AUTORITÉ
DE SÛRETÉ
NUCLÉAIRE

ABSTRACTS

ASN REPORT

on the state of nuclear safety and radiation protection in France in 2020

The French Nuclear Safety Authority presents its report on the state of nuclear safety and radiation protection in France in 2020.

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 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 oversight that is recognised by the citizens and regarded internationally as a benchmark for good practice.

ROLES

REGULATING

ASN contributes to drafting regulations, by submitting its opinion to the Government on draft Decrees and Ministerial Orders, and 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 responsible 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 1,500 inspections were thus performed in 2020 in the fields of nuclear safety and radiation protection.
ASN has graded enforcement and penalty powers (formal notice, administrative fines, daily fines, ability to carry out seizure, take samples or require payment of a guarantee, etc.).
The administrative fine is the competence of the Administrative Enforcement Committee within 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.

The website *asn.fr* is ASN's main information channel.

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, packages of radioactive substances, medical facilities, research laboratories, industrial activities, etc.
ASN monitors and regulates an extremely varied range of activities and facilities.

This regulation covers:

- 56 nuclear reactors(*) producing 70% of the electricity consumed in France, as well as the Flamanville EPR reactor under construction;
- about 80 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.

EXPERT SUPPORT

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 30 June 2020.*

OPERATIONS

THE COMMISSION

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

Bernard DOROSZCZUK Chairman	Sylvie CADET-MERCIER(*) Commissioner	Géraldine PINA JOMIR Commissioner	Lydie ÉVRARD(*)(**) Commissioner	Jean-Luc LACHAUME(*) Commissioner
from 13 November 2018 to 12 November 2024	from 21 December 2016 to 9 December 2023	from 15 December 2020 to 9 December 2026	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

** The Environment Code, modified by Act 2017-55 of 20 January 2017, introducing the general status of the independent administrative Authorities and the independent public Authorities, provides for the renewal of half of the ASN Commission, other than its Chairman, every 3 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 three Commissioners.*

*** By Decree of the President of the Republic dated 21 April 2021, Laure Tourjansky was appointed Commissioner for the remainder of the mandate of Lydie Évrard, called to other duties.*

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 Parliament with the *ASN Report on the State of Nuclear Safety and Radiation Protection in France*. 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 Evaluation of Scientific and Technological Choices. The Commission defines ASN's external relations policy at national and international level.

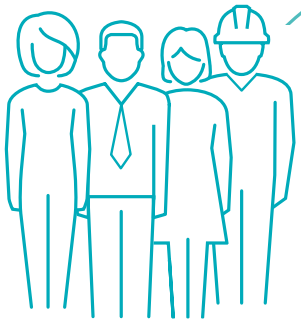
THE DEPARTMENTS

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 responsible for the protection of the population, and oversee the operations to safeguard the facility affected by the accident.

**** Administrative region headed by a Prefect.*

KEY FIGURES IN 2020



PERSONNEL

529 staff members

of which

85% management

47% women

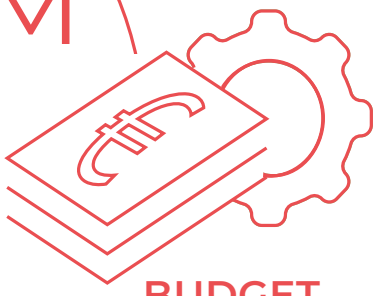
320 inspectors

€65.77M

budget for ASN
(programme 181)

€83M

budget for the IRSN
devoted to technical expertise
for ASN



BUDGET

ASN ACTIONS(*)

9 plenary meetings and **3** virtual consultations of the Advisory Committees of Experts

24,886
inspection follow-up letters available on *asn.fr* as at 31 December 2020

198
technical opinions sent to ASN by the IRSN

1,573
inspections including 320 performed remotely

1,651
individual licenses issued for facilities or activities

INFORMATION(*)

9
press conferences

67
information notices

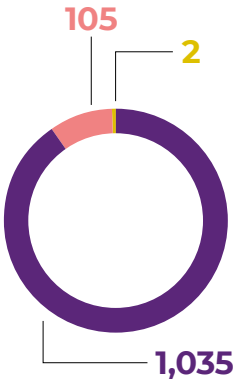
Nearly **600**
replies to queries from the public and stakeholders

** These figures take account of the impact of the Covid-19 pandemic on some ASN activities.*

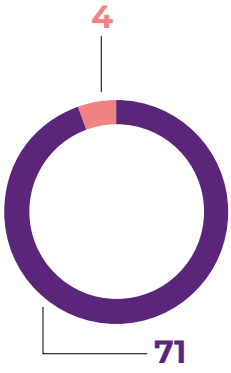
KEY FIGURES IN 2020

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

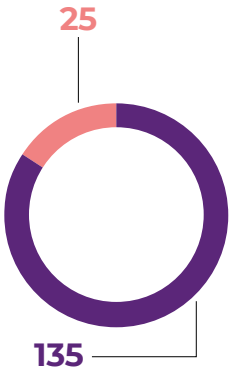
1,142
events in the Basic Nuclear Installations



75
events in the transport of radioactive substances



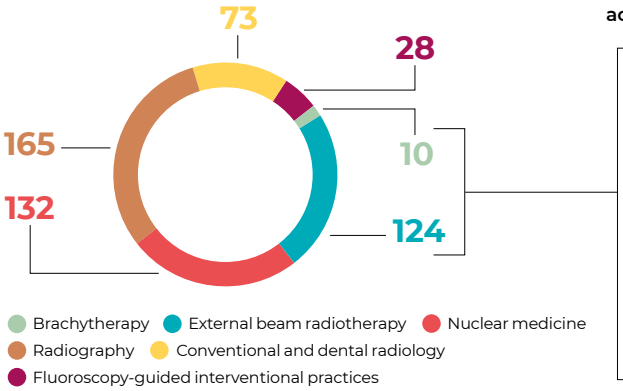
160
events in small-scale nuclear facilities (medical and industrial)



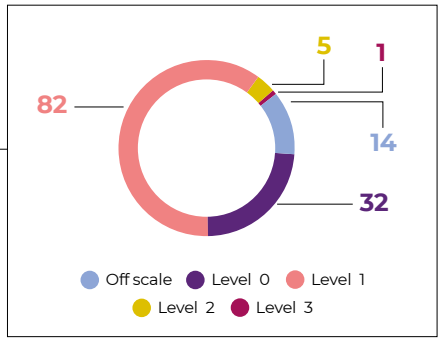
Level 0 Level 1 Level 2

NUMBER OF SIGNIFICANT EVENTS IN THE MEDICAL FIELD(*)

532
significant events per area of exposure



134
significant events in external beam radiotherapy and brachytherapy
according to the rating on the ASN-SFRO scale



** 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 2 March 2021

COMMISSION

Chairman
Bernard Doroszczuk

Commissioners
Sylvie Cadet-Mercier
Lydie Évrard
Jean-Luc Lachaume
Géraldine Pina Jomir

Head of Private Office
Sylvie Rodde

GENERAL DIRECTORATE

Director General
Olivier Gupta

Deputy Directors General
Julien Collet
Daniel Delalande
Anne-Cécile Rigail

Chief inspector
Christophe Quintin

Director of Private Office
Vincent Cloître

Ethics Officer
Alain Dorison

DEPARTMENTS

NUCLEAR POWER PLANTS
Rémy Catteau

NUCLEAR PRESSURE EQUIPMENT
Corinne Silvestri

WASTE, RESEARCH FACILITIES AND FUEL CYCLE
Christophe Kassiotis

TRANSPORT AND SOURCES
Fabien Féron

IONISING RADIATION AND HEALTH
Carole Rousse

ENVIRONMENT AND EMERGENCY SITUATIONS
Olivier Rivière

LEGAL AFFAIRS
Olivia Lahaye

INFORMATION, COMMUNICATION AND DIGITAL USAGES
Céline Acharian

INTERNATIONAL RELATIONS
Luc Chanial

OFFICE OF ADMINISTRATION
Brigitte Rouède

MANAGEMENT AND EXPERTISE OFFICE
Adeline Clos

REGULATION AND OVERSIGHT SUPPORT MISSION
Julien Husse

REGIONAL DIVISIONS

① BORDEAUX
Regional representative: Alice-Anne Médard
Regional head: Simon Garnier

② CAEN
Regional representative: Olivier Morzelle
Regional head: Adrien Manchon

③ CHÂLONS-EN-CHAMPAGNE
Regional representative: Hervé Vanlaer
Regional head: Mathieu Riquart

④ DIJON
Regional representative: Jean-Pierre Lestoille
Regional head: Marc Champion

⑤ LILLE
Regional representative: Laurent Tapadinhas
Regional head: Rémy Zmyslony

⑥ LYON
Regional representative: Jean-Phlippe Deneuvy
Regional head: Caroline Coutout

⑦ MARSEILLE
Regional representative: Corinne Tourasse
Regional head: Bastien Lauras

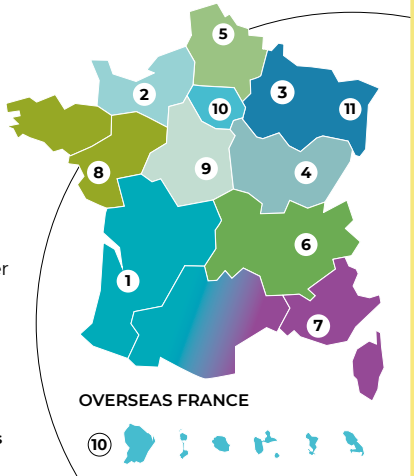
⑧ NANTES
Regional representative: Annick Bonneville
Regional head: Émilie Jambu

⑨ ORLÉANS
Regional representative: Hervé Brûlé
Regional head: Arthur Neveu

⑩ PARIS
Regional representative: Agathe Baltzer (p.i.)
Regional head: Agathe Baltzer

⑪ STRASBOURG
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. The Paris division intervenes in overseas France.



Competence
Independence
Rigour
Transparency

asn.fr

info@asn.fr

You can also follow ASN on social media

SUMMARY

ADVICE TO THE READER

- **FIND THE FULL ASN REPORT on the state of nuclear safety and radiation protection in France in 2020 on *asn.fr*.**
- **Only regulatory news for the year 2020 is present in this report. All the regulations can be consulted on *asn.fr*, under the heading "Réglementer".**

EDITORIAL BY THE COMMISSION

THE NUCLEAR STAKEHOLDERS ADAPT TO AN UNPRECEDENTED SITUATION

“Learning lessons from this situation to strengthen a culture of anticipation and precaution”

From left to right:*
Jean-Luc LACHAUME, Commissioner; **Lydie ÉVRARD,** Commissioner; **Bernard DOROSZCZUK,** Chairman; **Sylvie CADET-MERCIER,** Commissioner; **Géraldine PINA JOMIR,** Commissioner

** To ensure compliance with health restrictions, the members of the Commission were photographed separately.*

Montrouge, 02 March 2021

The year 2020 was profoundly marked by the crisis caused by the Covid-19 pandemic. ASN considers that the level of nuclear safety and radiation protection achieved remained satisfactory and that those responsible for nuclear activities were able to adapt and cope with the situation.

In early 2021, the health crisis is still not over and prudence is required with regard to the lessons to be learned, in an uncertain and changing context.

ASN considers that this situation raises systemic questions which could apply, in the same terms, in the event of a nuclear crisis. This notably concerns trust in scientific expertise and in the authorities by the population and the conditions determining the acceptability of the restrictive population protection measures.

More generally, ASN considers that the first analyses of the problems encountered during this health crisis confirm the absolute need, which it has regularly underlined, to strengthen the culture of anticipation and precaution among all those concerned by nuclear matters.

Proven adaptability by the stakeholders, but vigilance to be maintained

In the context of an unprecedented crisis, the ability of all the stakeholders to adapt was a key point for nuclear safety and radiation protection. It proved to be satisfactory. On the one hand the licensees continued with the activities crucial to supplying the country with electricity, while maintaining a high level of safety in their installations. On the other, those in charge of nuclear activities, notably in the medical sector, demonstrated great reactivity and adapted their organisation to ensure that the health situation was managed and the provision of health care remained uninterrupted.

However, the postponement of numerous activities in the spring of 2020, combined with new restrictions in the autumn, created a considerable amount of pressure, which will last well beyond 2020. The rescheduling of unit outages to take account of electricity production needs in the winter and the domino effect that this has for the coming years, is leading to operational constraints for the NPPs, strain on the management of unit outages and contractor mobilisation, and demands particular vigilance with regard to the regulatory requirements. In the medical field, long-term management of the health crisis is raising questions regarding patient radiation protection in some centres, owing to the lack of availability or the overwork of the medical professionals. In this context, ASN remains attentive to the steps taken to ensure the nuclear safety and radiation protection of the activities, whether material, organisational, or human.

Finally, ASN is committed to learning all long-term lessons from the management of this crisis, on the one hand regarding its own oversight, in particular concerning the complementary nature of on-site and remote inspections, and on the other regarding the conditions for maintaining a collective approach internally, as this is a key factor in the quality and robustness of its decision-making process.

Industrial capacity to be mobilised

Over the coming five years, the nuclear sector will have to cope with a significant increase in the volume of work that is absolutely essential to ensuring the safety of the facilities in operation.

Starting in 2021, four to five of EDF's 900 Megawatts electric (MWe) reactors will undergo major work as a result of their fourth ten-yearly outages. This workload will inevitably be compounded by the essential work needed to increase spent fuel storage capacity, as well as that linked to priority operations involved in the conditioning of legacy waste and the dismantling of installations.

All of this work will significantly increase the industrial workload of the sector, with particular attention required in certain segments that are under strain, such as mechanical and engineering, at both the licensees and the contractors. The prospect of increased work on the existing NPP fleet is a point demanding particular attention, but it should also be an opportunity for the nuclear sector which, in the past, lacked projects capable of maintaining its skills.

In the current context of the health and economic crises, ASN considers that the State and the ordering customers should pay particular attention to maintaining the industrial capacity of the key players in the sector, notably when they are also encountering difficulties in other high-tech sectors, such as aeronautics.

Results in terms of rigour, skills and quality expected as of 2021

A year ago, ASN drew attention to the need to reinforce skills, professional rigorousness and quality within the nuclear sector.

The measures initiated in 2020 under EDF's Excell plan and within the French Nuclear Energy Industry Group (GIFEN) reflect a real collective engagement on these issues. The correct performance of operations "first time round", the rapid detection and processing of any non-compliances, the evaluation of the maturity of the various phases of projects and the search for greater standardisation of equipment and of work programmes are key points in these approaches.

ASN considers that the goals of skills enhancement, notably regarding welding, as well as of increased rigorousness in project management and monitoring of activities, are steps in the right direction.

ASN will be attentive to ensuring that these goals lead to tangible results starting in 2021, notably for those installations under construction, such as the Flamanville EPR reactor, but also for work linked to the fourth periodic safety review of the 900 MWe reactors.

Safety improvements opening up the prospect of continued operation of the 900 MWe reactors

The objectives set for the fourth periodic safety review of the 900 MWe reactors are ambitious. They were defined in the light of the safety objectives defined for the third generation reactors, in particular the EPR. They will make the installations more robust to natural hazards and reduce the radiological consequences in the event of an accident, notably one with core melt.

In order to achieve these goals, EDF has proposed numerous modifications to the installations, notably to improve the safety of the spent fuel pool, reduce the risk of core melt and limit releases in the event of a severe accident. Following the generic phase of the periodic safety review, ASN considers that implementation of the modifications proposed by EDF leads to significant improvements in the safety of the installations. ASN prescribes the implementation of the major safety improvements planned by EDF, along with certain additional provisions it considers necessary to achieve the safety review objectives.

Deployment of the modifications proposed by EDF and the additional provisions prescribed by ASN will be implemented in two stages, to favour satisfactory management by the licensee and easier assimilation by the operating teams. ASN ensured that most of the

safety improvements are deployed during the first phase, that is during the reactor's ten-yearly outage.

ASN considers that these safety improvements open up the prospect for continued operation of the 900 MWe reactors for a further 10 years following their fourth periodic safety review.

By 2031, EDF will have carried out the specific phase of the fourth periodic safety review of each of the 900 MWe reactors. The provisions proposed by EDF will then lead to a public inquiry. ASN will then submit for public consultation the draft requirements it considers to be necessary for continued operation of each of the reactors.

Flamanville EPR, a complex project facing numerous setbacks

ASN remains vigilant with regard to the Flamanville EPR, a complex project facing numerous setbacks. The extensive test programme conducted with a view to reactor commissioning showed that, on the whole, the systems performance requirements are met, but it also revealed deviations, some of which entail installation modifications. On the basis of the tests performed on the fuel pool safety systems and the inspections it carried out, ASN authorised the arrival of nuclear fuel on the Flamanville EPR reactor site in October 2020 and it is being stored in this pool.

The inspection of the EPR equipment has already revealed numerous deviations from the required level of quality. ASN therefore asked EDF to perform a quality review of the Flamanville EPR reactor equipment. With regard to the secondary circuits (main steam lines and steam generator feedwater lines), more than a hundred welds are concerned by deviations. EDF plans to repair some of these welds and justify maintaining others as-is. The repair processes were defined by EDF and are undergoing specific testing and mock-ups for qualification of the processes. ASN gives its approval prior to each implementation step. ASN examination of the files justifying maintaining the welds as-is includes an analysis of the consequences of the deviation with respect to non-compliance with the post-weld heat treatment temperatures.

ASN is particularly attentive to operating experience feedback from the EPR reactors in Finland and China, which highlights certain subjects requiring specific investigation and examination. It notably concerns the stress corrosion on the pilot valves of the EPR reactor at Olkiluoto (Finland), as well as the anomalies on the power distributions in the EPR cores in Taishan (China).

A decisive period for decisions on the management of radioactive materials and waste

Following the public debate held in 2019 to prepare for the next edition of the National Radioactive Materials and Waste Management Plan (PNGMDR), the Minister in charge of ecology and the ASN Chairman set out the guidelines for this next edition, in a resolution dated 21 February 2020.

ASN's involvement in the drafting of the plan, which had already been queried in 2018 by its peers during an International Atomic Energy Agency (IAEA) mission, also led to questions being raised during the public debate. With the agreement of the Ministry for Ecological Transition, ASN has decided to cease its role as co-owner of the plan, which constitutes a management policy document that is the responsibility of the Government.

ASN has refocused its action on evaluation and oversight of the radioactive materials and waste management routes, to ensure that they are safe. In preparation for the fifth PNGMDR, ASN thus issued a number of opinions, concerning very low level waste, low level long-lived waste, radioactive materials and high level long-lived waste. One key issue emerged: reinforcing the anticipation culture.

Concerning waste management, the previous plans led to the development of numerous studies and the sharing of a large amount of data and information with the stakeholders, so that the possible solutions, their advantages and their drawbacks could be inventoried. The aim now is to make tangible progress

in the implementation of these routes. If no choices or decisions are made in the 5 year period covered by the next PNGMDR, no management route will be operational in the coming 20 years and our country will be unable to meet the capacity needs for disposal of the waste generated by the decommissioning of facilities and by completion of the legacy waste retrieval and conditioning operations.

With regard to materials, ASN's opinion set out the principles which should underpin this anticipation culture. Thus, reuse of a material could be considered to be plausible if the existence of an industry for use of this material is realistic within a time-frame of about thirty years, and if this reuse concerns volumes consistent with the stocks of material held now and foreseeable in the future. For the more distant future, long-term storage in safe conditions must be anticipated, along with the possible management of the radioactive substance as waste. In any case, if there are no prospects for use within a time-frame of about a century, the substance shall be reclassified as waste.

Decommissioning and management of legacy waste: large-scale projects falling behind schedule

Decommissioning operations are large-scale projects, from the technical and organisational viewpoints, which take place over lengthy periods of time, on installations which are constantly changing. The nuclear safety and radiation protection issues must therefore be periodically reassessed.

The observations made for a number of years now show that postponing the decommissioning of old facilities makes the operations considerably more complex and leads to major delays with regard to the planned schedules.

In 2020, ASN issued binding requirements concerning the next steps in the specific operations involved in the decommissioning of the six first-generation gas-cooled reactors, and asked that decommissioning files incorporating the new decommissioning scenario be submitted by 2022. It also found clear delays in implementation of the waste management and decommissioning strategy for the legacy facilities of the Alternative Energies and Atomic Energy Commission (CEA), for which ASN and the Defence Nuclear Safety Authority (ASND) issued a ruling in 2019. It observed improvements at Orano, albeit too slow, in the legacy radioactive waste retrieval and conditioning operations.

Overall, ASN continued with its examination of the steps taken by the licensees to manage their complex projects, which it considers to be essential if decommissioning is to be able to progress satisfactorily.

Organisational and technical failings still the cause of avoidable events in the medical sector

Even in the context of the health crisis, radiation protection in the medical field remained at a satisfactory level. There were very few level 2 or 3 significant Radiation Protection Events (ESR) but they were nonetheless avoidable (laterality error, dose fractionation error). The occurrence of these ESR reveals organisational and technical failings, recalling the importance of a radiation protection culture. The control of high-tech devices remains delicate, on the one hand for their handling and on the other during the implementation of new procedures. Adequate training time is essential for their appropriation by the teams and thus avoid incorrect setting of software parameters and standardisation of procedures would also help reduce the risk of transmitting incorrect data.

Preparing for and supporting technological innovation in the medical field

To prepare for the expansion of the therapeutic indications of radiopharmaceutical drugs marked with lutetium-177 and the increase in the number of patients who will benefit accordingly in France, ASN asked the Advisory Committee for Radiation Protection of Health Professionals, the Public and Patients for Medical and Forensic Applications of Ionising Radiation (GPMED) to update the conditions for the possession and administration of these drugs by the nuclear medicine units.

This anticipation approach, conducted jointly with the stakeholders (including the French Society for nuclear medicine) and the French National Agency for Medicines and Health Products Safety led, in 2020, to the nationwide distribution of and access to this class of drugs, while guaranteeing good conditions of radiation protection for the patients, the professionals concerned and the environment (management of contaminated effluents).

From post-accident preparedness to the development of a precautionary culture

In a letter dated 18 June 2020, the Prime Minister tasked ASN with continuing to lead the work of the Steering Committee for the post-accident phase of a nuclear accident (Codirpa) for a period of 5 years. After focusing primarily on the consequences of an accident affecting a nuclear power plant, Codirpa will thus deal with the cases of accidents leading to radioactive releases in the marine environment, as well as accidents that could lead to releases of alpha emitting radionuclides, which require appropriate management. Having learned the lessons from emergency situations, Codirpa will also expand its actions to contribute to the development of a radiation protection culture. This culture requires greater involvement of regional players and the population living near the nuclear facilities in the preparation of the response plans and the exercises and in crisis management.

ASN considers that the lessons learned from the health crisis and the work of the Codirpa, with the support of local partners, will be key factors in achieving progress in a precautionary culture.

International relations maintained in appropriate formats

In 2020, ASN maintained its international cooperation activities in various appropriate formats. After the cancellation, or the postponement sine die of all the major international events in the spring of 2020, exchanges were set up in virtual formats, notably to share the lessons learned from health crisis management. In certain exceptional cases, these postponements meant that it was impossible to fully meet certain obligations. This was the case of the peer review, scheduled by the Convention on Nuclear Safety and carried out under the aegis of IAEA. Although the current situation is a major obstacle to exchanges, in particular the informal exchanges which represent a significant part of international cooperation, contacts are nonetheless being maintained thanks to the pre-existing dynamics and ASN's involvement in the virtual events being organised.

EDITORIAL BY THE DIRECTOR GENERAL

“2020, from uncertainty to accelerated transformation”

Olivier GUPTA

Montrouge, 2 March 2021

In 2020, the health crisis was a real test for each and every one of us.

ASN and the sector it regulates were also faced with unprecedented challenges. Our institution coped and showed its resilience.

This crisis was a powerful accelerator of the transformations already under way, but also, owing to the inventiveness that it demanded, it was the starting point for new regulation and oversight practices.

Finally, this crisis reminded all players of the importance of preparedness and precaution, which have already been two ASN priorities for a number of years.
ASN will be drawing the relevant conclusions in its next multi-year strategic Plan.

The health crisis, the importance of robust operation at ASN

When the first lockdown was announced, little time was left for preparation, but it was essential that ASN guarantee the continuity of its activities, so that other problems in the short or long term did not further compound the health crisis. The nuclear power plants continued to operate, so their regulation and oversight therefore had to continue. In the medical field, numerous hospital centres required urgent adaptations of their licenses so that they could utilise equipment (mainly scanners) to diagnose patients suffering from Covid-19. Finally, the examination and preparation of decisions concerning important subjects had to be continued, as any delay would have led to a blockage in the longer-term.

This was possible because the digital transformation plan, launched in 2017, was already well advanced (ASN already had resources that were essential for remote-working on a large scale). It was also because the ASN personnel demonstrated exceptional commitment and continued to carry out their duties to the best of their abilities, despite sometimes difficult remote-working conditions. Finally, this is because they form a closely-knit entity.

I wish to pay tribute to them, simply by citing two examples, because it is thanks to them that the draft generic position statement on the continued operation of the 900 Megawatts electric reactors could be submitted for consultation, on-time, and that several opinions were published regarding the National Radioactive Materials and Waste Management Plan. It is thanks to them that on-site inspections were able to resume rapidly. In total, over the year, nearly 2,600 man-days will have been spent conducting field inspections.

To my mind, this commitment and these results are the fruit of a robust common culture and a collectively shared vision of the issues, of a management method that promotes accountability, combining stringency and goodwill, and a permanent and always constructive social dialogue.

The field of activity which suffered the most from the crisis was naturally that of international relations. However, certain activities were able to continue remotely: with ASN as Chair, the WENRA association thus reached a new milestone in publishing “reference levels”, that is harmonised safety requirements for research reactors, an area not hitherto covered by its work. The WENRA also proposed a subject which was selected for the next European level topical peer review: this concerns management of fire risks, an important subject and one that concerns all nuclear facilities.

“The ASN personnel demonstrated exceptional commitment, and continued to carry out their duties to the best of their abilities, despite sometimes difficult remote-working conditions.”

The health crisis, an accelerator of change in regulation and oversight practices

The exceptional nature of the situation led ASN to experiment with new ways of carrying out its duties, some of which will be adopted permanently.

It is clear that remote-working was a shot in the arm for ASN's digital transformation, owing to the increased use of videoconferencing, digital archival and dematerialisation in general.

New remote-inspection practices in particular were put into place. While first of all seen as a stop-gap pending the implementation of health protocols, they proved their worth as a complement to on-site inspections: possibility of remote-access to certain licensee databases, as well as to the state of the reactors; possibility of examining documents by devoting more time than would be possible on-site. These new forms of inspection are not intended to take the place of a presence in the field, which remains essential for understanding the issues linked to a nuclear facility or activity, examining the condition of premises and equipment, observing the performance of work and understanding the interactions between the persons involved. They do however enable the inspectors' presence in the field to be optimised, so that they can then focus on what cannot be inspected remotely.

The health crisis, a factor in ASN strategic thinking

Even if it profoundly marked the year 2020 and will probably do the same in 2021 as well, the health crisis did not call into question the guidelines of ASN's current strategy, which are still valid and for which work is continuing: enhance the use of a graded approach; improve coordination of technical examinations, enhance the effectiveness of our actions in the field; consolidate our operation; consolidate the French and European approach through international action.

However, this crisis requires that all stakeholders, including our institution, take a fresh look at preparedness and precaution. It helps highlight the fundamental questions regarding which ASN has for several years been asking for decisions, notably in order to avoid eventual blockages in the long term: margins needed to ensure both nuclear safety and the security of the power grid; decisions to be taken for long-term safe management of radioactive waste; boosting the skills of the sector.

Consideration of ASN's future strategic Plan will begin at the end of 2021. In this regard, several questions could be examined:

- for greater efficiency in public action, the methods whereby ASN can work with the various stakeholders, to ensure that, once identified, potential blockages are correctly anticipated;

> “The future strategic Plan will make it possible to determine a vision for the regulation and oversight of nuclear safety and radiation protection that is tailored to the new challenges...”

- interaction with the other oversight players in related fields, in order to reach optimal decisions, in other words, which take account of all issues regarding the protection of persons and the environment;
- any adjustments to be made to ASN’s regulation and oversight policy, so that it can be adapted to the context and to the challenges of the coming decade;
- ASN’s inspection procedures: apart from the already mentioned example of the balance between remote inspections and field inspections performed by ASN, the role to be played by the approved organisations carrying out inspections on behalf of ASN should be mentioned;
- the steps to be taken to consolidate ASN’s independence, notably in terms of operations;
- the resources that ASN will need in the coming years to carry out its duties, in both quantitative, but above all qualitative terms. The growing complexity of the questions to be dealt with means that the need to hire experienced personnel or those with rare skills must be identified far upstream.

This work is all the more important as it will enable a healthy perspective to be gained in relation to a situation that remains dominated by the health crisis. It will make it possible to determine a vision for the regulation and oversight of nuclear safety and radiation protection that is tailored to the new challenges. As ASN marks the fifteenth anniversary of its transformation to an independent administrative Authority, it will also be an opportunity to measure how far it has come.

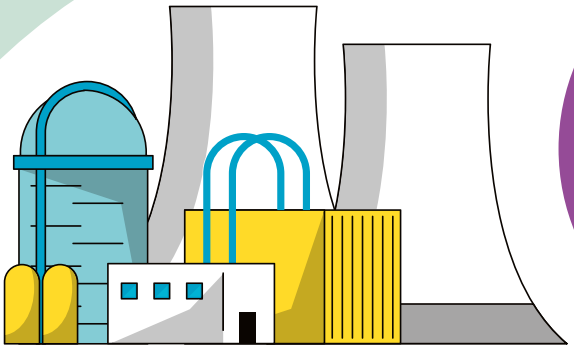
I must repeat my thanks to the ASN teams for their exceptional commitment throughout the year. I also particularly wish to thank our partners, especially the IRSN, and the members of the groups advising ASN or collaborating in its work: all have stood side by side with us in these difficult times and, without them, we would not have been able to make the progress that we did.

The health crisis is not over. The ASN teams know that much will still be expected of them in 2021, given the scale of the challenges ahead. They will do all they can to live up to the responsibilities entrusted to them and be worthy of the trust placed in them.

THE IMPACT OF COVID-19

An unprecedented stress test on the organisation of nuclear safety and radiation protection

The measures taken during the health emergency period severely affected nuclear activities. The licensees of the Basic Nuclear Installations (BNIs) activated their activity continuity plan and adapted their organisation in order to maintain the level of safety in the installations and guarantee compliance with the regulatory requirements. The medical nuclear players also had to deal with an unprecedented health situation. During this period, ASN adapted its oversight methods, notably by developing remote-inspections for certain subjects.



The licensees and activity managers demonstrated **a good level of adaptability**

Satisfactory management of the health crisis

- **Maintaining the required level of safety***
- **Implementing an activity continuity plan***

Organisational adaptability: continued preparation of the files required by ASN, by means of remote-working, efficient measures to ensure the permanent availability of qualified operating personnel on the sites.

Operational adaptability: continued performance of the priority activities considered to be essential (monitoring, safety checks), postponement or cancellation of non-essential activities, satisfactory compliance with the applicable requirements regarding nuclear safety and radiation protection, etc.

ASN was vigilant with regard to the steps taken **to ensure the nuclear safety and radiation protection of the activities**

ASN maintains links with the licensees and nuclear activity managers

- **In the medical field***

  Exchanges on organisational changes regarding patient care, in the light of the health and radiation protection constraints.

