ASNR
Autorité de sûreté nucléaire et de radioprotection

# ABSTRACTS

# ASN REPORT

## on the state of nuclear safety and radiation protection in France in 2024

The French Authority for Nuclear Safety and Radiation Protection presents the Report of the Nuclear Safety Authority on the state of nuclear safety and radiation protection in France in 2024.

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.

## ABSTRACTS

# ASN Report on the state of nuclear safety and radiation protection in France in 2024

*This report, which describes the state of nuclear safety and radiation protection in France in 2024, was drawn up by the French Authority for Nuclear Safety and Radiation Protection (ASNR). ASNR was itself created from the merging on 1 January 2025 of the Nuclear Safety Authority (ASN) and the Institute for Radiation Protection and Nuclear Safety (IRSN). The Commission and the departments speak on behalf of ASN concerning the year 2024, and on behalf of ASNR when it comes to more general considerations or projections.*

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**Only regulatory news for the year 2024** is presented in this report.
The regulations as a whole can be consulted on ***asnr.fr***

# Maintaining a high level of rigorous nuclear safety and radiation protection in an ambitious context

*From left to right*
**Pierre-Marie ABADIE**, Chairman
**Stéphanie GUÉNOT BRESSON**, Commissioner
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**Géraldine PINA**, Commissioner
**Jean-Luc LACHAUME**, Commissioner

Montrouge, 1 March 2025

The safety level of the nuclear facilities was satisfactory in 2024, with considerable mobilisation around the performance of the fourth periodic safety reviews of the 900 Megawatts electric (MWe) reactors, stabilised production levels in the Melox plant and efforts by the industrial sector to improve manufacturing quality. In the medical field, the level of radiation protection is also considered to be satisfactory, despite some points warranting particular vigilance.

At a time when nuclear energy is set to be a key component of the French energy system for the long-term, the French Authority for Nuclear Safety and Radiation Protection (ASNR) recalls that:

- anticipation is required in order to take decisions informed by the best knowledge and underpinned by a questioning attitude that is attentive to weak signals;
- the long-term future of the facilities must aim for the best safety standards, including by comparison with the projects for more modern facilities that will be replacing them;
- physical and time margins must be maintained to be able to deal with contingencies without compromising safety.

A strategy to examine the service life extension of the reactors is deployed on the occasion of the fourth and fifth periodic safety reviews and in anticipation of the possible continued operation beyond then. This strategy enabled these examinations to be industrialised. The launch of studies into the long-term future and upgrading of the fuel plants is a positive point with respect to the aim of balancing the "cycle".

With the up-turn in the construction of new reactors and new fuel plants, highly active innovation in the medical sector, or Small Modular Reactors (SMRs), as well as new prospects for service life duration, the nuclear safety and radiation protection stakeholders must meet new challenges: acquisition of new knowledge, dissemination of the safety and radiation protection culture to all the stakeholders, including in the subcontracting chain, mobilisation of resources and skills on behalf of nuclear safety and radiation protection, at a time of extreme competition for resources.

ASN, and now ASNR, are adapting to this new context. After the passage of Act 2024-450 of 21 May 2024 ratifying the merger of the Nuclear Safety Authority (ASN) with the Institute for Radiation Protection and Nuclear Safety (IRSN), the collective preparation work enabled ASNR to be immediately operational on 1 January 2025, with respect to all of its missions. ASNR covers research, expert assessment, examination and oversight, and comprises a full range of disciplines and skills ranging from the acquisition of knowledge, to decision-making and regulation/oversight. It is more independent, more robust and more visible, in France and internationally. The coming months will enable its organisation to be consolidated, enable ASNR to establish itself within its ecosystem, and gradually build an integrated strategy for research, expert assessment, oversight and transparency, and dialogue with society.

## The continued operation of the nuclear power plant fleet remains a major subject

The provisions of Article L. 593-18 of the Environment Code stipulate that ASNR shall issue a position statement on the continued operation of the nuclear facilities every ten years, following their periodic safety review.

The fourth periodic safety review of the 900 MWe reactors (RP4 900), is continuing reactor by reactor, in order to significantly improve the level of safety. In 2024, ASN issued a position statement on the guidelines to be followed for the fifth periodic safety review of these reactors, which will enable the conditions to be defined for their continued operation beyond 50 years, while maintaining the same safety objectives. EDF intends to focus the fifth periodic safety review on the one hand on verifying the conformity of the installations, maintaining equipment qualification and management of ageing. On the other hand, it will focus on reassessing the management of risks and detrimental effects, taking account of the effects of climate change. ASN considered that the general guidelines adopted by EDF are pertinent and consistent with the current level of knowledge.

With regard to the fourth periodic safety review of the 1,300 MWe reactors (RP4 1,300), ASN's examination of the main generic safety issues continued in 2024 with the support of IRSN. At the same time, in the opinion of the guarantors of the consultation appointed by the High Committee for Transparency and Information on Nuclear Safety (HCTISN), the public consultation on the conditions for improving the safety of the 1,300 MWe reactors as part of their fourth periodic safety review, conducted under the aegis of the HCTISN with the participation of EDF, IRSN, the National Association of Local Information Committees and Commissions (Anccli) and ASN, was able *"to publicly and successfully tackle essential questions concerning society as a whole, over and above the ongoing regulatory authorisation procedure"*.

The examination was conducted efficiently thanks to the reutilisation of the governance processes put into place for examination of the fourth periodic safety review of the 900 MWe reactors with EDF and IRSN, while also making full use of Operating Experience Feedback (OEF). This result, along with the division of future modifications into batches, and the continuity of the objectives with the fourth periodic safety review of the 900 MWe reactors, aims to allow standardised deployment of the safety modifications on the 1,300 MWe reactors as of the first reactors concerned, while giving priority to the high-stakes modifications, starting in 2026.

With regard to the possible operation of the current fleet of reactors beyond 60 years and on the basis of the work done by EDF, the year 2023 saw identification of the main technical subjects requiring specific analysis, or even research and development, ahead of the periodic safety reviews. The conclusions of EDF's early analyses will be reviewed so that ASNR can issue a position statement in 2026.

Finally, since they began operating, the operational baseline requirements of the reactors, in particular their General Operating Rules (RGEs), have become increasingly complex, notably to take account of OEF and reassessment of the threats from external hazards. This increased complexity may result in problems with applying the RGEs, or the operators may even lose sight of the purpose of their actions, which has consequences for risk management. EDF has started a short, medium and long-term simplification process, which has already led to exchanges with ASN and IRSN. At the same time, ASN called the profession together in 2024, for a round of discussions with the Steering Committee for Social, Human and Organisational Factors. A summary of this work will be published in 2025.

## Stress corrosion lessons to be consolidated

The existence of the stress corrosion phenomenon affecting certain auxiliary piping was discovered at the end of 2021 and led to a strategy of systematic replacement of the lines considered to be susceptible in 2023, and increasingly wide-ranging inspections which will continue on the entire fleet up until 2025.

On the occasion of the next periodic safety reviews, the lessons learned will need to be incorporated by EDF into its maintenance programmes. ASN in particular considers that the hypotheses concerning the lack of susceptibility to degradation mechanisms, adopted for certain zones which are not monitored by a preventive maintenance programme, must be backed up by a programme of additional investigations.

## Monitoring the commissioning of the Flamanville EPR and the EPR 2 programme

Following the examination carried out by ASN with the support of IRSN, and after consulting the public about EDF's dossier, the ASN decision of 7 May 2024 authorised commissioning of the Flamanville EPR reactor, thus allowing EDF to load nuclear fuel and carry out start-up tests. This authorisation comprised technical prescriptions concerning the performance of the tests, defining the deadline for replacement of certain components and stipulating provisions for the incorporation of OEF.

Since this authorisation, ASN holds daily discussions with the site and, in 2024, carried out ten or so commissioning follow-up inspections, notably at the most important stages. The licensee encountered various equipment issues, which delayed the reactor's power-up, but ASN has not at this stage identified any anomaly in the results of the start-up tests. About fifty significant safety events were however declared by the licensee between commissioning and the end of 2024, a rate that is significantly higher than expected, even for a new reactor. ASN was particularly vigilant on this subject, notably during inspections, and at this point considers the measures taken by the licensee to be pertinent.

EDF has started a programme to build EPR 2 type reactors in France. The first reactor pairs will be built at Penly, Gravelines and Bugey. The creation authorisation application for a Basic Nuclear Installation (BNI) on the Penly site, submitted by EDF in 2023, is being examined and should reach a conclusion in 2027. Given the lessons learned from the Flamanville EPR project, ASN has initiated a process to monitor EDF's project organisation and management, as well as management of the supply chain for safety-important equipment.

## Reception of the first examination files for small modular reactor projects confirms ASN's prior positions regarding the need for a systemic approach

In 2024, interest in SMRs, with more or less ambitious innovations, remained high, in the search for decarbonised energy production solutions. This context confirmed the pertinence of the organisation and the preparatory exchanges framework created by ASN in 2023 to support the new players, start-ups in particular, lead national and international discussions on the safety objectives to be applied to these objects and understand the diversity of designs and innovations. In 2024, the first creation authorisation application files or requests for opinions on the safety options were submitted for projects supported by the "France 2030" programme.

In this context, a number of issues are crucial. First of all, most of these reactors should be located on the non-nuclear sites of their customers. This type of site can be in areas comprising major industrial or natural risks, or in immediate proximity to densely inhabited areas, which would make it complicated to implement population and environment protection measures in the

event of an accident. When envisaging locating reactors on such sites, the safety objectives to be achieved must be adapted, consistently with the method used to take account of malicious attacks. ASN set up a pluralistic exchange framework involving the stakeholders, to inform its thinking and thus be able to define a position on the safety objectives of these reactors.

The most innovative reactors also need specific fuel for which the industrial production and reprocessing chains do not yet exist and would require significant investment. ASN recalls the importance of developing a systemic approach incorporating the industrial chain, supply of nuclear fuel, management of spent fuels and other waste generated, as well as management of the risk of malicious acts and the proliferation of nuclear materials.

## Faced with quality and safety culture challenges along the subcontracting chain, the industry has launched numerous initiatives

The revival of the nuclear industry represents a challenge for the sector, not only in terms of recruitment, but also with respect to growth not seen for several decades, as well as in terms of guaranteeing the required quality of all components involved in safety. Industrial rigour and the safety culture are essential and the sector, in particular within the French Nuclear Energy Industry Players Group (GIFEN), is fully aware of this.

However, 2024 again saw significant deviations and even irregularities, which were dealt with by the licensees concerned and examined by ASN's departments. Faced with these persistent deviations, the Commission held a hearing of the EDF Chief Executive Officer to ensure that there is a true collective mobilisation to avoid a recurrence of the manufacturing and construction defects that beset the construction of the Flamanville EPR, notably on the new nuclear construction sites. ASN considers that the plans proposed by EDF and the GIFEN are a step in the right direction, but finds that the mobilisation by the industrial players as a whole is insufficiently robust. In 2024, ASN produced a practical guide concerning the quality of equipment intended for nuclear facilities, which notably recalls the importance of accurately identifying the requirements and the need for appropriate and timely monitoring of the production chain.

## Considerations on the long-term development of the "fuel cycle" plants

For several years now, ASN has been warning of the pressure on the "fuel cycle" in France. The "cycle" facilities are vulnerable and each unit is a unique link in the processing chain. Saturation of the spent fuel storage facilities at La Hague would also have consequences for the operation of the Nuclear Power Plants (NPPs). The significant drop in production by the Melox plant and the faster than anticipated corrosion of the evaporators at La Hague, used to concentrate the nitric acid solutions of fission and transuranic products, illustrated this vulnerability in recent years.

This situation is however improving, with the gradual rise in Melox production over the past two years and replacement of the evaporators at La Hague which was completed this year.

With regard to pressure on the "cycle", the decision to continue to operate reactors consuming MOX fuel (those of 900 MWe), pushes back the prospect of saturation of spent fuel storage capacity. Following the Nuclear Policy Council meeting of February 2024, active consideration was given to the long-term future and upgrading of the "cycle" plants, with a view to continuation of the reprocessing policy up until the end of the century.

In this context, EDF abandoned its centralised pool project in favour of a facility integrated into Orano's industrial programme on the La Hague site. The new facilities will need to be designed taking account of the most recent safety standards, at least equivalent to those of EDF's centralised pool project. While waiting for these future facilities and given the fact that they will not be able to take over instantaneously from the existing ones, it is essential to continue to implement countermeasures against the risk of saturation.

Over and above simple announcements, it is essential that decisions be taken immediately so that the projects can move to the implementation phase and be completed as rapidly as possible, starting with commissioning of new pools in 2040. The major upcoming milestones are Orano's submission of the Safety Options Dossiers (DOS) for the new facilities and then referral to the National Commission for Public Debate (CNDP) concerning a dossier presenting the projects for new spent fuel storage ponds. Following the current study phase, the Future Back-End project should ideally be the subject of debate and consultation.

## Continued examination of the Cigéo dossier

Following the January 2023 submission by the National Radioactive Waste Management Agency (Andra) of the creation authorisation application dossier for Cigéo, a geological disposal project for high- and intermediate-level, long-lived waste (HLW and ILW-LL), ASN – with the support of IRSN – began a technical examination of the dossier, which will end with an ASNR opinion in 2025 and a public inquiry in 2026.

This technical examination continued in 2024, notably with two meetings of the Advisory Committee of Experts for Waste dealing with the basic data and hypotheses used to establish the safety case, and then with safety during the operating phase. On these two thematic subjects, this work enabled an evaluation of the extent to which the dossier presented by Andra complied with the requirements for the possible issue of the authorisation decree, but also identification of the additional data that will have to be provided in order to successfully pass the future milestones in the life of the facility. Andra will thus have to provide additional data before the beginning of excavation work, currently scheduled for 2035, notably on the safety case for operation of bituminous waste disposal, closure of the ILW-LL vaults and operation of the high-level vaults.

The long-term safety issues of the repository, following its closure, are studied in 2025 as part of the third and final phase of the technical examination of the dossier. At this stage, ASNR considers that there are no obstacles to the continuation of the examination procedure in accordance with the envisaged calendar, which schedules work for a period of five years.

As described earlier, with a view to continued operation of the reactors for 50 to 60 years and the creation of six EPR 2 reactors, the adaptability of Cigéo was evaluated and nothing has as yet emerged to rule this out. However, the adaptation of the facility to changes such as the service life extension of the reactors beyond 60 years, the construction of eight additional EPR 2, or a fleet of SMRs and/or fast neutron reactors, would be evaluated after publication of the Creation Authorisation Decree on the basis of future adaptability studies, once the corresponding scenarios have been defined.

## A contrasting situation in the medical field

In 2024, the level of radiation protection remained at a satisfactory level in the medical field, despite a contrasting situation and points warranting particular attention that have persisted for several years.

The context remains marked by pressure, notably on human resources, and constantly rising activity levels. Working organisations are increasingly complex, with pooling of resources, multi-site working, increasingly frequent use of outside contractors and increasing outsourcing of radiation protection skills, including among the most advanced facilities. This situation is creating new technical, operational and organisational constraints. In this context, ASN alerts all the stakeholders to the risk of a lesser assimilation of the radiation protection issues and recalls the need to evaluate the radiation protection impact of any organisational change. Certain significant events and the findings made during inspections in 2024 confirm the weak signals indicative of a context that is prejudicial to radiation protection, as already mentioned in 2023. ASN recalls that the main guarantee of a high level of radiation protection lies in a robust radiation protection culture, promoted by trained professionals. This culture must be regularly maintained in order to adapt good practices to the new risks, maintain an efficient optimisation approach and prevent the repetition of previous incidents.

ASN still observes an unsatisfactory situation regarding fluoroscopy guided interventional practices carried out in the operating theatre. In this field, where the indications and the number of patients concerned are increasing and diversifying, optimisation actions and the conformity of the facilities with the layout rules are essential to managing the radiation protection issues. Enforcement measures have been taken in the past two years owing to notable deficiencies in the registration of X-ray emitting equipment, as well as persistent deviations concerning the conformity of the premises and patients and personnel radiation protection training. In radiotherapy, target errors, notably wrong-side errors, were again observed in 2024. Nationwide operating experience feedback was collected, in collaboration with the professional organisations, and shared with the professionals, so that these admittedly rare errors are not repeated. In 2024, a radiotherapy accident with serious consequences affected a patient whose radiotherapy antecedents had not been taken into account. In the light of progress in the treatment of cancers, ASN draws the attention of the professionals to the increase in the cases of patients who could benefit from a second radiotherapy treatment and the over-exposure risks associated with these situations.

In nuclear medicine, two particular situations can pose problems and are made more frequent by the development of Internal Targeted Radiotherapy (ITR). This involves on the one hand care of the patient in the event of extravasation during administration of the treatment; on the other, the waste management route when waste contaminated by radioactivity produced at the home of patients after out-patient treatment triggers the alarms on the detection portals at the entrance to the collection

centres. Owing to their radiological nature, these events mobilise considerable response resources and specific operational and support procedures, even if the health implications remain limited. Their increased frequency in 2024 is a subject of concern, given the expected rise in the number of patients eligible for these treatments. ASN calls on the professionals to be extremely attentive to preventing such situations.

## Anticipating and supporting innovation in the medical field

The deployment of new techniques and practices in therapy is a source of hope for the patients, but a subject requiring vigilance in order to ensure that they are integrated into the health care system rapidly and safely. This entails being fully aware of the corresponding radiation protection issues, for the patient, their entourage, the workers and the environment, and identifying and then implementing the means needed to manage them. This vigilance is particularly important given the growth of ITR, the arrival of the ZAP-X® platform, or the development of flash radiotherapy, pulsed fields and adaptive radiotherapy. ASN recalls that the radiation protection issues are not limited to the performance of the procedure, but begin as of the design phase and, as applicable, continue up to management of waste and effluents. These radiation protection issues must be integral to the thinking at each step along the way. This means that data pertinent for radiation protection must be input and, as applicable, looked for or studied by the designers and developers.

In 2025, ASNR will continue its research, expert assessment and regulation work, with the assistance of its Advisory Committees of Experts, such as the Committee for the analysis of new medical techniques and practices using ionising radiation, or the Advisory Committee of Experts for Radiation Protection, together with the various institutional stakeholders in the field of health and the professional organisations. It will capitalise on the lessons learned from European projects in order to mobilise all stakeholders and develop the regulation and oversight system, both nationally and at the European level, so that radiation protection issues remain at the heart of the decision-making process in an innovative and constantly evolving health system.

## Sustained international activity

International activities continued apace. Numerous meetings with its counterparts enabled ASN to discuss its practices and share the challenges linked notably to the launch of new projects and the use of innovative technologies – such as Artificial Intelligence – in the nuclear sector.

Work relative to the second thematic peer review (TPR ENSREG), chaired by an ASN representative, concerning protection of nuclear facilities against fire risks, has ended and will enable each country to draft its national action plan in 2025. Two seminars, held in Luxembourg, were a forum for discussions on best practices and identifying areas for improvement in each country.

With regard to radiation protection, ASN – which is chairing the Heads of the European Radiological Protection Competent Authorities association (HERCA) – the aim of which is to promote a high level of radiation protection in Europe, was actively involved in encouraging sharing of experience between the European authorities regarding the practical implementation of international standards and contributing to balanced updating of them.

Finally, the creation of ASNR will make it possible to reinforce France's representation internationally on the subject of nuclear safety and radiation protection. With this in mind, the international teams at ASN and IRSN together laid the groundwork for the creation of a unified international department that is operational as of 1 January 2025. ■

EDITORIAL BY THE DIRECTOR GENERAL

# Unprecedented mobilisation in order to be ready by 1 January 2025

Olivier GUPTA

Montrouge, 1 March 2025

The reform of the governance of nuclear safety and radiation protection oversight and regulation, as a result of the Act of 21 May 2024, represents a historic milestone with the creation of the Authority for Nuclear Safety and Radiation Protection (ASNR). It is independent of the licensees and the Government and not only has considerable oversight and regulatory powers but also significant expert assessment and research capabilities. Therefore, each decision that it takes, each check that it performs, each authorisation that it issues, will be based on state-of-the-art investigations and expert assessments, backed by the results of research.

Preparation for the creation of ASNR required unprecedented mobilisation of the personnel of the Nuclear Safety Authority (ASN) and the Institute for Radiation Protection and Nuclear Safety (IRSN) along with the partner administrations, in order to be ready by 1 January 2025. ASNR is now operational. The founding documents have been adopted, its governance structure is in place and the internal organisation has been set up. The emergency response organisation is functional with a single centre. Yet the ASNR creation work is far from over: even if the fundamentals are in place, many aspects still have to be dealt with day after day, in order to ensure harmonious routine operations. Thought must also continue to be given to a more complete organisation, making full use of synergies.

This work has not however distracted the personnel from their primary role of protecting people and the environment.

## Unprecedented mobilisation of the departments so that ASNR can be operational as of 1 January 2025

### Legislative and regulatory work

It was essential for several Decrees needed for implementation of the 21 May 2024 Act to be published before 1 January. This is for example the case of the Decree transferring the goods, rights and obligations of the former IRSN to the Alternative Energies and Atomic Energy Commission (CEA), to the Ministry of the Armed Forces and to ASNR, or the Decree creating ASNR's interim social bodies. A total of seven Decrees were published after the mandatory consultation of several bodies and review by the *Conseil d'État* (Council of State). This demanded extensive work by the partner administrations and the ASN and IRSN personnel, within a very short period of time, and I must thank them for their commitment and efforts.

### Work on operation and organisation

While contributing to the preparatory work carried out by the Government on the specific Bill for this reform, the ASN and IRSN senior managements wished to see work started on defining the organisational and operating principles of the future entity by the autumn of 2023. Joint working groups were therefore set up, for individual fields of activity, with the aim of proposing broad outlines for the organisation and operation of the corresponding activity sector in the future ASNR. They mobilised the teams throughout the year 2024. A list of "essential" actions was drawn up to prepare for the creation of ASNR, mainly in the cross-cutting and support activities (human resources, budget and finance, IT, legal affairs, etc.). The work was extended to the Government departments whose support was needed, notably to determine the budgetary and financial architecture and set up a new budget programme dedicated to financing of the ASNR.

The positioning of the personnel in the new structure had to be prepared. To do this, the ASN Commission, in its capacity as the future ASNR Commission, submitted a draft organisation of the departments for consultation by the ASN and IRSN social bodies in July 2024. An Executive Committee was created, then first Directors of the future ASNR entities were appointed in November 2024, and the personnel of the two entities were assigned to their posts during the course of December.

The essential actions identified include ASNR's ability to provide a unified response to its mission in the event of a nuclear accident, or more generally any radiological emergency situation. The joint work on this question ended in the summer of 2024 with the creation of a single Emergency Centre, staffed by personnel from the two entities, with integrated working arrangements. The organisation thus defined was tested by several exercises in the autumn of 2024, confirming its validity.

Finally, as requested by Parliament, the ASNR internal rules of procedure, referred to by several Articles of the Act, notably to clarify the interface between "expert assessment" and "decision-making", were submitted to the social bodies for consultation, then presented to the Parliamentary Office for the Evaluation of Scientific and Technological Choices (OPECST), before being adopted by the ASNR Commission in January 2025.

This work as a whole guaranteed the continuity of the missions performed before and after 1 January 2025.

### Dialogue with and support for the personnel

At the end of 2023, the ASN and IRSN senior managements, the IRSN personnel representative trades union organisations and the ASN personnel representative trades union organisations reached a consultation agreement regarding implementation of the reform project.

This agreement made provision for the creation of a consultation commission for the merger project, in addition to the personnel representative bodies for each entity, so that joint discussions could be held up to the end of 2024 between the two senior managements and the personnel representatives of the two organisations.

The personnel representatives took part in the working groups set up to prepare for the creation of ASNR.

Finally, given the scope of the reform, the psychosocial risks prevention and treatment system was reinforced, both at IRSN and at ASN. The personnel were questioned and their responses were input into a "barometer" which, despite concerns surrounding the reform, revealed no particular negative aspects. A support unit staffed by occupational psychologists was also set up.

## Continuing to deploy ASNR in the future, adapting it to the new context, while performing its missions in full

Despite the scale and scope of the preparatory work, much remains to be done. Future work will focus on two key areas.

### Continuing with setting up ASNR

Setting up ASNR first of all entails implementing day-to-day operations. The beginning of the year 2025 is essentially devoted to smoothing out the differences in the operating and management methods between the two merged entities.

As with any merger, good day-to-day working involves the creation of a unified information system and identical digital tools for all the personnel: this is a colossal and costly endeavour in the short term, even if it will eventually lead to savings.

The overhaul of the management system (mapping of processes, management meetings cycles, internal oversight, etc.) has started, but is far from over. The Scientific Council and the Code of Conduct and Professional Ethics Committee, both required by law, should be set up in the first months of 2025.

With respect to budget and finance matters, the creation of the new budgeting and purchasing processes is underway: these processes were not the same at ASN, an independent administrative Authority, and at IRSN, an industrial and commercial public establishment. The construction of a medium-term budget plan is in progress, even if the "voted services" period represented an additional constraint on the start of the works. In mid-2025, ASNR will present Parliament with its evaluation of the anticipated human, technical and financial resources it will need for the coming five years in order to carry out its duties in the new nuclear context, along with the essential steps to ensure the attractiveness of the working conditions of its personnel on the labour market in the nuclear field.

With regard to human resources, a project is needed to harmonise employment conditions, which nonetheless respects the public or private status of the personnel. The long-term success of ASNR entails constructing an attractive framework for employment and skills. This involves setting up a legible hiring process, developing an "employer brand" which helps create an "ASNR" identify and stimulation of recruitment through an ambitious policy to take on young people in internships and apprenticeships.

Building on IRSN's experience, ASNR will be able to rely on an in-house tool, with the "Nuclear Safety and Radiation Protection University", tasked not only with developing and transmitting in-house knowledge and skills to ASNR, but also making it available to all nuclear safety and radiation protection stakeholders in France and abroad.

Setting up ASNR, also means building a collective mind-set. The general management decided to create joint integration days for the new arrivals at ASNR. Participative work was initiated around ASNR's values: it will have to be taken further and expanded to involve more personnel. The managers involved in the construction of this collective mind-set will make a decisive contribution. The collective mind-set also involves high-quality social dialogue, bringing together the representatives of the personnel, regardless of their status.

Finally, ASNR will have to be consolidated in its ecosystem in France and internationally, by reaffirming its legitimacy as the successor to ASN and IRSN, in the bodies where these two organisations were present. This also entails defining an ASNR integrated roadmap, in terms of dialogue with the stakeholders, notably with the support of the High Committee for Transparency and Information on Nuclear Safety (HCTISN).

### Adapting working methods and organisations to the new context

It is clear that today's French and global nuclear context is no longer that which existed in the aftermath of the accident at the Fukushima Daiichi Nuclear Power Plant (Japan). From the technical viewpoint, there are many challenges: the prospect of nuclear reactors operating up to 60 years and beyond represents technical challenges requiring the acquisition of new knowledge able to deal with these remote time-frames. The construction of several EPR 2 and the refurbishment of the "fuel cycle" plants requires the construction of an oversight strategy for this large number of worksites.

The development of innovation and the integration of new technologies, whether they concern small modular reactor or nuclear medicine projects, mean that ASNR must take a fresh look at how it dialogues with the stakeholders it regulates and oversees, so that it can anticipate future issues. The development of artificial intelligence will also modify interactions between ASNR and those responsible for nuclear activities, but will also offer new prospects for researchers, experts and inspectors. War at the gates of Europe raises the question of monitoring nuclear installations in areas of armed conflict.

More broadly, over and above the nuclear field, the organisations in charge of regulation or oversight are facing queries about their role and how they carry out their missions. Finally, the increasingly tight budget situation for public organisations is to be taken into account.

This changing context in which ASNR is carrying out its missions and today's nuclear safety and radiation projection challenges will have to be taken into account in future changes to ASNR.

The aim here is not simply change for change's sake, but to take account of the fact that the current working methods and organisations, to a large extent inherited from the existing situation, were designed to allow the coexistence of two separate organisations, whereas the corresponding missions are now carried out by just one.

As has just been done with management of emergency situations, a review will be needed of the extent to which these missions can be carried out differently, giving new meaning to the work of the personnel – taking account of their integration into ASNR – to benefit the protection of people and the environment, while ensuring that the processes are robust, notably in expert assessment and decision-making.

The personnel concerned will be involved in these reviews.

### Giving absolute priority to our primary mission of protecting people and the environment

Despite the scale of this work, which is to a large extent based on support or cross-cutting functions, the ASNR technical teams will remain fully committed to performing their mission to protect people and the environment.

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2025 will be a decisive year for ASNR, which will have to continue with its transformation and conduct its essential missions to protect people and the environment. I know that to achieve this, I can count on the commitment of all the personnel, driven by a single goal: the public interest. ■

# Notable events 2024

## Flamanville EPR reactor

# The first months of reactor operation

On 7 May 2024, ASN authorised commissioning of the Flamanville EPR reactor. This was the first commissioning of a nuclear power reactor in France since that of Civaux Nuclear Power Plant (NPP) reactor 2 in 1999. The EPR is the first third-generation reactor in France. Its design allows a significant reduction in the probability of core melt and radioactive releases in the event of an accident by comparison with the previous generation of reactors. Despite the considerable difficulties encountered during construction, the reactor was commissioned in good conditions of safety. However, the first months of operation showed that EDF needs to reinforce its oversight and control of operational activities.

### Completion of the start-up tests

In the commissioning authorisation, ASN regulated the various phases of the reactor's power increase, so that – throughout the process – the start-up tests were performed correctly until nominal power was reached.

Once the commissioning authorisation was given, EDF initiated fuel loading into the reactor vessel. First criticality, that is the beginning of the nuclear chain reaction in the reactor, took place on 3 September 2024.

EDF then carried out gradual power increases. The reactor was coupled to the electricity grid for the first time on 21 December 2024.

When the reactor is started for the first time, EDF has to perform a large number of specific tests to check the correct operation of the systems which could not be tested before fuel was loaded. The purpose of these tests is to check that:

• The core, its instrumentation and its protection systems behave as expected at the various power levels.

• The nuclear steam supply system and turbine controls are correctly adjusted.

• The secondary system, the turbine and the generator work correctly. These tests can only be carried out once enough steam is being produced.

• Certain situations, such as reactor trip or turbine shutdown for example, are correctly managed.

These tests are particularly closely monitored by ASN, which is kept informed in detail about their performance, the results and any incidents encountered. It also carries out inspections, most of which are unannounced. At the end of 2024, the tests already performed on the reactor's safety-important systems had taken place satisfactorily.

## The various events which occurred since reactor commissioning

Since the reactor was commissioned, EDF has notified a number of significant safety events that was higher than expected, even for the start-up of a new reactor.

These events are primarily related to the learning curve followed by the teams when carrying out initial operation of the reactor and the transition between management of a construction site and actual operation of an installation. The causes of the vast majority of the events are organisational and human, with few being linked to equipment failures. Most of the human errors are rapidly detected and lead to the installation being restored to conformity almost immediately.

