedra facility (BNI 164) processes intermediate-level long-lived waste (ILW-LL) pending the creation of appropriate disposal routes. The CEA forecasts that this facility will be filled to capacity by 2027. The studies concerning a project to double the storage capacity should start in 2020.

The CEA sent ASN the periodic safety review report for the facility in November 2017, and ASN is currently examining it. The licensee has been asked for additional information concerning the conformity check of the facility's baseline requirements and the external hazards.

ASN considers that the level of nuclear safety and radiation protection of Cedra is on the whole satisfactory. ASN remains particularly attentive to compliance with the requirements of resolution CODEP-MRS-2019-026031 of 23 July 2019 relative to the incoming inspections and examination of the packages from BNI 37-A which are stored in the facility.

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.

In 2019, the examination of the commissioning authorisation application for the glove boxes, submitted in 2018, led to a refusal decision on account of the shortcomings in the supporting file, particularly regarding the prevention of criticality risks and the exhaustiveness of the list of items important to control of the fire risk in these glove boxes.

ASN considers that the level of nuclear safety and radiation protection of the facility is relatively satisfactory. The CEA must nevertheless improve operating rigour, in particular regarding compliance with radiation protection requirements and the formal tracking of modifications. In view of the personnel changes, particular attention must be given to maintaining skills.

Effluent advanced management and processing facility (Agate) – *CEA Centre*

The Agate facility (BNI 171), commissioned in 2014 to replace BNI 37-B which is now shut down, uses an evaporation process to concentrate radioactive liquid effluents containing mainly beta- and gamma-emitting radionuclides.

The regulatory operations for the ten-yearly requalification of the evaporator, which a nuclear pressure equipment item, were completed in early 2019, after the licensee had met with difficulties in 2018 through the unexpected discovery of deposits on the internal surfaces of the tank. Evaporation operations resumed in September 2019.

ASN considers that the level of nuclear 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 since 2009, is a pressurised-water research reactor designed to study the behaviour of materials under irradiation and of power reactor fuels. It will also allow the production of artificial radionuclides for nuclear medicine. Its power is limited to 100 MWth.

The year 2019, which saw the continuation of the facility construction work, was marked by the completion of installation of the reactor pool lining and the start of assembly of the reactor pile block elements, which will continue until 2021. In addition, the three primary/secondary heat exchangers were introduced into the dedicated bunker of the reactor building in the second half of 2019. The lining of the pools and channels of the nuclear auxiliaries building is currently being installed. The off-site manufacture of large equipment items, which includes the reflector, is still in progress.

ASN considers that the nuclear safety requirements are taken properly into account in the construction of the facility and that the CEA's management of the construction worksite is satisfactory. Deviations are managed with rigour and efficiency.

Delays in construction and a third-party review of its project led the CEA to make a request to push back the commissioning deadline by 9 years with respect to the initial deadline of October 2019, a request which was authorised by a Decree of 10 October 2019 after receiving a favourable opinion from ASN, which considered in particular that the elements essential for the protection of people and the environment were not modified and that the CEA was implementing a procedure guaranteeing proper conservation of the equipment already installed or waiting to be installed on site. ASN will be attentive to the CEA's implementation of measures to maintain its technical skills for operating the reactor.

ITER

The International Thermonuclear Experimental Reactor installation (ITER-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 seconds). 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.

The inspections of ITER Organisation – the nuclear licensee of the facility – conducted by ASN on the Cadarache site and in South Korea on the manufacturing site of some of the sectors of the vacuum chamber, conclude that the safety requirements are taken into account in a generally satisfactory manner by the entire chain of outside contractors, as from the facility design stage.

Assessment of the CEA Cadarache centre

ASN considers that the level of nuclear safety of the CEA Cadarache centre in 2019 is on the whole satisfactory. It does nevertheless note persistent disparities between the facilities of the centre.

ASN considers that the BNIs are operated satisfactorily on the whole, especially the control of the condition of the equipment, compliance with the operating baseline requirements and, more generally, the radiation protection measures taken by the senior management of the centre. Improvements are however expected in waste management and the control of fire risks.

Nuclear safety management is on the whole satisfactory, but, as in 2018, ASN considers that the sharing of experience feedback and good practices between facilities must be improved, as must the management of deviations. Moreover, despite a noted improvement in 2019, the licensee's monitoring of outside contractors and subcontractors shows contrasts; the activities carried out under contracts concerning the centre must be monitored with the same rigour as those carried out under contracts concerning the BNIs.

ASN considers that the organisation in place for the periodic safety reviews of the facilities in on the whole satisfactory. The extent to which the results of studies are taken on board or the human resources allocated to performing them seem nevertheless to vary from one BNI to another. ASN will be attentive to the application of the BNI periodic safety review action plans, particularly with regard to carrying out the work identified in the reviews.