- **For the nuclear installations***

  Regular contacts with the licensees concerning the steps taken to adapt to the health context: check on the suitability of the adaptations selected.

  Postponement of deadlines for the transmission of certain documents, pursuant to the Health Emergency Act.

This crisis was an opportunity to innovate **and develop new inspection methods**

Adaptation of operation and ASN oversight methods

- **In the medical field***

  Adaptation of examination and licensing procedures in the context of the health emergency to allow the use of equipment or premises not normally covered by the licenses for the possession and utilisation of radioactive sources: scanners in nuclear medicine or radiotherapy units, radiation protected rooms or brachytherapy rooms, used to accommodate persons suffering from Covid-19.

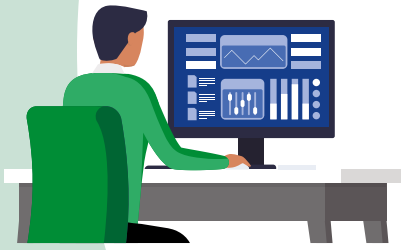
- **For the inspections carried out by ASN***

  Relaxation of the inspections programme in the medical field (check on the ability of the departments to host the inspection).

  Rapid resumption of inspections on-site as soon as adequate health measures are finalised.

  Organisation of remote-inspections instead of, and then in addition, to on-site inspections.

  Adaptation of the inspection programme to the context, so that inspections on important subjects were carried out in 2020.



** The boxes "The impact of Covid-19" can be found in the full ASN Report, 2020 edition, available on* asn.fr

ASN **ASSESSMENTS**

ASN carries out its oversight role by using the regulatory framework and individual resolutions, inspections, and if necessary, enforcement measures and penalties, in a way that is complementary and tailored to each situation, to ensure optimal control of the risks 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 year 2020 was on the whole satisfactory in terms of operating safety in the EDF NPPs. Operational rigorousness in particular made progress. The particular context created by the health crisis may have contributed to these good results. ASN does however observe that the step backwards seen in 2019 with regard to worker radiation protection was further accentuated in 2020. A strong reaction from EDF is expected on this point.

Managing the consequences of the health crisis

ASN considers that EDF correctly managed the changes to its organisations made necessary by the health measures linked to the Covid-19 pandemic.

The travel restrictions put in place by the Government in the spring of 2020 at first severely reduced EDF's ability to carry out scheduled maintenance work during the reactor refuelling outages. Faced with this situation, EDF decided to extend the expected duration of all the scheduled outages and to postpone certain others. ASN made sure that the maintenance and outage operations were pushed back by EDF in compliance with the applicable safety rules.

EDF also had to adopt measures to guarantee the safety of the installations, while complying with the health rules on the sites. Some of these changes in fact had safety benefits. This is particularly the case with the steps taken to limit contacts with the control operators, which created a calmer atmosphere in the control rooms.

EDF keeps ASN regularly informed during the health crisis, which enabled ASN to maintain precise monitoring of the situation in each NPP.

Operation

ASN observes that the vast majority of NPPs made progress in 2020 with respect to the rigorousness of monitoring in the control room and control of the installations. In most cases, this progress was accompanied by a clear reduction in the number of unauthorised excursions from the operating range and the number of failures to comply with the operating control rules. The organisational changes and activity postponements resulting from the health crisis may have been a contributory factor to this improvement.

In 2020, on the majority of NPPs, ASN did however observe an increase in the number of significant events. An analysis of their causes reveals that inappropriate documentation was used by the control team or that this documentation was incorrectly used.

In 2020, ASN observed a good level of familiarity with the control procedures in an accident situation, but again found that certain actions cannot be performed within the required times, or even cannot be carried out at all owing to the configuration of the facilities. These cases were however fewer in number than in 2018 and 2019.

The organisation put into place on the sites to manage skills, qualifications and training remained on the whole satisfactory in 2020.

As in 2019, 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 progressing. However, as in 2019, the analysis of the root causes fails to adequately call into question the organisation and still all too often leads to relatively unambitious corrective measures.

The conformity of the facilities

In 2020, ASN found that the management of deviations affecting the installations continued to improve. More specifically, EDF further improved its ability to correct deviations rapidly, even if efforts are still needed on this point.

However, as in previous years, ASN considers that the actual compliance of the facilities with the rules applicable to them needs to be significantly improved. The year 2020 was again marked by the detection of deviations affecting equipment that call into question its ability to fulfil its function in an accident situation. Some of these deviations date back to the construction of the reactors, others were created when implementing modifications to the facilities, including recently, or result from ageing or insufficient maintenance of the facilities. 2020 brought to light earthquake resistance defects on electrical power sources, back-up equipment and reactor cooling systems. EDF must continue the targeted inspection actions it has been gradually deploying over the last few years, but must also broaden their scope.

The inspections prescribed by ASN in 2019 on the electrical supply sources, in particular the emergency diesel generator sets, enabled the seismic resistance defects on 37 reactors to be detected and corrected. This event was rated level 2 on the International Nuclear and radiological Event Scale (INES) for certain reactors.

Maintenance

In general, the organisation in place in the NPPs for carrying out large-scale maintenance work was satisfactory in 2020, even in a situation made more difficult by the Covid-19 pandemic. In a context of a heavy maintenance workload, 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 high number of maintenance quality deficiencies. Over the last few years EDF has taken steps to reduce their occurrence.

However, in 2020, ASN still found areas for improvement with regard to reactor maintenance, such as the consideration of various hazards, the preparation of activities or the traceability of the work carried out. Faults in the management of the activities are also still caused by the procurement of non-conforming spare parts.

In the past, ASN regularly noted 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 2020 ASN confirms the improvement observed in 2019 in the technical oversight of contractor operations and monitoring, particularly through the use of computerised tools recently deployed in the NPPs.

Environmental protection

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 even further.

In 2020, ASN observed improved adoption by the sites of the methodical analysis of microbiological hazards and efforts made to improve the containment of hazardous liquid substances on certain sites. However, ASN considers that corrective measures are still needed with respect to pollution prevention and waste management. Despite a few occasional weaknesses, EDF has shown a good level of control over its management process for effluent discharges.

Worker radiation protection and occupational safety

ASN observes that the step backwards observed in worker radiation protection in 2019, was accentuated in 2020. The analysis of significant events in particular all too often shows inadequate perception of the radiological hazards and an inappropriate radiation protection culture. ASN considers that EDF must give radiation protection real meaning in order to unite the operators in dealing with the true issues and challenges.

In 2020, the occurrence of accidents fell significantly in EDF's NPPs. The particular context created by the health crisis may have contributed to these results. EDF has continued with implementation of improvement measures regarding the main risks for workers further to inspections by the ASN labour inspectors. However, certain hazard situations must be significantly improved. These concern the hazards linked to work equipment and more particularly to lifting gear, the explosion and fire hazard and electrical hazards.

Continued operation of the reactors

The ambitious modifications EDF plans making to the facilities and the operational methods within the framework of the reactor periodic safety reviews are significantly improving the safety of the facilities. EDF is deploying considerable engineering resources for these reviews. As in previous years, ASN observes that these engineering capacities are saturated.

ASN considers that all the provisions specified by EDF and those that it itself stipulates, open up the prospect of continued operation of the 900 Megawatts electric (MWe) of electrical power reactors for the ten years following their fourth periodic safety review. Implementation of this review on each reactor will include specific inspections and will take account of the particularities of each installation.

In 2020, EDF continued to carry out the fourth ten-yearly outages of its 900 MWe reactors, with the first of them being of a reactor on the Bugey site. As of 2021, the pace of these ten-yearly outages will accelerate, with several being performed every year. ASN will be attentive to EDF's capacity for deploying the resources needed to perform these operations in satisfactory conditions.

Individual NPP assessments

The ASN assessments of each NPP are detailed in the Regional Overview in this report.

With regard to safety, the NPPs of Saint-Alban and, to a lesser extent, Civaux and Cattenom stood out favourably in 2020. For the Cattenom NPP, the progress observed will need to be confirmed, as 2020 saw very little maintenance work carried out. ASN is maintaining the reinforced monitoring put into place on the Flamanville NPP in 2019. The Gravelines, Nogent-sur-Seine and Golfech NPPs also under-performed in 2020.

With regard to radiation protection, only the Civaux NPP stood out positively. ASN considers that several NPPs had under-performed. This is particularly the case with the NPPs of Dampierre-en-Burly and Flamanville and, to a lesser extent, those of Golfech, Chooz, Nogent-sur-Seine, Gravelines and Blayais.

With regard to environmental protection, the NPPs of Paluel, Nogent-sur-Seine, Saint-Laurent-des-Eaux, Chooz and Saint-Alban stood out positively. On the other hand, the NPPs of Belleville and Dampierre and, to a lesser extent, those of Blayais and Gravelines, had under-performed.

The Flamanville EPR reactor under construction

ASN considers that the organisation put into place to receive and store the fuel assemblies is satisfactory on the Flamanville EPR site. This led to authorisation for arrival of the fuel on the site in 2020.

The preparation for and performance of weld repairs on the main secondary systems are also taking place in good conditions. ASN will continue with its oversight of these activities in 2021 and will be vigilant to ensuring that adequate resources and organisational measures are in place for a greater volume of repairs simultaneously.

The organisation for performance of the start-up tests is satisfactory, but EDF must ensure that these tests are proven to be representative and that the results analysis is exhaustive.

However, ASN considers that EDF must significantly add to the programme of additional inspections scheduled as part of the quality review of equipment other than pressure equipment. This programme had been requested by ASN in 2018 due to serious shortcomings in EDF's monitoring of its contractors.

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, even though the progress of the decommissioning work slowed down considerably in 2020.

For the EDF facilities undergoing decommissioning from which the fuel has already been removed, nuclear safety consists in controlling the containment of the radioactive substances. With regard to the first-generation reactors (Gas-Cooled Reactor series, see chapter 13 of the full ASN Report), the vast majority of these substances are situated in the currently contained reactor vessels which are not undergoing any decommissioning operations that could put them back into suspension. EDF will thus have to manage the ageing of these facilities, while seeking to shorten the decommissioning time-frame for the reactor vessels, in order to minimise safety risks.

Progress with the decommissioning of the Chooz A and Superphénix reactors is in line with the schedules set out in their decrees. ASN however considers that the Superphénix emergency management organisation needs to be improved.

The issues that EDF has to address concern radiation protection of the workers and waste management. On these points, it has implemented measures to counteract the difficulties with managing the alpha radiation hazard, which is more particularly present in the Chooz A installation. However, the effectiveness of these action plans could not be evaluated in 2020, owing to the reduction in activity as a result of the health crisis. Furthermore, EDF is regularly confronted with the problem of asbestos in the equipment to be dismantled, causing it to suspend the work in order to establish appropriate protective measures and remove the asbestos.

In accordance with ASN's request, EDF reinforced the organisation of the Fessenheim decommissioning project and made the required additions to the installations decommissioning preparations, following its final shutdown in 2020. EDF also submitted the Fessenheim decommissioning file to the Minister in charge of nuclear matters at the end of the year. ASN observes common failings in some decommissioning or review files submitted by EDF. They do not always have the required level of detail to allow an evaluation of the safety and radiation protection consequences of the envisaged operations.

ORANO

ASN considers that the level of safety in the facilities operated by Orano remained on the whole at a satisfactory level in 2020. In the context of the health crisis, Orano maintained most of its activities, while adapting its organisation to guarantee the required level of safety.

The facilities operated by Orano are located on the sites of La Hague, Tricastin and Marcoule. They present significant implications for safety 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. These differences could be exacerbated by the restructuring of the group, carried out at the end of 2020, which split the licensee Orano Cycle into three separate companies responsible for the production of enriched uranium (Orano Chimie-Enrichissement), the reuse of materials derived from spent fuel (Orano Recyclage), and the decommissioning of nuclear facilities (Orano Démantèlement). In 2021, ASN will examine the long-term acceptability of the organisation defined by Orano, in which a part of the operational responsibility of the licensee of facilities undergoing decommissioning, such as the operation of sensitive equipment, is delegated to another entity of the group.

Managing the consequences of the health crisis

ASN considers that Orano correctly managed the changes to its organisations made necessary by the health measures linked to the Covid-19 pandemic and regularly informed ASN of the measures adopted. Orano to a large extent maintained its activities during the health emergency period, in accordance with the applicable nuclear safety and radiation protection requirements. Orano also maintained certain decommissioning activities with major safety implications.

Risk control

Orano is continuing its efforts to boost rigorousness in containing radioactive substances and is dealing satisfactorily with containment breaches that may occur in operating conditions on certain installations. Similarly, radiation protection issues are taken very seriously by Orano in its installations where they are the greatest. In 2020, Orano reported a worker contamination event, temporarily rated level 2 on the INES scale, pending the results of in-depth studies. Its analysis showed that the radiation protection instructions had been correctly followed by the licensee and it did not call into question the pertinence of its radiation protection provisions. It therefore led to research work to gain a clearer understanding of the behaviour of certain plutonium particles.

With regard to waste management, ASN observes that greater rigorousness is needed in all the Orano group's Basic Nuclear Installations (BNIs), with regard to the procedures for dropping off waste at the various collection points in the installation.

ASN observes major inadequacies regarding the fire hazard and excessively slow improvement within the BNIs of the Orano group on this subject. The licensee must improve its incident response instructions, so that they are more appropriate and operational, and carry out periodic exercises to test them. 2020 was in particular marked by a fire in a complete building on the La Hague site, regarding which the operating experience feedback would appear to have been examined in insufficient depth. On this site, ASN finds that the measures to prevent the flow and environmental dispersal of radioactive or hazardous liquid substances, including those liable to result from actions taken to combat a possible incident, must still be improved. On the Tricastin site, control of the fire hazard was the subject of enforcement measures by ASN in 2020. ASN observes that improvements have been made.

Orano demonstrated a proactive approach to its performance of the stress tests further to the Fukushima Daiichi NPP accident. Orano has completed the construction of virtually all the complementary resources resulting from these stress tests. These are resources 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. Only the emergency control post in the Melox plant is still to be completed.

Monitoring of outside contractors

In 2020, ASN observed that outside contractor monitoring practices in the BNIs of the Orano group still need to be improved. The group must continue and reinforce the efforts made on this subject, notably by improving the means of monitoring and its organisation.

Legacy waste retrieval and conditioning, decommissioning and waste management

Large quantities of legacy waste at La Hague are not stored in accordance with current requirements and present major safety risks. The retrieval and conditioning of this legacy waste determines the progress of decommissioning in the definitively shut down plants. ASN observes significant delays in the Orano legacy waste retrieval and conditioning projects. The complexity of this waste retrieval and conditioning, for shipment to approved routes, meant that Orano had to revise its retrieval and processing scenarios several times and announced significant postponement, sometimes for decades, of the deadlines to which it was committed. Thus, in 2019, ASN initiated a procedure to monitor the management of these projects, assisted by the General Directorate for Energy and Climate (DGEC). In this procedure, ASN asked Orano to make structural improvements to its organisation and to the management of these projects. In 2020, Orano presented improvements to its organisation and to its project management, which should lead to more robust management, notably by taking account of operating experience feedback and adopting a project maturity evaluation table. However, this approach needs to be taken further and supplemented in order to lead to better evaluation of the time-frame for Retrieval and Conditioning of legacy Waste (RCD) and decommissioning, so that Orano can announce firm dates that will actually be met. ASN will continue with its monitoring of the management of these projects in 2021. It will make a more complete evaluation of the progress made, by examining the integrated schedules that are to act as the basis for the revision of ASN resolution 2014-DC-0472 of 9 December 2014 concerning the binding requirements to be met by Orano concerning these retrieval operations.

ASN considers that the completion of vitrification of the legacy solutions of fission products from UP2-400 and the production of the first drums of waste from silo 130 are satisfactory. This progress means significant improvements in the safety of these ageing facilities, owing to the reduction in the source term. ASN however urges the licensee to achieve the industrial retrieval rate for the waste from silo 130, without delay.

CEA

ASN considers that the safety of the facilities operated by the Alternative Energies and Atomic Energy Commission (CEA) remains on the whole satisfactory, at a time of reduced activity. The safety issues concern on the one hand the continued operation of the facilities, designed in accordance with old safety standards, and on the other, the decommissioning of the definitively shut down facilities and the retrieval and conditioning of legacy waste, as well as the management of its radioactive waste and materials with no identified use. ASN considers that there are nonetheless weaknesses at the CEA, notably with regard to the organisation for the management of emergency situations and to safety-related projects which span several years.

Safety organisation and management

ASN considers that the CEA's organisation has been constantly changing for a number of years, with a further major modification in 2020. In the light of these changes, ASN considers that the CEA must remain attentive to ensuring that all the safety-related aspects are properly taken into account at all levels of the organisation and are led by people with the necessary resources, skills and authority. ASN is expecting the CEA to provide operating experience feedback regarding the latest organisational changes and rapidly propose a strategic vision of safety management for the coming years.

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 has no impact on compliance with other commitments, particularly those that are governed by ASN requirements.

Managing the consequences of the health crisis

The restrictions put in place by the Government in the spring of 2020 led the CEA to shut down most of its BNIs and make them safe. This interruption in operations, the restrictions placed on travel and the unavailability of certain contractors meant that, after analysis, the CEA was unable to carry out certain periodic checks and maintenance operations on schedule. Monitoring and the essential safety inspections were however maintained and the CEA conducted safety analyses in order to define the actions to be taken before resuming its activities. The CEA learned lessons from the first lockdown and in November 2020 maintained certain activities felt to be priorities by the operational divisions, along with maintenance and all inspections and periodic tests.

The CEA's regular reporting to ASN during the health crisis was satisfactory.

Installations in operation

Faced with the ageing of its facilities in operation and the uncertainty surrounding the projects to replace some of them, the CEA developed a medium/long-term strategy in 2019 concerning the utilisation of its experimental civil nuclear research facilities and its waste and material management facilities. The first conclusions show the need to streamline and optimise the existing facilities, along with significant renovation work and even the construction of new facilities. ASN considers that this prioritisation is legitimate from the safety standpoint and that the CEA must use it to identify clear action plans and precisely formalise the options it has taken (abandoning or optimising operation, work to be undertaken, etc.).

Facilities undergoing decommissioning

In 2019, ASN and the Defence Nuclear Safety Authority (ASND) underlined the in-depth and pertinent review by the CEA of its decommissioning and radioactive waste and materials management strategy, its prioritisation of operations, the human resources allocated and the efficiency of its organisation, while examining the resources devoted to these operations.

In 2020, the Authorities found that this strategy had substantially changed, with numerous postponements, scope reductions or even some projects being abandoned. Certain deadlines were pushed back by several decades, with no adequate justification, even though they concern ordinary decommissioning projects, based on sound operating experience feedback (notably the decommissioning of the research reactors). A number of responses to structural requests from ASN and ASND regarding this decommissioning strategy were sent belatedly in 2020. These responses will need to be clarified in 2021 and additional exchanges between the CEA and the Authorities will be needed in order to improve oversight of the management of decommissioning and RCD projects that are priorities in terms of safety.

With regard to control of the processing of its effluents and the management of its waste, its spent fuels and its materials, along with the corresponding transport operations, implementation of the strategy is expected within the time-frame announced by the CEA; the Authorities drew the CEA's attention to the need for particular vigilance on these points in 2019, in particular for the unique installations, the unavailability of which could weaken the process as a whole. Firm answers to the Authorities' questions regarding the financial resources allocated to these cross-cutting projects, the credibility of the performance time-frames and the progress made have yet to be received.

Radioactive waste management

The operation of radioactive waste management support facilities is satisfactory. In 2020, ASN observed improvements in the zoning, signage and tidiness of the collection areas for these wastes. The CEA must however remain vigilant as to compliance with the storage times for certain waste in its facilities. ASN also underlines the implementation of a new organisation in 2020 devoted to the management of radioactive waste which will eventually allow improved communication and greater sharing of resources, with harmonisation of practices among the CEA centres.

Finally, ASN notes that the provisions of the protocol between the National Radioactive Waste Management Agency (Andra) and the CEA regarding Andra's monitoring of the CEA waste packages liable to be disposed of in *Cigéo* are overly restrictive of Andra's scope of action and therefore fail to fully meet the provisions of ASN resolution 2017-DC-0587.

The conformity of the facilities

As in 2019, ASN observes the efforts made to improve the conformity of the facilities during the periodic safety reviews, notably an improvement in the scheduling of the compliance work designed to secure the commitments made by the CEA.

However, even if the CEA has supplied most of the additional studies for correct assessment of the conformity of its facilities, ASN notes that not all of the weaknesses identified in the safety review reports, submitted since the end of 2017, have as yet undergone compliance work. This situation is particularly noteworthy for facilities in which activities have ceased and with low potential safety implications. Even if the CEA attributes these delays to the health context in 2020, ASN observes that the postponements can be up to several years.

Management of deviations

The management of deviations within the CEA facilities is on the whole satisfactory. In 2020, the CEA continued to deploy a monitoring tool common to all the centres, and also modified its ranking of deviations, including a third level, to allow graded processing more compatible with the actual issues. 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 scheduling). ASN notes that the events are correctly dealt with in the facilities. The CEA must however modify its organisation so that the analysis of the generic nature of a significant event, carried out by the head office departments, is more robust and more operational (consultation of the CEA centres and top-down and bottom-up information). In addition, for the analysis of the organisational causes, improved traceability in the significant event reports is required. Finally, ASN underlines the quality of the experience feedback sheets produced by the head office departments for the centres and the nuclear facilities. It encourages the CEA to take measures to ensure that the actions defined in these sheets are effectively applied in the BNIs.

Change management

For many years now, the CEA has applied a change management system that is on the whole satisfactory, particularly through the quality of the files submitted to ASN when applying for authorisations for noteworthy changes. ASN also observes that the changes made in the field do effectively correspond to the information provided by the CEA in its authorisation applications.

Maintenance and the scheduling of periodic inspections and tests

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. As these operations are generally subcontracted, the CEA must remain attentive to the level of technical competence. Moreover, ASN still observes disparities between the facilities on these two subjects. In addition, the traceability of the inspections performed must be further improved. ASN also expects the CEA to implement a harmonised ageing and obsolescence management strategy for all its facilities, because, 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 the CEA personnel to specifically monitor the subcontracted activities. ASN notes the need for the CEA to reinforce the monitoring of the chain of outside contractors, particularly its contractors' subcontractors. Finally, there are still disparities in the quality of this monitoring between the facilities operated by the CEA and this needs to be remedied.

Risk control and emergency management

ASN observes significant delays in the construction of the emergency management buildings for the Cadarache, Marcoule and Saclay centres, designed to take account of the lessons learned from Fukushima Daiichi NPP accident.

The CEA's emergency organisation and resources still need to be significantly improved, in order to make up the delay 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. ASN notes that the teams in the field are engaged and motivated in the performance of emergency exercises. 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 finally considers that the CEA must continue its efforts to improve protection against the fire hazard. Management of the technical devices (fire doors and dampers, detection systems, etc.), must be improved and fire loads limited, particularly on worksites.

Personnel radiation protection

Within the various the CEA centres, radiation protection is on the whole dealt with satisfactorily. For all the centres, the identification of items and activities important to protection, management of measuring instrument ageing and the monitoring of outside contractors (handling of deviations, traceability and application of the ALARA (As Low As Reasonably Achievable) approach need to be improved.

Environmental protection

For the year 2020, control of the detrimental effects and impact of the CEA facilities on the environment is on the whole satisfactory. The action plans implemented in 2020 regarding non-conformities identified in the management of non-radioactive liquid effluents from certain facilities at Cadarache, are satisfactory. ASN does however consider that the CEA must continue with implementation of actions on several subjects associated with control of environmental impacts, in particular for its Cadarache site, such as the ageing of its industrial liquid effluents network and the compliance work need on the piezometers network.

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 currently under construction

The Jules Horowitz Reactor (RJH), 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 period and of the time required to commission the reactor, the CEA must address issues of project management, maintaining its technical skills over time and the conservation of equipment already manufactured and possibly installed, before it is commissioned. In 2020, the project governance changed, with no reduction in the resources allocated to safety.

ANDRA

Andra is the only licensee operating radioactive waste disposal BNIs in France. ASN considers that the operation of Andra's waste disposal BNIs is satisfactory. Andra is a dynamic player investing heavily in public information and in consultation.

Operation of Andra's existing facilities

ASN considers that safety and radiation protection in the facilities operated by Andra are satisfactory. In 2020, Andra's service continuity efforts during the lockdowns and its regular reporting to ASN on the conditions of operation in the facilities should be underlined. ASN considers that the measures adopted enabled a satisfactory level of monitoring to be maintained.

ASN observes that the number of significant events reported for the Aube repository (CSA) since 2018 remains at a very low level in 2020 (no significant event in 2018 and 2019, and just one in 2020). It has concerns regarding Andra's reporting of events.

ASN also considers that certain components of Andra's safety approach need to be improved, notably so that defence in depth can be better taken into account in the classification of certain elements or activities important for protection.

Organisation dedicated to the *Cigéo* project creation authorisation file

In 2020, ASN observes a further postponement in the announced date for the submission of the creation authorisation application for the *Cigéo* deep geological disposal project. It considers that the calendar must be stabilised, in order to identify the consequences of any postponement in the commissioning of *Cigéo* on the entire management route.

The technical exchanges between ASN and Andra continued in 2020 on the subject of the work identified during examination of the safety options file prior to the creation authorisation application.

ASN considers that the consultation regarding *Cigéo* is primarily the responsibility of the project manager. It observes that Andra is exemplary on this point, having brought in the National Public Debates Commission, which appointed guarantors for this process, and regularly informing ASN.

ASN considers that the principle of incremental development envisaged by Andra for the *Cigéo* repository needs to be clarified, in particular by identifying any nuclear safety justification data that would be provided after the creation authorisation application.

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

2020 was marked by the Covid-19 pandemic, which considerably disrupted the health care system and required that the health care facilities adapt their patient care procedures to ensure compatibility with the two-fold radiation protection and health constraints. ASN therefore adapted its oversight procedures, by opting for remote-inspections whenever necessary. ASN considers that on the basis of the inspections carried out in 2020, the state of radiation protection in the medical sector is comparable to that of 2019. However, the significant radiation protection events reported are a reminder of the need for regular evaluation of practices and reinforcement of the radiation protection culture.

In radiotherapy, the inspections confirm that the safety fundamentals are in place (equipment verifications, medical staff training, quality and risk management policy) and that quality assurance initiatives are progressing satisfactorily. However, the risk analyses are not updated sufficiently to take account of organisational or technical changes. The occurrence of events, such as laterality or fractionation errors, which sometimes have serious health consequences, shows that there are still organisational deficiencies. The inspections carried out in 2020 did however reveal that the radiation protection conditions had significantly improved in the centres which had received formal notice from ASN or which had undergone reinforced monitoring over the course of the previous years.

In brachytherapy, occupational radiation protection and the management of high-level sealed sources are considered satisfactory on the whole, but this level must nevertheless be maintained through a continuous training effort. Increased attention must be given to the security of access to these sources.

In nuclear medicine, the radiation protection of patients and medical staff in the nuclear medicine units inspected is satisfactory. Progress is however still required in terms of optimisation of practices and the efforts made in occupational training in worker radiation protection must be maintained. The events reported underline the fact that the radiopharmaceuticals administration process must be regularly evaluated, to ensure that it is correctly managed, in particular for therapeutic procedures.

In the area of fluoroscopy-guided interventional practices, and as in previous years, ASN finds that the measures taken are still insufficient to improve the radiation protection of patients and professionals, more particularly for surgical procedures performed in operating theatres. Events are still being reported to ASN with the dose limits for the extremities of interventional practitioners being exceeded. 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. Considerable work is still needed to raise the awareness among all professionals if a radiation protection culture is to be developed among medical and paramedical professionals, notably those working in the operating theatres. Continuous training of professionals, practitioners in particular, and the intervention by the medical physicist to optimise the radiation protection aspect of the procedures, are the two key areas for managing the doses delivered to the patients during interventional procedures.

In computed tomography, diagnostic examinations contribute very substantially to the collective dose received by the public, as medical imaging is the leading source of artificial exposure of the public to ionising radiation. The medical justification remains insufficiently traceable. During its inspections, ASN observes a lack of traceability of this justification and difficulties encountered by the professionals in implementing it. The lack of training on the part of the requesting physicians, or of use of the *Guide to good medical examination practices*, and the lack of justification protocols for the most common procedures, partly explain why this justification principle is not always followed. In addition, the lack of availability of other diagnostic procedures (MRI, ultrasonography) and of health professionals, limits the extent to which irradiating procedures can be replaced by non-irradiating procedures.

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 signage of the operations area during on-site work, even if a slight improvement on this point is observed by comparison with 2019. ASN also recalls the need for regular maintenance and periodic checks on the correct working of the safety systems integrated into the bunkers, so that they represent an effective line of defence against unintentional exposure. More generally, ASN considers that the ordering parties should give priority to industrial radiography services in bunkers and not on the worksite.

In the other priority sectors for ASN oversight in the industrial sector (industrial irradiators, particle accelerators including cyclotrons, suppliers of radioactive sources and devices containing them) the state of radiation protection is considered to be on the whole satisfactory. With regard to suppliers, ASN considers that advance 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.

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, more particularly the setting up of pre-disposal inspection procedures; nevertheless, progress is still needed on this point, particularly with a view to the retrieval 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, notably as a result of insufficient

traceability of the radioactive sources being held, are still not systematic enough, even if progress is being observed.

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 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 2020, the safety of transport of radioactive substances is on the whole satisfactory. Although a few transport operations –mainly by road– did suffer incidents, these must be put into perspective with the 770,000 transport operations carried out each year. They did not lead to any dispersal of radioactive substances into the environment. In 2020, ASN observed significant exposure, beyond the regulation dose limits, of three drivers carrying radiopharmaceutical products.

The number of significant events relating to the transport of radioactive substances on the public highway (75 events reported to ASN in 2020) is slightly down on the 2019 figures, even if the number of events rated level 1 on the INES scale remains stable. The events mainly comprise:

- material non-conformities affecting a package or its stowage on the conveyance. 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);
- conveyance placarding faults or deficiencies in the transport documents;
- 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 package model approval certificates and the corresponding safety files. This more specifically concerns transports relating to research facilities or the removal of legacy radioactive waste.

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 packaging, 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 familiarity with 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. This is moreover illustrated by the three cases in which the individual exposure limit for workers was exceeded. An inspection carried out at the end of 2020 at one of the main forwarding agents (the Isovital company) used by the manufacturers of radiopharmaceutical products, also sometimes as a carrier, brought to light a number of deficiencies in the performance of its activities.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NOTABLE EVENTS 2020

Conditions for the continued operation of the 900 MWe reactors

ASN has completed its examination of the generic phase of the 4th periodic safety review of the 900 Megawatts electric (MWe) reactors. ASN considers that all the provisions specified by EDF and those that it itself requires, open up the prospect of continued operation of the 900 MWe reactors for the ten years following their 4th periodic safety review.

Tricastin Nuclear Power Plant (NPP)

In France, the authorisation to create a nuclear facility is issued by the Government, after consulting ASN. This authorisation is issued without time limit. An in-depth examination, called the "periodic safety review", is performed every 10 years to evaluate the conditions for the continued operation of the installation for the next 10 years.

EDF's 32 reactors of 900 MWe are the oldest reactors in operation in France. Their 4th periodic safety review is of particular significance, because their design postulated an operating lifetime of 40 years. Their continued operation beyond this period requires the updating of design studies and equipment replacements.

ASN underlines the ambitious objectives of the 4th periodic safety review of the 900 MWe reactors and the substantial work carried out by EDF in the generic phase. It also underlines the scale of the modifications planned by EDF, the implementation of which will bring about significant safety improvements.