Faced with this finding, and even if these events had no consequences for the installations, people and the environment, EDF implemented a number of measures to reinforce the oversight and control of its activities. These measures notably consist in stabilising the activity schedules and more clearly identifying and managing the risks before starting an operation. EDF also reinforced the support provided by its national teams.

ASN considers that these measures are pertinent and appropriate for the difficulties encountered during this particular phase in the life of the installation.

## The next steps

ASN authorisation was required for the first reactor increase to a power of more than 25% its nominal power. Beyond this power level, the systems required for core protection are different and the Authority for Nuclear Safety and Radiation Protection (ASNR) will in particular check that they are able to perform their function.

ASNR approval will again be required before the first increase to a power higher than 80% nominal power. Most of the start-up tests will then have been carried out.

After the start-up testing phase, EDF will continue with reactor operation up until the first refuelling outage. During this outage, EDF will conduct specific checks, notably a complete requalification of the main primary system. The licensee will also have to incorporate modifications to the installation and in particular replace the reactor vessel closure head. ASNR will examine these modifications and will check the operations carried out during this outage, as it does for any nuclear reactor. It will pay particular attention to capitalising on the Operating Experience Feedback (OEF) acquired during this phase.

Finally, six months after the end of this outage, EDF shall send ASNR an end of start-up file presenting the results of other start-up tests, the OEF from the first operating cycle and shall update the reactor's safety analysis report and general operating rules. ♦

# The challenges involved in preparing for the upcoming examination of numerous small modular reactor projects

In 2024, ASN was faced with a significant acceleration in contacts from Small Modular Reactor[1] (SMR) project developers. The steps taken as of 2023 to set up new frameworks for technical exchanges meant that it was possible to deal with this unprecedented situation and prepare for effective examination of the first dossiers. On of ASN's main findings following these exchanges concerns the frequently unrealistic nature of the deployment schedules announced by many of the project developer.

## Acceleration in technical exchanges in 2024 with companies developing small modular reactor projects

In 2024, ASN and the Institute for Radiation Protection and Nuclear Safety (IRSN) had to deal with a very large number of contacts from all the companies developing SMR projects and who wished to initiate technical exchanges as rapidly as possible, while others wished to continue those already started in 2023.

The fact of having to deal with about ten SMR projects, all promoted by as many different project developers, is an unprecedented situation in the French context and represents a very real challenge to the examination capacity of both ASN and IRSN.

Given this challenge, ASN considered that it was essential to be able to initiate technical exchanges with the project developers rapidly, ahead of submission of the forthcoming applications required by the applicable regulatory procedures. Advance exchanges such as these have the advantage of making it possible to understand the innovations and new safety issues of these projects early on, and thus be as well prepared as possible to effectively examine the future dossiers to be submitted.

In 2023, ASN had thus carried out a reorganisation of its departments, by creating a new entity specifically for these innovative reactor projects, and had also adapted its methods for technical exchanges with the project sponsors (*see details in chapter 11 of the full ASN Report*) so that the commitment of its resources and those of IRSN was proportionate to the development level of these various projects.

These new technical exchange frameworks, gradually put into place in 2023 with the first France 2030 "Innovative reactors" award winners, were thus able to deal with a first significant increase in contacts from project developers in 2024. As shown in the diagram opposite, although these contacts in 2024 primarily concern preparatory technical exchanges (follow-up on screening phase and preparatory reviews), it should be noted that the developers of two projects this year decided to actually submit an examination request within a regulatory framework:

- on 3 May 2024, a creation authorisation application was submitted by the Jimmy Energy company to the Minister responsible for nuclear safety for its SMR project designed to provide high-temperature heat for an industrial site;
- on 31 October 2024, a request for an opinion on the main safety options of its SMR project designed to provide steam to an urban district heating network was submitted to ASN by the Calogena company.

## Creation of a specific Advisory Committee of Experts for innovative SMRs

ASN can consult Advisory Committees of Experts (GPEs) for opinions and recommendations when preparing its most important resolutions relative to nuclear safety or radiation protection issues.

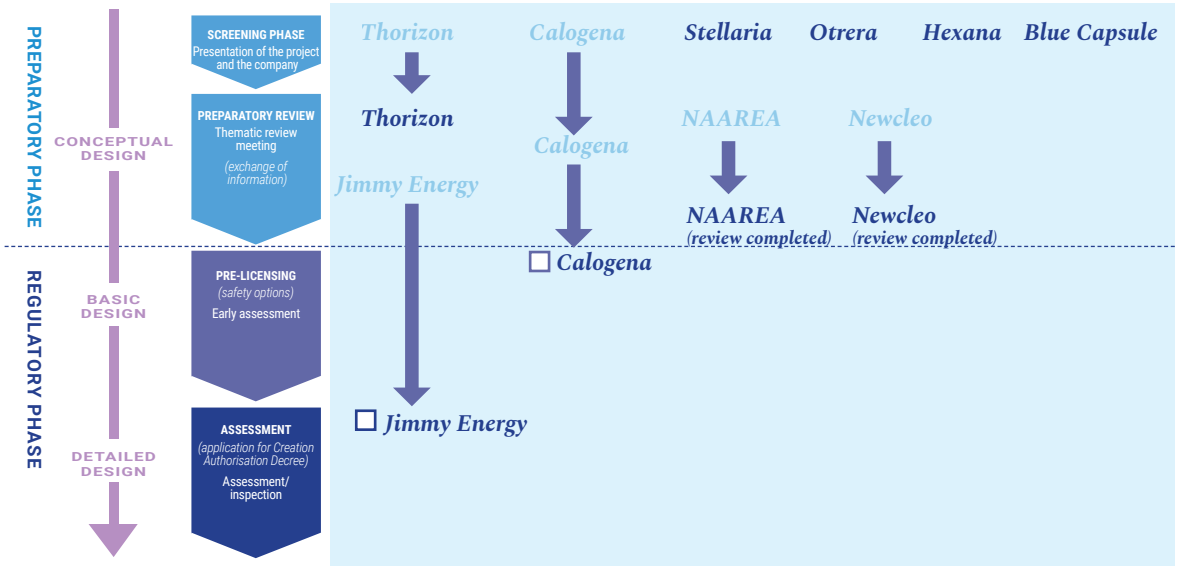
As part of its preparation for the forthcoming examinations of innovative SMR projects, ASN set up a Cross-cutting Advisory Committee of Experts in 2024[2] from

*1. Several SMR projects are currently being developed around the world. These are reactors with a power of less than 300 Megawatts electric (MWe), built mainly in a factory. They use a variety of technologies: that of the pressurised water reactors or advanced technologies (high-temperature, molten salt, fast neutron, etc. reactors).*

*2. asn.fr/reglementation/bulletin-officiel-de-l-asnr/fonctionnement-de-l-asnr/decisions-nominatives/decision-n-codep-mea-2024-019956-du-directeur-general-de-l-asn*

## Framework of technical exchanges with ASN and IRSN

Over the course of 2024, change in the situation of the nine SMR project developers
(except for Nuward, which is a project promoted by EDF)




various existing GPEs, which is intended to be consulted on technical subjects dealing with new innovative SMR projects.

The experts appointed to this "GT-RI" (Cross-cutting Group for Innovative Reactors) were thus involved in the summary and closing seminars of the preparatory reviews set up by ASN for the Jimmy Energy, NAAREA and Newcleo projects. This participation enabled them to familiarise themselves with the design and safety approaches adopted by these innovative SMR projects and thus improve their readiness for dealing with queries from ASNR regarding these projects in the context of the forthcoming examinations and reviews.

## The announced industrial schedules are often unrealistic

The development of these new companies is leading to significant time pressure on the projects because of:

• competition between the various projects to commission an industrial demonstrator and thus be the first to move to large-scale marketing of their SMR model nationally and internationally;

• the financial challenges to development, in particular the balance between raising and consuming capital, pending the commissioning of their first industrial reactor.

In this context of time pressure on the projects, one of ASN's main findings following these discussions in 2024 concerns the frequently unrealistic nature of the deployment schedules announced by many of the project developers.

ASN in particular identifies several time-frames related to its safety concerns which all too often tend to be under-evaluated by the project developers:

• The time needed for an innovative reactor project to acquire a sufficiently solid base of knowledge for validation of its technological choices, in order to ensure the industrial feasibility and viability of the project, during both the construction and operating phases, and to establish the required safety case in support of a creation authorisation application with all the necessary rigour.

• The duration considered for examination of the creation authorisation application for their first reactor; the project developers generally imagine a time-frame for examination of their experimental reactor or their industrial demonstrator shorter than actually set out in the current regulations. Whereas a shorter time-frame such as this could be envisaged for the examination of the subsequent reactors which could benefit from the series effect, it is hard to imagine this for particularly innovative reactors. ASN thus recalls that the dossiers for these SMRs will be examined with the same rigour as any other nuclear installation, in a way that is proportionate to the safety issues and that the examination time-frames will above all depend on the quality and complexity of the safety cases presented to it.

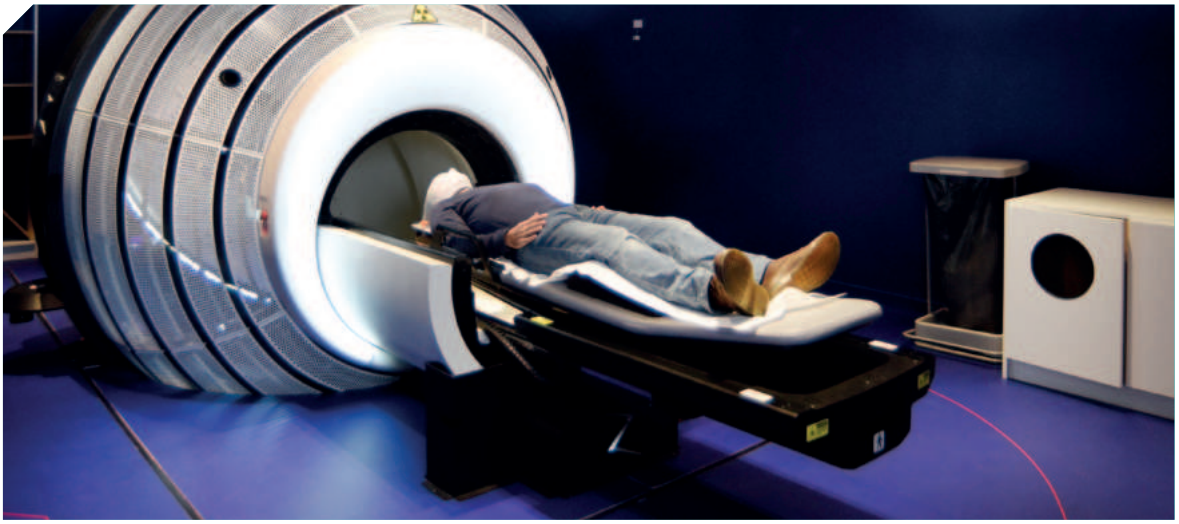
ASN also points out that over and above the actual reactor project, the industrial deployment schedules announced sometimes under-estimate the potential critical paths, in particular related to:

• the time needed to develop and commission the basic nuclear installations required to produce their specific nuclear fuel;

• the time needed for development and approval, when necessary, of any new packaging for the transport of their fuel on the public highway. ♦

# Radiation protection faced with the challenges of innovative medical techniques

In a medical sector experiencing perpetual innovation, 2024 was marked by an unprecedented acceleration in the development of innovative medical techniques using ionising radiation.



## Innovations in all medical fields

This acceleration is particularly noteworthy in the field of Internal Targeted Radiotherapy (ITR) where, following the generalised use of therapies employing lutetium-177, there are an increasing number of clinical trials with new radionuclides of interest such as actinium-225 or lead-212. In the radiotherapy field, pre-clinical research is being developed on the flash effect, which consists in delivering a very high dose rate in a very short period of time, which could significantly reduce the time needed for certain treatments. In the field of fluoroscopy-guided interventional practices, the multiplication in the number of indications and the increasing complexity of the procedures reflect the variety of practices and the conditions in which they are performed.

Innovation sometimes lies in the design of the technical dispensation platform, as is the case with the ZAP-X® self-shielded external radiotherapy system, which would make it possible to provide treatment with less constraints concerning the layout and outfitting of the premises.

These innovations offer new hope for the patients, and there is significant pressure to rapidly incorporate them into the health care system. Their rapid development, unlike the lengthy time-frames inherent in the nuclear industry, nonetheless constitutes a radiation protection challenge. Measuring the radiation protection challenges and even more so identifying and then implementing the means needed to manage them, are based on developing professional knowledge and skills, on acquiring and sharing data, some of which will only be available in the medium term, on providing appropriate infrastructures and on mobilising a large network of stakeholders and players.

## The particular case of internal targeted radiotherapy

In the field of ITR, the medical procedure entails particular radiation protection issues for the patients and their carers and comforters, the workers and the environment. These issues are sometimes incompletely evaluated, notably when new radionuclides or new vectors are being used. It is essential that knowledge of dosimetry and metrology be developed for the alpha and beta emitters used in ITR, and the data in the possession of the promoters, or collected by research teams during clinical trials, must be better shared with all the stakeholders. Finally, the health care system must become organised so that the additional data needed are collected, notably those concerning medium and long-term patient monitoring, radiological surveillance of the health care personnel, and the experience feedback

from undesirable and Significant Radiation Protection Events (ESRs), as of the first times the procedures are used for treatment. These data must be collected and analysed so that the steps to be taken to ensure safe treatment and worker protection can be defined and, if necessary, regulated, and shared with the other departments which will be using these same treatments. These must be able to plan or adapt the layout and outfitting of their premises, train their personnel, and conduct the required risk assessments for their quality management system and for occupational risk prevention.

Upstream of the delivery of a radiopharmaceutical, there can be nuclear safety issues for certain radionuclides of interest, notably when their production implies the use of research reactors or specific cyclotrons, and facilities for the purification and then preparation of radiopharmaceutical drugs. These processes also require numerous intermediate shipment operations with significant time constraints owing to the short half-life of the radionuclides. Despite the European level coordination efforts made to secure the supply of essential radionuclides to nuclear medicine units, there are often few synthesis alternatives, which makes continuity of the available treatments vulnerable to the contingencies that can affect these facilities.

Once the medical procedure has been completed, the management of effluents and waste contaminated by the radionuclides raises its own new problems. The particular case of waste contaminated by radionuclides produced at the home of patients and detected when it reaches waste collection centres, when disposed of in the household waste without adhering to decay management times, causes blocking situations or even emergencies in the waste management route and for its workers. The increase in the frequency of such events observed in 2024 is therefore of concern, given the expected increase in the number of eligible patients. The effect of the preference for out-patient treatments transfers the responsibility for managing this waste from the hospital units, which are generally organised to deal with this, to the patients when back home and the municipalities in charge of household waste management, for which operational procedures and support remain difficult to implement or may even be non-existent.

Similarly to the particular case of lutetium-177, which was the subject of an ASN Circular of 12 June 2020, these issues must now be taken on-board across the disciplines, taking account of a broad range of radionuclides and vectors. This implies close collaboration between the professional organisations, the authorities (Ministry responsible for health, National Authority for Health – HAS, Health Products Safety Agency – ANSM, Authority for Nuclear Safety and Radiation Protection – ASNR), the manufacturers and promoters of clinical trials, and the health care services, to ensure a complete and coherent approach.

## Anticipating for improved regulation and decision-making

In this context, it is essential that the decisions by all the health care system stakeholders be informed by adequate upstream consideration of the radiation protection issues.

For the medical services, this entails anticipating what their future will look like in order to adapt to the needs (reception capacity, sizing, technologies, regulatory compliance, etc.) and prepare the corresponding investments, including in terms of skills. For the manufacturers of radiopharmaceutical drugs, this for example implies limiting impurities and the presence of long half-life radionuclides, packaging the radiopharmaceuticals in an appropriate form such as to limit occupational exposure or ensure their safe dispensation. For the promoters of clinical trials, the licence application file shall include pertinent data so that the users can comply with the regulatory obligations for radiation protection of the patients and their entourage, the professionals and the environment, and carry out their risk assessment. For the manufacturers of new medical devices, it is essential that the necessary data be delivered with the equipment.

To identify the new techniques and emerging practices using ionising radiation and analyse their radiation protection implications, ASN calls on Advisory Committees of Experts (GPEs) and the Committee for the Analysis of New Medical Techniques and Practices using Ionising Radiation (Canpri), with the support of the Institute for Radiation Protection and Nuclear Safety (IRSN). In 2024, ASN issued a position statement on the ZAP-X®[1], based on the opinion issued from the Canpri, as well as on pulsed fields[2], based on an opinion from the Advisory Committee of Experts for Radiation Protection (GPRP). The Canpri opinion on flash therapy is expected in 2025. Finally, ASNR will issue an opinion in 2025 on the basis of the work done by IRSN and the GPRP to draw up recommendations intended for the promoters and investigating centres to promote access to innovative care treatments. The GPE opinions were presented to the HERCA network (Heads of the European Radiological Protection Competent Authorities) for forwarding to the European Union, and the Simplerad project was also able to identify areas for improvement to enhance the interface between pharmaceutical legislation and radiological safety standards.

Numerous exchanges took place with the professional organisations to make up for the lack of information on the important radiation protection data and to facilitate the collection of this information in order to allow the issue of authorisations. For ITR, ASN conducted exchanges with the ANSM to optimise and simplify the administrative approaches.

In 2025, ASNR will continue its efforts to mobilise all the stakeholders and change the regulatory system, ensuring that each stakeholder assumes its responsibilities and that radiation protection issues are at the heart of the decisions in an innovative and constantly evolving health care system. ♦

1. *asn.fr/information/archives-des-actualites/premier-avis-du-canpri-et-position-sur-l-installation-et-l-utilisation-de-la-plateforme-zap-x-R*
2. *asn.fr/reglementation/bulletin-officiel-de-l-asnr/activites-medicales/avis/avis-n-2024-av-0445-de-l-asn-du-3-septembre-2024*

# The guidelines of the fifth periodic safety review of the 900 MWe reactors

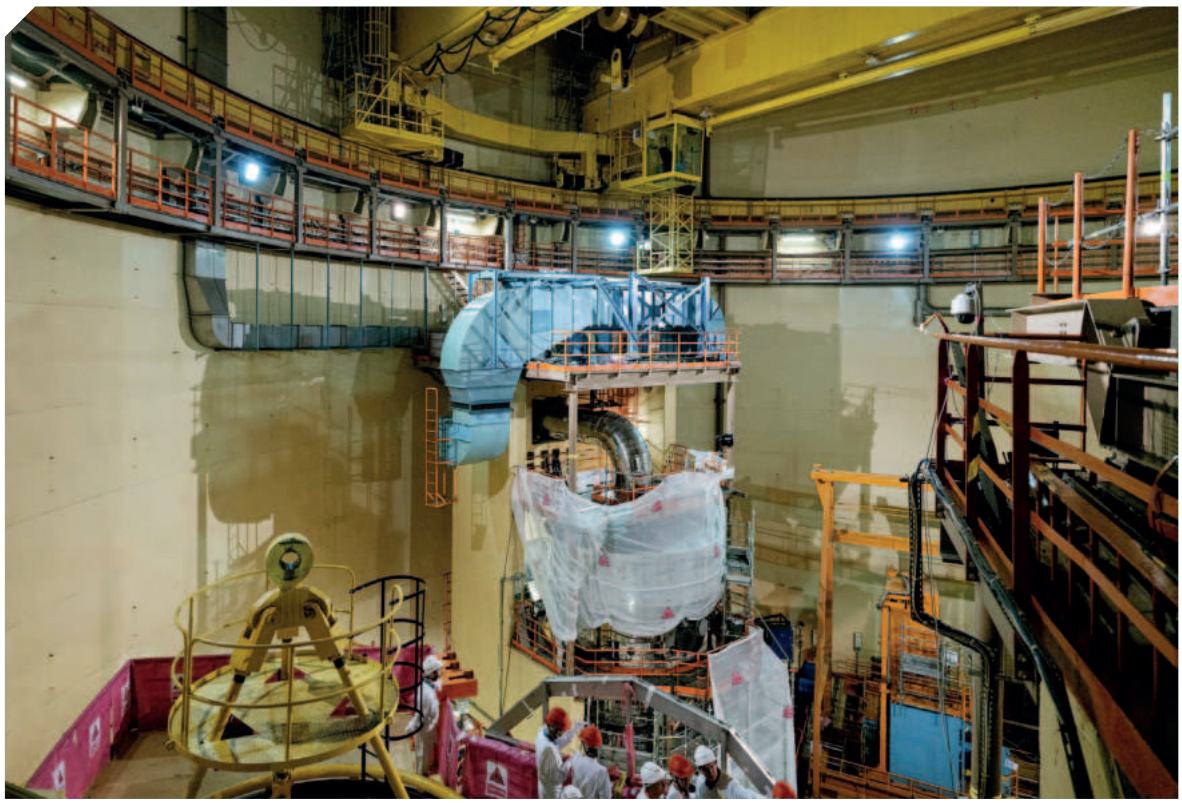
On 10 December 2024, ASN issued a position statement[1] on the guidelines for the generic phase of the fifth periodic safety review of the 32 reactors of 900 Megawatts electric (MWe) operated by EDF. ASN considers that this review should primarily look at conformity and installations ageing management and at reinforcing how the effects of climate change are addressed. It shall allow consolidation of the important safety improvements made to the reactors during their fourth periodic safety review.

The 900 MWe reactors are currently the oldest in France. They were commissioned between 1978 and 1987. This fifth periodic safety review will define the conditions for their fitness for service beyond 50 years.

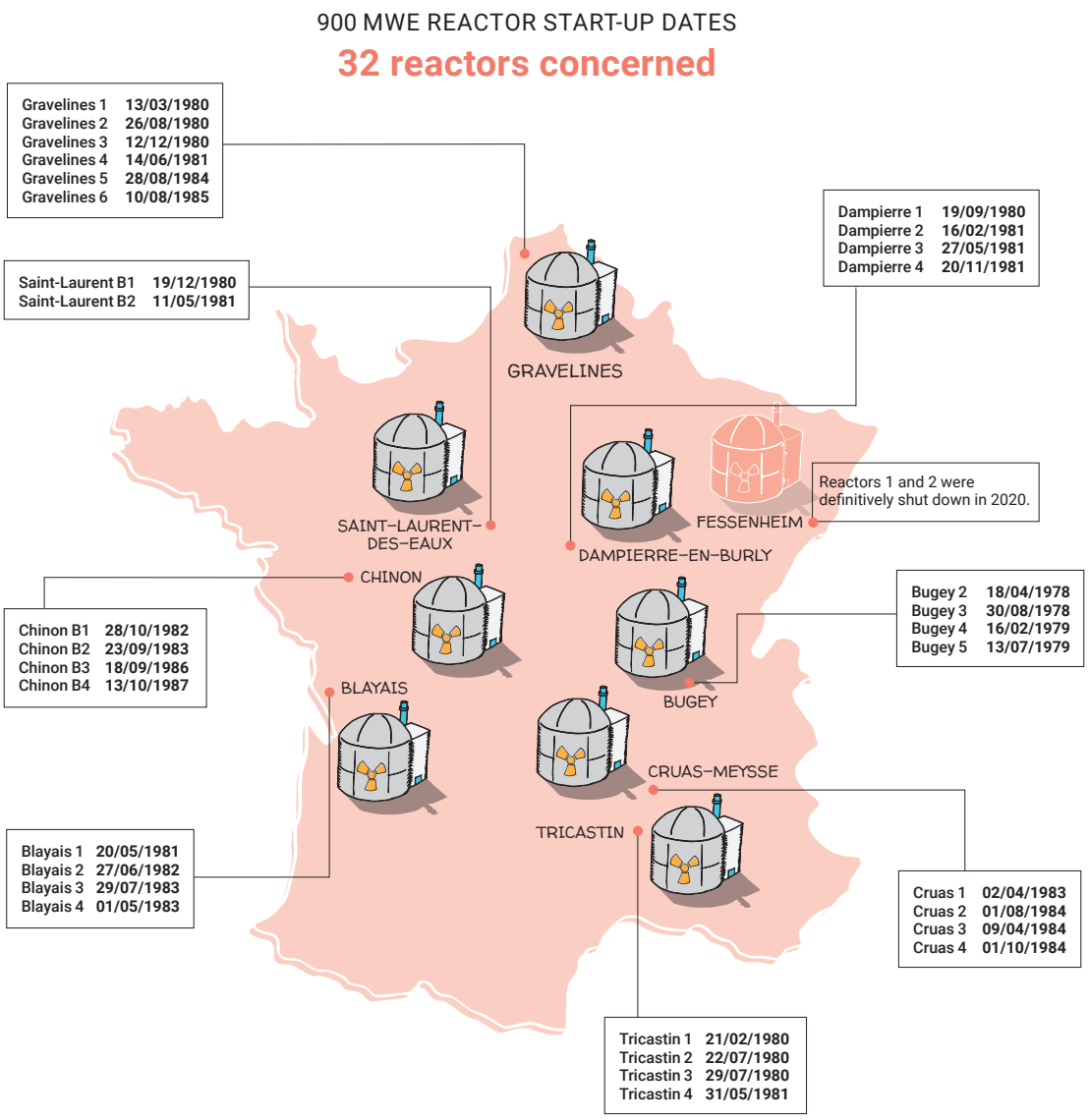
The fourth periodic safety review, which is currently being implemented on each reactor, is particularly detailed. Its aim is to move towards the safety level of the third-generation reactors and to complete the deployment of the "hardened safety core" defined in the wake of the accident at the Fukushima Daiichi Nuclear Power Plant (NPP – Japan). This review will continue until the last reactor in 2036.

In the light of the major modifications made as a result of the fourth periodic safety review, not all the hazards and environmental impacts will be reassessed during the fifth periodic safety review. This will primarily focus on:

- verifying the conformity of the installations with their applicable requirements, maintaining equipment qualification and managing ageing, for operation up to 60 years;
- the effects of climate change, whether regarding managing the risks of accident (rise in sea level, heat-waves, etc.), or the impact on the environment (water intake and consumption).



1. *asn.fr/information/archives-des-actualites/l-asn-prend-position-sur-les-orientations-du-5e-reexamen-periodique-des-reacteurs-de-900-MWe*




In its position statement, ASN drew EDF's attention to the particularities of the Bugey NPP reactors, the design of which predated that of the other 900 MWe reactors and which require a specific review process. With respect to the lessons learned from the stress corrosion cracks discovered since 2021, it also pointed out that EDF must improve its verification methods in areas where no degradation mode is to be feared.

As with the previous periodic safety reviews and in order to take advantage of the standardised nature of its 32 reactors of 900 MWe, EDF intends to carry out this fifth periodic safety review in two stages:

• A "generic" periodic safety review phase, covering subjects common to all the 900 MWe reactors, both for risk management and for management of the drawbacks presented by the installations. This generic approach is a means of pooling and sharing studies for management of facility ageing, obsolescence and conformity, as well as those for the safety reassessment and the design of potential modifications to the facilities.

• A "specific" periodic safety review phase, concerning each individual reactor and to be staggered between 2030 and 2041. This phase will make it possible to incorporate the specific characteristics of the installation and its environment, for example such as the level of natural hazards to be considered, the specific nature of the local environment, the other uses of the water resource and the condition of each installation.

Before issuing a position statement, ASN obtained the opinion of the French Institute for Radiation Protection and Nuclear Safety (IRSN) and the Advisory Committee of Experts for Nuclear Reactors (GPR) regarding the EDF guidance file.

ASN also consulted the public about its draft position statement, from 15 October to 11 November 2024. Upstream, in partnership with IRSN and the National Association of Local Information Committees and Commissions, (Anccli), it organised two webinars intended for the members of the Local Information Committees (CLIs) and the general public, so that they could familiarise themselves with the guidelines proposed by EDF, the assessment made by IRSN, and the draft ASN position statement submitted for consultation. ♦

# ASN Assessments

The French Nuclear Safety Authority (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 activity sector.

# ASN assessments per licensee

## EDF

### The nuclear power plants in operation

The quality of operation of the Nuclear Power Plants (NPPs) remained satisfactory in 2024.
The year 2024 was marked by the commissioning authorisation for the Flamanville EPR reactor issued by ASN on 7 May 2024. This authorisation allowed EDF to load nuclear fuel into the reactor vessel and begin the start-up tests. The assessment below concerns the other EDF reactors in operation. The Flamanville EPR reactor is dealt with in the Regional Overview of this report.

#### Reactor improvements and continued operation

The modifications made to the facilities and operational methods by EDF within the framework of the periodic safety reviews of the 900 Megawatts electric (MWe) reactors are significantly improving the safety of the facilities, making it possible to aim for the same safety objectives as those of the third generation reactors. EDF is devoting considerable resources to these reviews. ASN notes that deployment of the safety improvements is taking place in good conditions.

As EDF embarks on the fourth periodic safety review of the 1,300 MWe reactors, ASN considers that EDF must continue its efforts to prepare for and implement modifications to the installations in good conditions, despite the considerable workload on the engineering teams. Particular attention must also be paid to the assimilation of these modifications by the operators and to their training.

#### The conformity of the facilities

The steps taken by EDF for several years now to improve the detection and correction of deviations and to ensure that ASN is informed are satisfactory. More particularly, the specific inspections implemented during the fourth ten-yearly outages are bearing fruit and reinforcing the conformity of the facilities. In 2024, EDF also initiated multi-year programmes which are leading to concrete targeted oversight actions. ASN considers that these new measures will reinforce control of the conformity of the facilities throughout their lifetime.

#### Maintenance

EDF correctly managed the reactors outage campaign, which overall indicates that maintenance was well carried out in 2024. ASN also observes that the number of significant events caused by an anomaly during a maintenance operation has fallen since 2022.

EDF must continue its ongoing work on the competence of the personnel and improve preparation for maintenance activities, how experience feedback is taken into account and the quality of the risk assessments, against a backdrop of a significant industrial workload linked to continued operation of the reactors and the "Major overhaul" programme.

In addition, as in 2023, ASN considers that EDF's monitoring of manufacturing operations for safety-important equipment in supplier plants is unsatisfactory. EDF has implemented an action plan to address this.

#### Operation

The quality of reactor operation and control remained at a satisfactory level in 2024, but certain NPPs are experiencing difficulties.

ASN noted positive results in 2024 concerning the measures taken to manage the actual configuration of the systems, including during maintenance work. It also noted efforts made by EDF to improve the situation of the independent safety organisation, notably those aiming to gradually increase its workforce up until 2027. Overall management of the fire risk was also improved, even if the situation is not the same across all the NPPs.

However, monitoring in the control room has not been satisfactory for a number of years. Certain anomalies are detected too late by the operating teams. In addition, certain notable events concerning reactivity control should lead EDF to look again at the prevention measures in place.

Inspections focusing on the emergency organisation and resources confirmed, as in recent years, that the organisation, preparedness and management principles for emergency situations have been correctly assimilated. EDF must however continue to improve the through-life support of the resources that could be called on in an emergency situation, along with the training of and situational exercises carried out by the personnel concerned. ASN inspections also revealed that EDF must conduct an in-depth revision of the operational documentation defining the steps to be taken outside the control room in an accident situation with core melt. Finally, EDF must continue its efforts regarding preparedness for emergency situations of non-radiological origin.