ASN considers that the CEA ensures the on-site transport of radioactive substances at the Cadarache centre in a satisfactory manner. Improvements have been made in the centre's baseline requirements with regard to organization and support to the BNIs, particularly as concerns the maintenance of packages and vehicles.

With regard to emergency situation management, the CEA has initiated a plan of action to meet the requirements of ASN resolution 2017-DC-0592 of 13 June 2017. The main improvements achieved or under way concern the emergency management agreements signed with the outside organisations, the emergency exercises, the instruction and training of the personnel involved in emergency management and learning lessons from experience feedback.

With regard to the lessons learned from the Fukushima Daiichi NPP accident, in 2019 ASN authorised, in view of the compensatory measures put in place by the CEA, postponement of the construction of emergency situation management premises that are robust to extreme hazards until October 2023, given the CEA's project management difficulties.

ASN and ASND have made a position statement on the CEA's decommissioning and waste management strategy. This strategy leads to changes in the projects for facility renovation and the construction of new facilities for the CEA Cadarache centre, in favour of certain priority decommissioning work projects. ASN will nevertheless make sure that the CEA keeps the in-service facilities at the right operating level, while at the same time ensuring the progress of the priority decommissioning and legacy waste retrieval and packaging projects.

ASN considers that the radiation protection situation of the CEA centre is satisfactory.

Lastly, ASN observes that the level of environmental protection is relatively satisfactory. With regard to discharge management, the licensee has proposed an action plan to improve the management of stormwater in certain old BNIs (BNI 37-B and BNI 56 in particular) to comply with the requirements of the Order of 7 February 2012 and ASN resolution 2013-DC-0360 of 16 July 2013. ASN has asked that the plan be supplemented. With regard to monitoring of the environment, improvements are required in the representativeness of the measurement samples and the consideration of metrological uncertainties in the utilisation of the data. Furthermore, the laboratory performing the sample analyses for the non-radiological parameters must comply with standard 17025 in order to be able to continue its activity.

ASN is maintaining its focus on the quality of execution of this complex project and expects greater rigour in the assessment of the radiation protection issues. In effect, following ASN's discovery in December 2018 of the noncompliance with a defined requirement concerning the minimum thickness of a concrete wall, ASN and the licensee had technical discussions concerning the assessment of the radiological mappings in the facility. ASN considers that the licensee, at this stage, has not provided elements that can attest to its full control of radiation protection in the facility, even though the construction of the buildings is well advanced.

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, sterilising or improving the performance of materials. 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 level of nuclear safety and radiation protection of Gammetec remained satisfactory in 2019. The licensee must nevertheless make progress in the area of emergency situation management, as much with regard to safety as to the security of the sources.

The examination of the periodic safety review report for the facility continued and culminated in 2019 in the publication of ASN Chairman's resolution CODEP-MRS-2019-048140 of 5 December 2019 governing the continued operation of the facility. Alongside this, ASN has also set requirements relative to the limits and methods of effluent management, water consumption and monitoring the environment of the facility through ASN Chairman's resolutions CODEP-MRS-2019-048718 and CODEP-MRS-2019-048719 of 11 December 2019.

Photos and graphics credits

Editorial by the commission: p. 2: ASN/V. Bourdon.
Editorial by the Director General: p. 6: ASN/V. Bourdon.
Notable events 2019: p. 16-17: ASN/Appa/G. Arroyo; p. 18-22: ASN; p. 19: EDF Flamanville; p. 21: EDF – William Beaucardet; p. 25: Michel Coquema; p. 27: Orano, Eric Larrayadieu.
Regional Overview: p. 72 : ASN.

Abstracts ASN Report on the state of nuclear safety and radiation protection in France in 2019

15 rue Louis Lejeune – 92120 Montrouge – France
Public Information Centre
Tel: 33 (0)1 46 16 41 46 - E-mail: info@asn.fr

Publishing director: Bernard Doroszczuk, Chairman of ASN
Editor: Marie-Christine Bardet
Editorial staff: Fabienne Covard
Iconographer: Olivier Javay

ISSN 1967 – 5127

Printer number: 14036-7-2020 – **Legal deposit:** July 2020
Conception and production: BRIEF
Printing: Imprimerie Fabrègue

Find the full Report
on the state of nuclear safety and radiation protection
in France in 2019 on

asn.fr

For any information request
contact us on

info@asn.fr

You can also follow ASN on the social networks

AUTORITÉ
DE SÛRETÉ
NUCLÉAIRE

Improving nuclear safety
and radiation protection

15 rue Louis Lejeune – 92120 Montrouge – France – Tel.: 33 (0)1 46 16 40 00