The periodic safety review determined a roadmap for the specified safety improvements

These improvements more particularly concern **control of the risks associated with hazards (fire, explosion, flooding, earthquake, etc.), the safety of the spent fuel storage pool and the management of core meltdown accidents.**

In its resolution 2021-DC-0706 of 23 February 2021, ASN required the implementation of the major safety improvements planned by EDF, along with additional measures it considers necessary to achieve the objectives of the periodic safety review. This resolution closes the "generic" phase of the periodic safety review, which concerns the studies and modifications of the installations common to all the 900 MWe reactors, as they are all based on a similar design.

The measures planned at the generic stage of the periodic safety review and those that will be defined in the studies specific to each site, will have to be applied on each reactor with a view to its continued operation. ASN asks EDF to carry out the majority of the safety improvements before submitting the periodic safety review concluding report, and in practice during the 10-yearly outage of each reactor. The other improvements shall be carried out within a maximum of 5 years after submitting this report. This time is increased to 6 years for the first reactors, that is: Tricastin 1 and 2, Bugey 2, 4 and 5, Gravelines 1 and Dampierre 1.

This phased approach is linked to the scale of the works on each reactor, which will moreover be carried out concurrently on several 900 MWe reactors. It takes account of the ability of industry to conduct the works with the required standard of quality and the associated operator training necessary so that they can familiarise themselves with these changes.

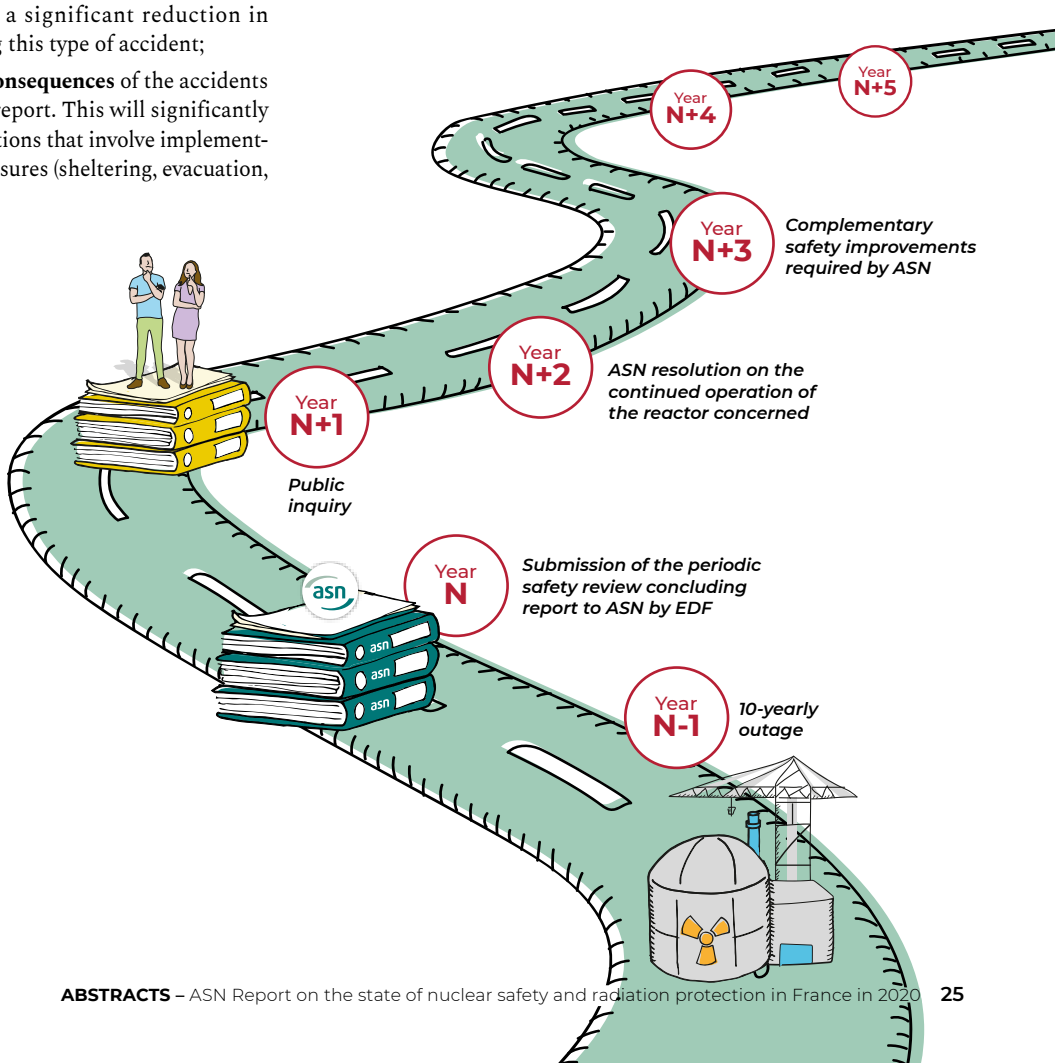
ASN underlines the ambitious objectives of the 4th periodic safety review of the 900 MWe reactors and the substantial work carried out by EDF during the generic phase

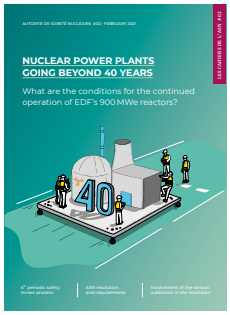
ASN asked EDF to report annually on the actions implemented to meet the requirements and their deadlines, and also on the industrial capacity of both itself and its suppliers to complete the modifications to the facilities on schedule. ASN asks that this information be made public.

ASN considers that the measures planned by EDF, supplemented by the replies to the requirements formulated by ASN, will make it possible to achieve the periodic safety review objectives and bring the level of safety of the 900 MWe reactors close to that of the most recent reactors (third generation), in particular:

- **by checking, across a broad perimeter, the conformity of the reactors with the safety rules** that apply to them;
- **by improving the way potential hazards** (earthquake, flooding, explosion, fire, etc.) are taken into account. The reactors will also be able to cope with more severe hazards than those hitherto considered;
- **by reducing the risk of accident with core melt** and mitigating any consequences of this type of accident. These provisions will thus lead to a significant reduction in environmental releases during this type of accident;
- **by limiting the radiological consequences** of the accidents studied in the safety analysis report. This will significantly reduce the occurrence of situations that involve implementing population protection measures (sheltering, evacuation, taking iodine tablets);
- **by improving the provisions for managing accident situations affecting spent fuel pools.**

The public was involved throughout the generic phase of this review. More specifically, the measures set out by EDF underwent consultation from September 2018 to March 2019, under the aegis of the High Committee for Transparency and Information on Nuclear Safety. ASN also posted its draft resolution on its website for public consultation between 3 December 2020 and 22 January 2021. Subsequent to this consultation, it modified or clarified certain provisions of its resolution. This is the case, for example, with certain studies required by ASN, for which the completion deadlines have been brought forward. ASN has also pushed back some deadlines on account of specific industrial and operating constraints when this was acceptable from the safety standpoint. ASN also explained its position regarding the deployment schedule for the modifications resulting from the periodic safety review and its requirements with regard to deviations detected during the 10-yearly outage.





Read online *Le cahier de l'ASN #02* on french-nuclear-safety.fr

Safety improvements made to nuclear facilities in France

Read online *Le cahier de l'ASN #03* on *french-nuclear-safety.fr*

The Fukushima Daiichi NPP accident highlighted the need to reinforce the resilience of nuclear facilities and organisations in the face of extreme situations. Extensive work was started at the national, European and international levels to learn the relevant lessons. Ten years later, how has the safety of nuclear facilities in France improved?

Stress tests

This French approach was part of two framework: on the one hand, at the request of the French Prime Minister (referral to ASN of 23 March 2011), the performance of a nuclear safety audit of the French civil nuclear facilities in the light of what happened in Fukushima Daiichi; on the other, at the request of the European Council (meeting of 24 and 25 March 2011), the performance of stress tests (*see chapters 10, 11, 12 and 13 of the full ASN Report*).

To ensure that the European and French frameworks were consistent, **the French specifications for the stress tests (ECS) were drawn up on the basis of the European specifications**, drafted by Western European Nuclear Regulators' Association (WENRA). One particularity of the French approach however was that it concerned all facilities and not simply nuclear power reactors.

The approach consisted in **evaluating the margins available in the facilities in situations beyond those considered in the safety studies**. To do this, scenarios resulting from extreme natural hazards (flooding, earthquake), or the total loss of systems important for safety, such as electrical power supply or cooling systems, were studied. The approach also covered the management of severe accidents that could result from these scenarios.

Examination of these evaluations led **ASN, as of 2012, to set binding requirements for the licensees of the nuclear facilities with the highest potential safety implications** (CEA, EDF, Orano) in order to:

- **define a "hardened safety core"** of material and organisational measures aimed at preventing a severe accident or limiting its spread, mitigating large-scale radioactive releases and enabling the licensee to perform its extreme crisis management duties;
- **implement a range of corrective actions or improvements** (notably additional water make-up and electricity supply means, additional instrumentation, improved management of emergency situations, etc.) and, for EDF, a Nuclear Rapid Intervention Force (*Force d'Action Rapide Nucléaire* – FARN), enabling outside resources to be brought to a damaged NPP;
- **study additional modifications and resources** to deal with extreme situations (*see chapters 10, 11, 12 and 13 of the full ASN Report*).

ASN then made additional demands to clarify certain provisions regarding the "hardened safety core".

ASN's demands are part of a continuous process to improve safety and aim to be able to cope with situations far beyond those considered in the safety studies. This Defence in Depth approach stands out on the international stage in the scope and scale of the resulting modifications.

For 22 lower priority facilities operated by CEA, EDF, CIS bio international and the International Thermonuclear Experimental Reactor (ITER), the evaluations were submitted in September 2012 and have been examined.

Finally, for the thirty or so facilities with lesser potential safety implications[1], a schedule for submission of the stress test reports during the periodic safety reviews was deployed until 2020.

*1. Operated by French radioactive waste management agency (*Agence nationale pour la gestion des déchets radioactifs *– Andra), EDF, Ganil, Ionisos and Steris.*

Large-scale works, phased over a period of time

The improvement approach was regulated by binding ASN requirements and phased over a period of time owing to its scope and scale:

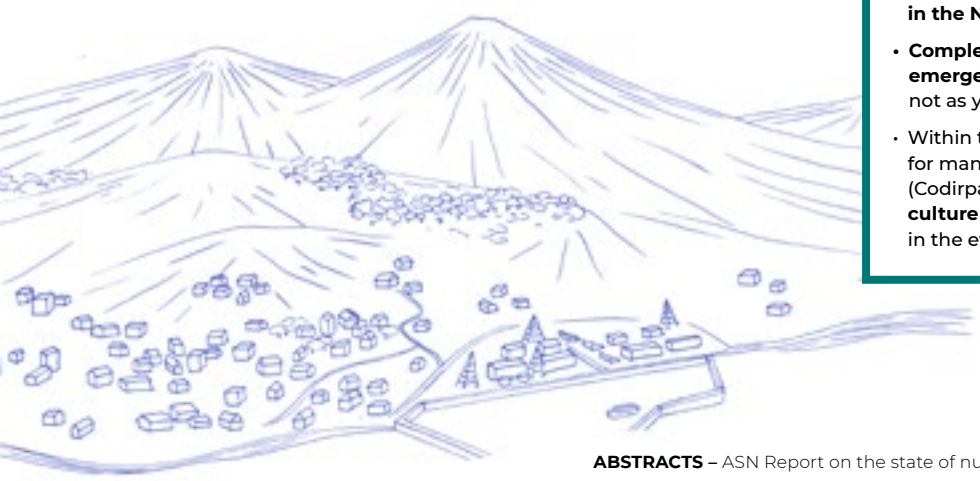
- first of all, **rapid reinforcement using mobile resources** (pumps, electricity generating sets, means of communication);
- then, **over the past ten years, the gradual deployment of additional mobile or fixed resources** to ensure water make-up, electrical power supplies and enable management of a crisis;
- finally, for the Basic Nuclear Installations (BNIs) on which the potential safety implications so warrant, the **gradual installation of a "hardened safety core" which is an additional line of defence** designed to prevent and mitigate large-scale releases in an extreme situation, as well as lasting effects in the environment.

Improvements already effective **today**

- **Deployment of mobile and then, gradually, fixed resources,** to guarantee resilient management of a situation in which electrical power or cooling systems are lost.
- **Reinforced emergency organisation** at the licensees; reinforcement of the existing emergency centres or the creation of bunkerised emergency centres.
- **Reduction in the quantities of radioactive substances in a number of laboratories and former plants:** rationalisation of storage of waste and materials, shutdown of old facilities, such as Comurhex.
- **Changes in French doctrine for managing the consequences of a nuclear accident,** more particularly by simplifying the response through actions that are more appropriate and more easily understood by the population.

Tomorrow, even more robust installations and organisations

- Within the framework of the periodic safety reviews, **continue to deploy the "hardened safety core" in the NPPs.**
- **Complete the construction of new bunkerised emergency rooms** for those installations not as yet equipped (EDF, CEA).
- Within the framework of the Steering Committee for management of the post-accident phase (Codirpa) **continue to work on the precautionary culture and the population protection measures** in the event of an accident.



Protecting and assisting the population following a nuclear accident

The Steering Committee for management of the post-accident phase (Codirpa) is a pluralistic group headed by ASN, the role of which is to propose changes to the Government concerning the national strategy for protection of the population and reconstruction following a nuclear accident. This Committee was created in 2005 at the request of the Prime Minister, who specified its mandate, and consists of experts and representatives of Government departments and civil society. Its work is made public on the ASN website.

Improving protection of the population by learning the lessons from the accident at the Fukushima Daiichi NPP

Between 2014 and 2019, the Codirpa proposed changes to post-accident doctrine to take account of the lessons learned from the accident that struck the Fukushima Daiichi NPP in Japan. These proposals, accepted by the Prime Minister in June 2020, will be implemented in the next update of the Major nuclear or radiological accident national response plan.

The principal recommendation consists in simplifying the post-accident zoning which underpins the population protection measures:

- **To protect the population from the external exposure risk**[1], a population evacuation perimeter (uninhabitable zone) would be put into place. The consumption and sale of foodstuffs produced in this zone would be prohibited.
- **To limit exposure of the population to the risk of contamination through consumption**, a non-consumption perimeter for fresh local produce[2] would be defined. First of all, this perimeter will be defined on the basis of the largest of the population protection perimeters (sheltering, ingestion of iodine, etc.) determined during the emergency phase.
- **With regard to the marketing of local agricultural produce**, a regional approach per production sector would be adopted. Checks prior to marketing will be adopted, to guarantee compliance with the maximum permitted levels[3] of radioactive contamination defined at European level for the sale of foodstuffs.

This zoning approach would be accompanied by protective measures adopted in the national plan (decontamination, etc.) taking account of the scale of the accident, the result of measurements and the perception of the situation by the population.

1. *External exposure corresponds to the exposure resulting from radioactive sources situated outside the organism.*
2. *Produce from gardens or from open-air market gardens and fruit orchards, as well as products taken from the natural environment (such as mushrooms, berries and wild game) and the marine environment (shellfish, notably in seashore fishing zones).*
3. *Council regulation (Euratom) 2016/52 of 15 January 2016 setting the maximum permitted levels for radioactive contamination for foodstuffs and animal feedstuffs after a nuclear accident or in any other radiological emergency situation.*

Between 2014 and 2019, the Codirpa proposed changes to post-accident doctrine to take account of the lessons learned from the Fukushima Daiichi disaster

Targeted support for the various categories of post-accident management players

To meet the demand for support from the local players, the Codirpa proposed various solutions:

- a website (in french only) 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 of use for preparing or managing life in a region contaminated by a nuclear accident;
- **a practical guide** intended for the inhabitants of a region contaminated by a nuclear accident;
- **frequently asked questions/answers** drawn up with and for health professionals (publication in 2021).

This information work will be continued on a long-term basis.

Download the practical guide (in french only) on *asn.fr*

The challenges for the coming period

The Prime Minister's mandate of 18 June 2020 sets the objectives for Codirpa for the period 2020-2024, with the following main priorities:

- **management of the consequences of an accident occurring in a facility other than an NPP** ("fuel cycle" plants, waste storage site, transport accident, etc.);
- **the impact of a radioactive release in the aquatic environment;**
- **the contamination mitigation and waste management strategy;**
- **the role of the local stakeholders** in developing a safety and radiation protection culture around nuclear sites.

Codirpa

A pluralistic structure

About a hundred participants in the Codirpa plenary meetings, since 2013:

- **33** persons from the administration
- **19** experts
- **17** persons representing the licensees
- **16** persons from associations
- **4** international representatives

From 29 October 2014 to 29 October 2019:

- **10** plenary meetings
- **61** meetings
- **7** working groups and 4 sub-groups:
  - **Waste**
  - **Long-term releases**
  - **Water**
  - **Involvement of stakeholders**
    - Health local group
    - Health experts group
    - Population guide
    - Website
  - **Overhaul of doctrine**
  - **Codirpa orientation**
  - **Food**

Bugey GCR reactor

Gas-Cooled Reactor decommissioning strategy

EDF's first-generation nuclear reactors are Gas-Cooled Reactors (CGRs), which operate using natural uranium as a fuel. This operation differs from that of Pressurised Water Reactors – PWR (*see chapter 10 of the full ASN Report*), which form the entirety of the current French NPP fleet and operate with enriched uranium.

The first GCR reactor was commissioned at Chinon in 1963. A total of six reactors of this type were built in France: at Chinon (Chinon A1, A2 and A3), Saint-Laurent-des-Eaux (Saint-Laurent A1 and A2) and Bugey (Bugey 1). These reactors were shut down between 1973 and 1994, as this technology was replaced by the PWR. The fuel, which represented virtually the entire safety risk in these installations, has been removed. **However, some of these installations were only partially decommissioned before being placed under surveillance**, pending final dismantling. The pertinence of immediate dismantling of nuclear installations was in fact only recognised by all players in the early 2000s. Since then, this notion became law in 2015, with the Environment Code now requiring "dismantling as rapidly as possible".

A change in decommissioning strategy

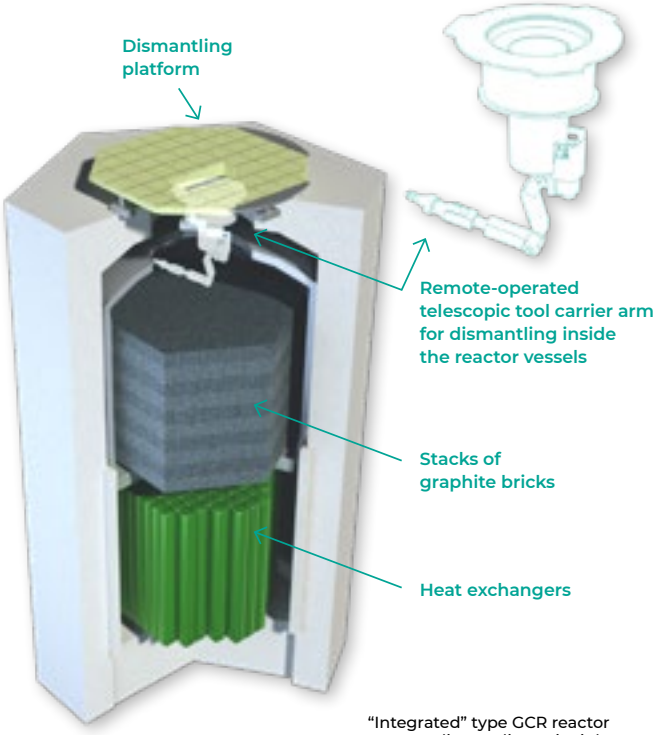
EDF has not as yet provided any demonstrations such as to permit authorisation of the next stages in the decommissioning of the Chinon A1 and A2 reactors. The other four GCR reactors (Bugey 1, Chinon A3, Saint-Laurent A1 and A2) have received decommissioning authorisation, in accordance with a scenario set out by EDF in the early 2000s. **This scenario was to fill the reactor core (or vessel) with water in order to perform the decommissioning operations**, to reduce the ionising radiation risks. EDF initially planned to complete decommissioning of these reactors in 2024, 2027 and 2031 respectively.

ASN duly notes the difficulties encountered with continued dismantling “under water” and [....] it will study the safety of the “in air” operations planned and the corresponding deadlines

Given the major technical difficulties (tightness of the reactor vessel and treatment of the contaminated water), but also technological progress which has identified other solutions, remote-operation in particular, EDF in 2016 announced that the “**under water**” **dismantling scenario was no longer the reference solution**, resulting in a change in strategy. EDF thus opted for an “**in air**” **dismantling scenario, eliminating the problems linked to the use of water**. This change also entailed a significant postponement in the dismantling operations on these reactor vessels. EDF felt that the feasibility of certain complex operations (such as cutting very thick concrete or the use of tools attached to an articulated arm required to descend to a depth of 20 metres) needed to be validated with an industrial demonstrator, followed by complete dismantling of one reactor vessel before beginning dismantling of the other five vessels. Given the results of the studies conducted, EDF has also significantly increased the time needed to decommission a reactor.

ASN duly notes the difficulties encountered with continued dismantling “under water” and, via the decommissioning files for the GCR reactors, it will study the safety of the “in air” operations planned and the corresponding deadlines. After examining a number of substantiation files, holding a hearing of EDF and carrying out inspections on the subject, ASN considers that the production of an industrial demonstrator for this new dismantling technique is relevant, notably in order to qualify the tools for use in harsh conditions. However, ASN considers that waiting for the end of decommissioning of a first reactor vessel and analysis of the lessons learned – which would not happen until about 2060-2070 – before starting to decommission the other reactor vessels, is not acceptable with regard to the obligation of dismantling within the shortest possible time-frame.

After consultation of the public, the ASN resolutions of March 2020 ordered EDF to submit a file requesting changes to the existing decommissioning decrees for the Bugey 1, Saint-Laurent A1 and A2 and Chinon A3 reactors and to submit the decommissioning files for those reactors which did not already have one (Chinon A1 and Chinon A2), no later than the end of 2022. ASN also stated that EDF must in particular shorten the decommissioning time-frame set out in its 2016 strategy, in order to meet the legislative obligation for dismantling in as short a time as possible for each reactor.



“Integrated” type GCR reactor dismantling principle

ASN also instructed EDF to submit a report on the activities of the industrial demonstrator, the construction of which began in the fourth quarter of 2020. ASN also instructed EDF to carry out decommissioning of the rooms and equipment situated around the vessel, which has already been authorised and remains unchanged. Only the reactor vessel decommissioning operations have been revised and prove to be more complex than initially envisaged. The other decommissioning operations shall therefore be carried out as soon as possible. EDF shall regularly inform ASN of the progress of its studies and work.

Finally, in order to make the reactor decommissioning schedule more reliable, **ASN asked EDF to choose robust waste management routes which could**, if necessary, lead to the creation of new waste storage facilities.

The main guidelines of the fifth Plan

Planning Act 2006-739 of 28 June 2006 on the sustainable management of radioactive materials and waste stipulated the periodic drafting of a National Radioactive Materials and Waste Management Plan (*Plan national de gestion des matières et déchets radioactifs* – PNGMDR). In concrete terms, the PNGMDR gives a detailed inventory of radioactive materials and waste management routes, whether operational or to be deployed, and then makes recommendations or sets targets to develop these routes.

CEA's Cedra facility in Cadarache

The production of the 5th edition of the PNGMDR was, for the first time, preceded by a public debate, organised by the National Public Debates Commission (CNDP). The debate was held between April and September 2019 under the aegis of a special public debates commission (CPDP) and enabled the public to express their opinions on the main topics related to the management of radioactive materials and waste. In November 2019, the CNDP and the CPDP published their conclusions following this debate.

On 21 February 2020, the Ministry in charge of energy and ASN published their decision as a result of the public debate. This decision specifies the main outlines of this 5th edition for each management route. It more specifically makes provision for a process including greater involvement by the stakeholders in the production of the subsequent editions.

In the light of the conclusions of the public debate, **ASN, together with the Ministry for Ecological Transition (MTE), decided to no longer be co-owner of the next PNGMDR**. The Government will henceforth be the sole signatory to the Plan.

ASN nonetheless continues to be involved and, jointly with the MTE, co-chairs the PNGMDR working group. This pluralistic group meets several times a year to monitor the implementation of the plan.

ASN analysed the studies specified in the Order of 23 February 2017, for the purposes of the 2016-2018 edition of the PNGMDR, and in 2020 and 2021, it issued **six opinions for each of the main management routes. A seventh opinion should be published in the second third of 2021**.

Classification of radioactive wastes and corresponding management routes

CATEGORY	VERY SHORT LIVED WASTE	SHORT LIVED WASTE	LONG LIVED WASTE
Very Low Level (VLL)	VSL Management by radioactive decay	VLL Surface disposal (Industrial centre for collection, storage and disposal)	
Low Level (LL)		LL/ILW-SL Surface disposal (Aube and Manche waste repositories)	LL-SL Near-surface disposal being studied
Intermediate Level (IL)			ILW-LL *Cigéo* geological disposal project
High Level (HL)	Not applicable		HL *Cigéo* geological disposal project

These opinions, which can be consulted on *asn.fr*, is ASN's contribution to the production of the next edition of the PNGMDR, emphasising the main nuclear safety and radiation protection issues. They more particularly draw the Government's attention to the following.

First of all, ASN stresses the importance of planning ahead when defining the management options for radioactive materials and waste, so that **concrete prospects for safe and lasting management of all types of waste for the 2035/2040 time-frame can be defined**.

More specifically:

- the need for the **nuclear licensees to use all necessary means for retrieval and conditioning of legacy** intermediate and high level waste, giving priority to safety aspects;
- the need for the **producers to implement an ambitious programme to characterise bituminous waste packages**, which is essential in order to develop the demonstration that some or all of the bituminous waste packages could be disposed of in the *Cigéo* facility without prior processing and with a high level of safety;
- the lack of credibility in the prospects for transmutation on an industrial scale of the waste already conditioned in the *Cigéo* reference inventory. If studies were to continue on the subject, **they should cover the radioactive substances currently categorised as materials, or the waste produced by a future fleet of reactors**;
- the need to **plan ahead for storage needs. More specifically, the construction of additional spent fuel storage capacity** is a strategic issue for the overall safety of the nuclear installations. As EDF chose the option of a centralised EDF fuel storage pool, ASN considers that it must submit a creation authorisation application as soon as possible;
- the fact that the recoverable nature of the material must be assessed, taking account of the time-frames within which industrial solutions for using these materials will be available, and the volume of material concerned. ASN considers that it is essential that **a substantial quantity of depleted uranium be requalified as waste, as of now**;
- the need for the next multi-year energy plan to **define reprocessing prospects beyond 2040**.

ASN also highlights the need to **involve all the stakeholders concerned**, notably the representatives of the regions involved or liable to be involved, via multicriteria and multi-player analyses, in particular for the choice of management of very low level waste, low level/long-lived waste, legacy waste locations for radioactive waste, mining processing residues and uranium mine waste rock.

Finally, ASN recalls that the management of very low level waste should in principle be based on the origin of the waste and guarantee its traceability, by means of specific routes. However, the recovery of certain types of waste, which will be produced in large volumes, is encouraged. ASN notably recommends the creation of a specific oversight framework for continuation of the metals recycling facility project.

In 2021, the MTE will oversee the drafting of this 5th Plan, it environmental assessment and the public consultation. **ASN will then issue an opinion on the draft regulatory produced by the MTE**.

The Plan will then be made public and transmitted to the Parliamentary Office for the Evaluation of Scientific and Technical Choices for its opinion.

MINISTÈRE DE LA TRANSITION ÉCOLOGIQUE
Liberté Égalité Fraternité

For the production of the 5th edition of this Plan, the Ministry for Ecological Transition (MTE) chose to rely on an orientations commission, chaired by an independent qualified person, and consisting of radioactive waste producers, licensees of management facilities for this waste, environmental protection associations and national elected officials and representatives from the local authorities. It issues opinions on each topic debated, which will be taken into account in the drafting of the next plan.

REGULATORY NEWS

The health situation meant that 2020 was marked by particular activity in terms of standards.

In addition, a number of ASN orders and resolutions resulting from Decrees transposing Council Directive 2013/59/Euratom of 5 December 2013 laying down Basic Standards for health protection against the dangers arising from exposure to ionising radiation were published in 2020.

NATIONAL NEWS

1.1 Acts and Ordinances

Act 2020-1525 of 7 December 2020 *accelerating and simplifying public actions*, known as the "*ASAP Act*", was published in the *Official Journal of the French Republic (JORF)* on 8 December 2020.

The main objectives of the ASAP Act are to eliminate administrative commissions (Articles 1 to 24), to decentralise individual administrative decisions (Articles 25 to 33), to simplify procedures applicable to companies (Articles 34 to 66), various simplification measures (Articles 67 to 139) and to eliminate "over-transposition" of certain European Directives into French law (Articles 140 to 149).

Three provisions in particular are of direct interest to ASN:

- the first concerns the frequency of the updating of the National Radioactive Materials and Waste Management Plan (PNGMDR) which goes from 3 to 5 years;
- the second concerns maintaining the National review board for financing the cost of decommissioning of Basic Nuclear Installations (BNIs) and the management of Spent Fuels and Radioactive Waste (CNEF). In carrying out its role of evaluating the adequacy of the provisions made for the cost of decommissioning BNIs, the CNEF will be able to consult the Prudential Supervision and Resolution Authority (ACPR);
- finally, the third allows improved "dissemination of the information transmitted to the Departmental Council for the Environment and for Health and Technological Risks (CODERST)": the documents transmitted to the members of this body for the matters it is examining will be made public. With regard to nuclear subjects, this obligation will apply when, at the request of ASN, the Prefect refers draft requirements to the CODERST concerning water intake and effluent discharges for a BNI or when ASN informs the CODERST of a project concerning unnecessary equipment within the perimeter of a BNI.

Moreover, the ASAP Act modifies numerous provisions concerning Installations Classified for Protection of the Environment (ICPE). They will apply to the unnecessary ICPEs located within the perimeter of a BNI:

- Article 34 modifies the conditions for the application of new rules and binding requirements for ICPE projects being examined;
- Article 44 modifies the conditions for public consultation regarding certain projects with an environmental impact;
- Article 56 enables the Prefect to authorise certain construction work to be carried out in advance, before the environmental authorisation is issued.

Articles 34, 44 and 56 of the ASAP Act were referred to the Constitutional Council and declared to be in compliance with the Constitution (Constitutional Council decision 2020-807-DC of 3 December 2020).

Act 2020-1672 of 24 December 2020, concerning the European Prosecutor's Office, environmental justice and specialised criminal justice, published in the *JORF* on 26 December 2020.

This Act, which deals with the creation of the "European Prosecutor's Office" (Part I), the role of which will be to investigate and prosecute fraud concerning the budget of the European Union and other offences harming the financial interests of the European Union, also comprises provisions concerning specialised criminal justice (Part II), aiming in particular to improve the fight against environmental delinquency. Regional centres specialising in environmental damage are thus created (in addition to the two national Public Health centres in Marseille and Paris which already exist), for graded treatment of environmental offences. They will be based in each Court of Appeal and will have civil and criminal competence. It also creates a judicial convention of public interest (known as the "Environmental Convention"), a new judicial means of implementing environmental compensation or reparation mechanisms in cases with major financial implications brought against legal persons, to ensure a rapid judicial response.