#### Environmental protection

ASN considers that the management of intakes and discharges into the environment of the various NPPs is on the whole satisfactory. However, deviations regarding checks on and monitoring of effluents or the environment, increased in 2024, in particular with regard to bypassing of the normal discharge routes.

ASN also expects to see improvements in the use of containment systems capable of managing an accidental spillage of dangerous substances.

With regard to waste management, ASN observes that – as in previous years – the situation is continuing to improve. However, progress is still needed regarding the duration and conformity of interim storage facilities, notably with respect to the fire risk and inventory keeping.

#### Worker radiation protection and occupational safety

ASN is encouraging EDF to continue its proactive approach to control the sources of worker exposure to ionising radiation, notably with respect to identifying and eliminating the most heavily irradiating areas on the worksites. It also observes that the number of significant events reported concerning industrial radiography work, the radiological consequences of which can be significant, fell by comparison with 2023. ASN however considers that improvements are needed in managing the risk of contamination dispersion within facilities and contamination of workers, as well as in the approach to preventing risks of exposure to ionising radiation for the most vulnerable workers (apprentices under 18 years of age or personnel with a fixed-term contract).

With regard to occupational health and safety, the inspections carried out by the labour inspectors show that worksite preparation needs to be improved, notably to limit the risks of exposure to asbestos and lead. Lifting operations and on-site traffic rules remain points meriting attention.

## The EPR 2 reactor projects

In 2023, EDF submitted the creation authorisation application for two EPR 2 reactors on the Penly site (Seine-Maritime *département*). The technical examination of this dossier is currently under way. The design of the EPR 2 reactor is more advanced than the Flamanville EPR reactor at the same stage, which is a positive point. ASN also finds that EDF and Framatome are making efforts to incorporate the lessons learned from the Flamanville EPR reactor in the design and manufacture of the nuclear steam supply System for the EPR 2 reactors.

## Individual nuclear power plant assessments

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

With regard to safety, the Cattenom and Penly NPPs stood out positively in 2024. The Dampierre-en-Burly, Blayais and Saint-Laurent-des-Eaux NPPs under-performed by comparison with the other NPPs operated by EDF.

With regard to radiation protection, the Saint-Alban and Chooz B NPPs stood out positively. ASN considers that the Tricastin and Saint-Laurent-des-Eaux NPPs had under-performed.

With regard to environmental protection, the Saint-Laurent-des-Eaux, Tricastin and Chinon NPPs stood out positively.

## Nuclear power plants being decommissioned and waste management facilities

ASN considers that the EDF facilities undergoing decommissioning or being prepared for decommissioning are well managed and that the licensee is correctly meeting its commitments. ASN considers that the decommissioning or Decommissioning Preparation Operations (DECPROs) on the facilities other than the Gas-Cooled Reactors (GCRs) are progressing at a satisfactory pace. With regard to the GCR reactors, the deadlines for completion of the decommissioning operations envisaged by EDF remain a subject requiring vigilance according to ASN.

### Installations shut down or undergoing decommissioning

The reactors operated by EDF finally shut down or undergoing decommissioning (Brennilis, Chooz A, Fessenheim, Superphénix, GCRs) no longer contain any spent fuel. The main safety issues therefore concern the containment of radioactive substances and radiation protection. Some installations also present an additional risk linked to the presence of asbestos, sometimes combined with the presence of radiological contamination, which makes the intervention conditions more complex.

With regard to radiation protection, the organisation put into place by EDF in its radiation protection expertise centres is satisfactory. With respect to these projects, EDF gives priority to risk mitigation in its facilities.

The DECPROs of the Fessenheim NPP are continuing so that the installation achieves its initial state planned for entry into force of the future Decommissioning Decree. ASN takes a positive view in 2024 of the initiation of decommissioning of the EL4-D facility (Brennilis NPP). EDF also intends to carry out post-operational clean-out operations on the structures of facilities undergoing decommissioning (Chooz A, Bugey 1), the methodology of which is currently being examined by ASN.

With regard to the GCRs, in 2024 EDF continued the "out of vessel" decommissioning work on the reactors at Saint-Laurent A, Bugey 1 and Chinon A3 in satisfactory conditions of safety, notably completing removal of the shells of the four Chinon A2 exchanger premises.

In 2025, as part of the continued examination of the decommissioning files for these reactors, the French Authority for Nuclear Safety and Radiation Protection (ASNR) will thus pay particular attention to the planned time-frames for decommissioning of these reactors, along with the robustness of the graphite waste management strategy presented by EDF.

ASNR will also remain vigilant with regard to the satisfactory performance of the various steps in the decommissioning of the Irradiated Material Facility (AMI – BNI 94) in Chinon, for which operations were halted during 2024 as a result of water infiltration.

### The spent fuel and radioactive waste management facilities

With regard to its facilities in operation, EDF is carrying out numerous equipment upgrades in the Superphénix spent fuel storage unit (Apec), which is satisfactory. ASN considers that EDF must continue to consolidate the radioactive waste retrieval projects, notably the soda blocks stored in the Apec and the graphite sleeves contained in the Saint-Laurent-des-Eaux silos.

# ORANO

ASN considers that Orano's current efforts, both to improve the overall working of the existing facilities and to anticipate the future issues of the cycle back-end, as a result of the Government's announcements in early 2024 regarding reprocessing-recycling strategy post-2040, are positive.

In 2024, on the La Hague site, Orano completed replacement of the previous fission products evaporator-concentrators, in which corrosion was more advanced than imagined at the design stage. The projects aiming to safeguard the management of radioactive materials and waste on the La Hague site continued. On the Tricastin site, the construction work on the containers maintenance facility 2 (AMC2) is continuing with a view to commissioning in 2025; that on the extension to the Georges Besse II plant (BNI 168) began in September 2024, following a public inquiry in the spring of 2024. Finally, deployment of the action plan intended to overcome the production difficulties at the Melox production plant in Marcoule is continuing. ASN considers that these points contribute to the continued improvements to the operation of all the facilities.

On 15 October 2024, during the plenary meeting of the High Committee for Transparency and Information on Nuclear Safety (HCTISN), Orano announced that it was taking over the project to build new "underwater" storage capacities for spent fuels, with a view to commissioning the first pond before 2040, in place of the centralised storage pool project, hitherto promoted by EDF. ASN considers that the studies leading to the transmission to ASN of a Safety Option Dossier on the new spent fuel "underwater" storage capacities in 2026 must be continued and intensified with a high level of rigour, in the same way as those started in 2024 on the continued operation of the existing facilities, in the light of the issues associated with the ageing of all the facilities, in terms of both safety and the robustness of the "fuel cycle".

Orano shall also ensure that the resources committed to these new projects are not to the detriment of other projects to improve support functions or process legacy radioactive substances stored on the site, which have just as high a priority.

## Installations in operation

ASN considers that the level of safety of the Orano sites at La Hague and Tricastin remained satisfactory. ASN observes good management of control and operation, while calling for greater rigour concerning adherence to technical prescriptions and periodic checks.

With regard to the Melox plant, ASN considers that its safety level is on the whole satisfactory and takes a positive view of compliance with its production targets as well as stabilisation of production of "MOX scrap" by comparison with 2023.

### Personnel radiation protection

With regard to radiation protection, ASN is encouraged by the operation of the expertise centre within the facilities, even if there are still radiation protection deviations to be dealt with by means of specific ongoing action plans. ASN welcomes the work to harmonise practices carried out on the Tricastin platform.

ASN remains vigilant with regard to the Melox facility, owing to the high number of preventive and corrective maintenance operations carried out on the facility's equipment, against a backdrop of a major maintenance programme intended to enhance the availability of the facilities. These operations entail dosimetric risks that are often significant.

### Environmental protection

On the La Hague sites, with regard to measures taken to control non-radiological risks, ASN considers that across the facility in-depth lessons must be learned from the occurrence of a leak from a nitric acid tank in an outdoor reagents storage unit.

ASN also notes recurring deviations concerning management of coolant fluids and fluorinated greenhouse gases, as a result of which Orano must improve the steps taken to prevent, detect and reduce the corresponding emissions to the lowest level possible.

## The safety reassessments of the facilities

ASN considers that the organisation put into place by Orano for evaluating the conformity of its facilities and for reassessing their safety during the periodic safety reviews, is satisfactory. It nonetheless urges Orano to increase its vigilance concerning the implementation of the action plans drawn up during each periodic safety review and compliance with the deadlines for the regulatory requirements and the commitments made.

Generally speaking, ASN considers that Orano must take advantage of the upcoming periodic safety reviews to reinforce and consolidate the safety improvements made to the facilities and anticipate management of the modifications given the prospects for the continued operation of the "fuel cycle" facilities. These reassessments shall in particular contribute to deploying a robust ageing management approach, including for the utilities or support functions directly or indirectly needed for the operation of the facilities' safety systems.

## Legacy waste retrieval and conditioning and decommissioning on the La Hague site

Large quantities of legacy waste at La Hague are not stored in accordance with current safety standards and present major risks. The retrieval and conditioning of this legacy waste (WRC) is a key step in the progress of decommissioning of definitively shut down plants.

ASN periodically monitors the progress of these complex projects and takes a positive view of good assimilation of the project maturity assessment by Orano, as well as the deployment of management tools. ASN considers that Orano must nonetheless make progress concerning the robustness of the waste retrieval and processing scenarios and in ensuring the reliability of the operational waste retrieval processes, in order to guarantee the schedules for the various WRC and dismantling projects announced.

ASN also considers that Orano must make progress in anticipating the interactions between the facilities in operation and certain equipment in the facilities being dismantled, which are currently still in use for operational purposes.

The decommissioning of the Tricastin facilities is progressing on the whole satisfactorily, notably in 2024 with the end of the detailed studies for decommissioning of the diffusion cascades in the Georges Besse I plant. However, Orano must improve management of the legacy material on the site, notably in BNI 105, where there is significant delay in removing materials and waste from storage in areas 61 and 79.

## Legacy waste retrieval and conditioning and decommissioning on the La Hague site

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

# CEA

Most French nuclear research facilities have been historically operated by the Alternative Energies and Atomic Energy Commission (CEA). Although some are still contributing to CEA's scientific and technical research programmes, a good number of them have been shut down and CEA is faced with major challenges in order to decommission them and manage the legacy waste satisfactorily.

ASN considers that the safety of the facilities operated by CEA is still under control but that the results of the projects to maintain the facilities in operation, decommission shutdown facilities, and legacy WRC projects still differ widely and remain exposed to potential major contingencies.

Despite the gradual reinforcement of the project management practices, performance remains limited by the resources available and by the operational capacity of the contractors in the sector. In addition, the operational reality of the worksites is nearly always more complex than anticipated, to the extent that an entire project is sometimes called into question, or at the very least the deadlines are significantly pushed back. In this respect, ASN considers that management of these projects remains a point warranting particular attention.

Finally, ASN deplores the fact that there was no significant improvement in 2024 regarding the organisation of emergency situations management, and the monitoring of outside contractors.

## CEA's decommissioning and materials and waste management strategy

In order to keep track of the progress of the projects with the highest priority for safety, the authorities and CEA set up regular and high-level reporting of the deadlines with the greatest safety implications; ASN underlines the commitment by the CEA managers to the oversight and monitoring of these milestones. In 2024, CEA notably continued with the removal of a certain number of radioactive substances from its facilities that had been definitively shut down, which helped substantially reduce the residual risks. CEA notably started up the DECAP process to allow the moving of araldited fuel from storage in the Pégase facility to the Cascad facility and completed the removal of fuel stored in the structures and pools of BNI 72. ASN however observes that CEA is encountering considerable difficulties with conducting the decommissioning operations on the facilities and with WRC, as well as with meeting the deadlines initially set. These delays are notably caused by technical or contractual difficulties. ASN also notes that its alerts regarding certain weaknesses in CEA's waste and effluent management strategy have led to no improvements. CEA is proposing no large-scale measures to safeguard this management, which is to a large extent based on unique facilities, for which there is no operational alternative, and which therefore each determine the satisfactory performance of the numerous projects using them. In this respect, ASN is particularly attentive to the measures to be put into place by CEA following the civil engineering defects found in 2024 on the waste treatment station (BNI 37-A) located in the Cadarache centre.

ASN also notes that CEA's annual budget to finance provisions for nuclear costs is limited. If it wishes to finance unexpected spending for priority projects, this budgetary constraint could cause CEA to smooth the budget for lower priority projects, thus delaying their performance schedules.

## Research facilities in operation

There are safety issues around the research facilities in operation linked to the development of their R&D activities (support for the current and future nuclear fleet), their activities to support other CEA facilities, and their being maintained in safe and operational conditions in compliance with the prescriptions stipulated further to their periodic safety reviews (renovation and seismic reinforcement works, removal of radioactive substances and waste from storage, etc.). As with the decommissioning and waste management projects, ASN observes that CEA is encountering major difficulties with meeting the deadlines initially set for the refurbishment of old facilities or the removal of legacy substances and waste present in these facilities.

The main new research facility project sponsored by CEA, the Jules Horowitz Reactor (JHR), is being carried out satisfactorily and transparently with regard to the safety issues.

## BNI operations

### Risk control and emergency management

ASN considers that the safety of the facilities is satisfactory. During the course of the inspections carried out in 2024, it nonetheless identified certain topics which require improvements. This mainly concerns the performance of periodic checks and tests, waste reconditioning operations, the safety of shielded cell handling operations and the traceability of outside contractor monitoring, and analysis of the results. For the year 2024, the number of significant safety-related events notified by CEA remains of the same order of magnitude as in 2023. A large number of these notifications concern non-compliance with the frequency of performance of the periodic checks and tests mentioned in the BNI general operating rules. CEA shall pay particular attention to these subjects.

In 2024, for the Cadarache site, CEA notified ASN of further delays in the construction of all the emergency management buildings with enhanced robustness, in order to take account of the lessons learned from the accident at the Fukushima Daiichi NPP (Japan). These delays can mainly be explained by contractual difficulties being encountered by CEA and are currently being investigated by the ASN departments. With regard to the Saclay site, CEA has finalised start-up of the facility housing the robust emergency situations management premises. In 2025, ASN will check that these premises are operational. With regard to the Marcoule centre, examination of the reinforcements envisaged by CEA or the emergency situations management building is continuing. Finally, the inspections carried out in 2024 showed that the CEA's national emergency management system needs to be improved, notably in terms of formalisation, traceability and control.

### Personnel radiation protection

The operation of CEA's radiation protection expertise centres was inspected in 2024 and this showed that the organisation put into place for worker radiation protection, as well as the action taken for the performance of the duties of these centres, were satisfactory.

It should however be noted that the Significant Radiation Protection Events (ESRs) notified by CEA are up in 2024. As had been observed in 2023, a significant share of these deviations is related to problems with wearing of dosimeters. Half of these ESRs actually concern outside contractors. CEA must reinforce its actions to raise awareness among these workers.

### Environmental protection

Control of detrimental effects and the impact on the environment by CEA's facilities, for the year 2024, is satisfactory. The number of significant environmental events notified in 2024 is of the same order of magnitude as in previous years, with no notable events.

ASN however considers that CEA must continue its efforts to take measures on several subjects associated with environmental protection and in particular upgrading of the network of piezometers, and management of the discharges continuous monitoring devices, notably with regard to pollution of soil and groundwater.

Since 2021, CEA has produced an inventory of the conformity of the outfalls from its facilities. An update of this inventory was provided in 2024 with regard to the outfalls from the Cadarache site. CEA also stated that it would be continuing its work to identify the corrective action to be taken. All of these points are currently being assessed by the French Institute for Radiation Protection and Nuclear Safety (IRSN). On the basis of its conclusions, ASN will be attentive to the pertinence of the measures finally adopted by CEA.

Finally, in 2024, CEA transmitted a consolidated impact assessment for the Cadarache centre and a limited impact assessment for that in Marcoule. These are currently being analysed by ASNR.

## Safety reassessment of facilities

ASN considers that the organisation put into place by CEA to evaluate the conformity of its facilities and reassess their safety during the periodic safety reviews, is appropriate. The inspections carried out by ASN on the topic of the periodic safety reviews identified some points for improvement which must be addressed by CEA, notably concerning monitoring of the action plan as a result of the periodic safety review. CEA will also have to continue its efforts in the coming years in order to comply with the schedule for implementation of the compliance and safety improvement work defined by these periodic safety reviews, so that in all cases a new review can be started once the deployment of the action plan from the previous review has been completed.

## Individual facility assessments

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

# ANDRA

ASN notes a positive dynamic around the examination of the creation authorisation application file for the Cigéo deep geological repository, submitted on 16 January 2023 by the National Radioactive Waste Management Agency (Andra).

## The Cigéo project

The technical examination of the Cigéo creation authorisation application continued in 2024, notably with two meetings of the Advisory Committee of Experts for Waste (GPD) during which the basic data and the hypotheses adopted to establish the safety case were examined, along with the safety of the facilities in the operations phase.

ASN considers that, without calling into question the design of Cigéo at this stage of the examination, Andra must provide additional data before excavation work begins, notably concerning the safety case for operation of bituminous waste disposal, the closure of the intermediate level, long lived vaults (ILW-LL) and the operation of the high level (HLW) vaults. ASN considers that Andra is reactive and constructive in its responses during examination of this dossier, a point which was also underlined during the meetings of the GPD. These points confirm the demonstration that Andra has the technical capabilities needed to successfully complete the Cigéo project. In 2025, ASNR will continue its oversight of the management of the Cigéo project.

## Operation of Andra's existing facilities

ASN considers that operating conditions in Andra's facilities remained satisfactory in the areas of nuclear safety, radiation protection and environmental protection in 2024. It also underlines the good quality of the safety assessments produced by Andra and the fact that the periodic safety reviews of the disposal facilities are carried out satisfactorily. The evaluation of the long-term impacts on fauna and flora of the radiological and chemical substances in the disposal facilities, as well as the approach adopted to take account of organisational and human factors for all of its activities and its operational implementation in these centres and head office departments, remain subjects for which management needs to be consolidated by Andra.

# ASN assessments by area for activity

## THE MEDICAL SECTOR

On the basis of the inspections carried out in 2024 and of an analysis over the period enabling the entire base of facilities with safety implications to be covered, ASN considers that the state of radiation protection in the medical sector is being maintained at a satisfactory level, relatively comparable from one year to the next, although with a number of persistent shortcomings.

ASN notes that the clinical audit experiments started at the end of 2023, in radiotherapy and radiology only, under the control of the Ministry for Health, are being deployed satisfactorily but will need to be continued before they can be generally adopted. It encourages their extension to higher-risk activities, primarily radiosurgery, as well as therapeutic nuclear medicine, and urges the National Professional Councils (CNPs) to immediately mobilise in order to construct the audit tables. It also encourages the radiotherapy units to participate in the evaluation of the new practices, similarly to that put into place for adaptive radiotherapy.

It encourages the CNPs to take account of the need to update the radiation protection training guides they produced, based on the results of the evaluation of the new patient radiation protection training system published by ASN in 2024.

ASN draws attention to the fact that the signals identified in 2023, and recalled below, lead to a deterioration in radiation protection culture. They are identified as a factor contributing to the occurrence of ESRs and are found during inspections to explain the fall in regulatory compliance:
• a finding that resources are on the whole shrinking, with pressure on radiographer (MERM), medical practitioner, medical physician staffing levels, with the expansion of temporary work and the postponement of tasks;
• in imaging, the use of insufficiently well-understood services to assist the Radiation Protection Expert-Officers (RPE-Os) and the medical physicians in the plants, liable to lead to a loss of radiation protection expertise and a lack of flexibility in implementing the regulation radiation protection requirements (training, verifications, etc.);
• constant growth in teleradiology with technical and organisational constraints linked to this type of organisation that are under-estimated by the facilities (communication problem, software interface); in 2025, ASNR will publish the lessons learned from a study it conducted on this subject;
• increasingly complex organisations, with sharing of resources and the risk of dilution of responsibilities, against a backdrop of health care authorisation reforms and buy-out of centres.

ASN thus maintains its demand for vigilance on the part of the decision-makers, regarding the need to assess the impact of these changes on the organisations and on the work of the participants and to precisely define the roles and responsibilities of all parties involved, so that the radiation protection requirements are met.

**In radiotherapy**, although the fundamentals of safety are in place, the radiotherapy departments are struggling to drive the experience feedback process, with fewer experience feedback committee meetings, insufficiently detailed ESR analyses and persistent difficulties with assessing the robustness of the corrective measures taken. The repetition of target errors (wrong-side, delineation or positioning errors in particular), the multiplication of simultaneous treatments of several locations, as well as re-irradiations, at a time when more and more patients will benefit from several radiotherapies during their lifetime, underlines the need on the one hand for regular assessment of the barriers in place, taking advantage of national Operating Experience Feedback (OEF), and, on the other, for updating of the preliminary risk assessments on the basis of local and national experience feedback. These studies are still insufficiently conducted upstream of technical and organisational changes.

**In brachytherapy**, the inspections confirm that the radiation protection rules are well taken into account. The challenges linked to maintaining the resources and skills needed for this activity will remain in the coming years. The new requirements concerning the protection of high-level sources against malicious acts are continuing to be gradually deployed, in particular through implementing a protection policy, measures to prevent unauthorised access to these sources and the identification and control of sensitive information. The situation is gradually improving although it cannot yet be considered to be conforming.

**In nuclear medicine**, the inspections indicate that patient radiation protection is adequately taken into account, through implementation of the optimisation principle with the collection and analysis of Diagnostic Reference Levels (DRLs), while underlining the fact that further progress is still required in the deployment of Quality Management Systems (QMS). The ESRs show that the administration processes must be regularly evaluated in order to ensure that the drug circuit is fully controlled, in particular those which could lead to errors involving several patients (use of the dose calibrator). ASN draws the attention of the entities Responsible for Nuclear Activities (RNAs) to the risk of extravasation with treatments using lutetium-177, which can lead to significant exposure on the injection site and, in collaboration with the professionals, is currently working on collecting experience feedback from the ESRs reported. It has also made available an "experience feedback" sheet concerning complications arising during liver cancer treatment by radioembolisation using yttrium-90. Particular attention must also be paid to management of the effluents (operation of the decay tank alarms) and the waste generated by the patients, linked to the emergence of new radiopharmaceuticals. Finally, despite progress regarding the training of professionals, a less satisfactory situation was observed in 2024 with regard to occupational radiation protection and monitoring of equipment and sources (analysis of dosimetry, verifications, coordination of prevention measures during concomitant activities).

**In the field of Fluoroscopy Guided Interventional Practices (FGIPs)** and more particularly in the operating theatre, regulatory nonconformities persist, year after year, whether the technical rules for layout of facilities, radiation protection training requirements for workers and patients, and coordination of prevention measures during concomitant activities. ASN observes that the centres are increasingly calling on Radiation Protection Organisations (RPOs), and that if insufficiently well managed, this subcontracting leads to a dilution of the responsibilities of the RNAs with less consideration for

and even deterioration of radiation protection. In addition, the inspections carried out on private practitioners employing staff reveal a lack of understanding of the regulatory radiation protection obligations in the Labour Code, with regard to both themselves and their employees. Finally, ASN found that several medical centres had not registered their X-ray emitting equipment and decided to initiate sanctions against a hospital.

In 2025, ASNR will continue with its inspections in the priority sectors, that is radiotherapy, radio-surgery, nuclear medicine, FGIP and computed tomography. In radiotherapy, after conducting a review involving all the stakeholders, ASNR will update its inspection guidelines and will start its new four-year inspection programme in 2025. In nuclear medicine, it will adapt the frequency of the inspections to take better account of the radiation protection issues, notably for departments carrying out clinical trials. In radiotherapy and nuclear medicine, based on the lessons learned from the ESRs reported in recent years, it will continue with specific inspections on management of the accelerator calibration process and verification of non-contamination respectively.

With regard to FGIPs, ASNR will continue with its targeted inspections on private practitioners employing staff. Finally, on the occasion of the work carried out to update ASN resolution 2019-DC-0667 on DRLs, having found inadequacies in correct use of Cone Beam Computed Tomography (CBCT) by dental surgeons as well as in the deployment of the optimisation approach, it will launch an inspections campaign in this field. It will thus provide the RNA with a chart enabling the dental surgeons to carry out a self-assessment.

In regulatory terms, ASNR will in 2025 review ASN resolution 2019-DC-0667 of 18 April 2019 setting DRL values to update the values applicable to mammography procedures and CBCT. It will continue the preparatory work for revision of ASN resolution 2008-DC-0095 of 29 January 2008 setting out the technical rules for the elimination of effluents and waste contaminated by radionuclides. In addition, ASNR will in 2025 publish the lessons learned from the study it is conducting on teleradiology.

Finally, the deployment of new therapy techniques and practices (radiotherapy, ITR) remains a subject requiring particular vigilance. ASNR will continue its work together with the various institutional stakeholders in the health field, the learned societies, and with the help of the Advisory Committees of Experts, in particular the Committee for the Analysis of new Techniques and Practices using Ionising Radiation (Canpri), notably with regard to flash therapy and the project group set up to define the procedures for evaluating adaptive radiotherapy, which will be deployed as of 2025. In therapeutic nuclear medicine, radiation protection issues for the patient, their entourage, and the workers, the management of effluent and waste, are a priority against the backdrop of the emergence of new radiopharmaceuticals, projected growth in the number of patients eligible for these new treatments, with limited infrastructures and with the out-patient method being the preferred choice for health care. ASNR will issue an opinion at the beginning of 2025 on the basis of the work done by IRSN, the Advisory Committee of Experts for Radiation Protection (GPRP) and the lessons learned from the SimpleRad[1] project run by the European Commission.

# THE INDUSTRIAL, VETERINARY AND RESEARCH SECTOR

The licensees of the industrial, veterinary and research sector are characterised by their diversity: they are numerous and carry out their activities in structures of widely varying size and status; they also use ionising radiation sources for a wide variety of applications. With regard to radiation protection, ASN's assessment of these licensees remains more or less unchanged and reflects a widely contrasting picture as in previous years.

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 observes that the vast majority of companies maintained the necessary degree of rigorousness to meet the regulatory obligations concerning the organisation of radiation protection, training and dosimetric monitoring of the workers, the use of operators holding the required Certificate of proficiency in handling industrial radiology devices (CAMARI) and maintaining gamma radiography devices. However, significant efforts are still required on the part of many companies to correctly define the programme of verifications required by the Labour Code, implement it, correct any nonconformities found on this occasion and ensure the traceability of the corrections made. If the risk of incidents and the doses received by the workers are on the whole well managed by the licensees when this activity is performed in a bunker in accordance with the applicable regulations, ASN is still concerned by the observed shortcomings in the signalling of the operations area during on-site work, even if a slight improvement has been observed every year since 2022. ASN underlines that the lack of preparation and cooperation ahead of the work, between the ordering customers and the radiography contractors, is frequently one of the causes of these nonconformities. Progress is in particular needed regarding the content of the prevention plans, and familiarity with and implementation of the provisions contained in them. More generally, ASN considers that the ordering parties should, whenever possible, give priority to industrial radiography services in bunkers and not on the worksite. As recalled by the event that occurred in Colmar in the spring of 2024, the repercussions of a radiological incident (impossibility of returning the radioactive source to the secure position in the gamma ray projector) are often considerable given the precautions to be taken to manage it. When the radiographic inspection takes place in a bunker, the consequences of such incidents are far more limited, provided that they are detected before someone enters the bunker and approaches the radioactive source. In this respect, in nearly one in three inspections in 2024 (bunkers and worksites), the operators did not correctly use their radiation meters to confirm that the radioactive source was actually in the safe position, from the moment they began to approach the gamma ray projector.

In the other priority sectors for ASN oversight in the industrial field (**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 ten years), information for the purchasers regarding future source recovery procedures, and the checks prior to delivery of a source to a customer, are areas in which practices progressed by comparison with 2023, but still need to improve further.

1. *SimpleRad – EANM EARL – Research4Life : earl.eanm.org/simplerad/*

As for the distributors of accelerators or X-ray emitting devices, the monitoring tools that they put into place to identify the devices distributed and who acquired them often need to be reinforced, to avoid compromising any recall or OEF processes.

The actions carried out by the licensees in recent years are continuing to improve radiation protection within the **research laboratories**, even if these efforts appear to be flagging somewhat. Correctly taking account of radiation protection is to a large extent based on the involvement of the radiation protection advisers and depends on the resources placed at their disposal. It should be recalled that the radiation protection issues in many research laboratories tend to be minor or are decreasing owing to the use of techniques other than those using ionising radiation. The conditions for the storage and elimination of waste and effluent remain the primary difficulties encountered by the research units or universities, including with regard to the performance and traceability of checks prior to elimination, the recovery of "legacy" unused sealed radioactive sources or the regular elimination of stored radioactive waste. On these latter points, the lack of forward planning for the funding needed to manage "legacy" sources or waste and their prior characterisation if necessary, is often observed. In 2024, two significant events – both correctly managed – recalled that vigilance is required during maintenance of particle accelerators or in the event of any changes to their conditions of use. Finally, the facilities are also still experiencing difficulties in taking on board and correctly implementing checks on equipment, workplaces and instrumentation, as a result of changes to the Labour Code and Public Health Code in 2018, in particular in the case of joint research units.

With regard to the **veterinary uses of ionising radiation**, ASN can see the results 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.

There are however rare cases of veterinary structures with a highly unsatisfactory radiation protection organisation, which, if explanatory measures are not sufficient, may lead ASN to take more rigorous steps, or even enforcement measures.

In addition, the growing outsourcing of the RPE-O function, with large-scale use of RPOs from outside the facilities, must not lead to veterinarians abdicating their prime responsibility for the level of radiation protection in their facilities.

# THE PROTECTION OF RADIATION SOURCES AGAINST MALICIOUS ACTS

The inspections conducted by ASN show that the licensees are gradually implementing the measures needed to comply with the requirements set out in the Order of 29 November 2019, more particularly when high-level radioactive sources or batches of equivalent sources are used.

Thus, on the basis of the inspections conducted in 2024:

- Source categorisation, an essential step in identifying the applicable requirements and implementing an approach proportionate to the risks, was carried out for the vast majority of facilities.
- The source protection policy, supported by the facility's general management and promoting the concrete measures to be taken, leads to no comments on the part of ASN in two-thirds of the industrial facilities and half the medical facilities, which constitutes progress by comparison with previous years.
- Even if all the facilities inspected have taken steps to protect the sources, a little over half of them had not formally identified the physical barriers guaranteeing this protection, or demonstrated that they offered adequate intrusion resistance. On the other hand, only 20% of the medical facilities had carried out this analysis, which is a deterioration by comparison with the results of the inspections carried out in 2023.
- In one third of the industrial facilities and half the medical facilities, no preventive maintenance programme is defined for the equipment designed to detect intrusions. In addition, when there is a programme, it is only correctly implemented in less than half the facilities.
- The issue of nominative permits for access to sources has barely progressed and still needs to be implemented in nearly half the facilities.
- Half of the industrial facilities do not take steps to identify and protect sensitive information concerning source security. This finding is less severe for medical facilities, because only one third of them are in this situation, which is a clear improvement on 2023.