Ordinances dealing with the health state of emergency

The health crisis led the Government to adopt exceptional measures. ASN adapted its working methods to take account of these measures, revising its inspection programme as part of its oversight duty, but also by implementing measures concerning the management of due dates, deadlines and administrative procedures during the health emergency period, as set out in successive ordinances on procedural deadlines (see Ordinance 2020-306 of 25 March 2020 *relative to the extension of expired dates during the health emergency period and the adaptation of procedures during this same period*, modified by Ordinance 2020-427 of

15 April 2020 *containing various provisions concerning deadlines to deal with the Covid-19 epidemic* and Ordinance 2020-560 of 13 May 2020 *setting the deadlines applicable to various procedures during the health emergency period*).

The purpose of the provisions of these Ordinances was to guarantee the continuity of the administration's actions, while ensuring the regularity of the procedures and protection of the public.

Ordinance 2020-306 of 25 March 2020 comprised a Part I devoted to the general provisions concerning the extension of deadlines and a Part II devoted to administrative deadlines and procedures.

Article 1 of the Ordinance determined the "legal protection period", that is the period considered when determining whether or not a deadline fell within the scope of the Ordinance.

The other provisions of the Ordinance set the nature of the deadlines concerned and the way in which their calculation was affected.

This "legal protection period" began on 12 March 2020 and ended on 23 June 2020, at midnight.

The Ordinance, published on 26 March 2020, was therefore retroactive, because it applied to current deadlines or those which expired on 12 March 2020.

The Ordinance first of all made provision for postponement of the deadline for certain procedures or formalities. Thus the due dates by which procedures or formalities, etc., had to be completed, which should have been between 12 March and 23 June 2020, were extended as of the end of this period for the legally allowed duration, within a maximum of two months.

The Ordinance did not therefore cancel the performance of a procedure or formality due within the legal protection period, but simply meant that the procedure performed within the additional time allocated was not considered to be late.

For example, an application for renewal of an authorisations or submission of a review report, which should have taken place between 12 March and 23 June 2020, was to be completed no later than 23 August 2020 in order to be considered as having been done on-time.

The Ordinance also stipulated that the authorisations and approvals in force, which would expire between 12 March and 23 June 2020, were extended until 23 August 2020, unless terminated or modified beforehand by ASN.

For example, the authorisations issued pursuant to the Public Health Code, which expired during this period, were thus automatically extended until 23 August 2020.

The Ordinance then comprised provisions which suspended or postponed certain procedural deadlines. This suspension of deadlines did not however suspend examination of the applications themselves, nor ASN's ability to issue administrative documents.

This possibility was however reserved for cases in which no public consultation or participation procedure is required, provided that the deadlines set for completion of these procedures were also suspended or postponed.

Finally, the deadlines set by the administration, pursuant to the law and the regulations, for any person to carry out inspections and works or to comply with requirements of whatsoever nature were also suspended, from 12 March 2020 to 23 June 2020.

These are deadlines set by individual resolutions, binding requirements, formal notices (etc.).

The starting point for deadlines of the same type which should have begun to run during this same period was postponed until the end of said period.

One provision included the possibility of an exception to the principle of deadline suspension, by a decree setting categories of documents, procedures and obligations for which, with a view to protection of the fundamental interests of the Nation, security, protection of individual and public health, preservation of the environment and protection of children and the young, the deadlines were restored.

For example, the deadlines regarding certain inspection obligations for pressure equipment and nuclear pressure equipment, were restarted as of 3 April 2020.

1.2 Decrees and Orders

1.2.1 Radiation protection

TEXTS ISSUED PURSUANT TO THE PUBLIC HEALTH CODE

▸ **Ban on the addition of radionuclides**

The Order of 25 May 2020 granting an exemption to the ban on the addition of radionuclides set out in Article R. 1333-2 of the Public Health Code, for the addition of krypton-85 and thorium-232 in certain discharge lamps grants an exemption to the Dr Fischer Europe SAS, Lumileds France SAS, Osram Lighting, Signify France and Tungsram Lighting SAS on the ban on the addition of radionuclides, for the addition of krypton-85 and thorium-232 to certain discharge lamps.

▸ **Radon**

The Order of 26 October 2020 regarding the communication of the results of analysis of the integrated radon measurement devices and the corresponding data to the Institute for Radiation Protection and Nuclear Safety (IRSN) implements Article R. 1333-31 of the Public Health Code. It defines the nature of the data to be communicated by the accredited organisations for analysis of passive integrated radon measurement devices to the IRSN and specifies the data transmission procedures.

▸ **Waters intended for human consumption**

The Order of 6 April 2020 modifying the Order of 5 July 2016 concerning the conditions for the approval of laboratories for the sampling and health checks on waters adapts the provisions of the Order of 5 July 2016 as amended, concerning the conditions for the issue of the approval by the Ministry for Health, regarding the measurement of radon-222 in waters until 31 December 2020.

TEXTS ISSUED PURSUANT TO THE LABOUR CODE

The Order of 28 January 2020 modifying the Order of 15 May 2006 as amended concerning the conditions for the demarcation and signage of monitored and controlled zones, called "demarcated zones" in the light of exposure to ionising radiation, brings the provisions of the Order of 15 May 2006 into line with the provisions of the Labour Code regarding the demarcation of zones for ionising radiation reasons. The provisions that contradicted the Labour Code or were redundant, were thus deleted. This is notably the case with the provisions relating to:

- the exposure levels used to define the zones and the transfer of radioactive materials, which are now set in the Labour Code;
- the conditions for access to the zone and the health and safety rules in the regulated zones which were deleted to take account of the new provisions of the Labour Code and those which exist in common law.

The entry into force of the modified Order rendered applicable all the provisions of the Labour Code regarding demarcation of zones.

The Order of 23 October 2020 regarding measurements taken for the assessment of risks and checks on the effectiveness of the prevention means put into place for the protection of workers against the risks from ionising radiation is implemented pursuant to Article R. 4451-51 of the Labour Code. It specifies the methods for taking measurements for risk assessment. The Order reorganises the procedures and the conditions for performance of technical inspections, henceforth called "verifications", by making them proportional to the scope of the implications for worker radiation protection. An accredited organisation is only required at commissioning of the installation and the working equipment, as well as after any major modification of them liable to affect the health and safety of the workers. Finally, the employer may use the company's own resources for the periodic verifications, notably by or under the supervision of its Radiation Protection Advisor.

1.2.2 Basic Nuclear Installations

The Order of 7 February 2012 setting the general rules concerning Basic Nuclear Installations ("BNI Order")

Revision work on this Order began in 2019 and continued in 2020 with the drafting of proposals for changes to the Order. Proposals were made taking account of feedback from application of the Order over the previous 6 years and the observations and proposed changes from the licensees.

All the stakeholders will be consulted on the draft modifying Order.

1.2.3 The security of radioactive sources

The Order of 24 June modifying the Order of 29 November 2019 relating to the protection of sources of ionising radiation and batches of radioactive sources of categories A, B, C and D against malicious acts, postponed the initial application deadlines by 6 months, because of the first health emergency period and in particular the legal protection period created on this occasion.

1.2.4 Transport of radioactive substances

The Order of 29 May 2009 relating to the Transport of Dangerous Goods by land ("TMD Order") was modified by the Order of 10 December 2020 creating exemptions to certain provisions of the Order of 29 May 2009 relating to the transport of dangerous goods by land so that, in addition to incorporating amendments to the international regulations and updating obsolete regulatory or technical references, a dematerialised procedure is introduced to appoint Safety Advisors for the Transport of Dangerous Goods (CSTMD – Article 6 of the TMD Order).

The Order of 25 November 2020 modified the Order of 6 February 2019 relating to the appointment of the body tasked with organising the initial examinations and renewal of the certificate for the Safety Advisor for Transport of Dangerous Goods by road, rail or inland waterway. Under 1.8.3.12.5 of the ADR Book, the examination leading to issue of the safety advisor certificate, organised by the competent authority or by an examining body appointed by it, may be carried out in part or in full, by means of an electronic examination. As technology has progressed rapidly in recent years, gradual dematerialisation of the safety advisor examination for the transport of dangerous goods is introduced. This dematerialisation will eventually allow:

- an increase in the number of examination sessions per year, offering a wider choice of examination locations, thus obviating the need for long journeys;
- an on-line registration, giving the candidate a greater choice of examination dates and locations;
- a significant reduction in the time needed to transmit the results.

The Order of 17 November 2020 amended the regulation appended to the Order of 18 July 2000 regulating the Transport and Handling of dangerous goods in Seaports (RPM). The modification of the RPM represents an in-depth update of the provisions and references of the applicable texts in the case of a temporary stay by class 7 materials and objects. This update refers to both international texts (International Maritime Dangerous Goods Code – IMDG Code), and national provisions (Labour Code, Public Health Code, specific Orders, and their implementing texts).

1.3 ASN resolutions

1.3.1 Radiation protection

ASN resolution 2020-DC-0694 of 8 October 2020 relating to the qualification of physicians or dental surgeons performing procedures using ionising radiation for medical or research purposes involving humans, to the qualifications required to be appointed coordinating physician for a nuclear activity for medical purposes or to request an authorisation or registration as a natural person

Article L. 1333-18 of the Public Health Code states that *"ionising radiation may only be used on the human body for medical diagnostic, therapeutic treatment, screening, prevention or biomedical research purposes"*. Article R. 1333-68 of this Code specifies that the examinations and procedures using ionising radiation for medical purposes are performed by physicians and dental surgeons who can justify the required competence and by radiographers intervening under their own responsibility.

ASN's resolution clarifies the definition of certain qualifications:
1. of the physician or dental surgeon performing procedures using ionising radiation for medical or research purposes involving humans;
2. the physician coordinating the steps taken to ensure radiation protection of the patients (Article R. 1333-131 of the Public Health Code);
3. the natural person responsible for a nuclear activity for medical purposes, in other words a physician who reports a nuclear activity to ASN or a physician who requests ASN authorisation for radiotherapy, nuclear medicine or computed tomography.

This resolution repeals ASN resolution 2011-DC-0238 of 23 August 2011 relative to qualifications as defined in Article R. 1333-45 of the Public Health Code, required for persons responsible for a nuclear activity for medical purposes.

1.3.2 Pressure equipment

ASN resolution 2020-DC-0688 of 24 March 2020 concerning the qualification of organisations tasked with the inspection of nuclear pressure equipment

This resolution sets out the procedures for the qualification of organisations working in the field of nuclear pressure equipment inspection, whether with regard to manufacturing aspects or to in-service monitoring. It recognises the NF EN ISO/IEC 17020 "Conformity assessment – Requirements for the operation of various types of bodies performing inspection" and NF EN ISO/IEC 17021 "Requirements for bodies providing audit and certification of management systems" standards, supplemented by the specific requirements of Appendix 2, assuming compliance with the guarantees in terms of organisation, independence and competence, as set out in Articles L. 557-31 and R. 557-4-2 of the Environment Code. Appendix 1 sets out the process to be followed by a body applying for qualification or renewal, appendix 2 sets out the specific requirements to be obtained to obtain this qualification.

This resolution repeals resolution 2007-DC-0058 of 8 June 2007.

It entered into force on 2 July 2020, after publication of its approval Order of 25 May 2020 in the *Official Journal*.

1.4 The professional guides approved by ASN

Guide No. 30 relative to policy for the management of risks and detrimental effects of nuclear installations and the licensees' integrated management system

ASN Guide No. 30 comprises the ASN recommendations for application:
- of Articles L. 593-6 and R. 593-63 of the Environment Code, as well as Part II of the Order of 7 February 2012 as amended setting out the general rules relative to BNIs;
- Articles L. 593-6-1 and R. 593-9 to R. 593-13 of the Environment Code, regulating the use of outside contractors by BNI licensees.

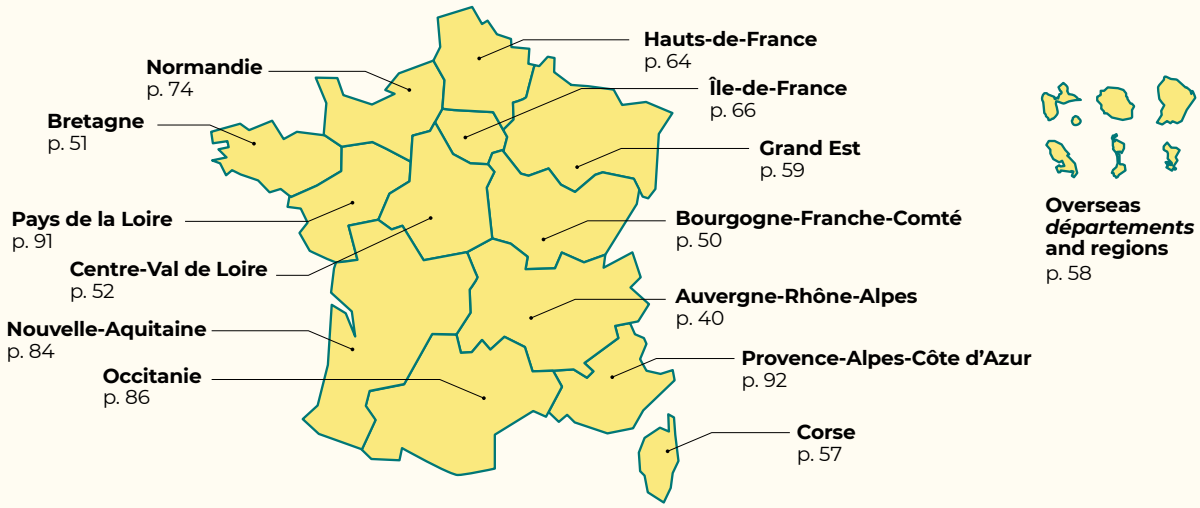
These recommendations concern all BNIs, whether in the design, construction, commissioning, operation, final shutdown, decommissioning phases or, for radioactive waste disposal facilities, in the closure or surveillance phase.

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

The recommendations set out in this Guide are the result of several years of work by ASN and were the subject of technical exchanges with the French licensees. The guide was the subject of a public consultation on the ASN website in December 2019.

Regional overview
of nuclear safety and radiation protection

ASN, the French Nuclear Safety Authority, has 11 regional divisions through which it carries out its regulatory duties 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 2020, the ASN regional divisions totalled 231 employees, including 175 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 regional 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).

In radiological emergency situations, the ASN regional divisions check the on-site measures taken by the licensee to make the installation safe and assist the Prefect of the *département*, who is responsible for protection of the population. To ensure 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 of the full ASN Report respectively.

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 FIELD > 07
RESEARCH AND INDUSTRY > 08
TRANSPORT > 09

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.

In 2020, ASN carried out 293 inspections in the Auvergne-Rhône-Alpes region, comprising 96 inspections in the Bugey, Saint-Alban, Cruas-Meysse and Tricastin Nuclear Power Plants (NPPs), 81 inspections in plants and installations undergoing decommissioning, 101 inspections in small-scale nuclear activities and 15 inspections in the radioactive substance transport sector.

ASN also carried out 32 days of labour inspections in the four NPPs and on the Creys-Malville site.

In the exercise of its oversight duties, ASN drew up three violation reports and gave one nuclear activity manager formal notice to comply with the regulations.

In 2020, ASN was notified of 30 significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES scale), of which 28 occurred in BNIs and 2 in small-scale nuclear activities.

Furthermore, one event was rated level 2 on the ASN-SFRO scale (scale specific to radiation protection events affecting patients undergoing a radiotherapy procedure).

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 kilometres (km) east of Lyon. It comprises four Pressurised Water Reactors (PWR), each of 900 Megawatts electric (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, 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 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 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 overall performance of the Bugey NPP with regard to nuclear safety, radiation protection and environmental protection is in line with ASN's general assessment of EDF plant performance. The NPP has satisfactorily controlled the impact of the sanitary crisis due to the Covid-19 pandemic, particularly with regard to monitoring and operation of the facilities, maintaining the emergency organisation and waste management.

ASN considers that the nuclear safety performance of the NPP remains contrasted, despite being in line with the general assessment of the EDF plants. The weaknesses observed in 2019 concerning compliance with the operating technical specifications, the implementation of error-reduction practices and the configuring of the systems persisted in 2020. Furthermore, lack of rigour was observed regarding monitoring in the control room and the identification and processing of deviations. On the other hand, ASN notes improvements in the monitoring of service providers, application of the operating and maintenance baseline requirements, and control of integrity of the first barrier which consists of the fuel assembly cladding. The four reactors of the Bugey NPP were shut down in 2020 for scheduled maintenance and partial refuelling. Quite apart from the health crisis situation, ASN considers that further progress is necessary in the control of outages, with improvements required notably in the management of conformity deviations, the scheduling and preparation of maintenance activities and activity quality assurance. The Bugey NPP reactors 2 and 4 were shut down in January and November 2020 respectively for their fourth ten-yearly outage, which is a part of the fourth periodic safety review.

With regard to radiation protection, ASN considers that the Bugey NPP's performance is in line with the general assessment of the EDF plants. Implementation of the radiation

protection optimisation process during the reactor outages is satisfactory. Weaknesses are nevertheless observed in the radiological cleanliness of the facilities.

ASN considers that the environmental protection performance of the NPP is in line with its general assessment of the EDF plants. Waste management is considered satisfactory on the whole. The management of liquid containment, especially the prevention of the risks of leakage of buried structures (pipes and conduits) carrying radioactive and chemical fluids, has improved. However, the control of conformity of the ultimate structures contributing to environmental protection must be improved and deviations affecting them must be addressed with the same rigour as those relating to nuclear safety. Lastly, improvements are required in the management of emergency situations relating to the environment.

With regard to occupational health and safety, ASN's inspections also confirmed EDF's compliance with its commitments. ASN notes the significant work undertaken by the NPP to remedy the deviations concerning safety and the inspection of scaffolding. With regard to worker protection in response to the health crisis, ASN noted that as of March 2020 the site had put in place appropriate protection measures, which evolved as knowledge progressed. Improvements are expected of EDF in the demonstration of conformity of the ventilation of premises where there is a specific pollution risk and facilities situated in identified explosion-risk areas.

Reactor 1 undergoing decommissioning

Bugey 1 is a graphite-moderated GCR. 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" GCR, 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. Through ASN Chairman's resolution CODEP-CLG-2020-021253 of 3 March 2020, in the context of EDF's change of decommissioning strategy, ASN instructed EDF to complete, by 2024 at the latest, decommissioning of the buildings and equipment which are not necessary for the decommissioning of the reactor pressure vessel.

In 2020, ASN authorised the creation of a new effluents storage facility at the Bugey 1 reactor to replace the old station, which will be put out of service, decommissioned and cleaned out.

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.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **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 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;**
- **the 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 CEA (French Alternative Energies and Atomic Energy Commission) 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,
  - 130 facilities using fluoroscopy-guided interventional procedures,
  - 148 scanners within 115 facilities,
  - some 10,000 medical and dental radiology devices;
- **small-scale nuclear activities in the veterinary, industrial and research sectors:**
  - one synchrotron,
  - about 700 veterinary practices (surgeries or clinics),
  - 34 industrial radiology agencies,
  - about 600 users of industrial equipment,
  - about 70 research units;
- **activities associated with the transport of radioactive substances;**
- **ASN-approved laboratories and organisations:**
  - 3 organisations and 7 agencies approved for radiation protection controls.

On 28 July 2020 ASN authorised the commissioning of Iceda and regulated operation of the facility through requirements relative to the operating range, the maximum storage durations for radioactive waste, the defining of criteria for activating the on-site emergency plan, the content of the end-of-startup file, compliance with waste package qualification heights, and the conditions of reception of source rods from Chooz A. The first activated waste package was received in late September.

ASN has also set the time frame within which EDF shall submit the end-of-startup file, as provided for in Article R. 593-34 of the Environment Code.

Activated waste packaging and interim storage facility

The Activated waste packaging and interim storage facility (Iceda), which constitutes BNI 173, is intended for the packaging and storage of various categories of radioactive waste on the Bugey site (Ain *département*). It is designed to receive, package and store:

- low-level long-lived (LLW-LL) graphite waste from the dismantling of the Bugey 1 reactor, which is destined – after interim storage – for near-surface disposal in a facility whose concept is still being studied;
- activated metallic intermediate-level long-lived waste (ILW-LL) from the operation of the in-service power plants, for example parts which have spent time near the reactor core, such as control rod clusters, destined for deep geological disposal after interim storage;
- some low-level or intermediate-level short-lived waste (LL/ILW-SL), called "deferred transfer" waste, intended for above-ground disposal but requiring a period of radioactive decay ranging from several years to several decades before being accepted at the Aube repository (BNI 149), operated by the French national agency for radioactive waste management (Andra).

Inter-Regional Warehouse

MIR, the inter-regional warehouse (BNI 102) operated by EDF at Bugey, is a storage facility for fresh nuclear fuel intended for the nuclear power plant fleet in operation.

MIR presented a satisfactory overall level of safety in 2020, a year in which its activities were greatly restricted to allow the renovation of the main handling crane in particular. ASN nevertheless wants to see tightened operational monitoring of the activities. 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, radiation protection and environmental protection stands out positively in comparison with the general assessment of EDF plant performance. The NPP has satisfactorily managed the impact of the sanitary crisis due to the Covid-19 pandemic, particularly with regard to monitoring and operation of the facilities, maintaining the emergency organisation and waste management.

With regard to nuclear safety, ASN notes that the Saint-Alban NPP maintained its good performance in 2020, which is at a higher level than ASN's general assessment of the EDF power plants. Despite this, ASN noted that some events indicate that compliance which the operating technical specifications needs to be improved.

Concerning maintenance, only reactor 1 was scheduled for a refuelling and maintenance outage and ASN considers that the planned activities were on the whole well managed by EDF. During this outage, EDF finished integrating the modifications stemming from the third ten-yearly outage of the reactor. The Ultimate Backup Diesel generator sets (DUS) were also commissioned within the deadlines set by ASN.

With regard to worker radiation protection, ASN considers that the operational results were satisfactory. Although the availability of radiation protection equipment and the monitoring of entry points to work sites involving a contamination risk have improved, ASN found that the quality of the estimated dosimetric evaluations for EDF employees must be improved. Lastly, ASN is still waiting for improved compliance with work site access rules and the wearing of the requisite protective equipment.

ASN considers that the environmental protection performance of the Saint-Alban NPP stands out positively compared with the general standard of EDF plant performance and is stable with respect to the preceding years. The organisation defined and implemented by EDF to meet the regulatory requirements concerning the monitoring of discharges and the environment is found to be satisfactory.

The results concerning health and safety at work are also satisfactory. ASN notes in particular that no serious accidents occurred during the reactor 1 maintenance outage. Nevertheless, ASN observes a relatively high accident rate during this outage. With regard to worker protection in response to the health crisis, ASN noted that as of March 2020 the site had put in place appropriate protection measures, which evolved as knowledge progressed.

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 overall performance of the Cruas-Meysse NPP has improved and is on the whole in line with its general assessment of the EDF plants in the areas of nuclear safety, radiation protection and environmental protection.

The impact of the health crisis associated with the Covid-19 pandemic was managed satisfactorily by the NPP and the planned nuclear safety measures were maintained.

ASN considers that the nuclear safety performance of the Cruas-Meysse NPP is in line with ASN's general assessment of EDF plant performance. ASN notes that the site has improved its compliance with operating technical specifications and prevention of reactor trips. Nevertheless, in 2020 ASN observed shortcomings in compliance with the authorised reactor operating ranges. With regard to maintenance and work associated with the reactor outages, ASN considers that, despite the health crisis, the Cruas-Meysse NPP on the whole adequately managed the planned schedule and quality of the activities.

In the area of radiation protection, ASN considers that the performance of the Cruas-Meysse NPP is in line with its general assessment of the EDF plants, and maintains the assessment it made in 2019. Shortcomings nevertheless persist in the radiological cleanliness of the facilities and control of the contamination risk during reactor outage periods.

As far as environmental protection is concerned, ASN considers that the performance of the Cruas-Meysse NPP is also in line with the general assessment of the EDF plants and improving with respect to the preceding years. The improvement actions implemented to meet the regulatory requirements are bearing fruit. Lastly, waste management has been improved, even though ASN still notes a lack of rigour in operational application of the new organisation put in place to manage waste on storage areas and to prepare for its shipment.

The site's results in occupational health and safety are satisfactory. With regard to worker protection in response to the health crisis, ASN noted that as of March 2020 the site had put in place appropriate protection measures, which it adapted as knowledge progressed. The ASN inspections confirmed compliance with the commitments made by the site, leading to an improvement in the prevention of vital risks. The vigilance and efforts must nevertheless be maintained regarding risks relating to the use of chemical products and to lifting activities.

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 spanning 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 one NPP comprising four 900 MWe reactors, "nuclear fuel cycle" facilities, and lastly the Operational Hot Unit (BCOT) which fulfilled maintenance and storage functions.

Tricastin nuclear power plant

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

ASN considers that the overall performance of the Tricastin NPP with regard to nuclear safety, radiation protection and environmental protection is in line with ASN's general assessment of EDF plant performance. The NPP has satisfactorily managed the impact of the sanitary crisis due to the Covid-19 pandemic, particularly with regard to monitoring and operation of the facilities, maintaining the emergency organisation and waste management.

ASN considers that the nuclear safety performance of the NPP remains contrasted, despite being in line with the general assessment of the EDF plants. The weaknesses observed in 2019 concerning compliance with the operating technical specifications, the implementation of error-reduction practices and the configuring of the systems persisted in 2020. Furthermore, difficulties were observed in the performance of the periodic tests. On the other hand, ASN notes improvements in the control of fire risks and the integrity of the first barrier made up by the fuel assembly cladding, despite one notable foreign-object related event when a screw was found in the reactor 4 pressure vessel during its refuelling. Regarding maintenance, the 4 reactors of the Tricastin NPP were shut down in 2020 for scheduled maintenance and partial refuelling. In the context of the health crisis, ASN considers that further progress is necessary in 2021 in the control of outages for scheduled maintenance and partial refuelling, with improvements required in particular in the management of conformity deviations, the scheduling and preparation of maintenance activities and quality assurance.

With regard to radiation protection, ASN considers that the NPP's performance is in line with the general assessment of the EDF plants and has improved with respect to 2019. Control of subcontracted activities in the area of radiation

protection improved throughout the year 2020. Weaknesses are nevertheless still observed in the radiological cleanliness of the installations and the implementation of the radiation protection optimisation procedure during reactor outages, with difficulties in establishing accurate and appropriate dosimetric estimates.

ASN considers that the environmental protection performance of the NPP is in line with its general assessment of the EDF plants and has improved in comparison with preceding years. Control of liquid containment has improved. With regard to the control of activities relating to discharges and environmental monitoring, occasional deviations were observed in 2020, and ASN wants to see a return to a nominal effluent treatment situation after the difficulties encountered in recent years in the systems for evaporation treatment of radioactive effluents. Lastly, waste management is on the whole satisfactory, despite a persistent lack of rigour in the monitoring of the quantities of radioactive waste stored in the packaging auxiliaries building.

ASN considers that the occupational safety results for the site are satisfactory. ASN notes that no serious accidents occurred in 2020 and that the accident rate, particularly during the reactor outages, was kept under control. With regard to worker protection in response to the health crisis, ASN noted that as of March 2020 the site had put in place appropriate protection measures, which evolved as knowledge progressed.

THE "NUCLEAR FUEL CYCLE" FACILITIES

The Tricastin fuel cycle installations mainly cover the upstream activities of the fuel cycle and, as of the end of 2018, they are operated by a single licensee, Orano Cycle, which became Orano Chimie-Enrichissement on January 2021 and is called Orano hereinafter.

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 former 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 2020, ASN considers that the level of safety of the Orano facilities on the Tricastin site has remained stable. The industrial commissioning of new facilities with reassessed safety standards displayed contrasting results in 2020. ASN has checked the tests and the start of commissioning of the new waste treatment unit "Trident", and the results are considered satisfactory. The results are less clear-cut for the Philippe Coste conversion plant however, where ASN has noted difficulties in the monitoring of the crystalliser replacement work and the corrective actions required for pollution prevention.

In 2019, ASN authorised the application of a new version of the On-site Emergency Plan (PUI), adapted to the new organisation of the site, under the responsibility of Orano as sole licensee. This new organisation was inspected by ASN during a tightened inspection carried out on a Sunday along with an unannounced emergency exercise. The organisation is considered satisfactory on the whole, but ASN has requested several operational improvements.

The campaign of unannounced inspections that ASN carried out simultaneously in BNIs 93, 105, 138, 155, 168 and 178 in 2020 showed that pollution prevention and the control of accidental spillages is generally satisfactory, except in the conversion plants. ASN also conducted several inspections in 2020 focusing on the organisation of Orano's platform on the Tricastin site for managing its significant modifications. ASN noted that this organisation needs to be better harmonised on the site, but that the internal inspection body handles the modification files with greater efficiency.

In 2021, ASN will ensure that Orano continues to deploy its action plans to improve safety management in order to further harmonise the practises of the BNIs on the platform. Lastly, in 2021 ASN plans engaging itself with the Defence Nuclear Safety Authority (ASND) in a new phase of delicensing of a significant proportion of the DBNIs.

Orano 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 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 placed in storage on the Tricastin site. The W plant situated within the perimeter of BNI 155 can process the depleted UF_6 from the Georges Besse 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. The new unit of the W plant, called EM3, commissioned in mid-2018 and having necessitated hardware modifications in 2019, now functions nominally.

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.

THE IMPACT OF COVID-19

ASN has noted that the Covid-19 pandemic has not disrupted the normal operation of the plants in service. The licensee managed to maintain safety and radiation protection both in the production units and on the BNI construction or modification worksites. During the first lockdown of the pandemic, all the facility decommissioning worksites were stopped, resulting in the year's targets falling behind schedule.

More generally, the licensee must maintain its efforts to increase its operating rigour, particularly through the detection and effective management of deviations.

Orano uranium fluorination plants

Pursuant to the ASN requirement, the oldest fluorination facilities were shut down definitively in 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.

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. ASN expects the licensee to make the necessary efforts to repackage the packages containing radioactive and hazardous substances stored on areas 61 and 79 within the set deadlines.

ASN also inspected the upgrading of the process core of the Philippe Coste plant, whose facilities are classified Seveso high threshold and replace those of BNI 105 (formerly Comurhex). The main units of this plant were commissioned in 2019 and revealed design defects. The second fluorine production unit underwent tests with a view to gradual commissioning until the end of 2020.

For the Philippe Coste plant the year 2020 was thus marked by a "major shutdown" during which, among other things, all the crystallisers were replaced further to design defects which had led to degraded operating conditions for several months and to compensatory measures. ASN notes that the licensee conducted the analysis and resolved these technical difficulties efficiently. ASN verified that the process core had been properly upgraded but nevertheless detected a lack of supervision and monitoring of the crystalliser replacement work. Commissioning of the Philippe Coste plant's unit 68 for treating non-uranium-bearing effluents has again been postponed until 2021, on account of an inappropriate initial design.

Lastly, ASN notes that the year 2020 was marked by high production expectations of the Philippe Coste plant in a context where the licensee had to cope with difficulties due to the defects in its new facilities and the design obsolescence of the old facilities still in service. Through its oversight actions ASN observed that this context led to a reduction in the control of risks in the management of nonconformities and technical problems. This context also led to the reporting of numerous events significant for the environment.

In 2021, ASN will be attentive firstly to the conditions of commissioning of the new fluorine production unit and the effluent treatment unit of the Philippe Coste plant, and secondly to the repackaging and processing of the uranium-bearing materials present in BNI 105 in preparation for its decommissioning.

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. These operations, which are now completed, allowed the extraction of virtually all the residual uranium deposited in the diffusion barriers.

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 to proceed with the decommissioning of the Georges Besse I plant was published on 5 February 2020.

The decommissioning issues particularly concern the large volume of very low level waste (VLLW) produced, including 160,000 tonnes of metal waste. In 2020, ASN monitored firstly the licensee's preliminary studies and operations to determine the procedures for cutting up the components, and secondly the supervision of the effluent transfers and the materials still to be removed.

In 2020, ASN checked the effective operation of the facility for hydraulic containment and treatment of the alluvial water table polluted with perchloroethylene and trichloroethylene and considers the results satisfactory.

The main residual risk of BNI 93 is now associated with the UF_6 containers in the storage yards, which are still attached to the perimeter of the facility. 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, became the site's new enrichment facility following the shutdown of Eurodif. It uses the centrifuge process to separate uranium isotopes.

The standard of safety of the plant's facilities in 2020 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.

Deterioration of the rail tracks of the external UF_6 cylinder handling gantry cranes obliged the licensee to stop using them since October 2020 and to use other handling equipment to move the cylinders. ASN will check that these gantry cranes are repaired in 2021, as they enhance the safety of the cylinder handling operations.

Despite an ambitious action plan deployed in 2019 and 2020, the licensee must continue its search for the causes of the significant losses of refrigerant to the atmosphere. Several facility modification applications authorised in 2020 will be implemented in 2021 and ASN will keep a close watch to ensure their safe application.

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 the licensee's efforts to improve the level of operational safety and operating rigour must be continued, particularly regarding prevention of the fire risk. In effect, shortcomings – some of them significant – were identified during two inspections on this theme in 2020.

Decree 2019-113 of 19 February 2019 authorised substantial modifications to the BNI, notably to create "Trident", a facility for treating the site's waste. In 2020, ASN inspected the end of the fitting out work in this facility and its tests. ASN issued the commissioning authorisation and "Trident" gradually began operational service in September 2020.

In 2021, ASN will be attentive firstly to the operation of the Trident facility, and secondly to the continuation of the licensee's actions to increase operating rigour, including prevention of the fire risk.

Tricastin uranium-bearing material storage yards and P35

Following the delicensing of part of the Pierrelatte DBNI by decision of the Prime Minister, the Tricastin uranium-bearing materials storage yards (BNI 178) have been created. This facility groups the uranium storage yards and the new emergency management premises of the Tricastin platform. Following on from the Pierrelatte DBNI delicensing by decision of the Prime Minister, the "P35" facility (BNI 179) has been created. This facility comprises ten uranium storage buildings. ASN registered BNI 178 in December 2016 and BNI 179 in January 2018, and made sure, with ASND, of the continuity of oversight of the nuclear safety of these facilities.

The overall level of safety of BNIs 178 and 179 operated by Orano was satisfactory in 2020. Progress has been made in the upkeep and cleanliness of the facilities. The licensee still has to process several legacy packages for which control of ageing has not been demonstrated. This point is one of the subjects of the analysis of the periodic safety review concluding report for BNIs 178 and 179 that ASN carried out in 2020. As a general rule, the licensee must improve its compliance with the deadlines for sending ASN replies to follow-up letters and submitting significant event reports, and with the deadlines for commitments made to ASN for the correction of deviations and the updating of its safety baseline requirements. With regard to the emergency management building and equipment, the licensee has improved its internal operating rules aiming to guarantee operation of the emergency centre and the various mobile emergency equipment items.

New uranium storage facility project

In February 2015, Orano informed ASN that it wanted to create a new BNI on the Tricastin site for the storage of uranium-bearing materials resulting from fuel reprocessing. Orano undertook work to optimise the existing storage facilities on the site in order to push back their saturation date 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 for its examination to continue. The public inquiry was held in November 2020.

Tricastin analysis laboratory

Authorised by Decree 2015-1210 of 30 September 2015 and commissioned in May 2017, the Tricastin analysis laboratory, Atlas, constitutes BNI 176. 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, major difficulties were encountered in sealing the bench in 2019 and 2020, which led ASN to conduct regular inspections on this subject.

As a general rule, ASN has noted a significant improvement in the licensee's deviation management and is now waiting for it to safely finalise the installation operations of the third UF_6 sampling bench and to improve the management of the ventilation system downtimes.

Tricastin Operational Hot Unit

The Tricastin Operational Hot Unit (BCOT) constitutes BNI 157. Operated by EDF, it was intended for the maintenance and storage of equipment and tooling, fuel elements excluded, originating from contaminated systems and equipment of the nuclear power reactors.

In a letter dated 22 June 2017, EDF declared final shutdown of the BCOT in June 2020. The storage and maintenance operations shall now be carried out on the Saint-Dizier maintenance base.

The last operating activity consists in finishing cutting up the used fuel cluster guide tubes from the PWR's operated by EDF. ASN considers that the level of safety of the BCOT is on the whole satisfactory. In 2021, ASN will be attentive to the rate of the fuel cluster guide tube cutting-up operations and to the planned removals of massive parts and obsolete tooling.

ROMANS-SUR-ISÈRE SITE

Framatome operates two BNIs on its Romans-sur-Isère site in the Drôme *département*, namely the plant fabricating fuel elements for research reactors (BNI 63) and the plant fabricating nuclear fuel for the PWRs (BNI 98).

Framatome nuclear fuel fabrication plants

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

BNI 63 includes building F2, which houses the "uranium zone" in which compacted powder cores placed in aluminium frames and plates are produced. The licensee has undertaken to replace this uranium zone by a new uranium zone called "NZU", in order to improve more specifically the containment of the premises, the process and the prevention of risks in the event of an extreme earthquake. The NZU construction work began in late 2017 and must accommodate the current activities of the uranium zone of building F 2 before 31 December 2022. This is because as from that date, which is stipulated in ASN resolution 2019-DC-0670 of 4 June 2019 relative to the periodic safety review of BNI 63, the presence of radioactive material in the uranium zone of building F2 shall be prohibited. Construction of the NZU continued in 2020, with the production of the new storage compartments for uranium-bearing materials and the glove boxes. The safety report update and the new operating rules associated with the NZU should be submitted in the first quarter of 2021.

A request for a modification of the Order of 22 June 2000 governing water intakes, discharges and environmental monitoring of the Romans-sur-Isère nuclear site was also submitted to ASN in July 2020. This request follows on from several changes, including in particular the modification of the Decree authorising creation of BNI 98 to increase its production capacity, the stopping of certain activities, the taking into account of the changes made to the liquid effluent treatment facilities, and the changeover from continuous discharging of liquid effluents to discharging into tanks. This file is currently being examined with a view to the preparation of two ASN resolutions: the first stipulating the requirements relative to the conditions of effluent discharge, water intakes and consumption and environmental monitoring, the second stipulating the environmental discharge limits.

Lastly, because the buildings of BNIs 98 and 63 are closely interlinked on the same site, a request to unite the two BNIs was submitted in 2020 and is currently being examined. In the last quarter of 2020 Framatome also filed a request for a substantial modification to BNI 98 so that it can increase its production of enriched reprocessed uranium.

Three significant events relating to control of the criticality risk and rated level 1 on the INES scale were reported in 2020. Particular vigilance remains essential with regard to the presence of radioactive material within the BNI 98 plants.

The sampling inspections in 2020 confirmed satisfactory accomplishment of the work carried out in summer 2020 in the F2 facility of BNI 63 and monitoring of qualification of the Protection Important Components (PIC) of the Geode unit (new waste conditioning facility) of BNI 98. It was observed that the licensee maintained its efforts with regard to operating rigour, particularly to provide proof of conformity of the PICs. As far as the overall waste management strategy is concerned, the Romans-sur-Isère site must make further progress, particularly in the preparation of the management of the radioactive waste produced during the large-scale works and the deployment of the management rules on all the facilities.

In 2021, ASN will be particularly attentive to the smooth running of the NZU worksite project. It will also closely monitor restarting of the TRIGA (Training, Research, Isotopes, General Atomics) facility of BNI 63 and the putting into service of Capadox, the new oxidation capability of BNI 98.

THE IMPACT OF COVID-19

ASN noted that the Covid-19 pandemic did not disrupt the normal operation of Framatome in the fabrication of nuclear fuels or the production of medical targets. The licensee managed to maintain safety and radiation protection in all its production units. One inspection was carried out on the organisation put in place during the pandemic and showed that the means deployed by the licensee were satisfactory and the level of safety maintained at the required level. The pandemic did however lead to the stoppage of the worksites of the Training, Research, Isotopes, General Atomics (TRIGA) facility, of the new oxidation capability (Capadox) and of the New Uranium Zone (NZU) from March to June 2020.

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 Megawatts thermal (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 constitutes BNI 67 which accommodates the European Molecular Biology Laboratory (EMBL), an international research laboratory. 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.

Through its inspection activities in 2020, ASN considers that the safety of the RHF is managed satisfactorily and that the integrated management system is correctly applied. Several inspection actions in 2020 targeted areas in which shortcomings had been detected in the preceding years. ASN has noted improvements in the management of waste and modifications, and in quality at the environmental radioactivity measurements laboratory. The ILL had established an ambitious action plan in 2018 to control fire-related risks. ASN observed that this plan was progressing but that several large-scale works were still unfinished. Attention shall continue to be focused on this area in the next few years. ASN continued its examination of the periodic safety review report in 2020 and will be attentive to the various action plans put in place by the ILL in this context.

THE IMPACT OF COVID-19

During the spring 2020 lockdown on account of the health crisis, the reactor was placed in safe condition (reactor shut down, fuel unloaded). The ILL maintained only its monitoring and servicing activities. The activities relating to the works and experiments were suspended.

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 2020.

ASN considers that the licensee must continue the foundation work initiated in 2019 aiming to better define the Components Important to the Protection (PIC) of the interests of the facility and more rigorous application of their requirements defined in the periodic inspection and test procedures.

In a letter dated 25 May 2020 the licensee applied for an authorisation to recover sludge from pool D1 (operated until November 1996). This file is currently being examined by ASN.

CERN accelerators and research centre

Following the signing of an international agreement between France, Switzerland and the European Organisation for Nuclear Research (CERN) on 15 November 2010, ASN and the Swiss Federal Office of Public Health (OFSP) – 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 2020 on the theme of following up the previous joint visits and on the security of sources. These visits revealed satisfactory practices.

FACILITIES UNDERGOING DECOMMISSIONING

Superphénix reactor and 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. In 2018, ASN 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 2020, a fire broke out on a decommissioning worksite, leading EDF to activate its on-site emergency plan and prompting ASN to carry out a reactive inspection. Shortcomings were found at various levels in the execution of the procedures during this incident, particularly as regards communication with the stakeholders.

Concerning the management of facility obsolescence, EDF reported difficulties in procuring certain items of equipment and significant delays in the replacement and repair of parts. ASN has asked the licensee to carry out a site-level diagnosis and to draw up an action plan on this subject.

ASN will focus particular attention on the improvement in the site's emergency organisation in 2021.

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 reactor in August 2017.

The last BNIs on the site (BNI 36 and 79) are the Effluents and Solid Waste Treatment Station and the decay storage facility (STED). All the buildings have been dismantled, in accordance with their Decommissioning Decree.

The technical discussions between ASN and the 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 establishing active institutional controls in December 2019, which were deemed inadmissible by ASN in 2020 and for which the licensee must submit a new request.

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.

ASN conducted 59 inspections in small-scale nuclear activities in the Bourgogne-Franche-Comté region in 2020, comprising 23 inspections in the medical sector, 22 inspections in the industrial research and veterinary sectors, 3 inspections concerning radon exposure, 5 inspections to monitor approved organisations and laboratories, and 6 inspections specific to the transport of radioactive substances.

One significant event rated level 2 on the ASN-SFRO scale was reported to ASN in 2020.

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 carried out 6 inspections in these plants in 2020.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **small-scale nuclear activities in the medical sector:**
- **8 external-beam radiotherapy departments,**
  - 4 brachytherapy departments,
  - 14 nuclear medicine departments, of which 3 practise internal targeted radiotherapy,
  - 35 centres performing interventional fluoroscopy-guided procedures,
  - 55 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 250 veterinary practices, 3 of them equipped with scanners,
  - about 400 industrial and research centres, including 31 companies with an industrial radiography activity,
  - 1 industrial irradiator per radioactive source,
  - 2 computed tomography scanners dedicated to research,
  - 2 accelerators, one for industrial irradiation, the other for research and the production of drugs for medical imaging;
- **activities associated with 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.

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 Nuclear Power Plant (Brennilis), currently undergoing decommissioning.

In 2020, ASN carried out 44 inspections: 2 at the Monts d'Arrée Nuclear Power Plant (NPP) undergoing decommissioning, 40 in small-scale nuclear activities and 2 in the transport of radioactive substances.

In 2020, 2 significant events in the medical sector were rated level 1 on the International Nuclear and Radiological Event Scale (INES scale).

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) is an industrial electricity production prototype (70 Megawatts electric – MWe) moderated with heavy water and cooled with carbon dioxide, and it was definitively shut down in 1985.

Decree 2011-886 of 27 July 2011 authorised the NPP decommissioning operations, with the exception of the reactor block. In July 2018, EDF submitted an application file for the complete decommissioning of its installation. This file is currently being examined by ASN.

During 2020, EDF more specifically:

- continued the preparatory work for reactor block decommissioning,
- started the reactor block sample-taking operations, authorised by ASN resolution of 20 September 2019,
- continued demobilisation of the former Effluent Treatment Station (STE) decommissioning worksite and, at the request of ASN, had deep soil samples taken from ground beneath the STE for analysis,
- implemented the protocol authorised in January 2020 for the gradual and controlled raising of the water table level.

Some operations, such as taking samples from the reactor block, were delayed due to the restrictions imposed to combat the Covid-19 pandemic. The activities were nevertheless resumed at the end of 2020.

ASN considers that the licensee is conducting its work in compliance with the safety and radiation protection requirements and is demonstrating transparency in the detection, handling and analysis of the malfunctions and events occurring on its site.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **one Basic Nuclear Installation:**
  - the Monts d'Arrée (Brennilis) NPP, undergoing decommissioning;
- **small-scale nuclear activities in the medical sector:**
  - 10 external-beam radiotherapy departments,
  - 5 brachytherapy departments,
  - 10 nuclear medicine departments,
  - 40 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,
  - 12 industrial radiography companies, including 4 performing gamma radiography,
  - about 450 industrial equipment and research licenses;
- **activities associated with the transport of radioactive substances;**
- **ASN-approved laboratories and organisations:**
  - 5 organisations approved for radiation protection controls,
  - 14 organisations approved for measuring radon,
  - 3 head-offices of laboratories approved for taking environmental radioactivity measurements.

In 2021, ASN will continue its examination of the complete decommissioning file and of the concluding report on the Brennilis site periodic safety review submitted at the end of 2019.

Centre-Val de Loire Region

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

In 2020, ASN carried out 151 nuclear safety and radiation protection inspections: 123 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 64 days of labour inspection in the Nuclear Power Plants (NPPs).

In 2020, 8 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.

ASN inspectors issued 5 violation reports in the exercise of their oversight duties.

Belleville-sur-Loire nuclear power plant

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

ASN considers that the performance of the Belleville-sur-Loire NPP is in line with ASN's general assessment of the EDF plants in the areas of nuclear safety and radiation protection. The environmental performance, however, is below the national average.

With regard to nuclear safety, the tightened surveillance exercised by ASN from 2017 to 2019 led the licensee to implement an action plan to improve the site's performance in facility management. ASN considers that the site's performance in this area in 2020 once again reached a generally satisfactory level and that it must keep up this level of rigour to maintain the observed improvements over the long term. The inspections revealed good management of the periodic tests and an improvement in the monitoring of parameters in the control room. Progress must nevertheless be made in the detection of deviations.

With regard to maintenance of the facilities, the NPP's performance must be improved, particularly in view of the unforeseen events induced by the performance of maintenance operations during the 10-yearly outage of reactor 1. Lastly, fire risk control is unsatisfactory: ASN effectively observed numerous deviations during inspections focusing on management of the fire risk, and two significant fire outbreaks occurred on the site in 2020.

ASN considers that the radiation protection performance of the Belleville-sur-Loire NPP is satisfactory. The licensee has maintained a high standard of rigour in radiation protection during the health crisis. It nevertheless appears that the implementation of measures to limit the exposure of certain workers to ionising radiation is insufficient.

In the area of environmental protection, ASN considers that waste management and the monitoring of discharges in normal operating conditions are satisfactory. On the other hand, the inspections carried out in 2020 revealed inadequate management of containment of the water used to extinguish fires that occurred on the site. ASN moreover observed several deviations concerning the prevention of the risk associated with Legionella. The site rapidly made commitments on this subject.

With regard to labour inspection in the context of the Covid-19 pandemic, various document and field inspections were carried out on the theme of health crisis management, particularly during the activities to seal the reactor 1 containment wall. The observations addressed to the NPP and to the subcontractor companies resulted in corrective actions. The licensee is also expected to take action in response to the finding made during the inspections conducted in the buildings of the Ultimate Backup Diesel generators (DUS), commissioned in 2020. Lastly, an inspection was carried out on the secondment of foreign employees.

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 Nuclear Rapid Intervention Force (FARN), 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 its general assessment of the EDF plants, even if the level of safety of the site has dropped compared with 2019. Environmental and radiation protection performance, for their part, remain below the national average.

As far as nuclear safety is concerned, performance in normal operational control is acceptable on the whole and progress in the configuring of systems is to be underlined. On the other hand, organisational deficiencies relating to skills, the training of operating staff and the management of the periodic tests of safety-important components led to several significant event reports during 2020. With regard to maintenance of the facilities, ASN notes that the corrective actions conducted by the site are still insufficient, particularly concerning equipment conformity and compliance with the applicable baseline requirements, since numerous deviations are detected during inspections on these subjects and in the context of reactor outage monitoring. Moreover, and for several years now, the control of the fire and explosion risks is not entirely satisfactory.

The radiation protection performance of the Dampierre-en-Burly NPP is still clearly inadequate, particularly with regard to the control of radiological cleanliness and the dispersion of contamination on worksites in controlled areas. A plan of rigour was put in place on the site in 2017, but did not produce the expected results. Given this situation, ASN will maintain targeted monitoring of the site's radiation protection in 2021.

Lastly, the environmental protection performance of the Dampierre-en-Burly NPP must be improved. Although the discharge limits for gaseous and liquid effluents are observed on the whole, the licensee must rapidly undertake corrective actions regarding management of the Legionella risk (given the exceeding of limit values observed in 2020), management of waste and management of hazardous substance containment.

With regard to labour inspection, the site must now put in place plans to remedy the nonconformities detected further to last year's actions in the electrical field. Lastly, the licensee is also expected to take action in response to the findings made during the inspections conducted in the buildings of the Ultimate Diesel Generator (DUS) commissioned in 2020. In the context of the Covid-19 pandemic, various inspections concerning management of the health crisis were carried out on documents and in the field. The observations addressed to the NPP and to the subcontractor companies resulted in corrective actions.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **the 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 (GCRs) 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) for fresh fuel;
- **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 associated with 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.

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 Gas-Cooled Reactors (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 ceased and been entirely transferred to a new laboratory called the Lidec, and to Inter-regional fresh fuel warehouse (MIR).

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 its general assessment of the EDF plants in the areas of nuclear safety, radiation protection and the environment.

ASN considers that the site is maintaining a satisfactory standard in incident and accident management and in the analysis of deviations that could affect safety. The year 2020 was nonetheless marked by an increase in significant events linked to failure of the operating teams to comply with the general operating rules, which is why ASN considers that the safety performance of the NPP is dropping.

The radiation protection performance of the Chinon NPP, which has been dropping since 2018, can be improved. The year 2020 was marked by a non-negligible number of significant radiation protection events, notably due to workers failing to wear dosimeters and to deficiencies in application of the radiation protection measures mentioned in the worksite risk analyses.

The environmental performance of the Chinon NPP must be improved. Although the discharge limits for gaseous and liquid effluents are on the whole respected, a case of exceeding of the average activity concentration was observed in 2020 in the Loire further to an error in the activity analysis of an effluent discharged by the site. Furthermore, the times taken by the NPP to reconstitute the sealing of the network that is supposed to collect the fire extinguishing water in the event of a fire are inappropriate for the risks, and the rigour of waste management is not of the required level. The licensee must take priority actions to address these deviations.

As far as labour inspection is concerned, the licensee must make improvements to ensure better control of the electrical risk and to respond to the findings made during the inspections in the buildings of the DUS sets commissioned in 2020. Lastly, an inspection was carried out on the secondment of foreign employees. In the context of the Covid-19 pandemic, various inspections concerning management of the health crisis were carried out on documents and in the field. The observations addressed to the NPP and to the subcontractor companies resulted in corrective actions.

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 if 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. ASN Chairman’s resolution CODEP-CLG-2020-021253 of 3 March 2020 requires EDF to submit a decommissioning file for the Chinon reactors A1 and A2 and to update that of Chinon A3 before the end of 2022 to take account of the changes in decommissioning scenario and time frame modifications.

The decommissioning worksites were delayed by several months in 2020 on account of the restrictions laid down to combat the Covid-19 pandemic. EDF has nevertheless put in place its activity continuity plan to maintain some of the worksites and perform the periodic inspections and tests of its equipment.

With regard to the Chinon A2 reactor, EDF has continued the decommissioning preparation operations outside the reactor pressure vessel and carried out investigations inside the pressure vessel. EDF also continued the decommissioning of the Chinon A3 heat exchangers following several interruptions in 2019 and 2020 due to the discovery of asbestos.

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 2020 have more specifically revealed proficiency in on-site waste

management and monitoring of the electrical installation inspections. Improvements are however necessary in the application of the outside contractor monitoring programme. Weaknesses were also observed in the lightning protection of Chinon A2.

THE "NUCLEAR FUEL CYCLE" FACILITIES

Inter-regional fresh fuel warehouse

Commissioned in 1978, the Chinon MIR is a facility for storing fresh fuel assemblies pending their utilisation in various EDF reactors. It constitutes BNI 99. Along with the Bugey MIR, it contributes to the management of flows of fuel assembly supplies for the reactors.

The MIR was equipped with a new handling crane in 2019. In the context of the updated baseline requirements, authorised by ASN, nominal operation of the facility resumed in 2020 with the reception and storage of fresh fuel assemblies. An inspection confirmed the smooth running of the operations in the facility.

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 be decommissioned. 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 Ceidre integrated laboratory (Lidec).

ASN completed its examination of the decommissioning file in 2020 and issued its opinion on the draft Decommissioning Decree in early 2020. The AMI Decommissioning Decree 2020-499 was published on 30 April 2020 and its entry into effect will mark the start of the facility decommissioning phase.

With a view to decommissioning the facility, the AMI activities were essentially decommissioning preparation and monitoring operations. The main activity in 2020 was the continued treatment and removal of the legacy waste and various unused items of equipment. Thus all the legacy waste from the wells (other than the magnesian waste) has been characterised and packaged. Furthermore, there is no more liquid waste to treat. The legacy magnesian waste for its part should be packaged by early 2021.

The large majority of the worksites were stopped from mid-March to the beginning of June 2020 on account of the health crisis. During this period, only the essential activities (the periodic inspections and tests in particular) were maintained. The non-essential activities were gradually resumed and returned to a normal level of activity in September 2020.

ASN considers that the management of the support functions and of the electrical power supplies in particular, is satisfactory. Particular attention must nevertheless be paid to operation of the ventilation system and determining the causes of the failures encountered. As an example, improvements are required in the monitoring of the negative pressure values recorded and the efficiency tests of the High-Efficiency Particulate Air ("HEPA") filters.

The licensee must moreover be stricter in its application of certain regulatory provisions, particular with regard to waste management or packaging.

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 with regard to nuclear safety and radiation protection is in line with its general assessment of the EDF plants. The environmental protection performance stands out positively and is considered satisfactory on the whole.

With regard to nuclear safety, ASN observes that the site's performance has been stable since 2018 despite putting in place a safety rigour plan. The origin of the deviations has nevertheless changed. Several events reveal deficiencies in the detection of deviations, compliance with the action to take or the reference documentation used for the activities. To give an example, in 2020 the Saint-Laurent-des-Eaux NPP experienced a reactor trip with unwanted operation of a safeguard system, which revealed deficiencies in the preparation and performance of certain activities, although corrective actions have been put in place since then. ASN wishes to underline the good overall upkeep of the worksites and the apparently satisfactory condition of the inspected equipment.

As a general rule, the management of radiation protection at the Saint-Laurent-des-Eaux NPP on the whole meets the expectations of ASN. The number of deviations detected by ASN in 2020 is down compared with 2019, when a tightened radiation protection was carried out. This finding must also be correlated with the fact that only one reactor outage took place in 2020, whereas usually there are two.

The organisation of the site to meet the environmental protection regulatory requirements is considered satisfactory. The various facilities inspected are well kept. The management of waste, like the liquid and gaseous discharges, raised no particular remarks.

As far as labour inspection is concerned, further to the fire-risk inspection carried out in 2019, the NPP must continue its efforts regarding the utilisation and maintenance of the evacuation systems. Lastly, the licensee is also expected to take action in response to the findings made during the inspections conducted in the buildings of the DUS. In the context of the Covid-19 pandemic, various inspections concerning management of the health crisis were carried out on documents and in the field. The observations addressed to the NPP and to the subcontractor companies necessitated corrective actions.

Reactors A1 and A2 undergoing decommissioning

The former Saint-Laurent-des-Eaux NPP constitutes a BNI comprising two "integrated" GCRs, 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.

However, given the change in the decommissioning strategy for the GCRs indicated by EDF in 2016, ASN Chairman's resolution CODEP-CLG-2020-021253 of 3 March 2020 requires EDF to submit a new decommissioning file before the end of 2022, to modify the current decree in view of the changes in the scenario for decommissioning the reactor pressure vessel and the changes in the stated time frames.

The decommissioning worksites were delayed by several months in 2020 on account of the restrictions laid down to combat the Covid-19 pandemic. EDF has nevertheless put in place its activity continuity plan to maintain some of the worksites and perform the periodic inspections and tests of its equipment.

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 put in place to control the static and dynamic containments of the facilities is satisfactory. ASN also notes that the radioactive effluents present on the nuclear waste storage areas have been repackaged in long-term containers better suited to the characteristics of the effluents. However, monitoring of ageing of the equipment used in the decommissioning operations must be improved.

Saint-Laurent-des-Eaux silos

The facility, authorised by the Decree of 14 June 1971, consists of two silos whose purpose is the storage of irradiated graphite sleeves originating 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 is limited to surveillance and upkeep measures: radiological monitoring inspections and measurements in the silos, checking there is no water ingress, checking the relative humidity, the dose rates around the silos, the activity of the water table, monitoring the condition of the civil engineering structures. ASN's inspections found that these actions were carried out satisfactorily.

In the context of the change of decommissioning strategy for the GCRs, EDF announced in 2016 its decision to start removing the graphite sleeves from the silos without waiting for a 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.

ASN is waiting for EDF to declare the final shutdown of the facility. Submission of the decommissioning file, which will take into account the emptying, post-operational clean-out and demolition of the existing silos, is planned for 2022.

Corse (Corsica) Collectivity

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

In 2020, ASN carried out 6 inspections in Corse, of which 5 were in the medical sector and 1 in the industrial sector.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **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, including 1 company with an industrial radiography activity;
- **activities associated with the transport of radioactive substances;**
- **ASN-approved laboratories and organisations:**
  - 2 organisations approved for measuring radon.

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.

Six inspections were carried out in the small-scale nuclear activities sector on the île de la Réunion in the French Overseas *départements* and regions in 2020.

In 2020, one event concerning patients was rated level 2 on the ASN-SFRO scale.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **small-scale nuclear activities in the medical sector:**
- **4 external-beam radiotherapy departments,**
  - 2 brachytherapy departments,
  - 3 nuclear medicine departments,
  - 24 centres performing interventional fluoroscopy-guided procedures,
  - about 30 centres in possession of at least one computed tomography scanner,
  - about 100 medical radiology practices,
  - 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,**
  - 3 industrial radiography companies using gamma radiography devices,
  - 1 cyclotron;
- **activities associated with the transport of radioactive substances.**

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.

In 2020, ASN conducted 170 inspections in the Grand Est region, of which 79 were in the NPPs in service, 4 in radioactive waste disposal facilities and on the site of the Chooz A NPP currently being decommissioned, 73 in the small-scale nuclear activities sector, 8 in the transport of radioactive substances and 6 concerning approved organisations or approved laboratories.

ASN also carried out 14.5 days of labour inspections in the NPPs.

During 2020, 19 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, 2 significant events were rated level 1 on the INES scale (1 in the industrial sector and 1 in the medical sector).

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 PWRs each with a power rating of 1,300 MWe, 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 the performance of the Cattenom NPP with regard to safety is improving and, despite some persistent weaknesses, is in line with the ASN's general assessment of the EDF nuclear fleet with regard to environmental protection and radiation protection.

The year 2020 was thus marked by a degree of improvement in the site's safety performance, with results that stand out positively with respect to the rest of the EDF power plants. This trend must nevertheless be analysed in the 2020 context of a relatively low maintenance work load which is more conducive to good results. This trend therefore remains to be confirmed in the light of maintenance programmes with significantly higher workloads in the years to come and the consolidation of the results expected from the deployment of the operating rigour improvement plan initiated in 2020.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **the Basic Nuclear Installations:**
  - the Cattenom NPP (4 reactors of 1,300 MWe),
  - the Chooz A NPP (1 reactor of 305 MWe undergoing decommissioning),
  - the Chooz B NPP (2 reactors of 1,450 MWe),
  - the Fessenheim NPP (2 reactors of 900 MWe) in final shutdown status,
  - 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:**
- **14 external-beam radiotherapy departments,**
  - 5 brachytherapy departments,
  - 20 nuclear medicine departments,
  - 93 computed tomography scanners,
  - 80 centres performing interventional fluoroscopy-guided procedures,
  - some 2,100 medical and dental radiology devices;
- **small-scale nuclear activities in the veterinary, industrial and research sectors:**
- **277 industrial and veterinary activities subject to the licensing system,**
  - 24 companies exercising an industrial radiography activity,
  - 50 research laboratories situated primarily in the universities of the region;
- **activities associated with the transport of radioactive substances;**
- **5 head offices of organisations approved in radiation protection.**

ASN has noted the strong commitment of the reactor operating teams to rigorous application of the operating rules, borne out by the absence in 2020 of reactor trips or events during several reactor shutdowns.

The efforts in maintenance have resulted in improved monitoring of the technical actions and measures that limit the deviations during maintenance operations and on worksites. This improvement, however, is offset by longer system return-to-service times, which has an impact on the end-of-outage time frames. Alongside this, the impact of the health crisis was well managed and planned for.

The number of significant events followed the improvement trend observed from the qualitative aspect, with 40 events reported compared with 51 in 2019. Nevertheless, many of these events still have to be put down to organisational or human deficiencies, in line with the preceding years; inspections carried out in 2020 highlighted numerous shortcomings in the conformity checks carried out as part of the ten-yearly outages of reactors 1 and 2 in 2016 and 2018, obliging the site to repeat a large number of conformity checks retrospectively. In addition, several recurrent outages of the Plant Radiation Monitoring System (KRT) and the Component Cooling System (RRI) are to be noted. Lastly, some minor deviations were identified in the embodiment or taking into consideration of the modifications to be made to the fire-fighting systems. The site's reporting and analysis of significant events remains satisfactory, with deadlines being observed and analyses of good quality.

The initial results of the operating rigour improvement plan put in place by EDF further to the negative trend diagnosed in 2019 are encouraging on the whole; its must be pursued in order to confirm and build on these results, particularly for the organisation, performance and monitoring of future maintenance actions.