Compliance with the requirements set for source protection against malicious acts usually implies modifications to the facilities and organisational and human changes, which may prove costly given the resources available to the facility. In the gamma radiography sector for example, ASN finds that the requirements for the protection of sources against malicious acts sometimes led the licensee to close certain facilities or branches to avoid having to upgrade them, with the result being increased operational constraints, notably longer transport times to the sites where the non-destructive inspections are to be conducted.

ASN asks the gamma radiography contractors to take greater account of this question in their responses to invitations to tender and in the preparation of their work. It also recalls that it is the responsibility of the ordering parties to ensure correct performance conditions for the inspections they order.

Overall, whether in the industrial or medical sector, ASN considers that considerable progress is still needed. In 2025, ASNR will continue its actions to raise licensee awareness on these subjects.

# TRANSPORT OF RADIOACTIVE SUBSTANCES

The Transport of Radioactive Substances (TSR) involves numerous players, the carriers of course, but also the consignors, the package designers and manufacturers, etc. The vast majority of shipments is linked to the needs of the non-nuclear industry, the medical sector or research.

ASN considers that in 2024, the safety of TSR is on the whole satisfactory, as in previous years. Although a few transport operations - mainly by road – did suffer incidents, these must be put into perspective against the 770,000 transport operations carried out each year.

The number of significant TSR events on the public highway is up on 2023, with a handful of events rated level 1 on the INES scale. This increase is essentially the result of events rated level 0 on the INES scale, with 16 more events than in 2023. This increase reflects increasing awareness on the part of the licensees of the good reasons for notifying a significant event. In 2024, nearly one quarter of the significant events notified to ASN concern road transport of radiopharmaceutical products, even if this proportion has fallen in recent years; a slight upturn in the number of events concerning the transport of gamma ray projectors is also observed.

On the whole, the events mainly comprise:
• material non-conformities affecting a package (notably damaged packaging) or its stowage on the conveyance, thereby weakening the strength of the package (whether or not an accident occurs). These cases do not concern transports of spent fuels or highly radioactive waste and primarily concern transports for small-scale nuclear activities;
• exceeding of the limits set by the regulations, usually by a small amount, for the dose rates or contamination of a package;
• errors or omissions in package labelling, mainly for transports concerning small-scale nuclear activities;
• delivery errors concerning radiopharmaceutical products. As these products are often similar from one hospital unit to another, most of them could be used for patient treatment without any impact.

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

With regard to **transports for Basic Nuclear Installations** (BNIs), ASN finds that the licensees carry out numerous checks and are therefore better able to detect any deviations. Package tie-down, the radiological cleanness of the spent fuel packages, and the tightening of the package screws remain points requiring particular vigilance, in particular at EDF. For BNIs performing research programmes, 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, notably when this demonstration is carried out by a third-party company. In addition, at the La Hague plant, Orano Recyclage reinforced the safety of on-site transports using mobile docking chambers (EMEM), capable of transporting samples, equipment or irradiating technological waste, adding mechanical protection and using a new transport trailer.

With respect to **transports concerning small-scale nuclear activities**, the ASN inspections confirm significant disparities from one carrier to another. The deviations most frequently identified concern the content and actual implementation of the worker radiation protection programme, the QMS, or actual compliance with the procedures put into place. The checks to be carried out prior to shipment of a package must therefore be improved. For example, the inspections concerning the transport of gamma ray projectors regularly reveal inappropriate stowage or tie-down.

At a time when the uses of radionuclides in the medical sector are generating a high volume of transport traffic, progress is still needed regarding 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. The QMS have not yet been formally set out and deployed, more specifically with regard to the responsibilities of each of the personnel involved. ASN considers that the radiation protection of carriers of radiopharmaceutical products, who are significantly more exposed than the average worker, remains a point warranting particular attention.

For transport operations involving packages that do not require ASN approval, progress continues to be observed by comparison with 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 per 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.

Finally, ASN points out that TSR may be a limiting factor for certain projects, concerning both BNIs and small-scale nuclear activities (for example, the transport of irradiated targets needed for medical applications). In terms of forward planning, ASN therefore asks the licensees to exercise vigilance regarding packaging availability, if necessary ensuring that they are available in sufficient numbers, as well as the existence of other package models which could replace those normally used in the event of any problem affecting them.

# Regulatory News

The year 2024 was marked by the publication of Act 2024-450 of 21 May 2024, relative to the organisation of nuclear safety and radiation protection governance, in order to address the challenges of the nuclear industry's renewal, and most of its implementing texts.

It also saw the completion of a certain number of important texts, in particular a Decree implementing Act 2023-491 of 22 June 2023 relative to the acceleration of the procedures linked to the construction of new nuclear installations in close proximity to existing nuclear sites and to the operation of the existing installations, and texts relating to protection against the risks from ionising radiation and prevention of the radon risk.

This year also saw continued work on revising the 7 February 2012 Order setting the general rules relating to Basic Nuclear Installations (known as the "BNI Order").

# National news

## Acts and Ordinances

**• Act 2024-450 of 21 May 2024, relative to the organisation of nuclear safety and radiation protection governance, in order to address the challenges of the nuclear industry's renewal**

This Act follows on from the President of the Republic's speech in Belfort on 10 February 2022, which underlined the need to move away from fossil fuels by reducing energy consumption and through a large-scale acceleration in the production of decarbonised energy, electrical energy in particular: renewable energies, which were the subject of a specific Act (Act 2023-175 of 10 March 2023), and nuclear energy, notably with the construction of six new Pressurised Water Reactors (Evolutionary Power Reactor – EPR) by 2035.

The adoption on 22 June 2023 of Act 2023-491 accelerating administrative procedures will simplify and speed up the implementation of new nuclear power reactor construction projects in France, in close proximity to existing nuclear sites (construction of the future EPR 2 reactors on the Penly, Gravelines and Bugey sites).

In the light of the above-mentioned challenges, which will exert significant pressure on the competent public authorities, and in order to maintain excellence in the oversight of nuclear safety and radiation protection in the future, the Government wished to conduct a reorganisation of the governance of nuclear safety and radiation protection, in order to respond to the unprecedented nuclear sector renewal process, both in terms of safety levels and the pace of the work to be done.

This change, as set out by Act 2024-450 is based on the creation of an independent civil nuclear and radiation protection Authority: the French Authority for Nuclear Safety and Radiation Protection (ASNR), combining the activities of the Nuclear Safety Authority (ASN) and the Institute for Radiation Protection and Nuclear Safety (IRSN), with the status of an independent administrative Authority.

ASNR will house all the activities contributing to the creation of efficient oversight and robust decision-making, which are split between ASN and IRSN: internationally reputed research, general and specialist expertise, inspection of installations and extensive knowledge of the field, contribution to drafting of regulations, enforcement and sanctions powers, management of emergency situations, environmental monitoring and information of the public. Furthermore, as in the previous system, ASNR will be able to call on Advisory Committees of Experts for an exchange of viewpoints.

Certain provisions of the Act require implementing Decrees and the adoption of the ASNR's internal rules of procedure, either currently under preparation or already published.

**• Constitutional Act 2024-448 of 21 May 2024, modifying Constitutional Act 2010-837 of 23 July 2010 relative to application of the fifth section of Article 13 of the Constitution**

This Act draws the consequences of the ASN and IRSN merger, with the status of an Independent Administrative Authority (AAI) and defines the procedures for appointing the ASNR Chairman, following on from the existing procedures for appointing the ASN Chairman and the IRSN General Director. It also states that this appointment is made by the President of the Republic in the conditions set out in the fifth section of Article 13 of the Constitution, that is *"further to the public opinion of the competent standing committee of each Assembly"*. Constitutional Act 2024-448 thus modifies the table appended to Constitutional Act 2010-837 of 23 July 2010 relative to application of the fifth section of Article 13 of the Constitution, on the one hand to supplement the reference to the Chairmanship of the Nuclear Safety Authority, which becomes the Authority for Nuclear Safety and Radiation Protection, and on the other, to delete the reference to the general directorate of the Institute for Radiation Protection and Nuclear Safety.

## Decrees and Orders

**• Decree 2023-1261 of 26 December 2023 specifying the categories of operations linked to the construction of nuclear power reactors, which could be initiated as of issue of the environmental authorisation**

This Decree, issued in application of the provisions of III of Article 11 of Act 2023-491 of 22 June 2023 relative to the acceleration of the procedures related to the construction of new nuclear installations in close proximity to existing nuclear sites, and to the working of the existing installations, specifies the operations linked to the construction of a nuclear power reactor from among those which can only be performed following issue of the creation authorisation and those which can be initiated as of the date of issue of the environmental authorisation.

**• Decree 2024-296 of 29 March 2024 defining the notion of immediate proximity with respect to the measures to accelerate procedures linked to the construction of new nuclear installations in close proximity to existing nuclear sites and containing various procedural adaptations**

This Decree defines the notion of immediate proximity, which appears in Article 7 of Act 2023-491 of 22 June 2023 relative to the acceleration of the procedures linked to the construction of new nuclear installations in close proximity to existing nuclear sites and to the working of the existing installations, and specifies the framework for modifications to the environmental authorisation following issue of the nuclear power reactor creation authorisation pursuant to the provisions of Article 11 of the same Act.

**• Decree 2024-758 of 6 July 2024 relative to the assistance bonus for civil servants further to the creation of the Authority for Nuclear Safety and Radiation Protection**

This Decree creates an assistance bonus further to the creation of the Authority for Nuclear Safety and Radiation Protection, for the civil servants actively working at or delegated to Nuclear Safety Authority as at 1 November 2024. It specifies the conditions and procedures regarding payment.

• **Decree 2024-1103 of 3 December 2024, issued in application of the provisions of Article 14 of Act 2024-450 of 21 May, 2024, relative to the organisation of nuclear safety and radiation protection governance, in order to address the challenges of the nuclear industry's renewal**

Act 2024-450 of 21 May 2024, relative to the organisation of nuclear safety and radiation protection governance, in order to address the challenges of the nuclear industry's renewal, created a new independent administrative Authority, the Authority for Nuclear Safety and Radiation Protection (ASNR), which on 1 January 2025 replaces the Nuclear Safety Authority (ASN) and the Institute for Radiation Protection and Nuclear Safety (IRSN). The purpose of this Decree is to define the working procedures of the social dialogue bodies within the ASNR during the transitional period, before the creation of the ASNR's Administration Social Committee (CSA), which is to take place no later than 31 March 2026.

• **Decree 2024-1135 of 4 December 2024 relative to the qualifications and training of pharmacists using radiopharmaceutical drugs or active implantable medical devices, with unsealed sources emitting ionising radiation**

The purpose of this Decree is to regulate the conditions for access to the activity of radiopharmacist (pharmacists operating within the framework of authorised nuclear medicine activities), through the inclusion of a new regulatory provision to the Public Health Code, requiring issue of an Order to define the diplomas and levels of qualification or experience determining this access.

• **Decree 2024-1186 of 19 December 2024 relative to the transfer of employment contracts and secondments set out in II and III of Article 11 of Act 2024-450 of 21 May 2024 relative to the organisation of the governance of nuclear safety and radiation protection**

This Decree concerns the employees of the Institute for Radiation Protection and Nuclear Safety (IRSN) who, on 31 December 2024, were carrying out duties within the Institute's nuclear expert assessment division, or duties relative to the supply and operation of passive dosimeters. It is issued in application of II and III of Article 11 of Act 2024-450 of 21 May 2024 relative to the organisation of the governance of nuclear safety and radiation protection, and specifies the procedures for the transfer of the employment contracts of the above-mentioned employees to the French Alternative Energies and Atomic Energy Commission (CEA) and the procedures for the secondment of certain of them to the Ministry of the Armed Forces.

• **Decree 2024-1194 of 19 December 2024 modifying various texts, to draw the consequences of the creation of the Authority for Nuclear Safety and Radiation Protection**

Act 2024-450 of 21 May 2024 relative to the organisation of the governance of nuclear safety and radiation protection in order to meet the challenges of the renewal of the nuclear sector, created a new independent administrative Authority, the Authority for Nuclear Safety and Radiation Protection (ASNR), which, as of 1 January 2025, replaces the Nuclear Safety Authority (ASN) and the Institute for Radiation Protection and Nuclear Safety (IRSN), to carry out oversight and regulation, expert assessment and research activities with regard to the nuclear safety of civil installations, as well as radiation protection. The Decree contains the necessary updates to the Environment Code, the Administrative Justice Code, the Transports Code, the Domestic Security Code, as well as the Decrees in force, to take account of ASNR replacing ASN and IRSN and the coexistence within this new entity of public and private sector employees.

• **Decree 2024-1203 of 23 December 2024 relative to the transfer of the assets, rights and obligations of the Institute for Radiation Protection and Nuclear Safety to the State and the French Alternative Energies and Atomic Energy Commission, and modifying the latter's activities**

This Decree organises the transfer of the assets, rights and obligations of the Institute for Radiation Protection and Nuclear Safety to the State and the French Alternative Energies and Atomic Energy Commission, and the legal conditions of this transfer. This text also specifies the procedures for producing, closing and approving IRSN's financial accounts for the 2024 financial year.

• **Decree 2024-1238 of 30 December 2024 relative to the protection of workers against the hazards of ionising radiation**

The creation of the Authority for Nuclear Safety and Radiation Protection (ASNR) on 1 January 2025 requires modification of all the Articles of the Labour Code which mention the Institute for Radiation Protection and Nuclear Safety (IRSN), replacing it with ASNR, except for passive dosimetry activities which are taken over by the Alternative Energies and Atomic Energy Commission. In addition to replacing the names of the IRSN and ASN by that of ASNR, certain provisions relative to these duties must be changed to take account of the independent administrative Authority status of the new entity, and the merging within a single entity of regulation and expert assessment activities, as well as the provision of services to third parties against remuneration. This Decree also creates the "radiological safety zone", for particular situations and clarifies the approach for preventing the risk of occupational exposure to radon from the soil (radon directly generated by rocks in the soil or secondarily by water circulating through these rocks, or the materials extracted from these rocks). Finally, this Decree transforms the certificates of the Radiation Protection Advisors (RPAs) and Certificates of competence for the handling of industrial radiology equipment (CAMARI) into professional certifications consistent with common vocational training law as derived from Act 2018-771 of 5 September 2018 concerning the freedom to choose one's professional future. It also completes the recognition of the systems of radiation protection experts and operatives required by Directive 2013/59/Euratom of 5 December 2013.

• **Decree 2024-1240 of 30 December 2024 modifying various regulatory provisions relative to protection against ionising radiation**

This Decree draws the consequences of Act 2024-450 of 21 May 2024, relative to the organisation of nuclear safety and radiation protection governance, in order to address the challenges of the renewal of the nuclear sector, by modifying the provisions of the Public Health Code and the non-codified regulatory texts. Its purpose is notably to replace the former names of the Nuclear Safety Authority (ASN) and the Institute for Radiation Protection and Nuclear Safety (IRSN) by the new name Authority for Nuclear Safety and Radiation Protection (ASNR).

• **Decree 2024-1241 of 30 December 2024 relative to the conditions for the performance of remunerated activities by the departments of the Authority for Nuclear Safety and Radiation Protection and to the procedures for the approval of technical regulations issued by this Authority**

This Decree specifies the conditions in which the departments of the Authority for Nuclear Safety and Radiation Protection can carry out the activities set out in Article L. 592-14-2 of the Environment Code, the procedures for the approval of certain decisions set out in Article L. 592-20 of the same Code, as well as the conditions in which the results of research programmes set out in Article L. 592-28-2 of the same Code can be commercially exploited.

• **Decree 2024-1278 of 31 December 2024 relative to the remuneration and hourly compensation for on-call work and interventions within the Authority for Nuclear Safety and Radiation Protection**

The Nuclear Safety Authority (ASN) and the Institute for Radiation Protection and Nuclear Safety (IRSN) had two on-call and emergency situation organisations. The creation of the Authority for Nuclear Safety and Radiation Protection on 1 January 2025 requires modification of the texts governing on-call work, applicable only to public sector employees, to allow the operation of a single on-call organisation based on public sector and private sector employees, these latter being governed by IRSN's existing collective bargaining agreements.

The proposed changes are also designed to allow harmonisation of the amount of the compensation received by public and private sector employees, as set out in Article 10 of the Act of 21 May 2024, relative to the organisation of nuclear safety and radiation protection governance, in order to address the challenges of the nuclear industry's renewal.

• **Order of 14 May 2024 relative to the protection of ionising radiation sources against malicious acts within the scope of responsibility of the Ministry of the Armed Forces**

In order to take account of the organisation of the specific working methods of the Ministry of the Armed Forces, this Order adapts several provisions of the Order of 29 November 2019, as amended, concerning the protection of ionising radiation sources and batches of radioactive sources of categories A, B, C and D against malicious acts. It takes up many of the provisions of the above-mentioned Order of 29 November 2019, thus adopting an approach proportionate to the issues and ensuring consistency between the applicable requirements, whether the ionising radiation sources are held, used, or transported within the framework of civil or military nuclear activities.

• **Order of 15 May 2024 relative to radon risk prevention and the implementation of a radon zone and the corresponding checks, within the framework of the reinforced worker protection system**

This Order is issued in application of Article R. 451-35 of the Labour Code, to set the terms and conditions specific to radon from the soil for implementing the "radon zone" mentioned in Article R. 4451-23 of the Labour Code, and the technical conditions for ensuring the intermittent nature of this zone. It also stipulates certain provisions for the risk prevention and reduction approach, as well as implementation of the reinforced measures to prevent the radon risk. Man-made radon resulting from a professional activity (industrial processes, residues, waste, etc.) is not covered by this text.

• **Order of 6 August 2024 relative to the training of occupational physicians and other occupational health professionals providing reinforced individual monitoring of a worker exposed to ionising radiation and to the conditions for the issue of the supplementary approval of occupational health departments**

This Order is issued in application of Articles R. 4451-85 and R. 4451-86 of the Labour Code, to set the terms and conditions for the specific training and supplementary modules required for the occupational health professionals mentioned in the first section of I of Article L. 4624-1 of the Labour Code, to allow supplementary approval of various types of occupational health departments for the performance of the reinforced individual monitoring set out in Article R. 4451-82 of the same Code and Article R. 717-16 of the Rural and Maritime Fishing Code.

• **Order of 10 December 2024 designating the restructuring operation within the Institute for Radiation Protection and Nuclear Safety entitling the staff to compensation and assistance**

This Order is relative to the reorganisation of the Institute for Radiation Protection and Nuclear Safety accounting office.

• **Order of 31 December 2024 relative to the transfer of assets, rights and obligations of the Institute for Radiation Protection and Nuclear Safety**

This Order is issued in application of Article 9 of Act 2024-450 of 21 May 2024, relative to the organisation of nuclear safety and radiation protection governance, in order to address the challenges of the nuclear industry's renewal.

Pursuant to the provisions of Decree 2024-1264 of 31 December 2024 relative to the immediate entry into force of Orders, the Order of 31 December 2024 enters into force with immediate effect as of its publication in the *Official Journal of the French Republic*, that is 1 January 2025.

• **Modification of the Order of 7 February 2012, setting the general rules concerning Basic Nuclear Installations ("BNI Order")**

The work to revise this Order continued in 2024.

# ASN resolutions

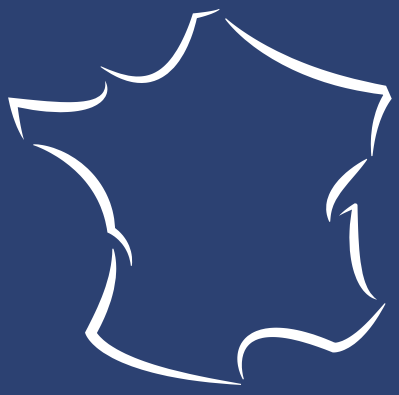
## Basic Nuclear Installations

*Reminder of a resolution issued in 2023 (included in the 2023 annual report), but approved in 2024:*

• **ASN resolution 2023-DC-0770 of 7 November 2023 modifying ASN resolution 2017-DC-0616 of 30 November 2017 relative to noteworthy modifications to basic nuclear installations (approved by the Order of 9 February 2024 approving ASN resolution 2023-DC-0770 of 7 November 2023 modifying ASN resolution 2017-DC-0616 of 30 November 2017 relative to noteworthy modifications to basic nuclear installations)**

This resolution defines the requirements applicable to the noteworthy modifications made during the construction phase of a basic nuclear installation. Prior to this modification, resolution 2017-DC-0616 was in fact only applicable to the modifications made after commissioning of the installations.

This resolution in particular defines the list of modifications subject to notification during the construction phase and those requiring ASN authorisation. It also adapts certain criteria concerning the notification system, to take account of lessons learned from application of resolution 2017-DC-0616 since it entered into force on 1 July 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 regions.

Several ASN regional divisions may have to coordinate their work in a given administrative region.

As at 31 December 2024, the ASN regional divisions comprise 222 employees of whom 168 are inspectors.

**Under the authority of the regional representatives (*see chapter 2 of the full ASN Report*), the ASN regional divisions carry out on-the-ground inspections of the Basic Nuclear Installations (BNIs), of Radioactive Substance Transport (TSR) operations and of small-scale nuclear activities;** they examine the majority of the licensing applications submitted to ASN by those Responsible for Nuclear Activities (RNAs) within their regions. For these activities and in these facilities, they check application of the regulations relative to nuclear safety, radiation protection, Pressure Equipment (PE) and 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 place the facility in a safe condition and they assist the Prefect of the *département***, who is responsible for protecting the public. To ensure preparedness for such situations, they participate in the development of the emergency plans drawn up by the Prefects and 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 BNI Local Information Committees (CLIs) and maintain regular relations with the local media, elected officials, associations, licensees and local administrations.

This section of the Report presents ASN's oversight action in 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 and 9 of the full ASN Report.

**Medical sector**
Chapter 07

**Research and industry**
Chapter 08

**Transport sector**
Chapter 09

# Auvergne-Rhône-Alpes

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

**339**
inspections

**23**
significant events rated level 1 or higher

ASN conducted 339 inspections in the Auvergne-Rhône-Alpes region in 2024, of which 115 were in the Bugey, Saint-Alban, Cruas-Meysse and Tricastin Nuclear Power Plants (NPPs), 100 in plants, research facilities and sites being decommissioned, 89 in small-scale nuclear activities, 15 in the Radioactive Substance Transport (TSR) sector, and 20 in organisations and laboratories approved by ASN.

ASN also carried out 22 days of labour inspections in the four NPPs and on the Creys-Malville site.

In 2024, 21 significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES) were reported to ASN, of which 19 occurred in BNIs and two in small-scale nuclear activities.

Furthermore, one Significant Radiation Protection Event (ESR) at the Tricastin NPP was rated level 2 on the INES scale and one event involving the irradiation by error of a healthy zone of a patient during a radiotherapy treatment was rated level 2 on the ASN-SRO scale (scale specific to radiation protection events affecting patients undergoing a radiotherapy procedure).

Lastly, inspection of one industrial radiography company resulted in the ASN inspectors issuing a violation report concerning the conditions of prevention of the occupational risks associated with ionising radiation. This same inspection detected a potential case of fraud in the provision of a service, which was reported to the Public Prosecutor under Article 40 of the Penal Procedure Code.

## Bugey site

**The Bugey industrial site comprises various facilities, including the Bugey NPP operated by EDF on the municipality of Saint-Vulbas in the Ain *département*, 35 km east of Lyon. It comprises four Pressurised Water Reactors (PWRs), each with a power 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 conditioning and interim storage facility (Iceda) and the Inter-Regional Warehouse (MIR) for fuel storage.**

**Lastly, the site accommodates one of the regional bases of the Nuclear Rapid Intervention Force (FARN), the special emergency response force created by EDF in 2011 following 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 performance of the Bugey NPP with regard to nuclear safety, radiation protection and environmental protection is in line with ASN's general assessment of the EDF plants.

With regard to nuclear safety, ASN notes that the facilities have been operated and maintained relatively satisfactorily despite an industrial programme with a particularly heavy workload. The fourth ten-yearly outage of reactor 3, the last for the site, was affected by many unforeseeable difficulties which considerably extended its duration. ASN discovered several deviations in the management of Pressure Equipment (PE) in 2024, particularly during this fourth ten-yearly outage, revealing the weaknesses in this area. The configuring of systems and the management of periodic tests and requalification tests have been the subject of EDF improvement plans since 2023, which must be continued. Nevertheless, ASN noted improvements in prevention of the risk of introducing foreign materials and management of the fire risk compared with the previous years.

ASN considers that the radiation protection performance of the NPP is improving and is now in line with ASN's general assessment of EDF plant performance. Although occupational exposure is controlled, ASN nevertheless still notes shortcomings in the radiation protection culture of the workers. Improvements are also required in the tracking of the radiation protection measuring aids provided for the workers and the cordoning off of zones that are, or risk becoming, contaminated.

ASN also considers that the NPP's performance in environmental protection has improved and is now in line with its general assessment of the EDF plants. Problems with leaks in retention structures which led to bypassing of the normal discharge routes in 2023 - without harming the environment - are still waiting for a long-term solution. ASN considers that the waste management remains at a satisfactory level; the site must nevertheless continue the actions initiated on the management of storage facilities.

With regard to occupational health and safety, ASN considers the site's results to be satisfactory, despite the high workload of the industrial programme. Appropriate measures were put in place reactively to take account of the accident levels during the year. ASN notes however that particular attention must be paid to the risks associated with lifting operations.

### Reactor 1 undergoing decommissioning

**Bugey 1 is a GCR. The first-generation reactor used natural uranium as the fuel, graphite as the moderator and was cooled by gas.**

The facility decommissioning operation were authorised by decree in 2008, but in 2022 EDF requested its amendment to take into account a radical change in decommissioning strategy for the GCRs. This request is currently being reviewed by the French Authority for Nuclear Safety and Radiation Protection (ASNR).

In 2024, EDF continued the decommissioning of the buildings, equipment and systems that are not necessary for reactor vessel decommissioning in application of ASN Chairman's resolution CODEP-CLG-2020-021253 of 3 March 2020. Today this work has been completed, apart from the demolition of some structures and the putting out of service and decommissioning of the plant for treating effluents originating from the installation, pending completion of the commissioning tests of the new replacement facility built between 2022 and 2024. Alongside this, the licensee also continued work on the installation in view of the future operations, notably by adapting certain ventilation systems and fitting out a waste sorting and conditioning unit.

ASN considers that the Bugey 1 reactor decommissioning operations are proceeding under satisfactory conditions of safety and radiation protection. In the area of occupational radiation protection, the licensee must nevertheless continue its actions to control the risk of internal exposure from alpha-emitting radionuclides.

## Activated waste conditioning and storage facility

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

- low-level long-lived (LLW-LL) graphite waste from the dismantling of the Bugey 1 reactor, intended – after interim storage – for near-surface disposal in a facility which is still at the concept study stage;

### The installations and activities to regulate comprise:

- **Nuclear Power Plants operated by EDF:**
  - Bugey (4 reactors of 900 MWe),
  - Cruas-Meysse (4 reactors of 900 MWe),
  - Saint-Alban (2 reactors of 1,300 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;**
- **EDF's Tricastin Operational Hot Unit (BCOT) undergoing decommissioning;**
- **the High Flux Reactor (RHF) operated by the Laue-Langevin Institute in Grenoble;**
- **the Activated waste conditioning and storage facility (Iceda) on the Bugey nuclear site and the Bugey Inter-Regional Warehouse (MIR) for fuel storage operated by EDF;**
- **reactor 1 undergoing decommissioning at the Bugey NPP operated by EDF;**
- **the EDF Superphénix reactor undergoing decommissioning and its auxiliary installations;**
- **the Ionisos irradiator in Dagneux;**
- **the international research centre of the European Organisation for Nuclear Research (CERN), situated on the French-Swiss border;**
- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 23 external-beam radiotherapy departments,
  - 6 brachytherapy departments,
  - 23 nuclear medicine departments,
  - 123 centres performing fluoroscopy-guided interventional procedures,
  - 170 computed tomography scanners in 120 facilities,
  - some 10,000 medical and dental radiology devices,
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - 1 synchrotron,
  - about 490 veterinary practices (surgeries or clinics),
  - 34 industrial radiography agencies,
  - about 600 users of industrial equipment,
  - about 75 public or private research units;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved organisations and laboratories:**
  - 1 organisation and 3 agencies approved for radiation protection verifications under the Public Health Code,
  - 13 laboratories approved for environmental radioactivity measurements,
  - 11 organisations approved for taking radon activity concentration measurements under the Public Health Code.

• intermediate-level long-lived (ILW-LL) activated metallic waste from operation of the in-service NPPs, for example parts installed near the reactor core such as the control rod clusters, intended for deep geological disposal after interim storage;
• certain types of low-level or intermediate-level short-lived waste (LL/ILW-SL), baptised "deferred dispatch" waste, intended for above-ground disposal but necessitating a period of radioactive decay ranging from a few years to a few tens of years before being accepted at the Aube repository (CSA– BNI 149), operated by the French National Radioactive Waste Management Agency (Andra).

By letter of 5 May 2021, EDF submitted to the Minister responsible for nuclear safety a request to amend the Iceda Creation Authorisation Decree (DAC), to allow the acceptance of decommissioning waste from the Fessenheim NPP, which is currently being examined by ASN.

The year 2024 was marked by a long production-free period, scheduled to continue until March 2025. The licensee devoted this time to maintenance operations, operator training, updating of the facility's baseline operating requirements and applying technical modifications in order to integrate the lessons learned from the first production campaigns.

Based on the inspections conducted in 2024, ASN considers that safety and radiation protection are duly taken into account in the operation of Iceda. The licensee must make sure that this good level of operating quality is maintained over time when the production operations resume and increase in intensity.

### Inter-regional warehouse

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

ASN conducted an inspection in 2024 to check the licensee's periodic verifications and its meeting of the commitments made to ASN. The inspection conclusions are positive and ASN deems the meeting of commitments to be satisfactory.

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

With regard to nuclear safety, ASN finds that the site's facilities are operated and maintained satisfactorily despite a context of intense industrial activity. ASN considers that the reactor refuelling outages were carried out under suitably safe conditions with a well-managed activities schedule. The safety-significant activities such as preventive cleaning of the reactor 1 Steam Generators (SGs) were carried out in accordance with the safety and environmental protection requirements. With regard to reactor operation, monitoring in the control room and operating team skills management are satisfactory.

With regard to occupational radiation protection, ASN considers the operational results to be satisfactory. ASN's tightened inspection in this area and the site's results indicators have revealed an improvement in the radiation protection culture and rigour in marking out worksites.

Regarding protection of the environment, ASN considers that the handling of unforeseen technical issues affecting the environmental protection devices is improving. The site's facilities are in satisfactory technical condition, which prevented the surrounding environments from being harmed in loss of liquid effluent containment situations.

In the area of occupational health and safety, ASN observes that the site is continuing the deployment of national actions, particularly with regard to electrical risks, lifting operation risks and the implementation of a tool for better managing the asbestos risk. Specific measures relating to the lead contamination risk have been successfully implemented on the site. Thanks to the vigilance applied during the outages in 2024, the accident rate low remained low.