With regard to the environment, 2020 was less constrained than 2019, which was marked by the lasting low-water period of the Moselle river. Nevertheless, the site's exposure to climatic risks, bringing increased needs for cleaning of the intermediate cooling system heat exchangers among other things, remains an issue requiring particular attention. Furthermore, a case of exceeding of the first Legionella concentration threshold was observed in the tertiary cooling system in 2020. This is an issue specific to the site that requires special management of the biocide treatment campaigns throughout the year.

A few events involving accidental spillages of chemical products (hydrazine, ferrolin) underline the need for the site to improve its product management and containment practices.

With regard to radiation protection, significant efforts have been made in worksite preparation from the radiological risks and contamination control aspects; it could benefit from being based on more direct consideration of the actual state of the facilities and its development, rather than on theoretical aspects of the optimisation approach. In addition, several deviations concerning fundamental aspects such as the control of access to prohibited areas have been noted and necessitate specific actions by the licensee.

Lastly, with regard to occupational safety, the Cattenom NPP has demonstrated its ability to put in place the necessary measures in the context of the health crisis and to adapt the site's organisation accordingly. The hydrazine spillage incident mentioned above brought to light a situation of concern within a service provider company, which received particular attention from the labour inspector.

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 nuclear safety performance of the Chooz B NPP is on the whole in line with the general assessment of EDF, but the radiation protection performance is below the average for the EDF plants. The environmental protection performance stands out positively and is considered satisfactory.

With regard to nuclear safety, ASN observes that the sustained progress in reactor operation witnessed over the last few years is continuing, notably with a reduction in the number of significant events despite a context of intense activity linked to the ten-yearly outage of reactor 1. Particular vigilance must be maintained regarding the management of operational documents and the traceability of validation of the inspections and the monitoring of the state of the installations.

With regard to maintenance, efforts to improve work intervention rigour must be continued. Particular attention must also be paid to the organisation of activities to guarantee the long-term durability of equipment qualification for accident conditions and the quality of the risk analyses.

In the area of radiation protection, lack of rigour in individual behaviour and shortcomings in radiological cleanliness are still observed too frequently during the ten-yearly outage of reactor 1. The licensee's in-depth reflection on the optimisation of radiation protection on worksites with high radiological risks has not yet fully borne fruit. An improvement is nevertheless noted in meeting the collective dosimetry targets during this ten-yearly outage.

ASN considers that the site's environmental protection organisation is on the whole satisfactory. Improvements are nevertheless expected in the prioritisation of curative maintenance work on the equipment involved in controlling the microbiological risks.

With regard to labour inspection, the health crisis occupied an important position in ASN's inspections and in the discussions

with the licensee and the personnel representative bodies. An inspection of lifting operations was carried out with the aim of checking the conformity of the work equipment, among other things. Particular attention must be paid to the servicing and maintenance of the lifting equipment.

Reactor A undergoing decommissioning

In 2020, the decommissioning of the equipment inside the reactor vessel continued, despite a long period during which all activities were stopped on account of the health crisis. After transferring the reactor closure head to Andra's Aube repository (CSA) at the end of 2019, the year was marked by the dispatching of the first low- and intermediate-level waste packages to the activated waste packaging and storage facility (Iceda) operated by EDF on the Bugey site in the Ain *département*.

ASN's examination of the facility's safety review file submitted in 2017 continued in 2020 after it had received several complements requested of EDF.

On a more general note, ASN considers that the licensee must maintain its vigilance in the areas of radiation protection, the environment and the monitoring of service providers. The low level of activity in 2020 due to the health context, however, makes it impossible to measure the effectiveness of the action plans put in place in these areas at the request of ASN.

In the specific area of radiation protection, the commitments made in 2019 concerning the licensee's organisation were met. The risk of alpha particle contamination remains a major issue on the site and continues to be monitored with particular attention by ASN.

Lastly, with regard to occupational safety, an inspection focusing in particular on the lawfulness of the conditions of work of foreign companies on the French territory was carried out. This inspection detected irregularities concerning subcontractor companies during the provision of their services.

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 were definitively shut down in 2020.

The year 2020 was marked by the final shutdown of the site's two reactors, one on 22 February and the other on 30 June, in accordance with the dates announced by EDF in its final shutdown declaration of 27 September 2019.

The Fessenheim site's electricity production activity ended with a highly satisfactory level of performance in terms of safety, in line with the good results obtained by the site over the last few years. The number of significant events declared during the reactor production period was below the average for the fleet and a very good standard of reactor operation was maintained. This performance reflects in particular the determination of the site's management and personnel to maintain exemplary operating rigour through to final shutdown of the reactors.

As from September 2020, in view of the ongoing personnel departures in the various departments and the end of production, the site's organisation was modified as regards the size of the operating teams, the organisation of the On-Site Emergency Plan (PUI), the fire teams' service, the site's organisation chart and the number of departments. Contrasting with the situation observed during the period of production, this period brought a transient increase in significant events with an inhabitual "organisational and human factors" component, possibly linked to the disruption of organisational and managerial practices resulting from the ongoing reorganisation of the departments.

Moreover, since production stopped, the on-site activity now concerns systems, procedures, and configurations that are less familiar to the site's teams than the previous habitual recurrent operating and maintenance operations. Consequently, in the area of the environment ASN has observed a few events stemming from system management errors that can be attributed to such inhabitual operations. The risk analysis practices must be adapted to the site's new activities and operations.

Over and beyond the activities associated with decommissioning preparation, a certain level of maintenance activity will continue, particularly for the systems remaining in operation, such as ventilation, effluent treatment of and fighting the fire risk. ASN has noted the site's proactive attitude and good management in this area of activity.

Lastly, in view of the presence of nuclear fuel on the site until 2023, ASN has prescribed, through resolution 2020-DC-0699 of 17 November 2020, the putting in place of an "adapted hardened safety core" of material and organisational measures designed to prevent uncovering of the fuel assemblies in the fuel pools in any extreme hazard situation that reaches the "hardened safety core" level. This same resolution obliges the reinforcement of some of the site's facilities, particularly the groundwater well and the associated generator set, which constitute an additional source of cooling and of electrical power that can be mobilised in the event of an accident. The necessary work was carried out in accordance with the deadline for these requirements set at 31 December 2020. Lastly, this resolution sets 31 December 2023 as the deadline for removal of the fuel from the site, which will automatically eliminate the source of the risk of any major nuclear accident.

Final shutdown of the Fessenheim site and preparation for decommissioning

Pursuant to the final shutdown declaration sent to the Minister responsible for nuclear safety and to ASN on 27 September 2019, EDF proceeded with the final shutdown of the two reactors of the Fessenheim NPP in 2020, the first on 22 February and the second on 30 June.

In June 2020, EDF published a new version of the Fessenheim NPP decommissioning plan in response to ASN's requests for complements to the initial version of the plan received with the final shutdown declaration. In this new version EDF provides the justifications requested by ASN concerning the strategy applied in choosing the decommissioning preparation operations and the details concerning primary system decontamination and the spent fuel removal schedule.

In November 2020, EDF sent the decommissioning file provided for in Article L. 593-27 of the Environment Code to the Minister responsible for nuclear safety with a view to obtaining the Decommissioning Decree. If the Minister deems this file admissible, it will refer it to ASN for examination as from 2021. Alongside this decommissioning file, ASN will also examine the concluding report of the periodic safety review of the two Fessenheim reactors submitted by EDF in September 2020. ASN will thus assess the conditions of safety of the installation during the decommissioning preparation and short-term decommissioning phases.

EDF plans a 5-year decommissioning preparation phase, which will span the period until the reactor Decommissioning Decree is obtained. Once this decree is obtained, it should take about twenty years for site decommissioning to reach the final state, with the aim of delicensing the Basic Nuclear Installation.

The main decommissioning preparation operations envisaged by EDF consist in removing all the fuel present on the site and decontaminating the primary system of each of the two reactors. The aim of this operation is to minimise the risks associated with ionising radiation during decommissioning of the installation. In addition, areas for treating and packaging the waste resulting from the future decommissioning work must be set out in the premises.

Consequently, following final shutdown the cores of the two reactors have been completely unloaded; the spent fuel has been stored in the site's cooling pools pending transfer to the La Hague treatment facilities. About ten spent fuel removal transport operations were carried out in 2020. ASN resolution 2020-DC-0699 of 17 November 2020 requires EDF to complete the fuel removal operations by the end of 2023.

EDF has also started decommissioning preparation work, notably concerning removal of the old steam generators which is planned during the decommissioning preparation phase, with the aim of freeing up and reusing the storage building for the decommissioned steam generators. EDF plans transferring the six old steam generators, currently stored on site, to its Cyclife plant in Sweden for melting down and recovery. As for the decommissioned steam generators, EDF plans recovering them in a centralised cutting and melting facility that EDF would like to set up in France. Although Article 6 of the resolution of 21 February 2020, taken jointly by the Minister responsible for nuclear safety and the ASN Chairman, opens up the prospect of a change in the regulatory framework applicable to the management of very low level waste (see chapter 14 of the full ASN Report), in order to introduce a new possibility of targeted waivers allowing, after melting and decontamination, recovery on a case-by-case basis of very low level radioactive metal waste, the corresponding regulatory framework remains to be developed with respect to French law.

ASN carried out an in-depth inspection at the EDF's Department of Dismantling Projects and Waste (DP2D) and on the Fessenheim site in November 2019. During that inspection ASN identified shortcomings in the management of the Fessenheim decommissioning project, which at the time did not give EDF an overall picture of the project with all its interactions. In response to this, EDF set up a project dedicated to the decommissioning preparation phase, the aim of which is to guarantee that the initial decommissioning state is reached by 2025: this new organisation integrates all the EDF contributing entities in this project, starting with the site. Through this project EDF has also bolstered its organisation in order to establish and validate the structuring decisions for the decommissioning preparation phase and then for the decommissioning itself. ASN considers that the organisational changes proposed by EDF are on the whole satisfactory and will make sure that they are reflected operationally in the management of the future operations.

See chapter 13 of the full ASN Report for further information on the decommissioning of the Pressurised Water Reactors (PWRs).

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 in nuclear safety, and to a lesser extent in radiation protection, is below the general assessment of EDF. The environmental protection performance stands out positively with respect to the average for the EDF plants and is considered satisfactory.

With regard to nuclear safety, ASN considers that the operating rigour is not of the expected standard. The significant number of system configuration errors and deviations from the reactor operating technical specifications must be addressed in priority by the licensee. ASN nevertheless notes progress in the rigour of monitoring in the control room.

As far as maintenance is concerned, given the context of sustained activity on account of the ten-yearly outage of reactor 2, ASN considers that the situation is on the whole satisfactory. The licensee must nevertheless continue its efforts in the monitoring of work interventions, primarily to better detect the nonconformities that make further interventions on the facilities necessary. This is because such nonconformities remain frequent.

As far as occupational radiation protection is concerned, the results at the end of the ten-yearly outage of reactor 2 are disappointing. The lack of control of the radiological cleanliness of certain worksites has effectively led to a large number of internal exposures of workers. Improvements in the coordination of work interventions are required. The modifications to protective measures while worksites are in progress must moreover be better formalised and tracked.

With regard to environmental protection, ASN considers that the site's results for 2020 are satisfactory. ASN notes an improvement in the control of discharges in particular, despite a context constrained by the works of the ten-yearly outage of reactor 2.

With respect to labour inspection, ASN was attentive to the adaptations of the safety instructions linked to the Covid-19 pandemic, and to compliance with them. In addition, the inspections focusing on lifting operations underlined areas lacking rigour, including in the verification of equipment conformity before use.

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 (m^3) 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 m^3 volume, or by compacting 200-litre drums.

At the end of 2020, the volume of waste in the facility had reached about 350,000 m^3, or 35% 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 estimate being based on better knowledge of the future waste and the waste delivery schedules.

The year 2020 was marked by a prolonged shutdown of the centre's facilities on account of the national health context. The construction of new disposal structures for the future waste continued elsewhere.

ASN considers that the CSA is operated under satisfactory conditions in the areas of safety, radiation protection and environmental protection.

The examination 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 2020, with a view to ASN making a position statement on the conditions of operation of the centre.

Deep geological disposal project

ASN considers that the scientific experiments and work conducted by Andra in the underground laboratory at Bure continued in 2020 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.

In 2020, ASN's carried out 114 inspections in the Hauts-de-France region, of which 35 were in the Gravelines Nuclear Power Plant (NPP), 75 in small-scale nuclear activities and 4 in the transport of radioactive substances.

ASN also carried out 21.5 days of labour inspection in the Gravelines NPP.

In the course of 2020, 10 significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES scale) were reported by the Gravelines NPP, including one concerning radiation protection.

In small-scale nuclear activities, 4 events were rated level 1 on the INES scale. In radiotherapy, one event was rated level 3 on the ASN-SFRO 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 Megawatts electric (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 performance of the Gravelines NPP with regard to nuclear safety, radiation protection and environmental protection is below ASN's general assessment of EDF plant performance.

Nuclear safety performance did not improve in 2020, particularly with regard to the rigour of work interventions. The licensee has initiated an action plan which aims to bring an end to a situation where deviations and inappropriate practices and behaviours have become habitual.

ASN gave the Gravelines NPP licensee formal notice to comply, before 31 October 2020, with the regulatory provisions regarding protection against the risk of explosion of external origin, imposed by the creation authorisation decrees for the Gravelines NPP reactors 1, 2, 3, 4 and 6 and by its resolution of 20 August 2015 relative to control of the risks associated with the Dunkerque methane terminal. The compliance notice deadline was met.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **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,
  - 29 nuclear medicine departments,
  - 92 centres using fluoroscopy-guided interventional procedures,
  - 127 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 organisations, including 29 companies exercising an industrial radiography activity, 3 particle accelerators including 2 cyclotrons, 38 laboratories, mainly located in the universities of the region, and 19 companies using gamma ray densitometers,
  - 340 veterinary surgeries or clinics practising diagnostic radiology;
- **activities associated with the transport of radioactive substances;**
- **ASN-approved laboratories and organisations:**
  - 3 organisations approved for radiation protection controls.

With regard to maintenance, the year 2020 was marked by significant increases in the refuelling and maintenance outage times. The licensee has undertaken a major repair program for the pipes carrying seawater. It must nevertheless continue its work on certain items of equipment protecting against external hazards and displaying levels of corrosion that could call into question their functional integrity.

As regards environmental protection, ASN considers that the Gravelines NPP must improve its management of the maintenance of equipment that uses the insulating greenhouse gas (sulphur hexafluoride – SF_6) and the facilities for treating the radioactive effluents produced by reactor operation.

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 once again the cause of significant radiation protection events in 2020.

38 labour inspection operations were carried out in the Gravelines NPP in 2020. The inspections are divided between inspections conducted on the maintenance worksites, particularly during reactor outages, and thematic inspections (exposure to chemical risks, lifting risks, electrical risks). Meetings were also organised with senior management, members of the health, safety and working conditions committee, and personnel representatives. ASN has effectively been attentive to the adaptations of the safety instructions on account of the Covid-19 pandemic, and to compliance with them.

The accident rate, widened to include accidents both with and without sick leave, is the highest of all the NPPs, but there were no serious accidents in 2020.

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.

ASN carried out 198 inspections in the Île-de-France region in 2020, of which 56 were in the field of nuclear safety, 105 in small-scale nuclear activities, 12 in the transport of radioactive substances and 25 concerning approved organisations or laboratories.

In Île-de-France, 2 significant events in the transport area were rated level 1 on the International Nuclear and Radiological Event Scale (INES scale).

In the small-scale nuclear activities sector, 2 events were rated level 2 on the ASN-SFRO scale, and 12 were rated level 1 on the INES scale.

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). Eight BNIs are located in this centre. 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 megawatts thermal (MWth). It was primarily intended for technological irradiation of structural materials and fuels for various power reactor technologies. Another of its functions was to produce radionuclides for medical purposes.

Its critical mock-up, the Isis reactor with a power of 700 kilowatts thermal (kWth), was essentially used for training purposes. These two reactors were authorised by a Decree of 8 June 1965 and constitute BNI 40.

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. Submitted in late October 2018, the decommissioning file for the installation as a whole received information complements further to ASN's admissibility analysis. These complements give greater details of the operations planned at each stage of decommissioning and justify more precisely the initial state envisaged at the start of decommissioning and the results of the impact study.

Since the shutdown of the Osiris and Isis reactors and pending decommissioning of the facility, the removal of radioactive and hazardous materials and the decommissioning preparation operations are underway, with an organisation adapted to the new state of the facility. The spent fuel removal operations should continue until the first half of 2021.

The activities were however slowed down in 2020 by the management of the Covid-19 pandemic, which led to modification work being put on hold.

The inspections carried out by ASN in 2020 found the management of the fuel removal operations to be satisfactory. Waste management must be made more robust in order, among other things, to avoid the build-up of waste in the facility. Management of the decommissioning preparation operations remains satisfactory from the technical aspects, but delays are observed, as in the previous years. Management of baseline requirement updating deadlines needs to be improved.

Lastly, the significant events reveal in part organisational and human shortcomings in the performance of the periodic inspections and meeting their deadlines, and in the monitoring

of the outside contractors who perform these inspections. ASN considers that the operator must be attentive to the maintaining of operating rigour, to the safety culture and to the management of the periodic inspections and tests, which was already found wanting in 2019.

Orphée reactor – *CEA Centre*

The Orphée reactor (BNI 101), a neutron source reactor, was 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, which was definitively shut down at the end of 2019, is now in the decommissioning preparation phase. The licensee submitted the decommissioning file in March 2020. The ongoing examination of this file also focuses on the third periodic safety review of the facility, for which the report was submitted in March 2019. The last irradiated fuel from the Orphée reactor was removed in 2020, greatly reducing the risks the facility represents.

Based on the facility inspections and monitoring carried out in 2020, ASN considers that the level of safety of the Orphée reactor is on the whole satisfactory. More specifically, the measures taken by the licensee during the health crisis enabled compliance with requirements to be maintained at a good level.

The significant events nevertheless show that vigilance is required with equipment maintenance, monitoring and qualification. More specifically, the management of nuclear pressure equipment must be more robust, insofar as a number of these items contain heavy water.

Following reactor shutdown, the decommissioning preparation phase is 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 and control of the schedules.

Spent fuel testing laboratory – *CEA Centre*

The Spent Fuel Testing Laboratory (LECI) was built and commissioned in November 1959. It was declared a BNI on 8 January 1968 by the French Alternative Energies and Atomic Energy Commission (CEA). An extension was authorised in 2000. The LECI (BNI 50) constitutes 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.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **the 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:**
- **26 external-beam radiotherapy departments,**
  - 12 brachytherapy departments,
  - 39 *in vivo* nuclear medicine departments and 16 *in vitro* nuclear medicine departments (medical biology),
  - 148 centres performing fluoroscopy-guided interventional procedures,
  - more than 200 centres possessing at least one CT scanner,
  - about 850 medical radiology practices,
  - 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,
  - 7 industrial radiography companies using gamma radiography devices,
  - some 130 licenses concerning research activities involving unsealed radioactive sources;
- **activities associated with the transport of radioactive substances;**
- **ASN-approved laboratories and organisations:**
  - 9 organisations approved for radiation protection controls.

From the safety aspect, this facility must meet the same requirements as the nuclear installations of the "fuel cycle", 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 the CEA had undertaken to implement. Some of the CEA's commitments have not been fulfilled within the deadlines. In particular, the removal of the radioactive substances whose utilisation cannot be justified and the implementation where necessary of measures to place and maintain the BNI in a safe condition in the event of fire in the areas adjacent to the nuclear areas have been delayed.

ASN is therefore still waiting for the CEA to submit a reliable and appropriate action plan.

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 2020 revealed satisfactory operational management of the fire risk. Improvements are nevertheless expected in the management of the criticality risk, more specifically with the updating of the operating documents and better management of the quantities of radioactive substances present in the various areas of the facility.

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 ASN Chairman's' 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 monitoring of ageing of the Poséidon storage pool.

In the light of the inspections carried out in 2020, ASN considers that the facility is operated satisfactorily. By way of example, the modifications to the Poseidon source-holder elevator following a failure that occurred in early 2020 were correctly carried out with good traceability of the modifications.

However, ASN observes shortcomings in the monitoring of the lightning protection devices and the maintenance operations on the Poseidon automatic fire extinguishing system. Compliance with the regulatory periodic inspection deadlines must also be improved.

SOLID WASTE AND LIQUID EFFLUENT TREATMENT FACILITIES

The CEA operates diverse types of 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.

In view of the Potential Source Term[1] (TSM) currently present in the facility, BNI 72 is one of the priorities in the CEA's decommissioning strategy which has been examined by ASN, which stated its position on these priorities among other things in May 2019.

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 10 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. These commitments have not been met.

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 2020, the CEA asked for a further extension of several years for the removal of the waste stored in the 40 wells area.

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. It is also requesting certain arrangements for the management of certain types of waste until 2025.

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 the French Institute for Radiological Protection and Reactor Safety (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.

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 nevertheless takes positive note of the removal of three isotopic generators from the facility in 2020, which contributes to the gradual reduction of its TSM.

1. *The Potential Source Term (*Terme Source Mobilisable – *TSM in French) corresponds to the quantity of radioactive actvity that could be involved in an incident or accident.*

In 2020, ASN inspected the organisation and methodology put in place by the CEA for the conformity check of the facility against its applicable baseline requirements, and for the development and monitoring of the action plan resulting from the periodic safety review report. ASN expects an improvement in the action plan coordination and monitoring in order to reach the level of risk control that the CEA has undertaken to achieve as quickly as possible. The CEA must moreover, when necessary, put in place compensatory measures pending the upgrading of the BNI further to its periodic safety review. ASN underlines that projects that contribute to reducing the potential source term within facilities constitute priorities for safety.

Alongside this, ASN's inspections find the facility to be in good overall condition. ASN nevertheless observes inadequate management of scheduling of the regulatory periodic inspections of the handling cranes.

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. The 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 the French radioactive waste management agency's (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 only packaged some effluents from one of the installation's tanks that contains 40 cubic metres (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 January 2020, the CEA obtained ASN's authorisation to put this process into service. However, the first cementation tests on 12H packages carried out with inert effluents gave unsatisfactory results and were continued until the end of 2020.

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. Tank clean-out and dismantling studies have been carried out. An application for authorisation to perform these operations is currently being examined by ASN.

The Decree of 8 January 2004 authorising the creation of Stella also stipulated 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 could not be completed, even though the licensee has good technical knowledge of the physical and chemical issues associated with the emptying of this tank. ASN is therefore waiting for the CEA to submit an action plan to complete the emptying of this tank.

The inspections carried out in 2020 evidenced good management of the facility's baseline requirements. ASN does however observe shortcomings in the monitoring and upkeep of the electrical installations of the BNI. Improvements are also expected in the recording of the requalification analyses and

Control of urban development around the Saclay site

In view of the changes in the Basic Nuclear Installations (BNIs) of the French Alternative Energies and Atomic Energy Commission (CEA) and CIS bio international, ASN had asked the CEA and CIS bio international to update their safety assessments in order to update the hazard zones defined around the BNIs.

These updates, which take into account the shutdown of the Orphée reactor and removal of the iodine-131 from the CIS bio international facility, show an effective reduction in the risks induced by the site's BNIs. The examination carried out by ASN confirms these results, making it possible to revise the provisions for controlling urban development.

Thus, applying a cautious approach to the urban development around a nuclear site where decommissioning activities present safety risks and are going to last for several years, the Prefect of the Essonne *département* has updated the Applicable Public information Notice by maintaining a land-use planning zone over a perimeter of 250 metres starting from the Saclay site fences.

The CEA – Saint Aubin station project on the route of the future line 18, which is situated at the Christ de Saclay roundabout, is now compatible with the proposed new urban development restrictions.

tests following the material modifications and compliance with the planned frequencies for the periodic inspections and tests, as witnessed by several significant events reported on this subject. Lastly, ASN considers that the replies to the follow-up letters and the information presented in the significant events reports are not detailed enough and must be improved.

FACILITIES OF THE CEA SACLAY CENTRE 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 in May 2019 on the priorities defined by the CEA.

Ulysse reactor – *CEA Centre*

Ulysse was 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 5 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 on account of radiation protection, or areas where nuclear waste can be produced.

At end of 2019, about a hundred blocks of concrete from the cutting-up phase of the "conventional" part of the reactor block were still present in the facility. Samples were taken from these blocks by an independent laboratory in December 2019 to check that the planned clean-out targets had been met. The results of the analyses confirmed the conventional nature of the concrete blocks, the removal of which was completed in November 2020.

After analysing the facility's safety review report, ASN communicated its conclusions to the Minister responsible for nuclear safety on 22 April 2020. On completion of this safety review, ASN has not planned to issue any particular requirements regarding the residual risks of the facility.

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 the course of 2021. 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 2008. Its submission is planned before the end of 2021. ASN will be attentive to the progress of the studies planned prior to submission of the file.

The year 2020 was marked by a change of industrial operator over the perimeter undergoing decommissioning. ASN considers that the level of safety of BNI 49 undergoing decommissioning is on the whole satisfactory. The inspections revealed good organisation between the CEA and its incoming and outgoing service providers, in order to optimise the transition between them in a restricted time frame. ASN also underlines the quality of the organisation set up between the CEA and its industrial operator for monitoring the periodic inspections and tests.

However, resumption of the service provider monitoring activities – partly postponed due to the health crisis – was slow. Compliance work on the electrical installations and the lightning protection devices must also be carried out. Lastly, ASN notes delays in the updating of the demonstration of control of fire-related risks, initially announced for the end of 2019. ASN will remain attentive to compliance with the CEA's new stated deadline of the first quarter 2021.

THE IMPACT OF COVID-19

As from the beginning of the first lockdown on account of the Covid-19 pandemic, the French Alternative Energies and Atomic Energy Commission (CEA) stopped activities of the Basic Nuclear Installations (BNIs) at the Paris-Saclay centre. The large majority of the worksites were safely shut down. Only the essential activities, primarily monitoring (including environmental monitoring) and safety oversight, were maintained. However, certain periodic inspections and tests and certain regulatory verifications and maintenance operations were not carried out by the set deadlines. These were operations for which the CEA had analysed the safety impact of not performing them and, where necessary, had defined compensatory measures.

At the end of the lockdown period, the activities of the BNIs gradually restarted on the basis of a safety analysis defining the inspections and the steps to take with a view to obtaining an activity resumption authorisation from the Director of the centre.

The CEA subsequently adapted its organisational arrangements. Thus, when the second lockdown began in November 2020, the CEA did not shut down its BNIs and it maintained the periodic inspections and tests, the regulatory verifications and the maintenance operations.

The overall experience feedback for this period still has to be compiled. Nevertheless, ASN's inspections have shown that the activity resumption measures were managed satisfactorily and the measures taken by the licensee during the crisis enabled compliance with requirements to be maintained at a good level.

Artificial Radionuclide Production Plant of CIS bio international

The Artificial Radionuclide Production Plant (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. Removal of these sources, which have been stored in the facility, is well advanced. The group moreover decided to stop its iodine-131-based productions on the Saclay site at the end of 2019, which has significantly reduced the consequences of accident situations.

More generally, ASN considers that the facility's safety improvement initiative, already observed last year, continued in 2020 despite the complications resulting from the health crisis. The measures taken by CIS bio international to ensure the continuity of its activities during the crisis enabled the safety requirements to be met. The stability of the organisation and better skills management were factors that favoured this approach.

Several projects bringing significant safety improvements are currently coming to a conclusion. Nevertheless, the time frames for carrying out the major actions undertaken by CIS bio international, some of which are difficult to deploy, must be better controlled.

The inspections found that waste management had improved, in particular with the removal of legacy waste, despite the fact that breaches of the storage rules were again noted. The implementation of a comprehensive plan to improve liquid effluent management, which had been the subject of deviations in recent years, is an appropriate response, and ASN shall check the quality of the results achieved. The organisation for managing transport operations, which are numerous and involve packages with varied contents, is also efficient, but deficiencies in quality assurance and document management must be remedied.

The number of significant events is falling significantly. Compliance with the operating rules, particularly outside working hours, with the operating range and the integration of experience feedback must be further improved. ASN also expects to see improvements in the identification of significant events. Compliance with the deadlines for the site's commitments must also be further improved.

To conclude, ASN expects CIS bio international to keep up the observed performance improvement efforts. Areas for improvement on which CIS bio international must particularly focus its efforts comprise the cross-cutting functioning of the organisation, compliance with the facility baseline requirements and management of schedules, while remaining vigilant with regard to operating rigour and improving the safety culture.

Assessment of the CEA Saclay site

ASN considers that the Basic Nuclear Installations (BNIs) of the Saclay centre are operated under suitably safe conditions on the whole and notes that certain operations contributing to the reduction of the source terms stored in the BNIs concerned were carried out in 2020. Consequently, there is no more irradiated fuel in the Orphée reactor and the removal of irradiated fuels from the centre's reactors should be completed in the first half of 2021. Moreover, several isotopic generators present in BNI 72 have been removed.

Nevertheless, the activities were slowed down by the Covid-19 pandemic, which obliged certain works and modifications to be put on standby. This is because during the first lockdown the French Alternative Energies and Atomic Energy Commission (CEA) stopped the activities of the BNIs while maintaining the essential monitoring and inspection operations (see box on previous page).

In view of the structural delays in the decommissioning operations, ASN expects the CEA to continue its efforts to make its implementation schedules for these operations more robust. ASN will maintain particular vigilance in monitoring the progress of the decommissioning and waste retrieval and packaging projects, with the aim of ensuring control of the schedules.

The decommissioning and waste recovery and packaging operations continued to fall behind schedule in 2020. 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.

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. After receiving a compliance notice from ASN in September 2019, the CEA submitted in December 2019 its file presenting and justifying the dimensioning of the future emergency management buildings, whose commissioning is planned for the end of 2021. The licensee also submitted an authorisation request to ASN in December 2020 for the commissioning of its future emergency management premises.

With regard to the emergency organisation and means, ASN requested complementary information concerning the proposed update to the 2019 On-site Emergency Plan which must be submitted by the CEA in 2021. The ASN information requests relate to the organisational or structural changes at the CEA and also concern updates of operational documents concerning each of the BNIs so that they correspond to the actual state of the facilities.

As part of its oversight actions, ASN performed an inspection further to loss of the centre's compressed air supply in order to ascertain that it has no impact on the BNIs, and observed that the overall organisation put in place to manage this situation was satisfactory. ASN also noted, during a specific inspection, the ready availability of the fire-fighting means, with tests performed on the fire network. ASN nevertheless considers that the CEA must maintain its vigilance in the performance of the periodic inspections and tests of its equipment.

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 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 in May 2019 on the priorities defined by the CEA.

Procédé facility and Support facility

– CEA Centre

Decommissioning of the 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. Initial responses were provided in 2020 and the remainder will be submitted in 2021. ASN has also observed through inspections that a specific organisation has been in place since September 2020 for the periodic safety reviews. This seems to be appropriate, but it must prove its effectiveness.

Assessment of the CEA Fontenay-aux-Roses site

To cope with the health crisis, the CEA Paris-Saclay centre rapidly implemented its activity continuity plan. The large majority of the worksites on the Fontenay-aux-Roses site were shut down safely and only the essential activities were maintained during the lockdown. The interruption of the operating activities, the restriction of movements and the non-availability of certain service providers meant that certain regulatory inspections could not be performed. Resumption of the operating activities was subsequently authorised by the Director of the centre after carrying out a safety analysis and the appropriate checks.

The inspections carried out in 2020 showed that the licensee has good command of the management processes for noteworthy modifications and the transport of radioactive substances. The first actions decided by the CEA to remedy the deviations observed in radiation protection during the ASN inspections in 2019 are satisfactory and must be continued.

Several significant events in 2020 are linked to the presence of legacy contaminations, which were unknown to the CEA, in some pipes and ventilation ducts of the facilities. ASN will keep track of the investigation results and their follow-ups.

ASN once again underlines the lateness in conducting the studies, in the project programming and in the decommissioning schedule of the Fontenay-aux-Roses nuclear facilities. The CEA has nevertheless presented ASN with its forecasts concerning the coordination of the files and work planned on the site to reduce the source term within the facilities. ASN expects the CEA to continue to implement proactive measures to control and render reliable the time frames associated with these projects, particularly the deadlines announced for the submission of the decommissioning worksite preparatory studies, which will be examined by ASN.

Normandie Region

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

In 2020, ASN carried out 188 inspections in Normandie, comprising 64 inspections in the Nuclear Power Plants (NPPs) of Flamanville, Paluel and Penly, 12 inspections on the construction site of the Flamanville 3 EPR reactor, 63 inspections on fuel cycle facilities, research facilities and facilities undergoing decommissioning, 42 inspections in small-scale nuclear activities and 7 in the transport of radioactive substances.

In addition to this, 15 days of labour inspection were carried out on the NPP sites and the Flamanville 3 construction site.

In 2020, ASN was notified of 22 significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES scale), of which 19 occurred in Basic Nuclear Installations (BNIs) and 3 in small-scale nuclear activities.

ASN inspectors issued 3 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 Megawatts electric (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 nuclear safety and radiation protection is below the general assessment of the EDF plants. The environmental protection performance is improving and is in line with the general assessment of the EDF plants.

ASN considers that the site's performance in reactor operation and management must be further improved, as recurrent deviations have been observed in the application of the operating management procedures. ASN nevertheless takes positive note of the implementation of reactive improvement actions further to these events, particularly with regard to personnel training and activity preparation. Particular attention must be paid to ensuring that these actions continue over the long term.

With regard to the maintenance operations, the licensee took advantage of the outages of the two reactors to perform compliance work on various items of equipment important for safety. The licensee also detected and corrected numerous anomalies in the application of the preventive maintenance programmes. ASN considers that the compliance work on the facilities is satisfactory but the licensee must nevertheless remain vigilant about controlling the quality of the maintenance operations.

In September 2019, ASN decided to place the Flamanville Nuclear Power Plant under tightened monitoring further to the difficulties EDF encountered during the two ten-yearly outages. During 2020, the licensee continued to implement its action plan to improve operating rigour. Improvements have been observed in the condition of the facilities and the detection of anomalies in the field. A number of deviations linked to the condition of the equipment were thus able to be remedied. The licensee has moreover carried out substantial compliance work on its facility, particularly concerning the emergency diesel generator sets. ASN nevertheless observes persistent deficiencies in the command of certain activities and will be attentive to ensuring that the new practices are properly taken on board by all the workers, especially those of outside contractors. EDF must submit a revised action plan in 2021 targeting the lines for improvement still to be deployed.

The site's performance in occupational radiation protection in 2020 remained insufficient. ASN considers firstly that skills organisation and management within the risk prevention department must be improved. Numerous deviations were also detected regarding compliance with the conditions of access to and work in certain premises. Lastly, progress is expected in implementation of the optimisation principle in the preparation of work involving greater radiation exposure risks.

The recurrence of certain events and their potential seriousness confirm that the licensee must still make substantial improvements in this area.

As regards environmental protection, ASN notes that the licensee took appropriate corrective measures as a follow-up to the various findings made during the tightened inspection of 2019. Improvements are still required in the monitoring of the service providers performing activities relating to environmental monitoring.

With regard to labour inspection, ASN considers that the frequent meetings organised in 2020 during the Covid-19 pandemic allowed the development of a management strategy adapted to the specific prevention measures within the site. Nevertheless, improvements are still required in the overall organisation of prevention, particularly concerning situations with a risk of falling from height, and the management of the prevention plans.

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), 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 nuclear power plant in France, by providing additional human resources and emergency equipment.

ASN considers that the site's nuclear safety and radiation protection performance is on the whole in line with the general assessment of the EDF plants. ASN observes progress in environmental protection, where the site's performance stands out positively with respect to the general assessment of the EDF plants.

With regard to operation and reactor operational management, ASN considers that the performance is satisfactory. The scheduling of periodic tests, however, must be carried out more rigorously, particularly during reactor outages. Activity preparation and the way the workers embrace the procedures must be improved. ASN takes positive note of the implementation of an action plan in this respect and will be attentive to its implementation.

With regard to maintenance, ASN considers that the Paluel NPP's performance is contrasted. Improvements in service provider monitoring have been noted and must be consolidated, and proficiency in the safety important equipment requalification activities has also been observed. The licensee must nevertheless remain vigilant in the preparation of maintenance activities. Several safety significant events were caused by insufficient preparation of the operations. One of these events led to the replacement of the rotary drum screen of one of the reactors.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **the Basic Nuclear Installations:**
  - the Nuclear Power Plants operated by EDF, namely Flamanville (2 reactors of 1,300 MWe), Paluel (4 reactors of 1,300 MWe) and Penly (2 reactors of 1,300 MWe),
  - the EPR Flamanville 3 reactor construction worksite,
  - the Orano 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 associated with 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.

With regard to reactor 2, the refuelling outage that should have ended in December 2019 actually ended at the beginning of 2021. The unloading inspections revealed the fact that three fuel assemblies were affected by a sealing fault caused by oxide deposits. In late 2020, ASN authorised EDF to carry out another fuel assembly reloading operation and will remain vigilant regarding compliance with the particular chemical specifications of the primary system, which are intended to prevent recurrence of this fault.

This year again ASN considers that the performance of the NPP with regard to worker radiation protection must be improved. The licensee must ensure that the optimisation principle is properly applied, particularly on worksites representing a high dosimetric risk. Shortcomings in the preparation of activities in controlled areas and in the radiation protection culture of the operators are still observed.

ASN observes that the situation regarding environmental protection is progressing, the site having improved its organisation for preventing flows and the unplanned dispersion of liquid radioactive or hazardous substances into the environment, and the operation of the wastewater treatment station further to the tightened inspection of 2019. ASN also notes an effective organisation for controlling discharges of ozone-depleting gases.

With regard to labour inspection, in 2020 ASN participated in various social and economic committees addressing the organization of the Paluel site in the context of the Covid-19 pandemic health crisis. ASN considers that the prevention measures implemented in this context are appropriate. ASN's inspections relating to safety revealed no significant failings. ASN does however expect to see improvements in the management of situations involving risks of falling from height.

Penly nuclear power plant

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

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

With regard to nuclear safety, ASN considers the performance of the site to be satisfactory on the whole. However, as in 2019, ASN considers that the NPP's organisation for detecting and dealing with deviations, in accordance with the applicable regulations, is not sufficiently robust and must be further improved.

With regard to reactor management and operation, ASN considers that the site's performance is improving. The number of events reported to ASN relating to operating management of the facility is down compared with the previous years, reflecting improvements which are also observed in the reactor management activities. ASN nevertheless once again observes deviations in the management of the operating procedures used in the incident or accident management phases.

With regard to maintenance of the facilities, ASN considers that monitoring of service providers and proper application of the maintenance baseline requirements must be improved in order to optimally address the coming years, which will involve a greater number of maintenance activities, particularly with the ten-yearly outage of reactor 1. Lastly, ASN's inspections have also revealed significant nonconformities in addressing the lightning hazard risk. A reactive remediation of the facility was carried out during the year.

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

With regard to environmental protection, ASN considers that the licensee has made progress in the prevention of the flows and unplanned dispersions of radioactive or hazardous liquid substances into the environment. ASN nevertheless considers that the site must make fundamental improvements in the management of ozone-depleting gases.

With regard to labour inspection, ASN conducted several labour inspection-related visits in 2020 concerning employees of EDF and the outside companies working in the Penly NPP. ASN did not detect any significant failings, but nevertheless made several observations with respect to the lifting risk concerning situations involving a risk of loads falling, and nonconformities in work equipment involving, among other things, situations of work at height. ASN also responded to direct requests from the employees, and checked the functioning of the employee representative bodies during the lockdown decided during the health crisis, which showed that the prevention measures were appropriately managed.

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.

During the first half of 2020, EDF completed the hot test phases of the facility, which serve in particular to test operation of the nuclear steam supply system and its auxiliary systems under nominal temperature and pressure conditions. ASN considers that the organisation for performing the start-up tests is satisfactory, but that EDF must bolster its analysis of the test results, particularly regarding their representativeness and the validation of the safety criteria.

Alongside this, ASN continued the verification of the equipment quality review. This review was requested by ASN in 2018 due to serious shortcomings in EDF's monitoring of outside contractors. As in 2019, ASN considers that EDF must supplement its complementary inspections programme, particularly as regards equipment other than pressure equipment.

In 2020, EDF defined a preservation strategy for the systems, structures and components that have been mothballed until the EPR reactor is commissioned. In the last quarter 2020, ASN started the review of this strategy and conducted an inspection to check that is was properly implemented. This inspection concluded that the organisation in place is satisfactory. Further inspections will be carried out on this subject in 2021.

ASN authorised the first repairs of the reactor main secondary system welds in 2020. ASN carried out several checks on the preparation of these activities and unannounced inspections to check compliance with the requirements concerning these operations. ASN considers that the preparatory work carried out by EDF and its service providers, and the organisation gradually put in place for performing the operations, are satisfactory. ASN will continue its monitoring of these welding activities in 2021 and will be attentive to ensuring that resources and the organisation are adequate to carry out a larger volume of repairs at the same time.

Lastly, on 8 October 2020 ASN authorised the partial commissioning of the Flamanville EPR reactor for the arrival of nuclear fuel within the reactor perimeter. Several inspections were carried out to check the conformity of the facilities and the operating rigour in the transport and handling of the fuel assemblies. The verifications carried out during these inspections showed the condition of the facility and the licensee's preparedness to be satisfactory for fuel to enter the site.

As regards environmental protection, ASN notes that the licensee took appropriate corrective measures to correct the various shortcomings found during the tightened inspection of 2019. ASN considers that the licensee's consideration of environmental risks is improving.

ASN fulfils the labour inspection duties on the Flamanville 3 construction site. In 2020, ASN checked in particular that outside contractors working on the site complied with the provisions relative to labour law. Observation of the applicable safety rules formed the subject of an inspection adapted to the health crisis conditions. These inspections relating to safety revealed no significant failings. The particular context of the facility, with its partial commissioning, has also been the subject of points requiring particular attention with regard to management of the fire risk in the industrial buildings and organisation for the prevention of risks under the joint responsibility of worksite management and the licensee. ASN also responded to requests coming directly from employees and conducted investigations further to workplace accidents.

Manche waste repository

The Manche waste repository (CSM), which was commissioned in 1969, was the first radioactive waste repository operated in France. 527,225 cubic meters (m^3) of waste packages are emplaced in it. The CSM stopped accepting further waste in July 1994. From the regulatory aspect, the CSM is in the decommissioning phase (operations prior to its closure) until the installation of the long-term cover is completed. An ASN resolution shall specify the date of closure of the repository (entry into monitoring and surveillance phase) and the minimum duration of the monitoring and surveillance phase.

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 is currently examining the CSM periodic safety review report submitted by the French radioactive waste management agency (Andra) in 2019.

ASN considers that the organisational set-up implemented for operating the facilities in 2020 is satisfactory. More specifically, in the context of the Covid-19 pandemic health crisis, the licensee has put in place an activity continuity plan based on the physical protection, environmental monitoring and curative maintenance of the facilities. In the light of the regular exchanges with the licensee and the inspection carried out in December 2020, ASN considers that the measures adopted have enabled monitoring to be maintained at a satisfactory level. In addition, the analysis of the experience feedback specific to this period will enable the organisation to be further improved.

National Large Heavy Ion Accelerator

The Ganil (National Large Heavy Ion Accelerator) 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 produce these exotic nuclei, Ganil was authorised in 2012 to build phase 1 of the SPIRAL2 project, whose commissioning was authorised by ASN in 2019.

In accordance with the requirements of ASN 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, through a resolution of 11 December 2019, to push back the deadlines for the compliance work provided for by six of the ten prescriptions of this periodic safety review.

Although the cyclotrons and the linear accelerator (SPIRAL2) continued to function during the lockdown, the Covid-19 pandemic health crisis has impacted the progress of the Ganil projects as a whole. Nevertheless, the start-up tests of the SPIRAL2 accelerator continued successfully.

In addition to the inspections it carried out, ASN participated in several technical meetings relating to the second periodic safety review of the facility, for which the licensee must submit its periodic safety review concluding report by 18 May 2021 at the latest.

ASN considers that several aspects of the organisation defined and implemented for the operation of the facilities in 2020 must be significantly improved. The licensee must in particular improve its documentation management, in relation with the updating of its safety baseline requirements, and be attentive to the transcription of the regulatory requirements into its integrated management system. Improvements are also expected in the completeness and quality of the files submitted to ASN.

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 15 km from the Channel Islands.

ORANO REPROCESSING PLANTS IN OPERATION AT LA HAGUE

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

Commissioning of the various units of the fuel reprocessing and waste packaging plants UP3-A (BNI 116) and UP2-800 (BNI 117) and the effluent treatment station STE3 (BNI 118) spanned from 1986 (reception and storage of spent fuel assemblies) until 2002 (R4 plutonium treatment unit), with the majority of the process units being commissioned 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 the site's discharges and water intake 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 casks, they are unloaded either "under water" in the spent fuel pool, or dry in a leaktight 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 pieces of cladding, which are 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 comprising the dissolved radioactive substances is then processed in order to extract the uranium and plutonium and leave the fission products and other transuranic elements.

After purification, the uranium is concentrated and stored in the form of 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 intended for the fabrication of MOX fuels in the Orano plant in Marcoule (Melox).

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 La Hague site until a definitive disposal solution is found (particularly the CSD-V et CSD-C packages).

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 products 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**: Solid waste storage area,
- **E/D EDS**: Solid waste storage/removal from storage facility
- **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/storing 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 facilities;

BNI 118 – STE3 facility: Effluent collection and treatment and storage of bituminised waste packages:
- **E/D EB**: Alpha waste storage/removal from storage,
- **MDS/B**: Mineralisation of solvent waste.

In accordance with Article L. 542-2 of the Environment Code, radioactive waste from the reprocessing of spent fuels of foreign origin is shipped back to its owners. It is however impossible to physically separate the waste according to the fuel 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).

Marking events of the year 2020

In order to replace the fission product evaporator-concentrators at La Hague, which are suffering from more advanced corrosion than imagined when they were designed, Orano is building new units, called "New Concentrations of Fission Products" (NCPF) and comprising six new evaporators. This project, which is particularly complex, has required several authorisations and was addressed by an ASN resolution in 2020, focusing on the process of three of these evaporators (NCPF T2). The authorisations to connect these new evaporators to the existing units will be the subject of further resolutions and authorisations in the coming months.

Orano made commitments concerning certain points that were insufficiently studied in the first periodic safety review of BNI 117 (UP2-800), and in particular to conduct a more detailed study of the behaviour of the civil engineering of the NPH pool in the event of an earthquake, and of the hazard risks that the Oxide High Activity (HAO) facility of the UP2-400 plant undergoing decommissioning represents for BNI 117. Orano provided complementary studies and reinforcement proposals in 2020.

In April 2017, Orano requested a modification of the UP3-A plant Creation Authorisation Decree so that CSD-C storage could be extended. This extension was authorised by the Decree of 27 November 2020 on which ASN issued a favourable opinion on 8 September 2020. It provides for significant margins with respect to the risk of reaching the French storage capacity limits for this type of waste.

FINAL SHUTDOWN AND DECOMMISSIONING OPERATIONS ON CERTAIN FACILITIES

The former spent fuel reprocessing plan UP2-400 (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 (which comprises the effluents and solid waste treatment station No. 2 – STE2, and the oxide nuclear fuel reprocessing facility No.1 – AT1), BNI 47 (radioactive source fabrication unit – ELAN IIB) and BNI 80 (HAO facility).

In 2020, 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 prescribed for the two BNIs. 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. Further to the additions Orano made to the file concerning firstly the elimination of the interactions between the "Intermediate-Level Plutonium" facility (MAPu) and the plutonium oxide storage facility (BST1) in the event of an earthquake, and secondly the memorandum in response to the opinion of the environmental Authority, a public inquiry was held from 20 October to 20 November 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 the 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 STE2 station of UP2-400 was used to collect the effluents from the UP2-400 plant, treat them and store the precipitation sludge resulting from the treatment. The sludge in STE2 is therefore composed of the precipitates which fix the radiological activity, and is 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 conducted at the end of 2019 confirmed that the project was not sufficiently mature for ASN to be able to give an opinion on this DOS. The DOS was to be revised, particularly in the fundamental options of the project concerning effluent treatment, discharges into the environment and control of the fire risk.

In 2020, ASN began examining the new DOS submitted by Orano in July 2020 and providing additional information, particularly on the subjects relating to reactivity of the sludge and treatment of the effluents. ASN also continued examining the application for authorisation to install recovery equipment on the roofs of the STE2 facility silos, focusing particular attention on the fire risk, the control of which is not fully demonstrated. ASN is still waiting for additional information on this latter subject.

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.

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 water-filled silo is only ensured at present by a single containment barrier consisting of a steel "skin". Silo 130 is monitored by a network of piezometers situated nearby. The scenario for retrieving and packaging this waste comprises four stages:
- retrieval and packaging of the solid GCR waste;
- retrieval of the liquid effluents;
- retrieval and packaging of the residual GCR waste and the sludges from the bottom of the silo;
- retrieval and packaging of the soils and rubble.

Orano Cycle has built a retrieval unit above the pit containing the waste and a new building dedicated to the storing and packaging operations. In 2020, preparation of the waste retrieval operations continued and the milestone of filling the first drum of waste retrieved from silo 130 was crossed. After a prolonged shutdown of the facilities due to the lockdown imposed for management of the health crisis, and the integration of material modifications before resuming operations, including replacement of the rake cables, Orano resumed operation in October 2020 after having sent the first shipment of drums to the solid waste storage/removal from storage facility (E/D EDS) on the La Hague site.

Orano has moreover conducted an initial analysis of the feedback from the entry into service of this retrieval unit and has identified organisational improvements in the management of this type of project. These improvements concern in particular the consolidation of the methodology for transferring the facility from the project teams – including those responsible for the tests – to the future licensee's teams. ASN considers this approach to be positive.

HAO silo and Organised Storage of Hulls (SOC)

The HAO (Oxide High Activity) facility (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.

Assessment of the La Hague site

ASN considers that the performance of the Orano La Hague site in 2020 is satisfactory in the areas of nuclear safety, radiation protection and environmental protection.

As far as the management of the Covid-19 pandemic health crisis is concerned, ASN notes that Orano managed to adapt its organisation and its modes of functioning to cope with the health risk, while maintaining the required standard of safety in its facilities in operation. Orano moreover maintained the activity of some decommissioning worksites representint significant risks.

With regard to nuclear safety, ASN considers that the site's performance remained satisfactory. Nevertheless, the detection of new delays in the performance of several periodic inspections should prompt the licensee to question the adequacy of the corrective actions already implemented to comply with the planned frequency.

With regard to operational management and the operating activities, Orano must demonstrate greater rigour in the formalisation of operator authorisations in the control room. In addition, ASN will continue to be attentive to the deployment of the facility's different operating teams.

Improvement actions have also been undertaken for the management of risks involving hazardous substances and the control of conformity of the site's Installations Classified for Protection of the Environment. ASN considers that they are satisfactory and will be watchful for the occurrence of new drifts in this respect.

ASN considers that the licensee must continue its efforts in the monitoring of outside contractors, particularly through the improvement of the monitoring means and the changes in its organisation. The licensee must also show greater rigour in the monitoring of certain services, particularly those involving fewer activities, by ensuring that the applicable regulatory requirements are integrated. Lastly, in 2021 ASN will examine Orano's request for a waiver to the principle of the licensee's direct operational responsibility, a consequence of the Orano group restructuring. In this context, ASN will check the added value introduced by this new organisation and see to the maintaining of the licensee's technical skills for the day-to-day operation of the site facilities undergoing decommissioning.

ASN considers that the licensee's organisation for controlling fire risks deteriorated in 2021. Delays have been noted in the performance of some compliance work. The licensee must also endeavour to draw full benefit from the lessons learned from the fire outbreak in February 2020 on the laundry storage platform. Lastly, ASN will be particularly attentive in 2021 to the match between the fire intervention times provided in its safety case and those observed during exercises, and the efficiency of the fire-fighting operational organization. Unannounced situational scenarios will continue to be played out on this subject.

With regard to radiation protection, ASN notes that the La Hague site's organisation and its results are on the whole satisfactory. This being said, the sampling checks carried out reveal that there are still divergences between the operational documents and the various computing aids for monitoring the regulatory checks. The licensee must thus ensure that these checks are carried out exhaustively. ASN considers that Orano must also improve the traceability of application of the recommendations or reservations expressed at the radiation protection committee meetings. Lastly, ASN will remain attentive to the experience feedback for the new radiation protection organisation implemented on the La Hague site.

The environmental protection performance of the site is on the whole satisfactory. ASN notes favourably the action plan implemented for the prevention of flows and the unplanned dispersion of radioactive or hazardous liquid substances into the environment. Nevertheless, greater rigour must be applied in the depositing of waste at the collection points provided for that purpose in the facilities.

With regard to the management of the decommissioning and legacy waste retrieval and packaging projects, ASN considers that the licensee's reflections into the fundamental improvements of project organisation and management must be continued in order to meet Orano's commitment deadlines, which are transcribed in ASN requirements or decrees. As regards project management, ASN has noted the implementation of methods of functioning that should foster greater robustness. In addition, the licensee must define the potential impact of the health crisis on the time frames of the various projects or operations and take appropriate corrective measures. In 2021, ASN will be particularly attentive to the assessment of the benefit resulting from implementation of these various improvements by Orano, particularly with regard to rigour in project management and the activity risk analyses.

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 SOC (Organised Storage of Hulls), comprising three pools in which the drums containing the hulls and end-pieces are stored.

In 2020, the licensee continued the operations prior to retrieval of the waste from the HAO silo (notably the fitting out of the future waste retrieval unit) and the tests important to safety which began in 2019.

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. The treatment and packaging of the fission "UMo" products contained in the SPF2 facility tanks were completed in July 2020, thereby meeting the deadline set by ASN resolution 2019-DC-0665 of 9 April 2019. ASN considers that the vitrification of these solutions constitutes a significant improvement for the safety of these old facilities due to the reduction in their potential source term in the event of an accident.

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.

In 2020, ASN carried out 111 inspections in the Nouvelle-Aquitaine region, comprising 42 inspections in the Blayais and Civaux Nuclear Power Plants (NPPs), 58 inspections in the small-scale nuclear activity sector and 11 inspections of approved organisations and laboratories.

ASN also carried out 15 days of labour inspection at the Blayais NPP and 7.5 days at the Civaux NPP.

During 2020, 8 significant events rated level 1 on the International Nuclear and Radiological Event Scale (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.

Within the framework of their inspection duties, the ASN inspectors drew up one violation report against a veterinary surgeon for using high-activity sealed sources.

Blayais nuclear power plant

Situated in the Gironde *département*, 50 km north of Bordeaux, the Blayais NPP is operated by EDF. This NPP comprises four 900 Megawatts electric (MWe) Pressurised Water Reactors (PWRs). Reactors 1 and 2 constitute Basic Nuclear Installation (BNI) 86 and reactors 3 and 4 BNI 110.

ASN considers that the nuclear safety performance of the Blayais NPP is in line with its general assessment of the EDF plants. ASN considers that the radiation protection and environmental protection performance fall short of its general assessment of EDF performance.

With regard to nuclear safety, although the performance of the Blayais NPP is in line with the general assessment of the EDF plants, ASN considers that it has dropped slightly compared with the preceding years. The Blayais NPP has shown its ability to satisfactorily manage a large number of maintenance and modification embodiment activities on its facilities in a difficult health crisis situation. ASN also notes that the addressing of conformity deviations is satisfactory. ASN does however observe, as in 2019, deficiencies in the quality of the operational documentation covering the preparation and performance of the activities. Lastly, the second half of the year was marked by a large number of significant events highlighting the need for the Blayais NPP licensee to implement improvement actions to maintain its performance.

ASN considers that the situation regarding worker radiation protection remains sub-standard and that the site is still not managing to restore a satisfactory level, despite putting in place preventive measures at the beginning of the year and corrective measures during the outages. This finding, made by ASN through its inspections, is corroborated by the numerous and diverse significant radiation protection events, two of which were rated level 1 on the INES scale. ASN expects a strong reaction on the part of the site to rapidly and lastingly improve its worker radiation protection performance in 2021. Radiation protection will be subject to a tightened inspection in 2021.

With regard to environmental protection, ASN has noted the actions undertaken by the licensee, but considers that their effects and results are insufficiently conclusive to lastingly remediate the legacy pollution of the site's soils and captive groundwater tables. These subjects require the implementation of determined actions on the part of the Blayais NPP licensee, with closely-spaced deadlines.

With regard to labour inspection, ASN considers that the regulatory monitoring of the electrical installations and control of the asbestos risk must be improved. ASN considers that the safety results are unsatisfactory, but takes positive note of the Blayais site's drive to identify, report and deal with risk situations. ASN has continued its monitoring of the conformity files of the heavy cranes, the locally manufactured tooling, and the ventilation of premises with specific pollution problems. Lastly, ASN has specifically monitored the health crisis, especially during the first lockdown, through its presence in the field, its participation at extraordinary meetings of the social and economic committee and by responding to individual and collective requests.

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 PWRs with a power rating of 1,450 MWe. 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 NPP in France, by providing additional human resources and emergency equipment.

ASN considers that the nuclear safety and radiation protection performance of the Civaux NPP stand out positively with respect to its general assessment of EDF plant performance, and that its environmental protection performance is in line with this general assessment.

ASN considers that the nuclear safety performance is improving. ASN considers that the reactor management operations are on the whole conducted with rigour and that the NPP is capable of preventing, detecting and correcting inappropriate operating actions. Nevertheless, on several occasions, the rules defining the authorised operating range of the installation and the associated operating management instructions were not followed. ASN considers that the licensee competently carried out the planned maintenance activities during the reactor 1 refuelling outage. ASN considers that these areas of progress must be consolidated in 2021 and 2022 for the second ten-yearly outages of the reactors.

With regard to radiation protection, ASN considers that the licensee has obtained satisfactory results in limiting worker exposure to ionising radiation. The licensee correctly evaluated the collective dose received by all the workers during the reactor 1 maintenance and refuelling operations.

In the area of environmental protection, ASN has observed the licensee's progress in its ability to contain an accidental spillage of hazardous products on the site. Nevertheless, the licensee must still put in place an ultimate containment basin that can ensure on-site containment of accidental spillages and fire extinguishing water should a fire break out.

With regard to labour inspection, ASN considers that the Civaux NPP's control of the asbestos risk can be improved. Specific investigations were carried out after the occurrence of workplace accidents, notably during work involving significant safety risks carried out in the space between the two containments of the reactor building. Lastly, ASN has specifically monitored the health crisis, especially during the first lockdown, through its presence in the field, its participation at extraordinary meetings of the social and economic committee and by responding to individual and collective requests.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **the 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 associated with 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.

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.

In 2020, ASN carried out 91 inspections in the Occitanie region, comprising 49 inspections in Basic Nuclear Installations (BNIs) 36 inspections in small-scale nuclear activities, 2 in the transport of radioactive substances and 4 concerning organisations and laboratories approved by ASN.

ASN also carried out 14.5 days of labour inspection at the Golfech Nuclear Power Plant (NPP).

During 2020, 1 significant event rated level 2 on the International Nuclear and Radiological Event Scale (INES scale) and 3 events rated level 1 were reported by nuclear installation licensees in Occitanie.

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 Megawatts electric (MWe) pressurised water reactors. Reactor 1 constitutes BNI 135 and reactor 2 BNI 142.

ASN considers that the NPP's nuclear safety and radiation protection performance, despite having improved, is below the general assessment of the EDF plants. ASN will continue its tightened inspections in these areas in 2021. ASN considers that the performance of the Golfech NPP with regard to environmental protection is on the whole in line with ASN's general assessment of the EDF plants.

In the area of nuclear safety, ASN has noted significant improvements resulting from the implementation of substantive corrective actions further to the in-depth inspection of October 2019. The inspections on the theme of operating management evidenced the significance of the work done by the Golfech NPP to increase operating rigour. ASN nevertheless considers that more rigorous application of the procedures by the workers and better preparation of the activities would have prevented the occurrence of certain significant events. Furthermore, in the area of maintenance and the management of works associated with the reactor outages, ASN considers that the site must rapidly improve its organisation in order to ensure better traceability of the activities and better management of the deviations and contingencies affecting the facilities.

With regard to worker radiation protection, ASN considers that the situation has improved with respect to 2019 but remains below the required level. The findings from inspections and the events reported by the Golfech NPP reveal inadequate application of the basic rules of radiation protection by the workers.

In the area of environmental protection, ASN considers that the Golfech NPP's monitoring and waste management results are satisfactory. The site must nevertheless finalise its strategy for containing an accidental spillage of hazardous products in certain areas of its facility.

With regard to labour inspection, ASN has noted deficiencies in the regulatory monitoring of the electrical installations and considers that the coordination of the risks linked to the interfaces between the various activities must be improved. ASN considers that the worker safety results are not satisfactory at present, but notes a drive to identify, report and deal with the risk situations to try to improve this situation. ASN has specifically monitored the health crisis, through inspections in the field, participation at extraordinary meetings of the social and economic committee and by responding to individual and collective requests.

MARCOULE PLATFORM

The Marcoule nuclear platform is situated to the west of Orange in the Gard *département*. Its six 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 Basic Nuclear Installations (DBNIs) which come under the responsibility of the Ministry of Defence.

CEA MARCOULE CENTRE

Created in 1955, the 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 Alpha facility and laboratory for transuranium elements analysis and reprocessing studies, known as "Atalante" (BNI 148), created in the 1980's, is to conduct research and development concerning the recycling of nuclear fuels, the management of ultimate waste, and the exploration of new concepts for fourth generation nuclear systems. Developments were made in 2017 to extend the research activities by accommodating the activities and equipment of the Laboratory for research and fabrication of advanced nuclear fuels (Lefca), transferred from the CEA Cadarache centre.

ASN plans to make a position statement in 2021 on the continued operation of the BNI on completion of examination of the facility's periodic safety review report submitted in 2016 and of the CEA's action plan, incorporating the improvement in control of the fire risk in particular.

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. This event injured the worker. ASN rated this event level 1 on the INES scale. In 2020, the licensee detailed the process it plans implementing to authorise the reopening of the laboratory concerned, which has been closed since the incident. The work scenario includes more specifically the operations to neutralise the reagents and retrieve the waste contained in the glove box.

ASN considers that the level of nuclear safety and radiation protection of BNI 148 Atalante in 2020 is relatively satisfactory. ASN has nevertheless observed shortcomings in radiation protection concerning the accuracy of the procedures and their adoption by the workers. The management of deviations, the monitoring of the actions implemented, the assessment of their effectiveness, and the traceability of radiological zoning histories also present shortcomings which must be remedied. ASN considers that the analysis of the causes of events displaying social, organisational and human factors is insufficiently documented and does not allow the assessment of the robustness of the measures taken to guarantee their non-recurrence.