## CRUAS-MEYSSE NUCLEAR POWER PLANT

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

ASN considers that the performance of the Cruas-Meysse NPP with regard to nuclear safety, radiation protection and environmental protection is in line with ASN's general assessment of the EDF plant performance.

With regard to nuclear safety, ASN considers that the large number of significant events related to inappropriate actions during operational operations reveals inadequacies in activity preparation and monitoring or incomplete operating documents. ASN therefore considers that the operating rigour improvement plan put in place by EDF in 2023 and prolonged in 2024 must be pursued. From the maintenance aspect, the site is tackling an intense industrial programme with a significant increase in the number of maintenance activities, particularly during the fourth ten-yearly outage of reactor 3 and the replacement of its SGs. This ten-yearly outage began in August 2024 and is proceeding with satisfactory levels of safety and a well-managed activities schedule.

Concerning radiation protection, improvements in practices were observed in 2024 compared with the preceding years, particularly in the management of containment air locks and worksite zones. The radiation protection controls on leaving the reactor building have been reinforced.

ASN notes that the site's environmental protection results are stable with respect to 2023. Control of liquid containment and the prevention effluent spillages remain the main areas in which ASN wants to see improvements.

The site's occupational health and safety results are satisfactory. ASN has nevertheless identified a point concerning occupational safety that requires particular attention, namely compliance with working times, given the intensity of the industrial programme.

# – Tricastin site

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

### Tricastin nuclear power plant

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

ASN considers that the nuclear safety performance of the Tricastin NPP is in line with ASN's general assessment of EDF plant performance. Its radiation protection performance, however, is considered to be below the general assessment of the EDF power plants. Lastly, ASN considers that the plant's environmental protection performance has improved thanks to the implementation of an ongoing action plan in this area.

As regards nuclear safety ASN considers that the plant's performance remains satisfactory. With regard to operational management of incidents and accidents and emergency situation organisation and means, ASN considers that the operating teams' knowledge of the instructions and equipment is satisfactory. As far as routine operating activities are concerned, however, weaknesses have been observed in system configuration management and the associated lockout/tagout operations, and in control room monitoring. With regard to maintenance, the marking event in 2024 was the fourth ten-yearly outage of reactor 4, the last of these outages for the site, which ran satisfactorily. For the other two reactor outages performed in 2024, ASN considers that EDF carried out the planned activities proficiently, complying with the corresponding safety requirements. ASN nevertheless expects to see improvements in the application of the regulatory requirements associated with work on PE.

The radiation protection performance of the Tricastin NPP shows some weak points, particularly concerning radiological cleanliness during the reactor outages. This situation led to several ESRs, one of which was rated level 2 on the INES scale after a site employee received a dose to the skin that could exceed the authorised annual limit. ASN expects to see improvements in worksite preparation, in the monitoring of radiological cleanliness and in practices for checking workers for contamination on leaving worksites involving a contamination risk.

With regard to environmental protection, ASN considers that the site's organisation to meet the regulatory requirements in this area has improved. This area is covered by an action plan that is presented regularly to ASN and the site's results have progressed.

As regards occupational safety, ASN considers the site's results to be satisfactory but not as good as in 2023. In effect, although no event led to serious consequences for the workers, the number of minor accidents is increasing.

## THE "NUCLEAR FUEL CYCLE" FACILITIES

**The Tricastin "fuel cycle" facilities mainly cover the upstream activities of the "fuel cycle" and are operated by Orano Chimie-Enrichissement, 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 uranium hexafluoride ($UF_6$) 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 $UF_6$;
- **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 (BNIs 178, 179 and 180) for storing uranium in the form of oxides or $UF_6$;
- **the maintenance, liquid effluent treatment and waste conditioning facilities** (IARU – BNI 138);
- **the Atlas process samples analysis and environmental monitoring laboratory** (BNI 176);
- **a Defence Basic Nuclear Installation** (DBNI), which more specifically accommodates former facilities undergoing decommissioning, radioactive substance storage areas and a liquid effluent treatment unit.

Following the inspections it conducted in 2024, ASN considers that the level of safety of the Orano facilities on the Tricastin site is satisfactory. ASN noted an improvement in the organisation for monitoring conformity with regulatory texts, better tracking of commitments made to ASN and efforts to be continued in the closing of modification files. The inspections of the organisational setup to prevent irregularities and fraud showed that the planned measures are applied.

In 2024, ASN conducted a campaign of simultaneous unannounced inspections focusing on occupational radiation protection in BNIs 93, 138, 155, 168, then in BNI 105, with the aim of checking Orano's organisation in this area. To this end the inspectors visited the facilities to verify the operational practices. These inspections found that the licensee had made progress in this area.

To ensure progress in dealing with the backlog of diverse radioactive substances stored on the site, ASN has asked Orano to present an annual progress report on its action plan for addressing this issue. In 2024, ASN continued its monitoring of the operations to prepare for the gradual clearing of areas 61 and 79 of BNI 105. These operations began very slowly and in 2024 Orano put into service various items of equipment capable of improving the conditioning of the substances for transfer to the site's storage yards.

The Tricastin site has two main liquid effluent management facilities: the Chemical Effluents Treatment Station (STEC – DBNI) and the Uranium-containing Effluents Treatment Station (STEU – BNI 138). Orano is planning for substantial changes in the treatment of the effluents from the Tricastin platform and has started to provide the Safety Options Dossiers (DOS) for these projects. These projects will ultimately lead to facilities ensuring better performance and higher safety standards.

In 2023, Orano started work on the AMC2 project which consists in adding a new facility for washing and rinsing containers dedicated to the transport of $UF_6$. This facility was authorised by Decree 2023-1220 of 19 December 2023.

In addition, to increase its enrichment capacities, Orano started construction work in 2024 to extend the Georges Besse II (GB II) North enrichment plant, which underwent a prior consultation in 2023. In June 2023, Orano submitted the application for a substantial modification to the facility authorisation decree in order to build this extension. The public inquiry was held in April 2024.

Lastly, Orano plans building the two other buildings of the reprocessed uranium storage facility "FLEUR" (BNI 180), whose commissioning was authorised by ASN in January 2023.

### Orano's uranium chemistry plants TU5 and W

**The "TU5" plant (BNI 155) can handle up to 2,000 tonnes of uranium per year, enabling it to reprocess all the uranyl nitrate ($UO_2(NO_3)_2$) produced by the Orano plant at La Hague, converting it into $U_3O_8$, a stable solid compound guaranteeing safer uranium storage 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 GB II enrichment 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. In 2024, ASN nevertheless kept careful track of the licensee's actions to maintain the operating rigour of its facilities.

ASN has noted a delay in the submission of the files associated with the consequences of the project to increase the capacity of the GB II North plant on the activities of the W plant. Orano has changed the schedule of these projects and the Authority for Nuclear Safety and Radiation Protection (ASNR) will be attentive to the conditions of work performance in the W plant, as it will to the management of the depleted uranium on the site should an offset in production capacity between the W plant and the GB II enrichment plant be maintained.

### 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 being decommissioned.**

The decommissioning of BNI 105 is authorised by Decree 2019-1368 of 16 December 2019 and should be completed by 31 December 2034. The main issues associated with decommissioning concern the risks of dissemination of radioactive substances, as well as exposure of the workers to ionising radiation and the criticality risk, on account of the residual uranium-bearing substances present in some items of equipment.

ASN notes that the decommissioning operations on the BNI part are falling behind schedule due to operational difficulties. Further to ASN's requests and inspections, the licensee has started transferring the radioactive and hazardous substances from areas 61 and 79 to the site's storage areas that meet today's safety standards. Areas 61 and 79 of BNI 105 were not completely emptied by the end of 2024 as planned. This is because the necessary reconditioning operations and the modalities of on-site transport started late and with sometimes inappropriate technical means, even though in 2024 Orano gradually put into service various items of equipment capable of improving the conditioning of the substances for transfer to the site's storage yards. ASNR will continue its tightened monitoring of these operations and now expects Orano to ensure rigorous technical and time frame management of the project.

ASN considers that the level of safety of the Philippe Coste uranium fluorination plant is satisfactory. ASN checked progress of the modernisation of the support functions in 2024. The works to replace the old surface treatment facility and the on-line fluorine conditioning facility have begun. On the other hand, the design of non-uranium-bearing effluent treatment units is still at the project stage.

## Georges Besse I enrichment plant

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

After this plant stopped production in May 2012, the licensee implemented the "intensive rinsing followed by air venting" operations (Prisme operation) from 2013 to 2016. These operations allowed the extraction of virtually all the residual uranium deposited in the diffusion barriers. 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 installation. These yards should in the short term be attached to the Tricastin uranium storage yards (BNI 178).

The Decree ordering Orano to proceed with the decommissioning of the Georges Besse 1 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 which is undergoing specific studies.

The licensee continued the decommissioning preparation operations in 2024, dismantling certain equipment items and conducting investigations to enhance knowledge of the residual contamination, and starting the works associated with the future unit in which the facility's 1,400 diffusers will be cut up and conditioned in packages.

In 2024, ASN also gave its approval for the dismantling of the facility's two cooling towers. The dismantling of these towers by mechanical "nibbling" should begin in 2025.

ASN considers that the BNI 93 decommissioning operations were carried out under satisfactory conditions of safety and radiation protection in 2024.

## Georges Besse II enrichment plant

**The Georges Besse II (GB II) plant, which constitutes BNI 168, has been the site's enrichment facility since the Georges Besse I plant was shut down. It separates uranium isotopes using the centrifugation process.**

The standard of safety of the plant's facilities in 2024 was satisfactory. The technologies used in the facility enable high standards of safety, radiation protection and environmental protection to be achieved. Refrigerant losses into the atmosphere dropped significantly in 2024 compared with 2023, but the hot weather temperatures were not as high in 2024.

In 2022, Orano began the project to extend the GB II North enrichment plant in order to increase its production capacities by adding centrifuge modules. The GB II North plant extension project underwent a prior consultation from 1 February to 9 April 2023, organised by the French National Commission on Public Debate (CNDP). In June 2023, Orano submitted the substantial modification application file in order to build this extension. This extension project underwent a public inquiry in April 2024 and construction work began in September 2024. ASN conducted a first inspection in December with satisfactory results.

## Maintenance, effluent treatment and waste conditioning facilities

**The effluent treatment and uranium recovery facility (IARU), which constitutes BNI 138, ensures the treatment of liquid effluents and waste, as well as maintenance operations for various BNIs.**

The level of safety in the BNI's various units in 2024 was satisfactory. ASN notes positively the fact that the treatment capacity of the new waste treatment unit can now absorb the waste from the site's temporary storage areas. ASN also considers that fire risk prevention is improving. Lastly, the commissioning of building 57L in 2024 improves the safety of certain storage areas.

Orano is planning for substantial changes in the treatment of the effluents from the Tricastin platform and has started to provide the DOS's for these projects. These projects will ultimately lead to facilities ensuring better performance and higher safety standards. The periodic safety review of BNI 138 obliged Orano to consider creating new units for certain effluent treatment steps given the technical/economic impossibility of reinforcing or improving the existing facilities. ASNR will remain attentive to the progress of these projects.

### Tricastin uranium-bearing material storage yards, P35 and FLEUR

**Following the delicensing of part of the Pierrelatte DBNI by decision of the Prime Minister, the Tricastin uranium-bearing materials storage yards (BNI 178) were created. This installation groups the uranium storage yards and the platform's new emergency management premises.**

**Following on from this delicensing process, facility "P35" (BNI 179) was created. It comprises ten uranium storage buildings. An additional storage area called "FLEUR" was authorised by a Decree of 18 March 2022. Commissioning of this new BNI (BNI 180) was authorised by ASN resolution 2023-DC-0750 of 3 January 2023.**

At the end of the periodic safety review of the yards, ASN ordered complementary measures in its resolution CODEP-CLG-2023-012740 of 8 March 2023. Among these measures figure the emptying or the decommissioning of material packagings.

ASN considers that the level of safety of the storage yards in 2024 was satisfactory. In 2024, these yards started accepting some of the substances removed from storage in BNI 105, which necessitated some rearrangements.

In mid-2023, Orano started work on the AMC2 project which consists in adding a new facility for washing and rinsing containers dedicated to the transport of $UF_6$. This facility will replace the existing AMC which is situated in the DBNI. The creation of AMC2 was authorised by Decree 2023-1220 of 19 December 2023 following a public inquiry held from 10 December 2021 to 12 January 2022. ASN's inspection of this worksite led to requests for several justificatory documents which will be examined before commissioning, planned for 2025.

Lastly, Orano plans building the two other buildings of the reprocessed uranium storage facility "FLEUR" (BNI 180), whose commissioning was authorised by ASN in January 2023.

## – Romans-sur-Isère site

### Framatome nuclear fuel fabrication plants

**On its Romans-sur-Isère site in the Drôme *département*, Framatome operates BNI 63-U, baptised "Nuclear fuel fabrication plant" resulting from the merging of two old BNIs, namely the unit fabricating fuel elements for research reactors (formerly BNI 63) and the unit fabricating nuclear fuel for the PWRs (formerly BNI 98).**

The fabrication of fuel for nuclear power plant reactors involves transforming $UF_6$ into uranium oxide powder. The pellets fabricated from this powder in Framatome's Romans-sur-Isère plant are placed in zirconium metal clads to constitute the fuel rods, then brought together to form the fuel assemblies to be used in the NPP reactors. In the case of experimental reactors, the fuels are more diverse, with some of them using, for example, highly-enriched uranium in metal form. These fuels are also fabricated in the Romans-sur-Isère plant called "Cerca".

The Cerca plant features a "uranium zone" in which the compacted powder cores placed in aluminium frames and plates to form the fuel elements are produced, as are the irradiation targets for the production of medical radionuclides. 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. These new buildings shall accommodate the current activities of the existing "uranium zone". Due to technical problems and the impact of the Covid-19 pandemic, the NZU construction work has fallen significantly behind schedule. In 2022, Framatome applied to ASN for a partial commissioning authorisation for the NZU to enable it to transfer materials between the existing buildings and the NZU. ASN issued this authorisation in October 2022. Difficulties with the tests of certain equipment items arose in 2023, leading Framatome once again to postpone commissioning of the NZU until 2024. Framatome mobilised its forces in order to put the NZU into service and in November 2024 ASN authorised commissioning of the process equipment.

In 2024, Framatome conducted further fuel production campaigns with Enriched Reprocessed Uranium (ERU). An application for a substantial modification to the unit fabricating nuclear fuels for PWRs, with the aim of increasing the production of fuels based on ERU is currently being reviewed by ASN and underwent a public inquiry in February 2024.

Based on the inspections it conducted in 2024, ASN considers that the level of safety of the Framatome facilities is satisfactory. However, after discovering a situation of noncompliant storage of inflammable liquid waste, ASN had to tighten its monitoring of the compliance work which obliged the licensee to temporarily transfer the waste in question to a safer building on the site pending procurement of technical means appropriate for the risks specific to this liquid waste. More broadly, Framatome gave ASN confirmation of its intention to apply an action plan to reduce the quantities of waste stored on the site, an issue that will be addressed in the periodic safety review, which is currently being examined.

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 Megawatt 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 and occupies a surface area of 12 hectares between the rivers Isère and Drac, upstream of their confluence, near the CEA Grenoble centre.

After operating for a little over one year, the RHF began a long outage in July 2024 to incorporate various modifications to improve the safety of the facility, the need for which was detected at its last periodic safety review. This involves large scale works, including in particular the installation of a sprinkler fire extinguishing system in part of the reactor building and reinforcing the seismic resistance of the polar crane in accordance with ASN resolution 2022-DC-0738 of 28 July 2022.

In 2024, ASN also finalised the review of the public information notice transmitted by the licensee in July 2022 in order to establish new technical requirements for discharges and environmental monitoring. The associated new draft ASN resolutions underwent a public consultation in late 2024 and have been sent to the Local Information Committee (CLI) of the ILL for its opinion. The procedure should be concluded in 2025.

In view of the oversight actions it conducted in 2024, ASN considers that the RHF is operated safely and radiation protection is satisfactory. The site's challenges in 2025 will particularly concern the correct performance of the work planned during the outage and dealing with the residual tritium inventory from the former detritiation facility, to be completed by 30 June 2025.

## 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 licensee submitted the periodic safety review concluding report for BNI 68 to ASN in 2017. ASN completed its analysis of this report in 2024 and has no objection to the continued operation of the facility.

In October 2021, the licensee filed an application for authorisation to build a new irradiator. This application is currently being reviewed by ASNR. The construction of this new facility also requires the licensee to finalise the Post-Operational Clean-Out (POCO) and dismantling of the site's old irradiators D1 and D2.

In 2024, the licensee renewed and reorganised the teams responsible for safety following several concomitant personnel departures in 2023 which had weakened its organisation. The new organisation is now in place and in September 2024 the licensee submitted to ASN an action plan to ensure the facility's conformity with the BNI regulations.

ASN considers that the operational safety of the facility was broadly satisfactory in 2024, given the risks it presents. The licensee must nevertheless, without further delay, finalise the updating of the facility's operating baseline requirements following its periodic safety review and the operational implementation of certain requirements.

## 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, including with regard to nuclear waste management and TSR.**

CERN is not directly subject to Swiss or French regulations, but it must implement the best practices with regard to international regulations, standards and recommendations.

Two joint inspections by the Swiss and French authorities were held in 2024 on the themes of protecting workers against ionising radiation and periodic inspections and tests respectively. These inspections found the practices to be satisfactory.

SITES 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 and conditioned in concrete blocks. 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.

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 2024, the licensee finalised the decommissioning of the reactor core closure plug and extracted the lateral neutron shield support – a massive activated and particularly irradiating part – from the reactor vessel, for cutting up in a dedicated unit using remotely-operated means.

Alongside the decommissioning operations, the licensee has started a major equipment obsolescence management programme, mainly concerning BNI 141, which in the coming years will lead to the replacement of the pool cooling system air heaters, the emergency diesel generator sets and complete renovation of the instrumentation and control of BNI 141.

In view of the inspections conducted in 2024, ASN considers that the safety of the Superphénix reactor decommissioning operations and of operation of the fuel storage facility is ensured satisfactorily.

## 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. The BCOT is situated in the Orano's Tricastin site.

In a letter dated 22 June 2017, EDF declared final shutdown of the BCOT in June 2020 and its decommissioning was authorised by Decree 2023-1049 of 16 November 2023. On completion of decommissioning, planned for 31 December 2033 at the latest, the cleaned-out buildings shall be returned to Orano.

EDF completed the removal of obsolete tools and decontamination and transfer of the cylindrical control rod cluster guide tube containers to Andra's Industrial centre for collection storage and disposal (Cires) in 2024. The licensee also carried out work to prepare the facility for the next decommissioning operations and continued investigations into the radiological status of the structures with a view to cleaning them out. On 22 March 2024, ASN authorised deployment of the facility's decommissioning baseline safety requirements.

In view of the conclusions of the two inspections of the BCOT in 2024, ASN considers its level of safety to be satisfactory.

# Bourgogne-Franche-Comté

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

**60**
inspections

ASN conducted 60 inspections in small-scale nuclear activities in the Bourgogne-Franche-Comté region in 2024, comprising 21 inspections in the medical sector, 24 in the industrial, research and veterinary sectors, seven concerning radon exposure, four to monitor approved organisations and laboratories, and four specific to the transport of radioactive substances.

ASN also devoted particular attention to the Framatome nuclear pressure equipment 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 ten inspections in these plants in 2024, of which five were in the Creusot plant and five in the Chalon Saint-Marcel plant.

In 2024, the company Jimmy Energy submitted to the Ministry responsible for nuclear safety an application for authorisation to create a plant for assembling fuel elements for its high-temperature Small Modular Reactor (SMR) project (*see box page 330 of chapter 11 of the full ASN Report*) at Le Creusot, in the Saône-et-Loire *département*.

## The installations and activities to regulate comprise:

- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 8 external-beam radiotherapy departments,
  - 4 brachytherapy departments,
  - 16 nuclear medicine departments, of which 3 practise internal targeted radiotherapy,
  - 36 centres practising fluoroscopy-guided interventional procedures,
  - 64 computed tomography scanners for diagnostic purposes in 51 centres,
  - about 800 medical radiology devices,
  - about 2,000 dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - about 250 veterinary practices, of which 5 have a computed tomography scanner and 16 practice equine radiology,
  - about 400 industrial and research centres, including 27 companies with an industrial radiography activity,
  - 1 industrial irradiator using radioactive sources,
  - 1 computed tomography scanner dedicated to research,
  - 2 accelerators, 1 for the production of drugs for medical imaging and 1 for industrial irradiation;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved organisations and laboratories:**
  - 1 organisation approved for radiation protection controls,
  - 5 organisations approved for measuring radon,
  - 1 laboratory approved for taking environmental radioactivity measurements.

# Bretagne

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 Brennilis Nuclear Power Plant (NPP), currently undergoing decommissioning.

**61**
inspections

**1**
significant event rated level 1 or higher

In 2024, ASN carried out 61 inspections, three at the Monts d'Arrée NPP currently being decommissioned, 13 in the transport of radioactive substances and 41 in small-scale nuclear activities (21 in the medical sector, 20 in the industrial, veterinary and research sectors) and four concerning natural radioactivity (radon).

In 2024, one significant event in the veterinary sector was rated level 1 on the International Nuclear and Radiological Event Scale (INES scale). The failure of an electrical device emitting ionising radiation resulted in a worker being exposed to more than a quarter of the annual regulatory limit.

Lastly, in the course of their inspection duties the ASN inspectors issued one violation report to a company for taking radon measurements without the requisite approval.

## 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 Megawatt 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 facilities, and this file was subject to a technical review followed by a public inquiry from 15 November 2021 to 3 January 2022. Decree 2023-0898 of 26 September 2023, published on 28 September 2023, requires EDF to completely decommission BNI 162 and amends Decree 96-978 of 31 October 1996 authorising the creation of this facility.

ASN issued the authorisations to implement the general operating rules and the on-site emergency plan for complete decommissioning in June 2024. During 2024, ASN also continued updating of the resolutions regulating the plant's water discharges and intakes which were published on 21 November 2024. Consequently, in 2024, ASN issued all the authorisations necessary for deployment of the complete decommissioning operations.

During the same year, EDF continued its preparatory work for complete decommissioning, including in particular civil engineering adaptations in preparation for decommissioning of the peripheral systems, planned as of 2025.

### The installations and activities to regulate comprise:

- **one Basic Nuclear Installation:**
  - the Monts d'Arrée (Brennilis) NPP, undergoing decommissioning;
- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 9 external-beam radiotherapy departments,
  - 5 brachytherapy departments,
  - 11 nuclear medicine departments,
  - 36 centres practising fluoroscopy-guided interventional procedures,
  - 63 computed tomography scanners for diagnostic purposes,
  - some 2,500 medical and dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - 1 cyclotron,
  - 15 industrial radiography companies, including 3 performing gamma radiography,
  - 23 research units,
  - about 400 users of industrial, veterinary and research devices;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved organisations and laboratories:**
  - 8 organisations approved for measuring radon,
  - 3 head-offices of a laboratory approved for environmental radioactivity measurements.

ASN notes that the discovery of asbestos is delaying the upgrading of the handling cranes necessary for removal of the reactor vessel fuel channels, without yet calling into question the date of start of operations, planned for 2027.

Broadly speaking, ASN considers that the management of the NPP decommissioning project remains satisfactory. Nevertheless, concerning the state of the facilities, EDF must ensure that all the infiltrations are dealt with and guarantee the upgrading of the facilities with respect to the fire risk within the planned times. EDF must also continue its actions to better control the temporary storage conditions and to define management routes for the waste than cannot be removed immediately.

Within the framework of the national inspection campaign on frauds, ASN also notes that the licensee must improve its organisation to counter this risk.

In 2025, the Authority for Nuclear Safety and Radiation Protection (ASNR) shall be particularly attentive to the application of the facility's new complete decommissioning baseline requirements and to equipment maintenance. ASNR shall moreover maintain its vigilance concerning the radiation protection plan, particularly regarding compliance with the rules for entering controlled areas.

# Centre-Val de Loire

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.

**170** inspections

**12** significant events rated level 1 or higher

In 2024, ASN conducted 170 inspections in the Centre-Val de Loire region, of which 123 were in the nuclear installations of the EDF sites of Belleville-sur-Loire, Chinon, Dampierre-en-Burly and Saint-Laurent-des-Eaux, 38 in small-scale nuclear activities, four in the transport of radioactive substance and five concerning approved organisations or laboratories.

ASN also carried out 39 days of labour inspections in the four Nuclear Power Plants (NPPs) of the region.

In 2024, ASN was notified of 11 significant events rated level 1 and one event rated level 2 on the International Nuclear and Radiological Event Scale (INES scale).

## 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, Loiret, Nièvre and Yonne) and two administrative regions (Bourgogne-Franche-Comté and Centre-Val de Loire). The NPP has two 1,300 Megawatt electric (MWe) reactors commissioned in 1987 and 1988, which constitute Basic Nuclear Installations (BNIs) 127 and 128 respectively.

ASN considers that the performance of the Belleville-sur-Loire NPP is in line with the general assessment of EDF in the areas of nuclear safety, the environment and radiation protection.

From the nuclear safety aspect, ASN considers that with regard to management of the facilities, operational rigour in the control room was maintained at a satisfactory level. ASN nevertheless considers that the NPP must continue its efforts in the management of system configurations (alignments, padlocking, administrative lockouts) through the action plan it has applied since early 2023.

As far as the maintenance of the facilities is concerned, the performance of the Belleville-sur-Loire NPP is considered satisfactory. More particularly, ASN considers that the management of the reactor 2 outage in 2024 was broadly satisfactory.

In the area of radiation protection, ASN considers that the action plan deployed implemented by the Belleville-sur-Loire NPP to reinforce the radiation protection fundamentals is appropriate. Its robustness will be assessed during the 2025 inspections, particularly during the reactor outages.

With regard to environmental protection, effluent management and the monitoring of discharges are deemed satisfactory. ASN notes positively the commissioning of the new legionella and amoeba treatment station. It will keep track of the renovation of the site's demineralisation station, which was delayed due toan incident that led to a spillage of hydrochloric acid inside this station, with no consequences for persons or the environment. Regarding nuclear waste management, ASN notes that the anomalies observed in early 2024 concerning the temporary storage of concrete shells in the effluent treatment building were resolved during the year.

In the area of labour inspection, ASN notes that no serious accidents occurred. Nevertheless, although the inspections have revealed progress in electrical risk prevention, ASN expects the site to take strong measures regarding prevention of the chemical risk in of its findings on the subject in 2024.

## 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 (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 performance of the Dampierre-en-Burly NPP is below ASN's general assessment of EDF plant performance. The radiation protection and environmental performance is broadly in line with ASN's general assessment of the EDF plants.

With regard to nuclear safety, following the significant deterioration observed in reactor operational management in 2022, the licensee implemented a rigorous recovery plan. Several measures to improve the performance of the service responsible for reactor operational management were thus applied during 2023 and 2024. Improvements were observed in 2024, notably in the management of the facilities in compliance with the General Operating Rules (RGEs) and in documentation management. Efforts are however still required to align the site's performance with the national average, particular regarding the management of configuration changes and control of reactivity. The in-depth inspection carried out by ASN in June 2024 also revealed the strong involvement of the site's managerial line in the turnaround in safety performance. The various actions of the recovery plan must now be fully assimilated and implemented in the field by all personnel involved.

With regard to maintenance of the facilities, the Dampierre-en-Burly NPP's performance is in line with the national average, in a high workload context marked by the fourth ten-yearly outage of the site's reactor 4. The site must nevertheless be particularly attentive to the quality of the first-level analyses, which aim to rule on the conformity of the maintenance operations performed and on the conducting of preventive maintenance at the specified intervals. Further to the technical difficulties encountered in 2023 on the emergency diesel generator sets, the licensee took measures in 2024 to improve the availability of these generators, even though some difficulties appear to subsist.

In the area of radiation protection, the performance of the Dampierre-en-Burly NPP is in line with the national average and has remained stable with respect to 2023. Although the site has one of EDF's lowest rates of worker contamination, progress must still be made in the management of the radiological work regimes, in the performance of the radiological checks of equipment leaving controlled areas – numerous hot spots were detected in 2023 and 2024 on the site's roadways – and in the management of the marking out of limited-stay areas.

The environmental protection performance of the Dampierre-en-Burly NPP remained at a good level in 2024, particular as regards management of the microbiological risk, management of copper and zinc discharges in the liquid effluents and waste management. The site must nevertheless continue its work to improve the containment of hazardous substances and undertake the necessary actions to increase the number of effluent storage tanks to take into account the effects of climate change and the ageing of the existing tanks.

### The installations and activities to regulate comprise:

- **Basic Nuclear Installations:**
  - the Belleville-sur-Loire NPP (2 reactors of 1,300 MWe),
  - the Dampierre-en-Burly NPP (4 reactors of 900 MWe),
  - the Saint-Laurent-des-Eaux site: the NPP in operation (2 reactors of 900 MWe), and the 2 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 GCRs undergoing decommissioning, the Irradiated Material Facility (AMI) and the Inter-Regional Fuel Warehouse (MIR);
- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 9 external-beam radiotherapy departments,
  - 3 brachytherapy departments,
  - 11 nuclear medicine departments,
  - 31 centres using interventional procedures,
  - 38 centres using one or more diagnostic computed tomography scanners,
  - some 2,700 medical and dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - 15 companies with an industrial radiography activity,
  - about 330 industrial, veterinary and research radiography devices;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved organisations and laboratories:**
  - 1 organisation approved for radiation protection controls,
  - 5 laboratories approved for taking environmental radioactivity measurements.

With regard to labour inspection, although the deviations found in the employment of young workers were rectified by reactive corrective actions, ASN considers that the management of the workplace airing and sanitation systems also requires corrective actions and close involvement of the site. Following the deviations observed when ASN inspected the employment conditions of employees of outside contractors working on the site, several work contracts were regularised. ASN also notes that there were no serious accidents on the site in 2024.

# – 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 undergoing decommissioning. On the south side of the site, the Chinon B NPP comprises four in-service reactors of 900 MWe; the first two commissioned in 1982 and 1983 constitute BNI 107, while the second two commissioned in 1986 and 1987 constitute BNI 132. To the north, the three old graphite-moderated GCRs designated Chinon A1, A2 and A3, are currently being decommissioned. The site also accommodates MIR and the irradiated materials facility AMI which is currently being decommissioned and whose former expert assessment activities have been transferred to a new laboratory at Chinon called "Lidec".**

## Chinon nuclear power plant

### Reactors B1, B2, B3 and B4 in operation

ASN considers that the environmental performance of the Chinon NPP stands out positively, while the nuclear safety and radiation protection performance is in line with ASN's general assessment of the EDF plants.

With regard to nuclear safety, ASN considers that the results for 2024 are in line with the average for the NPPs but show a decline compared with 2023. The reason for this is that although performance in the area of operational management of the reactors remained at a satisfactory level, improvements are required in the management of the fire risk and the availability of systems involved in controlling reactivity.