In the area of accident management and emergency organisation and means, ASN considers that substantial efforts must be made to comply with the regulatory provisions relating to emergency situation management.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **the Basic Nuclear Installations:**
  - the Golfech NPP comprising 2 reactors of 1,300 MWe,
  - the Mélox "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 Écrin facility for storing waste on the Malvési site;
- **small-scale nuclear activities in the medical sector:**
- **14 external-beam radiotherapy departments,**
  - 6 brachytherapy departments,
  - 21 nuclear medicine departments,
  - 98 centres performing fluoroscopy-guided interventional procedures,
  - 127 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, 27 companies exercising an industrial radiography activity and 77 laboratories situated mainly in the universities of the region,
  - about 560 veterinary surgeries or clinics practising diagnostic radiology;
- **activities associated with 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.

Assessment of the CEA Marcoule centre

ASN considers that the level of nuclear safety and radiation protection of the CEA Marcoule centre is on the whole satisfactory.

With regard to environmental protection, the CEA submitted two studies required by the Basic Nuclear Installation (BNI) discharges resolutions, which will be examined:

- **the health and environmental assessment of liquid and gaseous chemical discharges on the Marcoule platform;**
- **a technical-economic study of the provisions for avoiding or reducing the discharge of potentially polluted stormwaters. This study integrates the bus station project situated to the north of the Phénix BNI.**

The licensee satisfactorily continued its action plan for bringing its piezometers into compliance with the requirements of the Order of 11 September 2003 by 2024.

In the light of the inspections conducted in 2020, ASN considers that the management of on-site transport operations and environmental monitoring at the Marcoule centre are satisfactory.

With regard to emergency management, ASN authorised the implementation of the On-site Emergency Plan which will also be subject to the approval of the Defence Nuclear Safety Authority (ASND).

Complements to the examination of the stress tests carried out further to the Fukushima Daiichi NPP accident are still awaited and concern in particular the impact of the planned work to reinforce the earthquake resistance of the emergency management buildings and the proof of the habitability and accessibility of these premises in the various accident situations encountered.

Lastly, concerning the seismic hazard to consider for the Marcoule centre, the characterisation of the particular "site effects", within the meaning of Basic Safety Rule RFS 2001-01, and specific to each facility at the centre, is the subject of an ongoing technical examination.

Phénix reactor – *CEA Centre*

The Phénix NPP (BNI 71) 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 lays down various milestones and decommissioning operations for the CEA.

Removal of the spent fuel and equipment, despite unforeseen disruptions in the pace of work, continued in 2020 in accordance with the ASN requirements and the licensee's commitments made in the context of the facility's periodic safety review and transition to the decommissioning phase.

ASN considers that the level of nuclear safety and radiation protection of the Phénix NPP is on the whole satisfactory. Improvements are nevertheless expected regarding compliance with the environment resolution, optimisation of waste zoning, the times taken to implement corrective actions and preservation of the memory of the facility. Compliance with the deadlines for replying to ASN requests improved at the end of 2020, an improvement that must be maintained and continued.

Construction of the NOAH facility, which will treat the sodium from Phénix and other CEA installations, progressed in 2020 and the operating tests prior to commissioning are continuing.

The reference decommissioning scenario for the facility is currently being redefined in line with the decommissioning strategy for all the CEA facilities. These changes in the reference scenario will lead to a request to modify the Decree, which prescribes decommissioning of the NPP before the end of 2023.

Diadem facility – *CEA Centre*

The Diadem facility, currently under construction, 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).

ASN considers that worksite management is satisfactory despite the health crisis, whose impact on the project will nevertheless have to be quantified more precisely. The contractual management of the contracts is a critical point in the overall progress of the project. ASN emphasises that this facility is destined to play a key role in the CEA's overall decommissioning and waste management strategy and it is the only facility planned for the interim storage of waste packages of this type. The operations necessary for its commissioning, today planned for 2024, must therefore be a priority for the CEA. The filing of a request to modify the creation authorisation decree is planned in 2021 further to change in the package closure technology.

The CEA moreover is considering filing the first packaging approval requests, necessary for production of the intermediate-level long-lived waste (ILW-LL) packages which will be stored in the facility in 2021.

Melox plant

Created in 1990 and operated by Orano, 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 is on the whole satisfactory.

The containment barriers, on which a large part of the safety case is based, are effective and robust. The licensee is continuing its efforts to deal with the breaks in containment that can occur under normal operating conditions.

The radiation exposure risks 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. The dosimetry at the lens of the eye remains a subject of concern, particularly with regard to exposure measurement. The work to develop ergonomic radiation protection glasses adapted to the sight of each employee is completed.

On 24 June 2020, the licensee notified ASN of a significant event rated level 2 on the INES scale concerning exceeding of the annual dose limit. The licensee's analysis did not reveal any technical malfunctioning or error on the part of the operator.

Nevertheless, corrective measures and complementary studies are going to be implemented, particularly with regard to the workstation ergonomics. The rating of this event might change in the light of the complementary work initiated on the committed dose evaluation.

In April 2020, ASN authorised updating of the safety baseline requirements further to the examination of the periodic safety review report submitted in 2013. In October 2018, the licensee submitted a Periodic Safety Review Guidance File (DOR) to ASN, for which the next concluding report must be submitted in 2021. ASN issued a position statement on this DOR in the second half of 2020 and sent the licensee some additional requests.

With regard to the lessons learned from the Fukushima Daiichi NPP accident, the licensee was able to resume construction of the new emergency centre following the technical, contractual and health crisis difficulties encountered in 2020. The licensee has taken temporary measures, such as the deployment of a fall-back emergency centre, to make up for the delay.

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 and very low levels of radioactivity. The waste resulting from the plant's processes is then routed to Andra's CSA repository. The facility comprises:

- **a melting unit, melting a maximum of 3,500 tonnes of metallic waste per year;**
- **an incineration unit, incinerating a maximum of 3,000 tonnes of solid waste and 2,000 tonnes of liquid waste per year;**
- **and 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 improve the content of its files in order to meet the regulatory requirements. ASN considers that the safety management organisation put in place during the pandemic is on the whole satisfactory. In-service monitoring of the pressure equipment has been improved further to the inspection on this subject in 2019.

A request to modify the On-Site Emergency Plan was submitted to ASN in 2020 to bring it into compliance with the provisions of ASN resolution 2017-DC-0592 of 13 June 2017 concerning the obligations of BNI licensees regarding emergency situation preparedness and management.

In May 2020, a fire started in the waste introduction chamber of the facility's incineration furnace, the main cause of which is a recurrent equipment fault. This event was rated level 1 on the INES scale. The licensee is deploying corrective measures to prevent recurrence.

Lastly, in August 2020, ASN requested numerous complements to the DOR submitted in May 2019 for the next periodic safety review of BNI 160, for which the report was submitted in February 2021.

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 the performance of the materials. 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 the facility in 2020 is on the whole satisfactory.

The licensee must remain attentive to ensuring compliance with the technical requirements for monitoring discharges and effluent transfers and to the formalising of all periodic inspection and test results.

Écrin facility

The Ecrin facility, BNI 175, is situated in the municipality of Narbonne in the Aude *département*, within the Malvési site operated by Orano where the first step of the fuel cycle (excluding extraction of the ores) is carried out. The transformation process produces liquid effluents containing nitrated sludge loaded with natural uranium. The entire plant is subject to the system governing Seveso high-threshold Installations Classified for Protection of the Environment (ICPEs).

Two storage basins containing the legacy sludge from the plant constitute the Ecrin BNI. These two basins have BNI classification due to the presence of traces of artificial radioisotopes. This BNI was authorised by Decree of 20 July 2015 for the storage of radioactive waste for a period of 30 years.

The Ecrin facility was commissioned by ASN resolution 2018-DC-0645 of 12 October 2018. This authorisation enabled the licensee to start in February 2019 the work defined in the authorisation decree, which continued in 2020 with the start of filling of the PERLE vault (French acronym standing for "Project for Reversible Lagoon Storage in the Ecrin BNI"). The installation of a bituminous cover on the BNI's basins has also been started.

The licensee announced in 2020 that it would be late in submitting the results, provided for by Article 7 of the creation authorisation decree, relative to the storage options feasibility study with a view to final disposal of the radioactive waste from the Orano Malvési site.

ASN considers that the level of nuclear safety and environmental protection of the Écrin facility is satisfactory.

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.

In 2020, ASN carried out 37 inspections, comprising 2 inspections in the facilities of the company Ionisos (Pouzauges and Sablé-sur-Sarthe), 31 in small-scale nuclear activities, 3 concerning approved organisations and 1 in the transport of radioactive substances.

One significant event in 2020 at the Ionisos facility in Pousauges was rated level 1 on the International Nuclear and Radiological Event Scale (INES scale), due to noncompliance with the general operating rules.

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 constitute Basic Nuclear Installation (BNI) 146 and 154 respectively.

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 operation of the irradiator at Sablé-sur-Sarthe with regard to nuclear safety and radiation protection is satisfactory. With regard to the Pouzauges irradiator, ASN considers that the licensee demonstrates transparency, but a lack of operating rigour has nevertheless been noted. ASN continued its examination of the periodic safety review reports of the two irradiators in 2020. Several modification projects concerning the Pouzauges facility are currently being examined, and ASN has authorised extension of the period of utilisation of sealed sources in the Sablé-sur-Sarthe facility.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **the 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 units,
  - 11 nuclear medicine departments,
  - 40 centres performing fluoroscopy-guided interventional procedures,
  - 55 computed tomography scanners,
  - some 2,500 medical and dental radiology devices;
- **small-scale nuclear activities in the veterinary, industrial and research sectors:**
  - 1 cyclotron,
  - 26 industrial radiography companies, including 10 performing gamma radiography,
  - about 400 industrial equipment and research licenses;
- **activities associated with the transport of radioactive substances;**
- **ASN-approved laboratories and organisations:**
  - 4 agencies approved for radiation protection controls,
  - 13 organisations approved for measuring radon,
  - 1 head-office of a laboratory approved for environmental radioactivity measurements.

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.

In 2020, ASN carried out 95 inspections in the Provence-Alpes-Côte d'Azur (PACA) region, comprising 52 inspections in Basic Nuclear Installations (BNIs), 38 inspections in small-scale nuclear activities, 1 in the transport of radioactive substances and 4 concerning organisations and laboratories approved by ASN.

During 2020, no significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES scale) were reported by nuclear installation licensees.

In small-scale nuclear activities, 2 significant events rated level 1 on the INES scale were reported to ASN (1 in the industrial sector and 1 in the medical sector).

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 – BNI 32);
- the Masurca research reactor (BNI 39);
- the Éole research reactor (BNI 42);
- the enriched Uranium Processing Facilities (ATUe – BNI 52);
- the Central Fissile Material Warehouse (MCMF – BNI 53);
- the Chemical Purification Laboratory (LPC – BNI 54);
- the High-Activity Laboratory LECA-STAR (BNI 55);
- the solid radioactive waste storage area (BNI 56);
- the Phébus research reactor (BNI 92);
- the Minerve research reactor (BNI 95);
- the Laboratory for research and experimental fabrication of advanced nuclear fuels (Lefca – BNI 123);
- the Chicade laboratory (BNI 156);
- the Cedra storage facility (BNI 164);
- the Magenta storage warehouse (BNI 169);
- the Effluent advanced management and processing facility (Agate – BNI 171);
- the Jules Horowitz Reactor (RJH – BNI 172) under construction.

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, is continuing or has finalised the examination of the periodic safety review guidance files or the conclusion reports for 17 of the 21 installations: Pégase-Cascad, Cabri, Rapsodie, STD, STE, ATPu, Éole, ATUe, MCMF, LPC, 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 (BNI 22) entered service on the Cadarache site in 1964 and was operated for about 10 years. The CEA was authorised by a Decree of 17 April 1980 to reuse the Pégase facility for the storage of radioactive substances, in particular spent fuel elements stored 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. Although a large proportion of the stored substances has been removed from the facility, the CEA is significantly behind schedule with some of the

removal from storage operations initially prescribed for 2018 in the ASN Chairman's resolution CODEP-CLG-2017-006524 of 10 February 2017. This deadline was revised in ASN Chairman's resolution CODEP-CLG-2020-062379 of 21 December 2020 relative to the periodic safety review of the facility which stipulates the deadlines for the nearest stages in these removal actions before 2025. The furthest removal from storage deadlines, planned by 2035, shall fall under application of the future Decommissioning Decree of the Pegasus facility.

In 2019, the CEA submitted a decommissioning file for the Pégase part of BNI 22, which is currently being examined.

The Cascad facility, authorised by a Decree of 4 September 1989 modifying the Pégase facility and operated since 1990, remains in service, dedicated to the dry storage of irradiated fuel in wells.

The creation authorisation decree for the facility stipulates that ASN authorises the storage of fuels in Cascad for a period of 10 years. In the context of its last authorisation renewal application sent in 2014, the CEA had informed ASN of its aim to remove a portion of this fuel from storage for reprocessing in the La Hague plant before the end of 2023. These removal operations began at the end of 2020.

ASN considers that the nuclear safety and radiation protection of the Pégase and Cascad facilities for 2020 is on the whole satisfactory. It more specifically notes improvements in the monitoring of the action plans stemming from the last periodic safety review of the facilities in 2017, but remains attentive to the deadlines prescribed for the various removal from storage operations.

Cabri research reactor – *CEA Centre*

The Cabri reactor (BNI 24), created on 27 May 1964, is intended 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 (PWR). 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.

On 25 September 2020, the licensee reported a significant event concerning a leak detected and collected in the "core water" system containment. This event and the compensatory measures proposed by the CEA are currently being examined by ASN, particularly their implications for reactor safety and protection of the environment.

The periodic safety review of the facility submitted at the end of 2017 is currently being examined by ASN.

Examination of the request to modify its authorisation decree in order to conduct irradiations on electronic equipment, which was submitted in 2019, continued in 2020. The next cycle of tests is planned for 2021.

ASN considers that the level of nuclear safety and radiation protection of the facility is on the whole satisfactory.

THE INSTALLATIONS AND ACTIVITIES TO REGULATE COMPRISES:

- **the 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:**
- **13 external-beam radiotherapy departments,**
  - 3 brachytherapy departments,
  - 17 nuclear medicine departments,
  - 112 centres performing fluoroscopy-guided interventional procedures,
  - 105 computed tomography scanners,
  - some 8,200 medical and dental radiology devices;
- **small-scale nuclear activities in the veterinary, industrial and research sectors:**
  - about 400 industrial and research centres, including 3 cyclotron particle accelerators and 20 companies with an industrial radiography activity,
  - about 465 veterinary surgeries or clinics practising diagnostic radiology;
- **activities associated with the transport of radioactive substances;**
- **ASN-approved laboratories and organisations:**
  - 2 laboratories approved for taking environmental radioactivity measurements
  - 1 organisation approved for measuring radon,
  - 6 organisations approved for radiation protection controls.

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.

The licensee is continuing the clean-out and decommissioning preparation work. ASN continued its examination of the decommissioning file in 2020 and issued an opinion on a draft decree to regulate this forthcoming phase in the life of the reactor and which also sets a new perimeter for the installation.

ASN considers that the level of nuclear safety and radiation protection of this installation in 2020 is on the whole satisfactory, particularly with regard to the organisation put in place for monitoring and dealing with deviations.

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 in 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 intermediate-level, long-lived (ILW-LL) 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 of the STD over the long term necessitates renovation work, which has been prescribed by ASN Chairman's resolution CODEP-CLG-2016-015866 of 18 April 2016. ASN is currently examining the significant reinforcement project "Pagode", which presents particular challenges, especially regarding the civil engineering work.

In view of the state of progress of the project, the CEA has announced that it would be unable to meet the prescribed project completion date of 2021. An official request will be made to push back this deadline. In the meantime, compensatory measures concerning in particular the limiting of the quantities of radioactive substances in the facility and fire protection, are applied.

Concerning the fall of a waste package that occurred in October 2017, the analysis of the root causes, prescribed by ASN, has been carried out by the CEA head office departments. This analysis is monitored by ASN. The points concerned by the compliance notice have been satisfied, as have the majority of the requirements. An inspection carried out in 2020 on "waste management" did however show that the licensee's safety culture needed to be further improved.

The file applying for authorisation to retrieve the package from the bottom of the well was submitted in 2020 and is currently being examined. It governs the restarting of activities in the well.

The level of safety and radiation protection of the facility, integrating the action plan necessary for improvement of the safety culture and operating rigour, is relatively satisfactory.

On 23 September 2020, the CEA submitted the guidance note for the STD's next periodic safety review, for which the report will be submitted in 2022. The licensee must finalise as soon as possible the actions stemming from the last periodic safety review which were still not completed in 2020.

ASN will also remain attentive to ensuring that the analyses presented in the significant event reports and the replies to its follow-up letters are as complete as possible.

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 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.

The periodic safety review file for the STE was submitted to ASN on 30 October 2017 and its examination continued in 2020.

Following the discovery of artificial radionuclides outside the identified area, the licensee deployed an action plan – which was the subject of discussions in 2020 – to improve stormwater management.

The level of nuclear safety and radiation protection of BNI 37-B is on the whole satisfactory.

Plutonium Technology Facility and Chemical Purification Laboratory – *CEA Centre*

The Plutonium Technology Facility (ATPu – BNI 32) produced plutonium-based fuel elements intended for fast neutron or experimental reactors as from 1967, then, from 1987 until 1997, for Pressurized Water Reactors (PWRs) using MOX fuel. The activities of the Chemical Purification Laboratory (LPC) (BNI 54) were associated with those of the ATPu: physical-chemical verifications and metallurgical examinations, treatment of effluents and contaminated waste. The two facilities were shut down in 2003 and are currently undergoing decommissioning.

The decommissioning schedule has been reviewed further to the health crisis:

- for the ATPu: the removal of waste and materials from the facilities was less consequential than forecast, particularly as regards removal of the drums containing alpha-emitting radionuclides from BNI 56;
- for the LPC: further to the measurement campaigns and the subsequent obtaining of an authorisation for simplified management of criticality on the worksite at the start of the year, the cryotreatment process removal operations were resumed.

ASN considers that the level of nuclear safety and radiation protection of the facilities in 2020 is on the whole satisfactory. Despite observed improvements in the facility's waste management, further progress is expected, particularly regarding compliance with the decommissioning plan.

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.

Final shutdown of the facility was declared by the CEA on 31 December 2018. The licensee submitted the facility decommissioning file in December 2020.

ASN considers that the level of nuclear safety and radiation protection of Masurca in 2020 is on the whole satisfactory.

Éole and Minerve research reactors
– CEA Centre

The experimental Éole and Minerve reactors are very-low-power (less than 1 kW) 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 PWRs 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.

The CEA submitted the periodic safety review report for the Éole and Minerve facilities in February 2020. ASN continued the examination of the decommissioning files for these reactors in 2020.

Pending decommissioning, removal of the radioactive materials prescribed by ASN resolution CODEP-CLG-2016-049370 of 16 December 2016 took place before the end of 2020 deadline.

ASN considers that the level of nuclear safety and radiation protection of the Éole and Minerve reactors in 2020 is on the whole satisfactory. The facility gives ASN half-yearly reports on the progress of its decommissioning preparation operations to prove compliance with the planned schedule.

The enriched Uranium Processing Facilities – *CEA Centre*

From 1963 to 1995, the enriched Uranium and Plutonium Facilities (ATUe – BNI 52) converted uranium hexafluoride (UF_6) 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 prior assessment of the radiological condition of the facility. Consequently, the licensee has requested the modification of its decommissioning decree on several occasions to take account of the true radiological condition of the facility. At the end of 2020, ASN issued an opinion on a draft decommissioning decree amendment intended to update the regulatory oversight of the last decommissioning steps of this facility.

The level of nuclear safety and radiation protection of the ATUe facilities in 2020 is on the whole satisfactory. The only activities in the facility today are the maintenance and regulatory periodic inspection operations.

Central Fissile Material Warehouse
– CEA Centre

Created in 1968, the Central Fissile Material Warehouse (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 initiated in 2018, notably the chemical and radiological characterisations of the facility, continued in 2020. By resolution CODEP-MRS-2020-023523 of 3 April 2020, ASN also authorised the emptying and degassing of the fuel tanks necessary for supplying the facility's fixed generator set with a view to shutting it down.

Alongside this, an inspection of the facility's periodic safety review methodology supplemented the ongoing examination of the BNI 53 safety review report, submitted in October 2017.

LECA-STAR High-Activity Laboratory
– 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 increase its earthquake resistance.

On 10 July 2020, ASN issued a resolution CODEP-CLG-2020-036269 setting the requirements applicable to LECA in the light of the conclusions of its periodic safety review, which makes continued operation conditional on the limiting of the potential source term of the facility in accident situations and the performance of work to improve control of the risks relating to earthquakes, fire and flooding. The CEA had identified the reinforcements necessary to guarantee the stability of LECA in an earthquake of intensity equivalent to the maximum historically probable earthquake. These provisions are to be implemented before the end of 2023.

Commissioned in 1999, the STAR facility is an extension of the LECA laboratory, designed for the stabilisation and reconditioning of spent fuel.

The CEA submitted the STAR periodic safety review report to ASN in February 2018 and it is currently being examined.

Further to the inspections conducted in 2020, ASN remains vigilant regarding due consideration of the social, organisational and human factors in the operation of the facility and the meeting of commitments made further to the inspections and the analyses of significant events.

ASN considers that the level of nuclear safety and radiation protection of BNI 55 in 2020 is on the whole satisfactory.

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 three pools, six pits, five trenches and hangars, which contain in particular ILW-LL from the operation or decommissioning of CEA installations. BNI 56 is one of the priorities identified by the CEA in its new decommissioning and waste management strategy.

Apart from during the first lockdown period, the operations to retrieve the waste contained in the recent pits and to empty the hangars continued.

In the preparatory phase for retrieval of the "intermediate level" waste, the CEA is continuing to characterise the composition of the waste, an operation for which an authorisation request has been submitted to ASN and is currently being examined.

With regard to environmental protection, the last periodic safety review of the facility revealed the necessity to improve the monitoring of the groundwater tables beneath the facility. The CEA started installing new piezometers for this purpose in 2020. An action plan for improving stormwater management on the facility is currently being deployed to ensure compliance with ASN resolution 2013-DC-0360 of 16 July 2013.

ASN considers that the level of nuclear safety and radiation protection of BNI 56 is satisfactory. More specifically, improvements have been observed in the tracking of the commitments made to ASN.

Phébus research reactor – *CEA Centre*

The Phébus reactor (BNI 92) is an experimental pool-type reactor with a power rating of 38 Megawatts thermal (MWth) which functioned from 1978 to 2007. Phébus was designed for the study of serious accidents affecting light water reactors and for defining operating procedures to prevent core melt-down or to mitigate its consequences.

The licensee submitted its periodic safety review file in October 2017 and its decommissioning file in February 2018. These two files are currently being examined.

The decommissioning preparation operations continued in 2020, notably with the removal of unused sources and operations to characterise certain items of equipment further to completion of removal of irradiated fuel from the reactor in 2019. The removal of non-irradiated materials however, initially planned for 2020, has been pushed back to 2021 due to the health crisis.

ASN considers that the nuclear safety and radiation protection of the Phébus installation in 2020 is satisfactory.

Laboratory for research and experimental fabrication of advanced nuclear fuels (Lefca) – *CEA Centre*

Commissioned in 1983, Lefca (BNI 123) was a laboratory tasked with conducting studies on plutonium, uranium, actinides and their compounds with the aim of understanding the behaviour of these materials in the reactor and in the various stages of the fuel cycle. In 2018, in preparation for the stopping of its activities, Lefca finalised the transfer of part of its research and development equipment to the Atalante laboratories (BNI 148) at Marcoule.

The CEA submitted the final shutdown declaration for the facility in April 2019. The decommissioning file should thus be submitted in 2021.

In accordance with ASN resolution 2017-DC-0597 of 11 July 2017, the CEA submitted an update of the facility's impact study to ASN at the beginning of 2020.

ASN considers that the level of nuclear safety and radiation protection of the facility in 2020 is on the whole satisfactory. Monitoring of outside contractors and of the fire load has been improved further to the inspections conducted in these areas in 2019.

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 must undertake to submit a request to modify the facility's creation decree to take into account gaseous discharges of tritium, not provided for in its baseline requirements.

Examination of the periodic safety review concluding report submitted in 2017 continued in 2020, with the licensee submitting a series of commitments to improve the safety of the facility.

Examination of the packaging approval request for the composition of intermediate level "870 L bulkvrac sources" packages, submitted in June 2017, did not enable ASN to rule on approval. A qualification programme for this type of package must be finalised by April 2021, and proof of the number of packages that will be produced during the process development phase must be provided in order to guarantee compliance with the facility creation authorisation decree.

Cedra storage facility – *CEA Centre*

Since 2006, the Cedra facility (BNI 164) is used to store 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 began in 2020.

ASN considers that the main steps of this project need to be better defined and that CEA must look ahead to all the procedures in order to have the necessary storage capacities for overall management of the CEA's waste.

The CEA sent ASN the periodic safety review report for the facility in November 2017, and it is currently being examined. Complementary information has been requested, particularly concerning the facility's baseline requirements conformity check and the action plan.

ASN considers that the level of nuclear safety and radiation protection of Cedra is on the whole satisfactory.

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.

Commissioning of the glove boxes was refused by ASN in 2019 and no new commissioning request was made in 2020. These glove boxes are intended for work on the facility's uranium- and plutonium-bearing materials, notably for the repackaging of fissile materials and to allow better characterisation of certain materials.

ASN considers that the facility must further improve its operating rigour, and more specifically the monitoring of protection important components and their modifications.

Effluent advanced management and processing facility – *CEA Centre*

The Effluent advanced management and processing facility (Agate) 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.

ASN considers that the level of nuclear safety, radiation protection and environmental protection in the Agate facility is on the whole satisfactory. The CEA announced in December 2020 that the Agate evaporator would be out of service for a period of from six months to one year further to a failure on the steam production system. ASN underlines that this facility plays a central role in the management of the CEA effluents and as such constitutes a sensitive facility in the CEA's decommissioning and material and waste management strategy.

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 installation of the reactor pool equipment continued during 2020, more particularly with the insertion of the core containment (central part of the reactor pile block) at the end of the year. Several items of equipment were also introduced into the various buildings of the facility (cooling towers, transfer conveyor, diesel fuel tanks and systems). The lining of the pools and channels of the nuclear auxiliaries building is still being installed.

The CEA made a major reorganisation of the RJH project in 2020, setting up a team integrating project ownership and project management under CEA authority, in order to enhance the efficiency of project execution and monitoring.

ASN considers that the new organisation maintains the skills of the initial teams. On the other hand, this has had consequences on the requirements with regard to conformity assessments of the assemblies containing nuclear pressure equipment. This led the CEA to submit to a request to adjust certain requirements to ASN, which responded positively for some but not all of the items of equipment.

Lastly, the CEA identified a technical problem in 2020 during the qualification tests of certain components inside the reactor pile block. Problems of wear and excessive vibration were observed at the extremities of these components. Consequently, the CEA has set up an ad hoc working group to solve this problem. The technical solutions could lead to design modifications and revising of the corresponding safety studies.

ASN considers that the RJH construction site is managed satisfactorily by the CEA and that the management and addressing of deviations is rigorous and effective.

ITER

The ITER installation (BNI 174), under construction on the Cadarache site since 2010 and adjacent to the CEA facilities, will be a fusion experimental reactor used for the scientific and technical demonstration of the control of thermonuclear fusion energy obtained by magnetic confinement of a deuterium-tritium plasma during long-duration experiments with a significant power level (500 Megawatts developed for 400 seconds). This international project enjoys financial support from China, South Korea, the United States, India, Japan, Russia, the European Union, who make in-kind contributions by providing equipment for the project.

The large quantities of tritium that will be brought into play in this installation, the intense neutron flow and the resulting activation of materials have serious implications regarding radiation protection and will represent true challenges for the safe management of waste during the operation and decommissioning of the installation.

The work on the site and the manufacture of equipment continued in 2020 with the objective of deploying the first hydrogen plasma by 2025. An assessment of the impact of the health crisis on the overall construction schedule is expected in 2021.

The installation of the first components of the cryostat, which help support the vacuum chamber, was specially monitored during ASN's inspections in 2020. These activities will make it possible to start the vacuum chamber assembly phase, for which the first components arrived on the site in 2020.

ITER organisation requested approval to start this assembly phase in March 2020, in accordance with the requirement (BNI 174-07) of the amended ASN resolution of 12 November 2013. ASN made numerous additional information requests in order to improve the consistency of this file and the justification of the items submitted.

Assessment of the CEA Cadarache centre

ASN considers that the level of nuclear safety of the CEA Cadarache centre in 2020 is on the whole satisfactory. The stopping of the facilities' activities for the first lockdown from March to May 2020 and their subsequent restarting were carried out satisfactorily.

ASN considers that the Basic Nuclear Installations (BNIs) are operated satisfactorily on the whole, especially the control of the condition of the equipment, compliance with the operating baseline requirements and waste management. Improvements are nevertheless expected in the in-depth analysis of significant events and the management of obsolescence of certain Protection Important Components. The CEA is moreover changing its system for managing fire loads in BNIs in order to remedy the recurrent failings in this area.

Nuclear safety management is on the whole satisfactory, but, as in 2019, ASN considers that the sharing of experience feedback and good practices between facilities must be improved, as must the management of deviations. In addition, the monitoring of service providers and subcontractors is found to be contrasted, with some BNIs remaining below standard in this area.

ASN considers that the organisation in place for the periodic safety reviews of the facilities is 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 application of the BNI periodic safety review action plans, particularly with regard to carrying out the work identified in the reviews. The CEA must also put in place compensatory measures when actions fall behind schedule, whether due to the health crisis, to particular technical difficulties or to the priorities laid down in its general decommissioning and waste management strategy.

This strategy, on which ASN and Defence Nuclear Safety Authority (ASND) have issued a position statement, induces changes in facility renovation and new facility construction projects for the CEA Cadarache centre, in favour of certain priority decommissioning worksites. The CEA must maintain a good operating standard in the facilities in operation, while at the same time ensuring that the priority decommissioning and legacy waste retrieval and packaging projects continue to move forward.

With regard to emergency situation management, ASN considers that, despite the progress observed on certain BNIs concerning compliance with resolution 2017-DC-0592, the organisation implemented for emergency situation management requires improvements, particularly in the following of training courses and participation in emergency exercises.

ASN considers that the radiation protection situation of the CEA centre is satisfactory. Optimisation of zone transition areas and of the positioning of radiological control equipment is nevertheless necessary in certain BNIs.

ASN observes that the level of environmental protection is relatively satisfactory. With regard to monitoring of the discharges, improvements are required in the monitoring of the representativeness of measurement samples and the consideration of metrological uncertainties in the utilisation of the data. A nationwide request to this effect has been sent to all the BNIs of the CEA. Alongside this, improvements are expected in the application of ASN resolution 2013-DC-0360 of 16 July 2013 to hazardous or radiological product storage areas.

Lastly, the laboratory analysing the samples for the non-radiological parameters, which did not comply with standard 17025, has implemented compensatory measures for the continuation of measurement activities.

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 the facility in 2020 is on the whole satisfactory. The licensee must remain attentive to the monitoring of the pressure equipment present in the facility.

On completion of examination of the safety review file submitted by the licensee, ASN, through resolution CODEP-MRS-2019-048140 of 5 December 2019, has set technical requirements governing the continued operation of the facility. The licensee has produced an action plan and informs ASN of its progress every six months.

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