The site's performance in maintenance of the facilities deteriorated over the year 2024. The equipment items inspected appear to be in good condition but the quality of the first-level analyses has regressed and several events have brought to light a lack of skills or training of the actors involved.

ASN considers that the radiation protection performance of the Chinon NPP is progressing. The level of worker contamination remains among the lowest of the EDF NPPs. The measures taken in response to the difficulties encountered in performing industrial radiography work in the last few years seem to have borne fruit in 2024. ASN nevertheless notes an increase in the number of triggerings of radiation portal monitors at the site exit and in the detection of contamination on the site roads, despite some progress being observed.

The environmental performance of the Chinon NPP is progressing and rankse among the best of the EDF plants. The site controls its discharges and the containment of hazardous liquid substances. Waste management however remains below expectations. The year 2025 should be used to continue the treatment and removal of the waste resulting from reactor maintenance that has been accumulating on the site for several years.

The year 2024 was marked by numerous accidents requiring labour inspection investigations by ASN, which revealed the need to improve some worksite procedures. ASN considers that the site must improve worksite preparation, particularly by taking full account of all risks, such as those related to potential asbestos and lead exposure. Lastly, ASN notes that the site has made significant efforts to address the risk of falls from height, through the implementation of a verification of all relevant collective protection measures.

### Reactors A1, A2 and A3 undergoing decommissioning

The graphite-moderated GCR 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 $CO_2$ 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" GCRs. They were shut down in 1973, 1985 and 1990 respectively.

Reactors A1 and A2 have been partly decommissioned and transformed into facilities for the storage of 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, until the end of 2022, housed GIE Intra (robots and machines for interventions on accident-stricken nuclear installations). Complete decommissioning of the Chinon A3 reactor was authorised by the Decree of 18 May 2010, with a decommissioning "under water" scenario.

In March 2016, EDF announced a complete change of decommissioning strategy for its definitively shut down reactors. In this new strategy, the planned decommissioning scenario for all the reactor pressure vessels involves decommissioning "in air"[1] and the Chinon A2 reactor pressure vessel would be decommissioned first (*see chapter 14 of the full ASN Report*). In this context, ASN has analysed the periodic safety review concluding reports submitted by EDF concerning the six GCRs, supplemented further to the request from ASN. On completion of its analysis, ASN indicated in December 2021 that it has no objection to the continued operation of BNIs 133 (Chinon A1 reactor), 153 (Chinon A2 reactor) and 161 (Chinon A3 reactor). The Authority for Nuclear Safety and Radiation

1. *Among the possible scenarios for decommissioning the highly activated or contaminated structures, we find decommissioning "in air" and decommissioning "under water". In the case of the GCRs, the "under water" approach consists in filling the reactor core (reactor pressure vessel) with water in order to benefit from the protective effect of a layer of water with respect to the radiation-related risks, but it is more complicated to implement than the "in air" approach. In view of the major technical difficulties (sealing of the reactor pressure vessel and treatment of the contaminated water), but also the technological advances bringing other solutions, such as remote operation, EDF has finally adoptyed the decommissioning "in air" scenario, which overcomes the problems linked to the use of water.*

Protection (ASNR) will verify, during the examination of the decommissioning files for these reactors, submitted by EDF at the end of 2022 and still being examined, that the decommissioning operations will be carried out under suitable conditions of safety and radiation protection, within controlled time frames.

For the Chinon A2 reactor, in 2024, EDF continued the decommissioning preparation operations situated outside the reactor pressure vessel, particularly as concerns removal of the shells from the heat exchanger premises, and continued the investigations inside the pressure vessel. The shells have been removed from the four heat exchanger rooms. EDF also continued the decommissioning of the Chinon A3 heat exchangers.

The action plan undertaken by EDF following water infiltrations in several parts of Chinon A1, Chinon A2 and the AMI (BNI 94) in 2023 turned out to be insufficient to prevent new infiltrations during a heavy storm episode in June 2024. This plan has subsequently been reinforced, in particular through additional curative and preventive measures, such as waterproofing work and updating the emergency procedures in the event of a weather alert. ASN considers that EDF must continue its efforts to improve the monitoring and management of infiltrations and the civil engineering structure maintenance work. ASNR will be particularly attentive to the implementation of the action plan in 2025.

ASN considers that the level of safety of the Chinon nuclear installations undergoing decommissioning (Chinon A1, A2 and A3) is satisfactory. The inspections carried out in 2024 revealed good preparation of the decommissioning worksites, good upkeep of a worksite to ensure safe conditions linked to the asbestos risk and meeting the defined schedules. Furthermore, the organisation in place to prevent and address the risk of counterfeiting, falsification and suspicions of fraud was found to be operational and capable of dealing with the situations encountered. Lastly, additional information is required to clarify the lists of applicable Protection Important Components (PICs) for protection of the interests.

## "NUCLEAR FUEL CYCLE" FACILITIES

### Inter-regional fresh fuel warehouse

**Commissioned in 1978, the Chinon Inter-Regional Fuel Warehouse (MIR) is a facility for storing fresh fuel assemblies pending their utilisation in 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 facility was equipped with a new handling crane in 2019 and operations have resumed since 2020, with the reception and storage of fresh fuel assemblies. EDF reported no significant events in 2024 and responded to the requests made further to the inspection conducted in 2023. The second periodic safety review concluding report is to be given to ASNR in 2025 and the facility will undergo an inspection.

## RESEARCH FACILITIES UNDERGOING DECOMMISSIONING

### Irradiated materials facility

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

The expert assessment activities were entirely transferred in 2015 to a new facility on the site, the Lidec.

Decree 2020-499 for AMI decommissioning was published on 30 April 2020 and the new RGEs were approved by ASN in April 2021, thereby enabling the Decree to enter into application. ASN also subjected the starting of several future decommissioning operations to its approval.

Further to the updating of the resolution regulating the installation's discharge limits in July 2022, a new discharge monitoring system has been put into service and decommissioning operations have started that include equipment cutting-up and interventions in several facilities.

The legacy magnesian waste from the expert assessments of certain parts requires inerting operations[2] in order to meet the disposal criteria of Andra, the French Radioactive Waste Management Agency. As the characterisation results differed from what was initially expected, the necessary waiver was obtained from Andra in late 2022, thereby allowing the waste to be accepted. A work school was set up in early 2023. During an inspection in 2024, before the resuming the inerting work, ASN observed that the licensee had correctly implemented certain fire risk control measures relating to this project. The inerting operations were completed in 2024 and the transfers of waste to Andra began in late 2024.

ASN granted a decommissioning authorisation for the highly active liquid effluent systems in August 2023. Due to technical and contractual difficulties encountered by EDF in 2022, these operations – initially planned for 2023 – were rescheduled and they began in 2024. The treatment of the legacy chemical products present in controlled areas continued and the transfer of this nuclear waste, which began in 2022, is still in progress.

EDF resumed its "Thermip" pollution monitoring (non-radiological pollution by hydrocarbons and naphthalene) in 2023 and supplemented its management plan in 2024 with technical elements to be approved by ASN. Examination of this file will continue in 2025.

As was the case with certain areas of the Chinon reactors A1 and A3, infiltrations were observed in certain aeras of the AMI during heavy rainfalls in 2023 and 2024. The overall action plan implemented by EDF includes measures specific to the AMI, notably pumping and on-site storage of the waters that infiltrated into the basement. In April and October 2024, ASN issued two authorisations allowing EDF to store this

*2. Inerting in this instance is a process enabling the radiological activity of the magnesian waste to be contained in an enclosure of specific materials to allow risk-free transportation and storage.*

water in two tanks in a dedicated area, pending their routing by truck to a treatment facility.

Based on inspections carried out, ASN considers that the safety management applied at the AMI is satisfactory. Particular attention must nevertheless be paid to the monitoring of the civil engineering structures and water infiltration in the basement retention area. In 2025, ASNR will monitor the progress of EDF's action plan to prevent further infiltrations.

# 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 has two 900 MWe reactors in operation, 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 environmental performance of the Saint-Laurent-des-Eaux stands out positively with respect to its general assessment of the EDF plants. In the areas of nuclear safety and radiation protection however, the performance falls short of the general assessment.

ASN notes that the nuclear safety results of the Saint-Laurent-des-Eaux NPP deteriorated in 2024. An overall lack of training and communication was noted in operational management, particularly regarding control room monitoring and system configuration management. ASN does however observe a distinct improvement in fire safety on the site thanks to the robust corrective measures implemented following numerous deviations identified during inspections in 2023. Improvements are nevertheless still required in the management of the fire load and hot work permits.

With regard to maintenance, Saint-Laurent-des-Eaux NPP's performance is deemed insufficient in support function systems, control of reactivity and cooling. ASN considers that the licensee must make progress in the development of action plans tailored to operational issues, in the preparation of maintenance activities, the management of work orders and the monitoring of outside contractors.

In the area of radiation protection, ASN considers that the Saint-Laurent-des-Eaux NPP's results remain below the national average. Work site preparation and the monitoring of radiological cleanliness must be improved. Several cases of worker contamination were also reported in 2024.

The site's organisation to meet the regulatory environmental requirements is considered to perform well, thanks in particular to satisfactory management of extinguishing water containment, good control of discharges, adequate monitoring of the environment and appropriate management of the microbiological risk.

One accident in 2024 led to major labour inspection investigations by ASN which revealed the need to improve worksite procedures. Furthermore, in the light of the inspections, significant improvements are required in the areas of lifting and the management of explosive atmosphere risks.

### Reactors A1 and A2 undergoing decommissioning

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

On completion of the analysis of the periodic safety review concluding reports for all the GCRs, ASN indicated in December 2021 that it has no objection to the continued operation of BNI 46 (Saint-Laurent reactors A1 and A2). ASNR will verify during the examination of the new decommissioning files for these reactors, which were submitted by EDF in late 2022 to set out the new "in air" decommissioning strategy, that the decommissioning operations will be carried out under suitable conditions of safety and radiation protection, within controlled time frames.

ASN has completed the examination of the management plan for the soils polluted with hydrocarbons in the zone of the old transformers of the Saint-Laurent A2 reactor and has authorised EDF to proceed with the soil clean-up operations by a resolution of 10 February 2023. These operations began in the last quarter of 2024 and will continue in 2025.

EDF continued the decommissioning work sites in 2024, particularly the decommissioning work outside the reactor pressure vessel (Saint-Laurent A2). After stopping some works in 2023 due to the discovery of lead in the worksite dust, the activities resumed in 2024 after cleaning out the areas concerned. ASN considers that the level of safety of the Saint-Laurent A reactors is satisfactory.

During its inspections, ASN found that the overall upkeep of the premises and worksites was good. However, although management of the periodic inspections and tests is judged satisfactory on the whole, efforts must be made to guarantee that deadlines are met and certain internal procedures are updated. Furthermore, additional information is awaited in order to clarify the list of PICs in effect.

## Saint-Laurent-des-Eaux silos

The installation, which was authorised by Decree of 14 June 1971, comprises two silos which are used to store irradiated graphite liners from operation of the GCRs of Saint-Laurent A. The static containment of this waste is ensured by the concrete structures of the silo bunkers which are sealed by a steel liner. 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 installation 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.

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 definitive 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.

The final shutdown notification for the facility was sent by EDF in March 2022. At the end of 2022, EDF submitted the silo decommissioning file, integrating the silo emptying operations for the recovery and repackaging of the graphite waste and creation of the future graphite waste package storage facility. Based on the current assumptions made in the file currently being examined, silo emptying should begin in the early 2030's.

# Corse (Corsica) collectivity

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

**3**
inspections

ASN conducted three inspections in the Corse collectivity in 2024, two in the medical sector and one in an organisation approved for measuring radon.

No significant event in small-scale nuclear activities was rated level 1 or higher on the International Nuclear and Radiological Event Scale (INES).

**The installations and activities to regulate comprise:**

- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 2 external-beam radiotherapy departments,
  - 2 nuclear medicine departments,
  - 8 centres practising fluoroscopy-guided interventional procedures,
  - 8 computed tomography scanners,
  - some 330 medical and dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - some 40 veterinary surgeons using diagnostic radiology devices,
  - some 40 industrial and research centres, including 2 companies exercising an industrial radiography activity;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved organisations and laboratories:**
  - 2 organisations approved for measuring radon.

# Overseas *départements* and regions

The regulation of radiation protection and the transport of radioactive substances in the five overseas *départements* and regions (Guadeloupe, Martinique, Guyane, La Réunion, Mayotte) and in certain overseas collectivities is ensured by the Paris division. It also acts as expert to the competent authorities of Nouvelle-Calédonie and French Polynesia.

**9**
inspections

Nine inspections were carried out in the small-scale nuclear activities sector in the French Overseas *départements*, regions and collectivities in 2024. Three on-site inspection campaigns were carried out by ASN.

No significant events in small-scale nuclear activities were rated level 1 or higher on the International Nuclear and Radiological Event Scale (INES).

**The installations and activities to regulate comprise:**

- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 5 external-beam radiotherapy departments,
  - 1 brachytherapy department,
  - 5 nuclear medicine departments,
  - 21 centres practising fluoroscopy-guided interventional procedures;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - 3 industrial radiology companies using gamma radiography devices;
- **activities associated with the transport of radioactive substances.** Chapter 9

# Grand Est

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.

**164** inspections

**8** significant events rated level 1 or higher

In 2024, ASN conducted 164 inspections in the Grand Est region, of which 62 were in the Nuclear Power Plants (NPPs) in service, ten in radioactive waste disposal facilities and on the sites of the Fessenheim and Chooz A NPPs currently being decommissioned, 81 in small-scale nuclear activities, five in the transport of radioactive substances and six concerning approved organisations or approved laboratories.

ASN also carried out 15 days of labour inspections in the NPPs.

During 2024, three 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).

In small-scale nuclear activities, two significant events were rated level 1 on the INES scale (one in the industrial sector and one in the medical sector) and three significant events concerning patients were rated level 1 on the ASN-SFRO scale.

Lastly, within the framework of their inspection duties and pursuant to Article 40 of the Penal Procedure Code, the ASN inspectors filed a report for suspicions of falsification in a facility manufacturing equipment intended for nuclear installations.

## CATTENOM NUCLEAR POWER PLANT

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

It comprises four 1,300 Megawatts electric (MWe) Pressurised Water Reactors (PWRs) commissioned between 1986 and 1991. Reactors 1, 2, 3 and 4 constitute Basic Nuclear Installations (BNIs) 124, 125, 126 and 137 respectively.

ASN considers that the performance of the Cattenom NPP with regard to nuclear safety stands out positively with respect to ASN's general assessment of EDF plant performance. ASN considers that the environmental and radiation protection performance of the Cattenom NPP is in line with ASN's general assessment of the EDF plants.

ASN considers that the performance regarding operations and operational management of the reactors is broadly satisfactory. Weaknesses do however persist in control room monitoring.

Regarding maintenance, 2024 was marked in particular by one ten-yearly outage, one refuelling outage and one three-month outage during summer to economise fuel. The maintenance performance remains satisfactory, in particular with good organisation of activities resulting in a well-controlled ten-yearly outage schedule and good anticipation of unscheduled interventions.

Fire risk prevention, an area in which the site was considered below average for several years, improved in 2024, particularly regarding the control of fire loads. A fire that occurred in June 2024 in a non-controlled area causing activation of the on-site emergency plan, was correctly managed by the site.

In the area of environmental protection, the site's progress observed in 2023 on themes, considered below average in the preceding years, was confirmed in 2024. ASN notes more specifically better management of liquid pollution containment and of the oil separators. However, the consumption of biocides is still high, generating significant discharges.

In the area of radiation protection ASN considers that the site must progress in controlling contamination dispersion and limited stay (orange) areas management. On the other hand, improvements have been noted in the management of radiographic inspections. Although ASN considers that the site is aware of its weaknesses, in-depth actions have to be engaged to improve radiation protection performance.

Lastly, with regard to occupational safety, ASN considers that the working environment is broadly suitable, except for certain rooms situated in non-controlled areas. Moreover, some accidents and near-accidents that occurred in 2024 raise doubts about the identification and taking into account of specific risks during worksite preparation.

# 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 (BNIs 139 and 144), commissioned in 2001.

## Reactors B1 and B2 in operation

ASN considers that the performance of the Chooz B NPP with regard to nuclear safety and the environment is in line with ASN's general assessment of the EDF plant performance. It stands out positively in radiation protection.

Progress must be made in the operation of the facilities, particularly in the management of system configuring operations. Increased attention must also be paid in 2025 to the quality of, and strict compliance with, the reactor operational management documents, a point which, as in 2023, was the cause of significant events.

As far as maintenance is concerned, the year was punctuated by two refuelling outages involving a limited volume of activities, the management of which ASN considered satisfactory. Areas for progress have nevertheless been identified in Steam Generator (SG) maintenance and the in-service monitoring of nuclear pressure equipment.

With regard to occupational radiation protection, ASN considers that the site has made progress compared with the previous year. The radiological cleanliness of the facilities is satisfactory. A few areas for improvement nevertheless deserve particular attention in 2025, namely the radiation protection culture of the workers and control of the risk of contamination dispersion on the worksites.

With regard to protection of the environment, ASN considers that the site's organisation remains satisfactory. Nevertheless, it was found occasionally that the effluents discharge process could be better controlled. In addition, attention must be devoted to the availability of the sampling equipment.

Lastly, the inspections focusing on health and safety at work revealed no particular problem situations. The steps taken by the employer in response to the observations made during the inspections are appropriate for resolving the occasional deviations noted. Some improvements are nevertheless required in the organisational setup for monitoring the ventilation of rooms with specific pollution risks.

## Reactor A undergoing decommissioning

The activities carried out in 2024 on the Chooz A reactor undergoing decommissioning mainly focused on the operations in preparation for lifting the reactor vessel, planned for 2025, that is to say final pumping of the bottom of the vessel, renovation of the reactor building handling crane and cutting the primary system pipes at the reactor vessel. Alongside this, decommissioning of all the equipment still present in the fuel building continued.

### The installations and activities to regulate comprise:

- **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 (LL/ILW-SL) 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:** Chapter 7
  - 14 external-beam radiotherapy departments,
  - 5 brachytherapy departments,
  - 20 nuclear medicine departments,
  - about 100 computed tomography scanners,
  - 74 centres performing fluoroscopy-guided interventional procedures,
  - some 2,320 medical and dental radiology centres;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - about 220 industrial and veterinary activities coming under the licensing or registration system,
  - 30 companies exercising an industrial radiography activity,
  - about 40 public or private research units;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved organisations and laboratories:**
  - 6 laboratories approved for taking environmental radioactivity measurements,
  - 2 organisations approved for measuring radon.

With regard to nuclear safety and the environment, the performance judged by ASN to be satisfactory on the whole over the last few years was maintained in 2024, despite deviations relating in particular to fire sectorisation, which must be specifically monitored.

Concerning radiation protection, the inspection carried out in 2024 confirmed that the actions undertaken in the last few years are appropriate for improving site's performance in this area. The year 2024 was nevertheless marked by a large number of internal contaminations, particularly on the primary cooling system pipe cutting worksite which is exposed to the risk of contamination by "alpha" particles. The specific measures applied on this particular worksite did not enable the targeted level of protection to be attained. The licensee must define and put in place more stringent measures for the future worksites presenting the same type of risk.

## FESSENHEIM NUCLEAR POWER PLANT

**The Fessenheim NPP is situated 1.5 km from the German border and about 30 km from Switzerland. Its two reactors, which were commissioned in 1977 and definitively shut down in 2020, are currently undergoing preparation for decommissioning.**

ASN considers that the site is continuing decommissioning preparation conscientiously. An important milestone in the review of the decommissioning file was reached in the first half of 2024, with the holding of the associated public inquiry.

As in the previous years, the decommissioning preparation activities proceeded satisfactorily and in accordance with the set schedules, with for example, completion of the preparatory work for converting the turbine hall into a waste management and storage area; preparation of the lower parts of the old steam generators for transportation to Cyclife's facilities in Swedenfor decontamination and recovery through a melting process; continuation of treatment of activation products waste; and continuation of boron removal and achievement of the required residual level at the start of decommissioning.

ASN considers moreover that the organisational changes in 2023 and the successive headcount reductions since 2020 have been well managed and have no negative impacts on site operations.

The sites performance in radiation protection is considered broadly satisfactory.

## 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 NPP is in line with its general assessment of the EDF plants in the areas of nuclear safety, radiation protection and the environment.

With regard to nuclear safety, ASN considers that the results are on the whole satisfactory, but the management of unanticipated situations in the control room needs to be improved. ASN notes a distinct improvement in the management of equipment lockout/tagouts and administrative lockouts.

With regard to maintenance, a notable event in 2024 was the refuelling outage of reactor 2. ASN considers that the maintenance operations during this outage went well on the whole.

As far as occupational radiation protection is concerned, although ASN observes that results regarding the management of worksite radiological cleanliness remain satisfactory, significant deviations were found during inspections. These deviations concern in particular the management of the maintenance worksite access airlocks and the servicing and tracking of the radioactivity measuring devices, particularly in the site's laundry. Particular vigilance is expected of the licensee in these aspects. Lastly, broadly speaking, ASN considers that further progress must be made in the radiation protection culture of people working on the site.

With regard to environmental protection, ASN notes that the subject is receiving greater attention, but considers that the licensee's organisation in this area can still be improved. Improvements are still required in the management of discharges and the containment of liquid pollutions in particular.

Lastly, the labour inspections did not find any particular weak points, other than the abovementioned deviations in occupational radiation protection. The points to be improved identified during the inspections are moreover addressed conscientiously by the employer.

## 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 (CSM) which ceased its activities in July 1994, while benefiting from the operating experience feedback gained from the latter. This facility, located 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 conditioning 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 2024, the volume of waste in the facility had reached about 387,000 $m^3$, or 39% of the authorised capacity. According to the estimates made by the French National Radioactive Waste Management Agency (Andra) in 2016 in the concluding report on the periodic safety review of the CSA, the repository could be completely filled by 2062 rather than 2042 as initially forecast. This can be explained by having better knowledge of the future wastes and their delivery time frames, as well as by an optimisation of waste management through the compacting of certain packages.

ASN considers that the CSA is operated satisfactorily in the areas of safety, radiation protection and the environment. The inspections conducted in 2024 revealed more specifically that the organisation for selecting and monitoring outside contractors was well managed and appropriate for the risks, and that the quality baseline was robust, well mastered and applied for environmental monitoring on the site.

## DEEP GEOLOGICAL DISPOSAL PROJECT

ASN considers that the scientific experiments and work conducted by Andra in the underground laboratory at Bure continued in 2024 with a good standard of quality, comparable with that of the preceding years.

ASN also continued examining the Creation Authorisation Application (DAC) for the Cigéo project that Andra filed with the Minister responsible for nuclear safety on 16 January 2023 (*see chapter 15 of the full ASN Report*).

## SMALL MODULAR REACTOR PROJECT IN BAZANCOURT

On 3 May 2024, the company Jimmy Energy filed a DAC for the construction of a Small Modular Reactor (SMR) in the Marne *département*. The intended purpose of this reactor would be to provide industrial heat to a factory of the Cristal Union group.

As at 31 December 2024, ASN had completed analysing the admissibility of the application and the follow-up to be given to the analysis was being examined by the Ministry responsible for nuclear safety (*see chapter 11 of the full ASN Report*).

# Hauts-de-France

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

**93** inspections

**15** significant events rated level 1 or higher

In 2024, ASN carried out 93 inspections in the Hauts-de-France region, of which 36 were in the Gravelines Nuclear Power Plant (NPP), 53 in small-scale nuclear activities and four in the transport of radioactive substances.

ASN also carried out 13.5 days of labour inspection in the Gravelines NPP.

During 2024, the Gravelines NPP notified ASN of nine significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES).

In small-scale nuclear activities, one event was rated level 1 on the INES scale. In radiotherapy, five events were rated level 1 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 (PWRs) giving a total power of 5,400 MWe. Reactors 1 and 2 constitute Basic Nuclear Installation (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 and environmental protection and radiation protection is in line with ASN's general assessment of the EDF plants.

The nuclear safety performance improved slightly in 2024, particularly in the addressing of significant events. The site has managed to stabilise its performance in the areas of cooling and fire protection. The licensee's recovery plan is continuing, focusing on subjects presenting difficulties such as the control of reactivity and maintenance. Despite the measures in place, ASN has again noted a number of inappropriate practices or behaviours, including noncompliance with procedures and poorly executed maintenance operations. The licensee must therefore continue its efforts to federate all the protagonists.

With regard to maintenance, 2024 was again marked by the substantial extensions in the reactor outage durations, largely due to unforeseeable technical issues. Three reactors were in outage at the same time for 12 weeks from mid-June to early November, putting an unusual amount of pressure on the departments in mid-summer. The intense activity linked to the reactor outages in 2024 included the fourth ten-yearly outage of reactor 4, in addition to an industrial programme including construction of the new local emergency centre and the creation of ultimate water make-ups further to the lessons learned from the Fukushima Daiichi NPP accident in Japan. This situation led to inadequately prepared maintenance activities. ASN thus observed poorly executed maintenance operations and work postponements due in particular to the unavailability of spare parts.

With regard to environmental protection, ASN considers that the Gravelines NPP's organisation and performance are broadly satisfactory, even though some deviations must be corrected, such as in the management of liquid effluent discharges or the application of the general requirements concerning the competence of the calibration and test laboratories. The efforts made over the last few years have brought an improvement in the management of equipment using $SF_6$ (a powerful greenhouse gas), but vigilance remains necessary for all greenhouse gas refrigerants.

ASN notes some progress in occupational radiation protection. The site has taken account of the difficulties encountered in the preceding years and the measures deployed are starting to bring positive results on the ground. The downward trend in the number of significant events continued in 2024, but two contamination-related events rated level 1 on the INES scale were reported. This assessment remains contrasted due to persistent shortcomings in the application of the optimisation approach in work preparation and the coordination of radiation protection measures with outside contractors. ASN also observes an increase in deviations linked to deficiencies in the radiation protection culture or rigour of the workers, particularly regarding the conditions of access to controlled areas and taking regulatory zoning into account.

With regard to labour inspection, the site's deployment of prevention actions concerning safety over the last few years brought a reduction in the number of workplace accidents involving outside contractors in 2024. It is still necessary to continue these practices over the long term, and perhaps even reinforce them, given that the accident rate remains high. Deficiencies have been detected in the control of conformity of the ventilation facilities with the regulatory requirements associated with specific pollution areas, occasionally leading to uncontrolled exposures of employees in rooms in which hazardous substances are emitted. Lastly, occasional deviations were noted in the lifting of loads and the use of electrical equipment designed by the services of the NPP.

## The installations and activities to regulate comprise:

- **one Basic Nuclear Installation:**
  - the Gravelines NPP (6 reactors of 900 MWe) operated by EDF;
- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 19 external-beam radiotherapy departments, 3 brachytherapy departments,
  - 30 nuclear medicine departments, of which 7 practise internal targeted radiotherapy,
  - 97 centres practising fluoroscopy-guided interventional procedures,
  - 148 computed tomography scanners,
  - some 4,600 medical and dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - about 600 industrial and research establishments, including 23 companies exercising an industrial radiography activity, 6 particle accelerators, including one for inspecting freight trains and 2 cyclotrons, 40 laboratories situated mainly in the universities of the region and 11 companies using gamma ray densitometers,
  - 340 veterinary surgeries or clinics practising diagnostic radiology;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved laboratories and organisations:**
  - 2 organisations approved for radiation protection controls.

# Île-de-France

The Paris division regulates radiation protection and the transport of radioactive substances in the 8 *départements* of the Île-de-France region. The Orléans regional division regulates nuclear safety in the Basic Nuclear Installations (BNIs) of this region.

**240**
inspections

**11**
significant events rated level 1 or higher

ASN carried out 240 inspections in the Ile-de-France region in 2024, of which 90 were in the field of nuclear safety, 127 in small-scale nuclear activities (four of them in the area of polluted sites and soils), 14 in Radioactive Substance Transport (TSR) and nine concerning approved organisations or laboratories.

Seven significant events were rated level 1 on the International Nuclear and Radiological Events Scale (INES) in the small-scale nuclear activities sector, three at level 1 on the INES scale in the BNIs sector and one at level 1 on the INES scale in the area of TSR.

Lastly, pursuant to Article 40 of the Penal Procedure Code, a report was filed against an inspection agency for falsification of documents.

## CEA Saclay site

**Since 2017, the Alternative Energies and Atomic Energy Commission (CEA) Paris-Saclay centre accommodates activities previously conducted on several geographically distinct sites close to Paris, and the sites of Saclay and Fontenay-aux-Roses in particular.**

**The CEA Paris-Saclay centre, of which the main site covers an area of 125 hectares, is situated 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 NPPs. Seven BNIs are located on this site.**

**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

The Osiris pool-type reactor, which has an authorised power of 70 Megawatts thermal (MWth), 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. Following submission of the decommissioning file for the entire facility in October 2018, ASN requested and received additional information giving more details on the operations planned at each stage of decommissioning and substantiating more precisely the initial state envisaged at the start of decommissioning and the results of the impact assessment. In late 2021, the CEA announced a radical change in the decommissioning strategy of BNI 40 with the postponement of commissioning of the equipment for treating and packaging irradiating waste. For the purpose of the examination, further information on the new decommissioning scenario, particularly regarding the management of irradiating waste, had to be provided. The CEA submitted a new decommissioning file at the end of 2023 and it is currently being examined.

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. More specifically, the last of the irradiated core fuel stored in the facility was removed in 2021.

ASN considers that the level of safety of BNI 40 is satisfactory, particularly with regard to control of external hazards and the management of liquid discharges. Improvements are however required in waste management. The organisation put in place to keep track of the Decommissioning Preparation Operations (DECPROs) is appropriate for the current status of the facility, despite the postponement of operations due to a lack of means. The commitments made to ASN are tracked with rigour and the progress on the whole is in conformity with the set time frames. The Authority for Nuclear Safety and Radiation Protection (ASNR) will focus its attention in 2025 on the licensee's control of the DECPROs, in particular compliance with the critical path to achieve the initial state described in the decommissioning file. It will also be attentive to the measures implemented by CEA to upgrade the waste storage areas in the facility and to the studies and works aiming to reduce the facility's water consumption.

## Orphée reactor

**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 was used for conducting experiments in areas such as physics, biology and physical chemistry. The reactor allowed the introduction of samples to be irradiated for the production of radionuclides or special materials, and to perform non-destructive tests on certain components.**

The Orphée reactor, which was definitively shut down at the end of 2019, is now in DECPRO phase. The licensee submitted its decommissioning file in March 2020. The last irradiated fuel from the Orphée reactor was removed in 2020, greatly reducing the radiological risk of the facility. The continuation of the DECPROs and the facility decommissioning scenario were discussed following the CEA's re-prioritising of the DECPROs, resulting in the updating of the decommissioning strategy for BNI 101. A new decommissioning file was submitted at the end of 2023 and it is currently being examined.

**The installations and activities to regulate comprise:**

- **Basic Nuclear Installations regulated by the Orléans division:**
  - the CEA Saclay site of the CEA Paris-Saclay centre,
  - the UPRA (Artificial Radionuclide Production Plant) operated by CIS bio international in Saclay,
  - the CEA Fontenay-aux-Roses site of the CEA Paris-Saclay centre;
- **small-scale nuclear activities in the medical sector regulated by the Paris division:** Chapter 7
  - 26 external-beam radiotherapy departments,
  - 12 brachytherapy departments,
  - 43 *in vivo* nuclear medicine departments and 12 *in vitro* (medical biology) nuclear medicine departments,
  - 150 centres practising fluoroscopy-guided interventional procedures;
- **small-scale nuclear activities in the industrial, veterinary and research sectors under the oversight of the Paris division:** Chapter 8
  - 9 industrial radiology companies using gamma radiography devices,
  - about 143 authorisations and 42 registrations relative to research activities;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved laboratories and organisations:**
  - 3 organisations approved for radiation protection controls..

Based on the facility inspections and monitoring carried out in 2024, ASN considers that the level of safety of the Orphée reactor is on the whole satisfactory. However, some points of vigilance require particular attention, particularly with regard to Human and Organisational Factors (HOFs) and the updating of baseline requirement documents. Furthermore, despite progress in the sorting of the equipment dedicated to the researchers, improvements are required in waste management. Clarifications are also expected concerning the actions associated with the periodic safety review, notably their incorporation in an action plan, a precise explanation of their objectives and proof of their completion.

Since the shutdown of the reactor, the DECPRO phase has started, but is subject to recurrent schedule push-backs. It is subject to close scrutiny by ASN, particularly regarding the suitability of the organization and the personnel's competence to manage new activities while maintaining the level of safety of the facility and controlling the schedules of the associated activities.

## Spent fuel testing laboratory

The Spent Fuel Testing Laboratory (LECI) was built and commissioned in November 1959. It was declared a BNI on 8 January 1968 by the 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.

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 CEA had undertaken to implement. Some of the CEA's commitments have not been fulfilled within the deadlines.

In particular, the licensee has requested pushing back of the deadlines for 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. The decommissioning of Célimène (unit formerly intended for the examination of fuels from reactor EL3) is also concerned by this request. The examination of the provisions relating to fire led ASN to decide to issue a compliance resolution to regulate performance of the works initially expected for the end of 2019. In view of the risks and the work already undertaken by the licensee's personnel, the corresponding technical requirement must be met before 31 December 2026. ASNR will be particularly attentive to the monitoring and implementation of the necessary actions to meet this deadline.

Since the end of 2022, BNI 72 no longer accepts irradiating waste from the CEA Saclay site. Consequently, the CEA has started a new project baptised "GDILE", a French acronym for "Management of irradiated waste from LECI", in order to process, package and remove the irradiating waste (existing and future) without saturating the storage capacities of LECI. CEA initiated reflections in 2024 to redefine and size this project, and they will continue in 2025 in collaboration with ASNR. In this context, in 2024 ASN started examining the file for the facility's second periodic safety review which CEA submitted in December 2023.

The inspections of LECI carried out in 2024 were considered satisfactory, even though improvements are required in taking account of risks associated with the use of lifting equipment and with static containment. The time taken to respond to ASNR's requests remains a point requiring particular attention.

## Poséidon irradiator

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.

ASN has regulated the continued operation of the facility following its periodic safety review through ASN Chairman's resolution CODEP-CLG-2019-048416 of 22 November 2019. The major areas for improvement are in particular 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 2024, further to its examination of the periodic safety review concluding report submitted by CEA at the end of 2021, ASN considered that it had no objection to the continued operation of BNI 77. Attention must nevertheless be paid to monitoring the ageing of the pool.

ASN considers that the level of nuclear safety of the facility is satisfactory. ASN has observed in the course of its inspections that the licensee provides adequate responses within the set deadlines to its commitments resulting from the preceding periodic safety review (commitments made by licensee, technical requirements or requests from ASN), particularly regarding the management of fire loads. It also underlines with approval the putting in place of visual internal communication tools which facilitate the operators' understanding of the operational management operations. Improvements are nevertheless required in the management of sources. This is because in 2024 the facility's pool was again contaminated by tritium during the provisioning of new cobalt-60 sources. This event highlights the need to reinforce the measures taken following a similar contamination in 2021.

## SOLID WASTE AND LIQUID EFFLUENT TREATMENT FACILITIES

The CEA operates various 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

**The Solid Radioactive Waste Management Zone (ZGDS – 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 "dispersible inventory[1] "currently present in the facility, BNI 72 is one of the priorities of the CEA's decommissioning strategy which has been examined by ASN, who stated its position on these priorities in May 2019 (*see chapter 14 of the full ASN Report*).

BNI 72 has been definitively shut down since 31 December 2022. Nevertheless, certain wastes can be accepted by the facility until 2025. After analysing the periodic safety review report for BNI 72 submitted at the end of 2017 and examined jointly with the decommissioning file, ASN regulated the conditions of continued operation of the facility through ASN Chairman's resolution CODEP-CLG-2022-005822 of 2 February 2022. Furthermore, Decree 2022-1107 of 2 August 2022 requiring the CEA to proceed with the decommissioning of BNI 72 was published in the *Official Journal*. This Decree came into effect on 26 July 2023, the date on which ASN approved the revision of the General Operating Rules (RGEs).

ASN has observed numerous delays in the operations to remove fuel or waste from storage. The removal from storage of fuel rods contained in a specific packaging were suspended in 2024 after discovering loss of fuel pellet integrity during handling operations. ASNR will be attentive to CEA's updating of the safety case and the resumption of operations.

The "EPOC"[2] project (a French acronym meaning "Removal of fuel drums") has experienced difficulties due in particular to termination of the project management contract in 2020, and CEA has taken measures to take over said project management. A pit was opened in 2023 and complementary investigations were carried out in 2024 to consolidate the project input data. ASNR will nevertheless remain attentive to CEA's management of this project, particularly regarding the work to be carried out with a view to recovering the first drum.

ASN takes positive note of the completion of removal of the fifteen fuel cans from a pool in a building and the removal of four isotopic generators containing sources in 2024. These operations contribute to the gradual reduction of the facility's "dispersible inventory".

Lastly, the monitoring of outside contractors must be improved. CEA must also be particularly attentive to preserving the site memory, particularly as regards the equipment necessary for the decommissioning and removal from storage operations.

### Liquid effluents management zone

**The Liquid Effluents Management Zone (ZGEL) 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 National Radioactive Waste Management Agency (Andra).**

The evaporation facility used to treat the radioactive effluents has been out of service since 2019 due to technical anomalies on an equipment item. At present the facility is no longer capable of fulfilling its functions (evaporation of effluents, encapsulation of concentrates in cement, collection of effluents from the Saclay effluent producers). In 2023, ASN authorised a modification concerning the separator shell, enabling the evaporation campaigns to be restarted. The corresponding work began at the end of 2024.

The process of encapsulation in cement, used to treat the concentrates in the facility, was stopped temporarily by CEA in June 2021, following the production of two 12H active packages that did not comply with packaging approval issued by Andra. CEA obtained Andra's approval in 2024, allowing removal of the 12H packages stored under a derogation provision, which will enable removals to be resumed in 2025. Work is also in progress to obtain a further approval.

Alongside this, the CEA has suspended reception of effluents from other BNIs since 2016, due to the conducting of complementary investigations into the stability of the structure of the room for storing low-level liquid effluents (room 97). The majority of the low- and intermediate-level radioactive effluents produced by the Saclay site production sources are now directed to the Marcoule Liquid Effluent Treatment Station (STEL).

This situation raises questions as to whether management of liquid effluents in the facility will be resumed in the future. ASNR will keep close track of this situation and expects CEA to redouble its efforts to render the facility operational in order to be able to retrieve and condition the stored legacy effluents within appropriate time frames.

*1. Part of the inventory of the radionuclides of a nuclear facility that groups the radionuclides that could be dispersed in the facility in the event of an incident or accident, or even, for a fraction of them, be released into the environment.*
*2. This project involves a process intended to retrieve and package drums containing a mix of waste and fuel fragments which are currently stored in pits in the facility. The retrieval of these drums requires specific equipment, given the uncertainties concerning their integrity.*

The emptying and cleaning out of the MA 500 tanks and the pit 99 tanks represent major challenges for the facility. A priority pit 99 tank was emptied in 2024. However, non-pumpable residues remain in the bottom of this tank. The inspections carried out in 2024 highlighted the good execution of this tank emptying work, the improvement in the conditions of waste storage in a hall and the progress of the action plan stemming from the periodic safety review, particularly concerning control of the fire risk. Improvements must however be made in the monitoring of outside contractors and implementation of the recommendations resulting from the fire risk control study.

### FACILITIES UNDERGOING DECOMMISSIONING

The decommissioning operations on the Saclay site concern two BNIs, the High Activity Laboratory (LHA) and the solid radioactive waste management zone (BNI 72). DECPROs are being carried out in two definitively shut down BNIs, namely the Osiris and Isis reactors (BNI 40) and the Orphée reactor (BNI 101). Operations are also being carried out on parts of the in-service ZGEL (BNI 35) which have ceased their activity. 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, are also concerned by decommissioning. 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 (*see chapters 14 and 15 of the full ASN Report*).

## High-activity laboratory

**The High-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 disused 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 conducted between 2019 and 2021. The licensee submitted a Decommissioning Decree modification file in December 2021. The justification for the time necessary to complete the decommissioning operations authorised by the Decree of 18 September 2008 shall be reviewed in the ongoing examination of this file.

In 2024, after examining the periodic safety review concluding report submitted by CEA in 2017, ASN considered that it had no objection to the continued operation of BNI 49 pending the amendment of its Decommissioning Decree In the context of this periodic safety review, compliance actions, particular regarding control of fire-related risks, were identified. ASN also asked CEA to take measures to guarantee the integrity of certain items of equipment whose decommissioning has been delayed.

The investigations and studies allowing the management of unidentified waste discovered in late 2022 in the set of structures constituting the TOTEM shielded process continued in 2024.

ASN considers that the safety of the BNI 49 undergoing decommissioning is satisfactory on the whole. However, particular vigilance is expected in monitoring the condition of the ventilation ducts, particularly the internal sections which are inaccessible or display defective areas. Particular attention must also be paid to the operation of the main air manifold extractor in view of the technical problems encountered. Improvements are also necessary to guarantee the monitoring of the lightning protection facilities which, in their current state, cannot guarantee the required level of protection.

ASN remains vigilant with regard to the management of the very low level waste zones of BNI 49, particularly on account of the future decommissioning work which will produce additional waste. Consequently, the adequacy of the existing waste storage areas for the future needs is of major importance to enable the decommissioning operations to run to the planned schedule.

### Assessment of the CEA Saclay site

ASN considers that the CEA Saclay site BNIs are operated under suitably safe conditions on the whole, and observes that the operations to reduce the radiological inventory stored in the BNIs – which have been in progress for several years now – continued in 2024.

The DECPROs and decommissioning work continue for the facilities concerned. Managing work progress and keeping to the associated schedules remain a major challenge for CEA Saclay. This area, which forms the subject of regular ASN inspections and meetings, must still be improved given the drifts in schedule observed over the years.

On another note, further to the Fukushima Daiichi NPP accident (Japan), ASN had ordered the creation on the Saclay site of new emergency management facilities capable of withstanding extreme conditions. After discovering reinforcement defects in civil engineering work which led to the suspension of the worksite, CEA failed to meet its commitment to commission the premises before the end of 2021. An inspection conducted in 2022 confirmed that the new premises had not been commissioned, contrary to a requirement of an ASN resolution of 2016. Following the analysis of CEA's reply to the report established in the presence of both parties, and in view of the reduction in the nuclear risk of the Saclay site further to the shutdown of BNIs 40 and 101, the requirement in question was repealed. A new technical requirement then framed the finalisation of the construction of robust emergency situation management premises, with commissioning planned for 2024. During inspections in 2023 and 2024 ASN observed that work has resumed and was progressing. At the end of 2024 CEA informed ASN of the commissioning of the new premises. An update of the On-site Emergency Plan (PUI) remains necessary to formalise the changes concerning these premises.

With regard to the environment, two ASN resolutions dating from 2009 and updated in 2023 regulate all the discharges from the CEA's BNIs. Following an inspection in 2024 focusing in particular on effluent discharges and groundwater during which samples were taken, ASN observed that the measurements taken by an independent laboratory were consistent with those taken by CEA.

The organisation put in place to prevent the risk of frauds was also inspected. Although personnel training sessions have been organised, efforts must nevertheless be made to put in place an overall process for managing the prevention of irregularities and the risk of fraud.

Two years after setting up radiation protection skills centres, the subject was inspected by the head offices of CEA, which focused in particular on the skills centres of the CEA Paris-Saclay centre and found the situation to be satisfactory.

Lastly, an in-depth inspection involving several inspection teams was carried out in 2024 to examine the monitoring of outside contractors on the CEA Saclay site. ASN considers that outside contractor monitoring is broadly unsatisfactory and insufficient. ASN also underlines the major deficiencies in the application of the regulatory requirements, particularly regarding the identification of protection important components and activities. The first responses on the part of CEA were found to be satisfactory and ASNR will monitor the development of the situation in 2025.

## ARTIFICIAL RADIONUCLIDE PRODUCTION PLANT OF CIS BIO INTERNATIONAL

**The Artificial Radionuclides Production Facility (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. They are manufactured using a cyclotron installed on the site or using radionuclides produced by outside suppliers or other facilities of the Curium group. 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 were stored in the facility, was completed in 2024. 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 potential consequences of accident situations on the site. The manufacture of a new radiopharmaceutical was authorised by ASN in 2024, with a view to obtaining a marketing authorisation.

In the light of the inspections and the examination, ASN considers that the deterioration in the overall level of safety of the facility observed in 2023 has not been made up in 2024, despite the licensee's efforts in mobilising the personnel at various levels of the organisation. Although the number of significant events notified to ASN decreased in 2024, HOFs are still over-represented in the identified causes of the events. A large number of events linked to failure to wear or to activate active dosimeters are still observed. The inspections, one of which focused on HOF aspects, identified that within the facility there is a degree of habituation to deviations, which has led ASN to ask the licensee to conduct an overall analysis of this situation to determine its root causes.

With regard to the fire theme, although certain actions identified during the last periodic safety review have been completed, the fire safety system qualification work must still be carried out within time frames appropriate for the risks. Furthermore, the licensee has been unable to transit the required updates of the safety analysis report and the RGEs, in order to demonstrate that the conclusions of the substantial amount of work accomplished in this safety review have been duly taken into account.

Moreover, the inspections revealed that several documents relating to emergency situation management are out-of-date and must therefore be updated. Improvements are expected in the personnel's emergency situation training,

in the sealing of the facility's enclosures and glove boxes, in the conditions of reception of radioactive substance packages and in waste management. On this latter subject, ASN gave CIS bio international formal notice at the end of 2024 to remove, before the end of January 2025, certain nuclear wastes held in storage beyond the deadlines stipulated in the baseline requirements of the facility.

A recurring nonconformity has been observed since 2022 in the effectiveness of the last filtration levels of the facility's ventilation system. The technical causes of these deviations have not yet been found, therefore the investigations must continue in 2025 in order to introduce robust preventive measures. CIS bio international met the deadline set by ASN's formal notice resolution of 2023 on the pressure equipment theme, even though further information is still awaited on this subject.

More broadly, ASN notes – as was the case in the previous year – the difficulties CIS bio international is having in meeting the deadlines for the actions decided further to inspections or significant events and resulting from the action plan associated with the periodic safety review. Furthermore, and despite the substantial work undertaken, delays are still observed in submitting significant event reports and replying to ASN follow-up letters. This being said, the quality of the content of the significant event reports remains high and this must be maintained.

The numerous projects, studies and works undertaken by CIS bio international require better scheduling so that the files to be addressed to ASN can be prepared and submitted sufficiently early. Operating rigour, maintaining the safety culture and the management of industrial projects or aiming to improve safety or radiation protection remain the areas in which CIS bio international must focus its efforts. To improve the performance in the areas of safety, radiation protection and the environment, the licensee must be particularly vigilant regarding the adequacy of the human and technical resources to be deployed, and ensure that these resources are sufficient to operate the facility in complete safety.

# – 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 CEA Fontenay-aux-Roses site, part of the CEA Paris-Saclay centre since 2017, 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 ceased 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 (*see chapters 14 and 15 of the full ASN Report*).**

**Decommissioning of the Fontenay-aux-Roses site includes priority operations because it presents particular risks, linked firstly to the quantity of radioactive waste present in the facilities, and secondly to the radiological contamination of the soils under part of one of the BNI 165 buildings. In addition to this, the Fontenay-aux-Roses centre, which is situated in a densely-populated urban area, is engaged in an overall delicensing process.**

## Procédé and Support facilities

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 had to be extended 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. These files were supplemented over the 2019-2022 period, particularly with respect to the planned decommissioning operations and their schedule. The CEA forecasts end of decommissioning of the BNIs beyond 2050, perhaps even 2060 in the case of BNI 165. These two projects are currently being examined. The new decrees will set the future decommissioning characteristics, and notably their completion time frame.

### Assessment of the CEA Fontenay-aux-Roses site

ASN considers that the level of safety of the CEA Fontenay-aux-Roses site is acceptable. CEA must nevertheless maintain its efforts to ensure the operational safety of its facilities.

After delays identified in the preceding years in the performance of the studies, in project programming and in the decommissioning schedule of the nuclear installations of Fontenay-aux-Roses, two of the CEA's major decommissioning-related worksites were stopped for contractual and technical reasons in 2023.

This situation led to technical changes in the choice of equipment design and pushing back of the decommissioning time frames. CEA must be particularly vigilant regarding the coordination of the files and the work planned on the site in order to reduce the dispersible radiological inventory within the facilities. It must also continue to implement strong measures to control and render reliable the project time frames, particularly the deadlines for submission of the decommissioning worksite preparatory studies.

In 2023, in view of the conclusions of the periodic safety review of BNI 165, ASN regulated its continued operation through a resolution setting technical requirements. With regard to BNI 166, in view of CEA's commitments and the action plan established at the end of the periodic safety review and further to its examination of the concluding report of the said review, ASN considered in 2024 that it had no objection to the continued operation of BNI 166.

The inspections ASN carried out in 2024 found TSR management to be satisfactory and an improvement in waste management in one of the BNI 166 buildings. Nevertheless, the areas requiring close attention – concerning in particular the emergency management means and control of the fire risk – still persist after several years. An update of the PUI is expected further to the changes in the emergency premises in particular. Despite the compliance work already undertaken on one of the BNI 165 buildings, the efforts must be continued in 2025 to achieve the required level of safety. Although the number of significant events notified is lower than in the preceding years, they mainly relate to fire. In view of the recurrence of this subject, ASN considers that an in-depth analysis of the causes is necessary.

Lastly, ASN underlines with approval the steps taken by CEA in 2024 to improve the safety of the facilities. These include a complete update of the RGEs, which had been obsolete for several years, and the implementation of a maintenance action plan. This plan has two main objectives: improve knowledge and command of the physical configuring of the facilities in relation with the components important for the protection of interests, and tighten daily work monitoring by creating a work coordination office. ASN enjoins the licensee to continue its actions in 2025.

## The polluted sites and soils in Île-de-France

**In Île-de-France, the Paris division oversees the depollution activities for contaminated radiological sites, which usually concerns legacy contamination resulting from past industrial or research activities which used radium. The actors can be industrial players, but also private individuals.**

**The Paris division can, at the request of the *département* Prefect, give technical opinions on the planned pollution management measures and on the effective performance of remediation work (*see chapter 15, point 4 of the full ASN Report*).**

On account of its expertise in the risks presented by polluted sites and soils, the Paris division of ASN issued in 2024:
- three opinions concerning the remediation operations or their follow-ups: stopping of the monitoring in the vicinity of the Orme des Merisiers landfill in Saint-Aubin (Essonne *département*), total clean-out of a construction worksite in Gentilly (Val-de-Marne *département*) and remediation of a private individual's parcel of land in Gif-sur-Yvette (Essonne *département*);
- four opinions concerning management of the pollution of the sites of Budin, Fort d'Aubervilliers and Charvet in the Seine-Saint-Denis department, and Vaujours in the Seine-Saint-Denis and Seine-et-Marne *départements*;
- two opinions for the environmental authority concerning the Public Development Zone (ZAC) in Aubervilliers (Seine-Saint-Denis *département*) and the Clamart college ZAC (Hauts-de-Seine *département*);
- one opinion on a verification concerning the flooding of a college near the Federal Mogul site in Gif-sur-Yvette (Essonne *département*).

Furthermore, in 2024 the Paris division carried out four inspections to check the clean-out or development operations on four different sites, namely the old Vaujours Fort, a former Marie Curie laboratory in Arcueil (Val-de-Marne *département*), Charvet – VLM in Île Saint-Denis (Seine-Saint-Denis *département*) and the Curie Institute (Paris).

Furthermore, as part of the monitoring of these long-term clean-out operations which have been in progress for several years, the Paris division also took part in the monitoring commissions of the Vaujours Fort site and the Marie Curie laboratory in Arcueil.

The Paris division also carried out the following actions in 2024:
- three requests to the French Institute of Radiation Protection and Nuclear Safety (IRSN) for verifications and placing in safe condition after radioactive objects were discovered in the homes of private individuals and in a high school in Val-de-Marne;
- various technical meetings with the Prefectoral body and the Regional and Interdepartmental Directorate for the Environment, Development and Transport (DRIEAT) concerning depollution of the Charvet – VLM site;
- drafting of a soil hazard information sector concerning the residual radiological contamination of a land parcel in Gif-sur-Yvette after remediation;
- various technical interchanges bringing together the Prefectoral administration, DRIEAT, ASN, IRSN, the design office and the project sponsor, concerning the diagnosis of the polluted Galeries Lafayette site in Seine-Saint-Denis, with a view to its remediation;
- a technical meeting with the town council of Gif-sur-Yvette and the DRIEAT concerning the future of the Federal Mogul site;
- responses to requests from private individuals faced with radiological contamination problems in certain areas of Gif-sur-Yvette.

# Normandie

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

**213** inspections

**20** significant events rated level 1 or higher

In 2024, ASN carried out 213 inspections in Normandie, comprising 72 in the Nuclear Power Plants (NPPs) of Flamanville, Paluel and Penly, 17 on the Flamanville EPR reactor, 64 on "fuel cycle" facilities, research facilities and facilities undergoing decommissioning, 41 in small-scale nuclear activities, 11 in the transport of radioactive substances and eight in ASN-approved organisations and laboratories.

In addition to this, 21 days of labour inspection were carried out on the NPP sites and the Flamanville 3 EPR construction site.

In 2024, ASN was notified of 20 significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES), of which 18 occurred in Basic Nuclear Installations (BNIs) and two in small-scale nuclear activities.

Lastly, in the context of their oversight duties, the ASN inspectors issued one violation report.

## 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 (PWRs), each of 1,300 MWe commissioned in 1985 and 1986. Reactor 1 constitutes BNI 108 and reactor 2 BNI 109.**

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

In the area of nuclear safety, ASN observed a stable situation with regard to control of the state of the facilities and application of the fundamental safety principles by the plant personnel and outside contractors. With regard to reactor management and operation, ASN considers that the site's performance is stable but remains tenuous. The restarting of reactor 2 following an outage involving numerous maintenance operations, including the ten-yearly requalifications of the secondary systems, went well on the whole. The year 2024 was nevertheless marked, as in the preceding years, by a large number of significant events notified to ASN linked to a deficiency in facility monitoring and noncompliance with the baseline operating requirements. The licensee must take action on these points to improve work rigour in the service responsible for operational management.

ASN considers that the maintenance operations were carried out proficiently by the licensee during the reactor outages in 2024, despite the damage that occurred during a test on an emergency diesel generator set at the start of reactor 2 shutdown, making it necessary to review the activities schedule. In 2025, the licensee must be particularly attentive to the coordination and monitoring of subcontracted activities, especially during the reactor 2 outage during which replacement of the four steam generators is scheduled.

The radiation protection performance remained stable in 2024, with an effective process for detecting and analysing significant radiation protection events. Nevertheless, anomalies regarding the wearing of dosimeters and control of the risk of contamination dispersion were still present in 2024. ASN expects to see improvements in these two points.

With regard to environmental protection, ASN observes a stable situation where the licensee controls the impacts of its facilities and seeks to reduce them. The year 2025 must be used to improve responsiveness when anomalies are detected and achieve greater rigour in the treatment of the waste produced during reactor outages.

With regard to labour inspection, despite an apparently robust organisation, ASN considers that the licensee is not making sufficient progress in correcting its weak points for the situation to be deemed satisfactory. The occurrence of several accidents, one of them particularly noteworthy, justified the licensee's deployment of a specific action plan at the end of 2024. The Authority for Nuclear Safety and Radiation Protection (ASNR) will be particularly attentive to the progress and application of this action plan.

## 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 PWRs commissioned between 1984 and 1986. Reactors 1, 2, 3 and 4 constitute BNIs 103, 104, 114 and 115 respectively.

The site accommodates one of the regional bases of the Nuclear Rapid Intervention Force (FARN) created by EDF in 2011 further to the Fukushima Daiichi NPP accident 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 performance of the Paluel NPP with regard to nuclear safety, radiation protection and environmental protection is on the whole in line with the general assessment of EDF plant performance.

With regard to nuclear safety, ASN considers the performance of the NPP to be satisfactory. However, even if operational rigour has improved in certain activities, such as monitoring of the facilities when managing transient operating phases, it must be further improved for the activities relating to the configuring of systems and components (lockout/tagouts, administrative lockouts). A marking event in 2024 was a fire in the reactor 3 transformer, during which the operating and fire-fighting teams responded well. The site must nevertheless be particularly attentive to the quality and presentation of the operating documents, especially the procedures used for operational management in incident or accident situations.

With regard to maintenance and the work associated with the reactor outages, ASN considers that the Paluel NPP on the whole maintained good control of the programme and of the quality of performance of the planned activities, despite their very substantial volume. ASN notes that further progress must be made in the management of deviations affecting the facility and that the efforts to improve worker monitoring must be continued. ASNR will also be particularly attentive to the in-service monitoring of pressure equipment further to the shortcomings found in 2024.

ASN considers that the site's organisation for radiation protection is broadly satisfactory, particularly in the preparation of operations with high radiation exposure risks. Nevertheless, despite proactive measures on the part of the licensee, inadequacies persist in control of the contamination risk and the radiation protection culture during reactor outages.

ASN considers that the site's organisational setup for environmental protection enables the corresponding requirements to be satisfied on the whole. The fire outbreak on the reactor 3 transformer nevertheless highlighted shortcomings in the management of the fire-extinguishing water effluents. The licensee must define a clear management strategy for these effluents that is applicable in incident situations. Lastly, the licensee must continue its efforts in the management of on-site transport of hazardous substances, which was again sub-standard this year.

With regard to labour inspection, ASN observes that the workers generally know and comply with the safety requirements.

### The installations and activities to regulate comprise:

- **Basic Nuclear Installations:**
  - the NPPs of Flamanville (2 reactors of 1,300 MWe), Paluel (4 reactors of 1,300 MWe), Penly (2 reactors of 1,300 MWe) and Flamanville 3 (1 reactor of 1,600 MWe) operated by EDF,
  - the construction site of two EPR 2-type reactors at Penly,
  - the Orano spent nuclear fuel reprocessing plant at La Hague,
  - the Manche repository (CSM) of the French National Radioactive Waste Management Agency (Andra),
  - the Ganil (National large heavy ion accelerator) in Caen;
- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 8 external-beam radiotherapy departments (27 devices),
  - 1 proton therapy department,
  - 3 brachytherapy departments,
  - 12 nuclear medicine departments,
  - 50 centres practising fluoroscopy-guided interventional procedures,
  - 70 computed tomography scanners,
  - some 2,100 medical and dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - 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;** Chapter 9
- **ASN-approved laboratories and organisations:**
  - 9 head-offices of laboratories approved for taking environmental radioactivity measurements,
  - 1 organisation approved for radiation protection controls.

## 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 PWRs commissioned between 1990 and 1992. Reactor 1 constitutes BNI 136 and reactor 2 BNI 140.**

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

With regard to nuclear safety, ASN considers that the NPP's performance is progressing slightly, particularly in operating rigour. Some weaknesses nevertheless persist. In effect, there are Significant Safety Events (ESS), linked in particular to shortcomings in the facility configuration management (alignment, lockout/tagout), communication deficiencies within the operational management group (Human and Organisational Factors – HOFs) and in the completeness of the operating documents. ASN considers that particular attention must be paid to the quality of preparation of the activities and the documents associated with the routine operation activities (periodic tests, alignments, etc.) and to improving the way in which HOFs are taken into account.

With regard to maintenance, ASN considers that the organisation in place is robust and capable of guaranteeing the conformity and good overall condition of the equipment. ASN has nevertheless observed shortcomings in the process sheets and procedures used, leading to errors during maintenance operations. Efforts must be continued in order to limit these errors resulting from deficiencies in document presentation or completeness. Alongside this, the overlapping of two reactor outages in the second half of 2024 highlighted the weaknesses in the performance and traceability of the operations aiming to guarantee the conformity of the facilities. ASNR will be particularly attentive to these points in 2025, particularly the restarting of reactor 2 on completion of its ten-yearly outage.

In the area of radiation protection, ASN considers that progress has been made in organisational aspects, particularly with the continued deployment of the centres of competence in radiation protection. The inspections found a good standard of monitoring of the condition of the facilities. ASN considers that the site must continue the ongoing efforts to prevent the risk of contamination and be attentive to the processes involving high radiation exposure risks (industrial radiography work, marking out limited stay areas), which showed weaknesses at the end of the year.

With regard to protection of the environment, ASN considers that the Penly NPP has a robust organisation for managing and monitoring environmental discharges. On the occasion of an unannounced inspection, ASN found the EDF teams' organisation for deploying mobile means for taking environmental samples and measurements to be responsive and appropriate. In addition, the improvement in the measures taken to control discharges of ozone-depleting gases seems to be lasting over the long term.

With regard to labour inspection, ASN observes that the workers generally know and comply with the safety requirements. Inspections have nevertheless occasionally revealed deviations in the prevention of vital risks (such as prevention of the risk of falling from height and those associated with lifting activities), and in the ventilation of workplaces. ASNR will therefore be particularly attentive to the steps taken to reinforce the measures to prevent these risks.

## EPR REACTOR – FLAMANVILLE 3

**Under construction since September 2007, the Flamanville EPR reactor was commissioned on 8 May 2024 after receiving commissioning authorisation from ASN. The first nuclear chain reaction took place on 3 September 2024 and the reactor was coupled to the French electricity grid for the first time on 21 December 2024. The reactor was continuing its startup tests at the end of 2024.**

With regard to the pre-commissioning operations, ASN considers that EDF worked very hard to obtain issuance of the reactor commissioning authorisation. ASN consolidated its position essentially on the basis of the inspection of the startup tests, the state of completion of the facilities, the operational capability, and the assessment of the conformity of the Nuclear Pressure Equipment (NPE).

Completion of the pre-commissioning startup test programme underwent two dedicated inspections, and the test results report was examined by ASN. Furthermore, as requested by ASN, EDF conducted several complementary periodic tests to ensure that the safety criteria, verified through tests sometimes performed several years ago, still meet requirements.

With regard to completion of the facility, EDF gave ASN work progress reports on a virtually daily basis right up until the reactor was commissioned. In addition, ASN conducted two inspections dedicated to fuel preparation prior to loading and commissioning of the controlled area, and a campaign of six inspections on preparation for loading and loading of the fuel into the reactor vessel.

The preparation of the teams assigned to reactor operation was subject to a tightened inspection. This inspection, which mobilised six ASN inspectors and one expert from the Institute for Radiation Protection and Nuclear Safety (IRSN) for two days, provided the opportunity to check the effective implementation of the measures decided by EDF in response to ASN's requests after the in-depth inspection conducted from 22 to 26 May 2023. ASN kept close track of the follow-ups to this inspection through to reactor commissioning.

The conformity of the NPE was established on the basis of the quality review, the way the irregularities affecting certain items of equipment were addressed and the appropriate preservation of the equipment. ASN continued the equipment conformity assessments through examinations

and inspections until May 2024, enabling the level-1 NPE conformity assessment reports and the reactor nuclear steam supply system report to be issued.

Thus, between the start of 2024 and issuance of the commissioning authorisation (7 May 2024), ASN's oversight action was equivalent to 18 days of inspection on the Flamanville EPR reactor.

Since the reactor was commissioned, ASN has directed its oversight essentially towards the addressing of significant events, monitoring the action taken further to unforeseen events encountered by the licensee and monitoring the startup tests. For this startup phase, ASN's oversight action was equivalent to nine days of inspection.

As concerns the post-commissioning reactor startup operations, ASN considers that the licensee managed the activities proficiently, particularly the startup tests, and dealt with the unforeseen events adequately.

EDF has notified a large number of safety-significant events since the reactor was commissioned, of which about a third have been rated level 1 on the INES scale. ASN is particularly attentive with regard to the analysis of the root causes of these events and the action taken by EDF to build on the lessons learned from the events and safeguard the forthcoming startup activities and future operation of the reactor. The large number of events notified is linked in particular to the rise in the personnel's competence in the implementation of the first reactor operation actions and the transition from a worksite culture to an operational culture. The large majority of the events have human or organisational causes; few of them are associated with equipment failures. Furthermore, a large proportion of the events are linked to human errors that are detected immediately with rapid restoration of facility conformity. ASN considers that the measures taken by EDF further to these findings are relevant and appropriate for the difficulties encountered during this phase.

More specifically, ASN expects the licensee to demonstrate greater rigour, notably in the application of the fundamentals of facility operational management. The licensee must remain vigilant regarding the control of reactivity and the assimilation of operation of the main emergency generator sets.

Alongside commissioning and startup, ASN initiated inspections – as it does on the other EDF reactors – on varied themes such as containment, control of the fire risk, environmental discharges, waste management, command of configuring the facility and in-service monitoring of NPE. ASN thus carried out oversight actions on these subjects equivalent to ten days of inspection and considers that EDF's organisation is satisfactory, except for the monitoring and taking of water intakes and effluent discharges, and for waste management. On these points ASN expects the licensee to improve its knowledge and management of the equipment involved in discharge monitoring, and considers that the organisation of waste transfer management must be improved in view of the future reactor outages.

ASN also ensures the labour inspection duties on the Flamanville EPR reactor. In 2024, apart from checking companies' compliance with the provisions of labour law, ASN examined more particularly the conformity of the air purification systems of the work spaces. ASN considers that the safety organisation is appropriate on the whole.

## MANCHE WASTE REPOSITORY

**The Manche waste repository (CSM), which was commissioned in 1969, was the first radioactive waste repository operated in France. 527,225 m³ of waste packages are emplaced in it. The last waste packages to enter this facility were accepted 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.**

On 29 April 2024, after completing its examination of the periodic safety review report submitted by Andra in 2019, ASN authorised the continued operation of the repository. It has nevertheless issued a number of requirements aiming to continue the studies on the behaviour of the existing cover, of the long-term cover and preservation of the site memory. One requirement also concerns the continuation of the studies into the retrieval of packagings containing long-lived radionuclides.

ASN also considers that the organisation defined and implemented for operation of the CSM facilities with regard to safety, radiation protection, environmental monitoring and meeting commitments is broadly satisfactory. As part of the continuous improvement process, the licensee must nevertheless consolidate, within its baseline requirements, the information relative to the fraud risk analysis, particularly with respect to outside contractors.

## NATIONAL LARGE HEAVY ION ACCELERATOR

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

A new project is currently underway on the site with the "DESIR" facility, standing for Disintegration, Excitation and Storage of Radioactive Ions. The primary function of the DESIR project will be to create new experimentation areas based on beams of radioactive ions produced by the SPIRAL1 and S3 facilities (experimental area of the SPIRAL2 phase 1 facility). This project involves modifying the BNI perimeter. The examination of this file continued in 2024 and ASN issued a favourable opinion on the draft decree on 10 December 2024.

Examination of the second periodic safety review of the facility is also in progress. The review inspection of 20 December 2023 confirmed the Ganil's progress in characterising the defined requirements associated with the activities and elements important for the protection of interests and the progress in incorporating these changes into the baseline operating requirements. The licensee must formalise more precisely the methods of taking the human and organisational aspects into account in the modifications made to the facility.

In the context of a national campaign in 2024 focusing on counterfeits, falsifications and suspicions of fraud, ASN observed that the licensee had taken measures to prevent, detect and address such infringements. However, these measures are not structured in a single process in the licensee's integrated management system. ASNR will be attentive to the setting up of such a structured process.

The licensee presented a change in its organisation in 2024, which should be effective in 2025. ASNR will be attentive to ensuring that the nuclear safety and radiation exposure risks are duly taken into account when it is implemented.

# 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. The site is situated about fifteen kilometres from the Channel Islands.**

## THE ORANO RECYCLAGE REPROCESSING PLANTS IN OPERATION AT LA HAGUE

The La Hague plants for reprocessing fuel assemblies irradiated in the nuclear reactors are operated by Orano Recyclage 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 (t/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 t/year. The limits and conditions for discharges and water intake by the site are defined by ASN resolutions 2022-DC-0724 and 2022-DC-0725 of 16 June 2022.

### 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 then stored in pools to cool them down. They are then sheared and dissolved in nitric acid to separate the pieces 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 stable solid compound ($U_3O_8$) in the TU5 facility on the Tricastin site. The uranium resulting from this process is called "reprocessed uranium".

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

### The effluents and waste produced by the operation of the plants

The fission products and other transuranic elements resulting from reprocessing are concentrated, vitrified and packaged in Standard vitrified waste packages (CSD-V). The pieces of 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

## 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 à 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**: Storage pools for 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**: Package reception and servicing facility;

**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.

from the French reactors is, depending on its composition, either sent to the Aube repository (CSA) or stored on the Orano Recyclage La Hague site until a definitive disposal solution is found (particularly the CSD-V and CSD-C packages).

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", 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 usually 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).

## FINAL SHUTDOWN AND DECOMMISSIONING OPERATIONS ON CERTAIN FACILITIES

**The former spent fuel reprocessing plant 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).**

Orano submitted two partial decommissioning authorisation requests for BNIs 33 and 38 in April 2018. The schedule push-backs requested by the licensee lead to decommissioning completion deadlines in 2046 and 2043 instead of 2035, the previous deadline prescribed for the two BNIs. Further to Orano's additions to the file concerning firstly the elimination of the interactions between the MAPu facility and the plutonium BST1 facility 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. At the end of the inquiry, the inquiry commission issued a favourable opinion. ASN issued an opinion on the draft decrees in July 2022. Decrees 2022-1480 and 2022-1481 dated 28 November 2022 were published in the *Official Journal* of 29 November 2022.

ASN notes that the schedule push-backs requested are significant and largely due to the delays in legacy Waste Retrieval and Packaging (WRP). Consequently, ASNR will continue to monitor the management of these projects in 2025.

## LEGACY WASTE RETRIEVAL AND PACKAGING OPERATIONS

**Unlike the direct on-line packaging of the waste generated by the new UP2-800 and UP3-A plants at La Hague, most of the waste generated by the first UP2-400 plant was stored in bulk without permanent packaging. The operations to retrieve this waste are 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 facilities.**

### Retrieval and packaging of the STE2 sludges

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

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

ASN authorised the first phase of the work to retrieve the sludges from STE2 in 2015. The Creation Authorisation Decree for STE3 was modified by the Decree of 29 January 2016 to allow the installation of the STE2 sludges treatment process.

At the end of 2017 however, Orano informed ASN that the process chosen for treating the sludges in STE3 could lead to difficulties in equipment operation and maintenance. Orano proposed an alternative scenario using centrifugation and in August 2019 it submitted a Safety Options Dossier (DOS), which is however based on as yet 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.

In 2022, during the technical discussions held between Orano, ASN and IRSN, Orano committed itself to a new roadmap for this project. Orano has thus abandoned the centrifugation scenario and undertaken to conduct new studies in parallel aiming firstly to look into the sludge treatment and packaging solutions in more detail, and secondly to put in place an intermediate storage facility (new silos) under suitably safe conditions, enabling the retrieval and safe storage of these sludges to be separated from their final packaging. Orano sent ASN the DOS associated with this project to create new sludge storage silos (project called "NABUCO") in December 2023. It is currently being examined by ASNR.

### Silo 130

**Silo 130 is a reinforced concrete underground storage facility, with a 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". Furthermore, the civil engineering structure of silo 130 is weakened by ageing and by the fire that occurred in 1981. The water is therefore in direct contact with the waste and can contribute to corrosion of the carbon steel liner.**

One of the major risks for this facility concerns the dispersion of radioactive substances into the environment by infiltration of contaminated water into the water table. The leak-tightness of silo 130 is monitored by a network of piezometers situated nearby. 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 fire and explosion risks.

The WRP scenario comprises four steps:
- 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 has built a retrieval unit above the pit containing the waste and a new building dedicated to the storing and packaging operations.

The licensee validated industrial commissioning of the waste recovery process in 2022, further to the tests carried out in 2020 and 2021. About fifty drums of waste were retrieved in 2023, and the retrieval work in 2024 brought this figure to 200 drums of waste: about a third of the total quantity of waste of phase 1 has thus been retrieved since the operations began in 2020. The increase in the retrieval rate in 2024 is mainly due to the setting up of a maintenance team dedicated to silo 130 and the change, as of November 2023, to teams working three 8-hour shifts a day instead of the initial two 8-hour shifts.

ASN considers that these measures are positive, but the various technical problems observed on the equipment in 2024 confirm the need for Orano to improve the reliability of the waste retrieval facilities.

## HAO silo and Organised Storage of Hulls (SOC)

The Oxide High Activity facility (HAO – BNI 80) ensured the first steps of the spent nuclear fuel reprocessing process: reception, storage, then shearing and dissolution. The dissolution solutions produced in BNI 80 were then transferred to the UP2-400 industrial plant in which the subsequent reprocessing operations took place.

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

In 2024, the licensee continued the operations prior to retrieval of the waste from the HAO silo and the implementation of the physical modifications defined on completion of the analysis of hard spots identified during the functional tests of the waste retrieval system. Through ASN resolution 2024-DC-0784 of 3 September 2024, the licensee was authorised to commission the unit for retrieving and packaging the waste from the HAO silo and the SOC pools in ECE drums. However, the licensee encountered several technical difficulties during the tests and suffered delays in delivery of some of the retrieval equipment, leading it to announce that the project schedule was pushed back by two years. In this context, Orano determined the technical, organisational and human causes, then defined and implemented measures to mitigate the consequences. To this end, ASN notes the plan for tightened monitoring of the supplier in question in order to better control the supply times, even if risks of further delays in equipment delivery subsist.

## Assessment of the Orano site

ASN considers that the performance of the Orano Recyclage La Hague site in 2024 is satisfactory in the areas of nuclear safety, radiation protection and environmental protection.

With regard to nuclear safety, ASN finds the command of the internal baseline requirements and of operational management to be satisfactory. ASN also takes positive note of the tracking of the operational management teams' skills and staff numbers. However, in the context of the organisational changes linked to the "Convergence" project, the level of serenity in the centralised control room must be improved, notably by eliminating the untimely alarms, by improving the digital shift log functionalities and by limiting external demands. Greater rigour is also still expected in the tracking of periodic inspections.

Alongside this, ASN views favourably the ongoing deployment of an organisational setup aiming to enhance the efficiency of facility maintenance operations. Nevertheless, across-site action must be taken to identify the spare parts for safety-important equipment concerned by a risk of technological obsolescence.

ASN underlines the generally good organisation of outside contractor monitoring. However, the monitoring of maintenance operations must be reinforced. Orano must also ensure that it monitors its contractors' subcontractors sufficiently closely. Lastly, ASN confirms the need to improve the rigour with which the monitoring reports are filled out (reference of the monitoring actions, consistency between what is expected and the final results, etc.).

With regard to fire risk management, ASN takes positive note of the personnel's responsiveness during unannounced exercises, and the proficiency of the operational management teams and the site's emergency response department in fulfilling the tasks incumbent on them. However, improvements are required in the management of fire detection system disabling operations and in the integration of new fire-risk control equipment in the maintenance management system. Across-site action is also required to identify and then correct or justify the deviations from the reference standards relative to the maintenance and periodic inspections of equipment involved in controlling the fire risk.

In the area of radiation protection, ASN has a positive judgement of the functioning of the site's centre of competence. However, a large number of deviations in radiation protection subsist, and shortcomings pertaining to the contract for tracking the radiation protection-related devices are identified. ASN takes note of the specific action plans initiated to address these issues and more broadly remains attentive to the ongoing modernisation and transformation of the radiation protection professions. Regarding radioactive source management, ASN notes the progress made in the replacement of expired/disused sources, even though it must be continued in 2025. Furthermore, the steps to remove expired/disused sources must be reinforced in 2025.

With regard to environmental protection in 2024, no major deviation was noted concerning compliance with discharge limits, control of effluents or monitoring of the environment. ASN does however consider that take-up of the measures to control non-radiological risks on the site must be improved. In particular, the inspections on this theme showed differences between the safety barriers stipulated by the hazards assessment and practices actually implemented. These findings are supported by the occurrence of a leak in a nitric acid tank in an outdoor reagent storage yard, which must give rise to in-depth analysis on the scale of the site. ASN also notes recurrent deviations involving control of refrigerants and fluorinated greenhouse gases and considers that Orano must improve the measures taken to prevent and detect the associated emissions and reduce them to as low a level as possible.

Concerning the hydraulic structure of the Moulinets Dam, an ASN resolution of 19 June 2024 gives Orano formal notice to make this structure fully compliant before the end of 2025, and to this end it sets intermediate deadlines. ASN considers that Orano met the deadlines for 2024.

Alongside this, ASN considers that the operations to complete the projects concerning the setting up of the new fission products concentration units (NCPF) went satisfactorily, which enabled the NCPF project associated with the R2 unit to be commissioned in June 2024. ASN does however note that modifications incorporated into the project at a late stage led to difficulties at the end of the commissioning review.

ASN observes that the organisation for the off-site and on-site transport of radioactive substances and for the maintenance of the packagings used on the La Hague site remains satisfactory. New on-site transport routes integrating new accident prevention measures were put in place in 2024 to take into account the new tightened protection area, and feedback on its implementation is expected, particularly regarding the impact of the infrastructure on the transport systems. Orano also continued putting in place the improvements to the Mobile Material Evacuation Enclosure (EMEM) transport system. ASN nevertheless finds it regrettable that the licensee has difficulty in carrying out its improvements within the prescribed deadlines.

With regard to the progress of the decommissioning and WRP projects, the work continued in 2024 under suitably safe conditions on the whole.

ASN nevertheless again observes that several decommissioning and legacy WRP projects continue to encounter problems leading to further delays. With regard to decommissioning, Orano must continue its efforts to address the issues that impact the operations schedule.

With regard to silo 130, which is the furthest advanced project and in the industrial operation phase, the rate of waste retrieval has increased following the organisational changes implemented by Orano at the end of 2023 (transition to teams working three 8-hour shifts instead of two 8-hour shifts, setting up of a maintenance team dedicated to the task, etc.). However, numerous unforeseeable events affecting the waste retrieval equipment where again encountered in 2024, leading to several periods of work stoppage. Consequently, ASN considers that Orano must improve equipment reliability and continue to integrate the lessons learned from silo 130 into the other legacy waste retrieval projects.

As concerns the project for retrieval of waste from the HAO silo, in 2024 Orano confirmed the two-year push-back in the project schedule, particularly due to the lateness in delivery of certain retrieval equipment items. In this context, Orano determined the technical, organisational and human causes, then defined and implemented measures to mitigate the consequences. Among these measures, ASN notes the plan for tightened monitoring of the supplier in question in order to better control the supply times, even if risks of further delays in equipment delivery subsist.

With regard to silo 115, ASN takes positive note of the work completed in 2024 to make the structural framework secure. ASN however also notes the delays in the detailed design study and the waste retrieval schedule, delays which remain to be quantified given the change in the retrieval technique that will be used.

Concerning the HAPF unit, some of its evaporators were used to manage the effluents from the plants in service until the end of 2024. The licensee asked ASN for authorisation to continue using these evaporators in the decommissioning of the facilities, but the need to better substantiate the ability of these devices to function for prolonged periods in complete safety prolonged the examination of this file. ASNR will be attentive to the defining of alternative solutions that allow the decommissioning operations to continue, whatever the decision concerning prolongation of the use of the evaporators.

Lastly, ASN notes that Orano has taken measures to ensure broadly satisfactory management of the interfaces between the facilities and units in operation and the decommissioning and WRP projects on the La Hague site.

# Nouvelle-Aquitaine

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

**135** inspections

**9** significant events rated level 1 or higher

In 2024, ASN carried out 135 inspections in the Nouvelle-Aquitaine region, comprising 63 in the Blayais and Civaux Nuclear Power Plants (NPPs), 62 in small-scale nuclear facilities, five in the area of radioactive substance transport and five concerning ASN-approved organisations and laboratories.

ASN also carried out 17 days of labour inspection at the Blayais NPP and 12 days at the Civaux NPP.

During 2024, eight significant event rated level 1 on the International Nuclear and Radiological Event Scale (INES) were notified by the NPP licensees in the Nouvelle-Aquitaine region. In small-scale nuclear activities, one significant radiation protection event rated level 2 on the ASN-SFRO scale was notified to ASN.

ASN filed a report with the Public Prosecutor pursuant to Article 40 of the Penal Procedure Code concerning occupational safety.

## BLAYAIS NUCLEAR POWER PLANT

The Blayais NPP situated in the Gironde *département*, 50 km north of Bordeaux, is operated by EDF and comprises four Pressurised Water Reactors (PWRs) with a power of 900 Megawatts electric (MWe), commissioned in 1981 and 1982. Reactors 1 and 2 constitute Basic Nuclear Installation (BNI) 86 and reactors 3 and 4 BNI 110.

ASN again considers that the performance of the Blayais NPP with regard to nuclear safety is below ASN's general assessment of EDF plant performance. The radiation protection and environmental performance is in line with ASN's general assessment of the EDF plants.

With regard to nuclear safety, in 2024 the Blayais NPP did not manage to stop the deterioration in performance observed since 2022. In the area of reactor operational management, ASN considers the licensee's performance to be far below average, as evidenced by the number and nature of the notified significant events. With regard to fire risk control, ASN notes a lack of results on the ground, despite the deployment of a plan of rigour. Lastly, with respect to maintenance, where a strong response from the licensee was expected, ASN observed that the site still has difficulties in activity preparation and management, and in the monitoring of maintenance operations. ASN expects results following the action plans initiated in 2023 and 2024 to significantly raise the level of performance, and it will conduct an in-depth inspection in June 2025 to make a detailed assessment of the situation.

With regard to occupational radiation protection, ASN considers that the performance has slightly declined compared with 2023, when it was judged to be improving. ASN underlines the licensee's continued commitment in this area, but observes that its efforts are undermined by

### The installations and activities to regulate comprise:

- **Basic Nuclear Installations:**
  - the Blayais NPP (4 reactors of 900 MWe),
  - the Civaux NPP (2 reactors of 1,450 MWe);
- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 19 external-beam radiotherapy departments,
  - 6 brachytherapy departments,
  - 23 nuclear medicine departments,
  - 97 centres practising fluoroscopy-guided interventional procedures,
  - 135 computed tomography scanners,
  - some 6,000 medical and dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - about 960 industrial and research centres, including 60 companies with an industrial radiography activity,
  - 1 cyclotron particle accelerator,
  - 45 laboratories situated mainly in the universities of the region,
  - some 450 veterinary surgeries or clinics practising diagnostic radiology;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved laboratories and organisations:**
  - 1 organisation approved for radiation protection controls,
  - 12 organisations approved for measuring radon,
  - 9 laboratories approved for taking environmental radioactivity measurements.

chronic difficulties some workers have in complying with the radiation protection fundamentals.

With regard to environmental protection, ASN underlines the licensee's efforts in this area over the last few years, for example in waste management, and the way it fully resolved the event declared in late 2023 regarding the deterioration of a retention structure in the demineralisation station. The site nevertheless reported several events revealing malfunctions, particularly concerning gaseous or liquid discharges. In addition, following the tightened inspection in 2024, ASN is waiting for elements to substantiate the liquid containment capacities.

With regard to labour inspection, ASN notes that the results concerning worker safety continue to deteriorate. ASN has asked the licensee to remedy the risk of machines colliding with pedestrians and the risks of falling from height. Accident situations involving the use of machine tools occurred in 2024. ASN also considers that the risk assessments must be improved and underlines that, despite the efforts made, there are still too many accidental exposures to asbestos fibres during maintenance work.

Lastly, ASNR will be vigilant in ensuring that installations maintain long-term compliance with the Labour Code requirements.

## CIVAUX NUCLEAR POWER PLANT

**The Civaux NPP operated by EDF in the Vienne *département*, 30 km south of Poitiers in the Nouvelle-Aquitaine region, comprises two 1,450 MWe PWRs commissioned in 1997 and 1999. 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 performance of the Civaux NPP in 2024 with regard to nuclear safety, radiation protection and environmental protection is in line with its general assessment of EDF plant performance.

In the area of nuclear safety, ASN considers that performance improved in 2024, particularly in the operational management of the facilities and in maintenance. Command of the shutdowns and restarting of the two reactors has improved in particular. The safety management improvement measures that brought this progress are to be continued. There is still room for progress in the documentation used, in preparation and assimilation of the various activities, particularly in the area of maintenance, and in the rigour with which they are carried out. The skills of workers in certain specialities also constitute a point requiring close attention. Lastly, ASN took positive note of the satisfactory management of a simulated emergency situation during a national emergency exercise.

In the area of radiation protection, ASN observed an improvement in performance on the particularly sensitive worksites during reactor shutdowns. The site has drawn lessons from the contamination dispersion event that occurred in the reactor building in 2023 during the reactor 2 outage. ASN has nevertheless detected shortcomings outside outage periods, showing that the radiation protection culture among workers and the monitoring by EDF can still be improved.

ASN conducted a tightened inspection focusing on environmental protection in 2024. Even though the prospects are encouraging, with the start of the work to create a fire-extinguishing water containment basin, ASN considers that the current containment of liquid effluents is not sufficiently controlled: more effective verification of the performance level of the isolating material is expected. No major deviation has been observed in the management of liquid effluents during normal operation or in the preservation of the water resource used for the site's needs.

With regard to labour inspection, ASN notes positively the depth of the analyses carried out following near-accidents. However, regarding occupational safety, shortcomings have been observed in the exhaustiveness of the risk analyses. ASN also expects the licensee to mobilise its resources to restore the regulatory conformity of the site's roadways, heavy cranes, and areas presenting an explosion risk.

# Occitanie

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.

**115** inspections

**8** significant events rated level 1 or higher

In 2024, ASN carried out 115 inspections in the Occitanie region, comprising 53 in the Basic Nuclear Installations (BNIs), 53 in small-scale nuclear facilities, five in the area of Radioactive Substance Transport (TSR) and four concerning ASN-approved organisations and laboratories.

ASN also carried out 12 days of labour inspection at the Golfech Nuclear Power Plant (NPP).

During 2024, four significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES) were notified by the NPP licensees of the nuclear installations in the Occitanie region, and one in the industrial sector. In small-scale nuclear activities, one significant radiation protection event rated level 4 on the ASN-SFRO scale and two events rated level 2 on the ASN-SFRO scale were notified to ASN.

Lastly, in the context of their oversight duties, the ASN inspectors issued one violation report.

## GOLFECH NUCLEAR POWER PLANT

The Golfech NPP operated by EDF is located in the Tarn-et-Garonne *département*, 40 km west of Montauban. It comprises two Pressurised Water Reactors (PWRs), each of 1,300 Megawatts electric (MWe), commissioned in 1990 and 1993. Reactors 1 and 2 constitute BNIs 135 and 142 respectively.

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

In the area of nuclear safety, ASN considers that the level of performance is now satisfactory, in an industrial context where the workload is nevertheless lower than in the previous years. During 2024, reactor 2 was shut down several times to save fuel and reactor 1 shut down following the detection of a leak on a secondary system equipment item. ASN takes a positive view of the management of the transient operating conditions associated with these situations. Weaknesses were nevertheless noted in system configuring and control of the documentation. Furthermore, ASN's inspections revealed shortcomings in control of the internal explosion risk and management of emergency resources. With regard to maintenance, several technical incidents involving automatic systems occurred, three of which led to reactor trips. Lastly, the changes in the reactor outage scheduling led to several activity postponements, which caused a few omissions in the planning of periodic inspections.

ASN thus considers that the licensee must consolidate its efforts in 2025 and confirm the stability of the site's nuclear safety performance in the context of the scheduled outages of the two reactors.

The radiation protection situation is considered satisfactory. The number of significant events remained low and ASN underlines that the workers take the radiation protection rules duly into account. Particular vigilance must however

### The installations and activities to regulate comprise:

- **Basic Nuclear Installations:**
  - the Golfech NPP (2 reactors of 1,300 MWe),
  - the CEA Marcoule research centre, which includes the civil BNIs Atalante and Phénix and the Diadem waste storage facility construction site,
  - the Melox "MOX " nuclear fuel production plant,
  - the Centraco facility for processing low-level radioactive waste,
  - the Gammatec industrial irradiator,
  - the Écrin waste storage facility on the Malvési site;
- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 14 external-beam radiotherapy departments,
  - 6 brachytherapy departments,
  - 20 nuclear medicine departments,
  - 91 centres practising fluoroscopy-guided interventional procedures,
  - 121 computed tomography scanners,
  - some 5,000 medical and dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - about 800 industrial and research centres, including 4 cyclotron particle accelerators, 29 companies exercising an industrial radiography activity and 60 laboratories situated mainly in the universities of the region,
  - some 600 veterinary surgeries or clinics practising diagnostic radiology;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved laboratories and organisations:**
  - 6 laboratories approved for taking environmental radioactivity measurements,
  - 7 organisations approved for measuring radon,
  - 2 organisations approved for radiation protection controls.

be maintained regarding road contamination and proper completion of the prior exposure evaluations.

With regard to environmental protection, ASN conducted a tightened inspection on the site which revealed improvements in this area, and more specifically in control of the risk of hazardous substance run-off into the environment. Nevertheless, the site is not yet completely up to the required standards, particularly in the management of effluent discharges into the stormwater tank.

With regard to labour inspection, the results concerning occupational safety are stable compared with 2023. However an accident occurred during the use of a machine tool. ASN has asked the licensee to remedy the risk situations observed in traffic movements and the risk of collisions between pedestrians and machines. Efforts must still be made to ensure better control of work situations involving a risk of falling from height. ASN also considers that the relevance of the risk analyses must be improved. Lastly, the Authority for Nuclear Safety and Radiation Protection (ASNR) will be vigilant regarding in ensuring that installations maintain long-term compliance with the Labour Code requirements.

# – 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 back-end of the "fuel cycle" and the irradiation of materials, and to industrial activities concerning in particular the fabrication of MOX (Mixed OXides) fuel, the processing of radioactive waste and the irradiation of materials. The majority of the site moreover consists of the Defence Basic Nuclear Installation (DBNI) under the oversight of the Ministry responsible for 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 facilities and laboratories for transuranium elements analysis and reprocessing studies (Atalante – BNI 148), created in the 1980's, is to conduct research and development in the recycling of nuclear fuels, the management of ultimate waste, and the exploration of new concepts for fourth generation nuclear systems. In order to extend these research activities, activities and equipment from the Laboratory for research and fabrication of advanced nuclear fuels (Lefca – BNI 123), were transferred here from the CEA Cadarache centre in 2017.**

ASN published resolution 2022-DC-0720 of 19 April 2022 imposing on the Alternative Energies and Atomic Energy Commission (CEA) the requirements applicable to Atalante and designed to regulate the continued operation of the BNI. This resolution more specifically sets the deadline of 31 December 2035 for treating the Radioactive Organic Liquid Waste (ROLW) stored in the facility. Pending removal of this waste, CEA must take measures to ensure that the ROLW storage drums do not corrode and that it has sampling capabilities in order to monitor the physical-chemical quality of the ROLW. In that same resolution, ASN prescribes the implementation of a system for detecting and automatically cutting off the BNI's water and electricity supplies in the event of an earthquake. The commissioning of this system was authorised in 2023. The deadline for effective commissioning of the system, set by the ASN prescription, was amended by resolution 2024-DC-0785 of 11 September 2024, pushing it back from end of December 2024 to end of August 2027. ASNR remains attentive to the tracking of the ongoing actions.

CEA submitted the Safety review guidance file (DOR) for its next periodic safety review, for which the concluding report is expected in December 2026.

Two significant events linked to prevention of the criticality risk and rated level 1 on the INES scale were notified by CEA in 2024. These events concerned a lack of preparation during fissile material transfers within the Atalante laboratories. CEA examined the causes of these events, which were essentially linked to human and organisational factors, and defined an action plan to correct the observed deviations in the short term and, in the longer term, to improve the prevention of criticality risks. These elements have been communicated to the other CEA BNIs concerned by criticality risks. ASNR will remain attentive to the licensee's implementation of the long-term measures of its action plan, aiming to reinforce the prevention of criticality risks.

ASN considers that the level of nuclear safety of Atalante is only relatively satisfactory, on account of the significant events relating to prevention of the criticality risk. However, the measures taken to monitor outside contractors and to track deviations and periodic inspections and tests are satisfactory on the whole. With regard to nuclear waste management in the facility, ASN expects the licensee to take measures to improve compliance with the waste storage time limits, which are defined in the Atalante baseline safety requirements.

## 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 sets the CEA various milestones and decommissioning operations.

Removal of the irradiated fuel and equipment continued in 2024.

However, the reference decommissioning scenario for the facility, set by the Decommissioning Decree of June 2016, is currently being redefined by the licensee. This new definition mainly concerns the phasing of the decommissioning operations to favour treatment of the sodium, in accordance with the decommissioning strategy for all the CEA facilities. CEA plans to file a request to modify the Decommissioning Decree of BNI 71, with the aim of integrating this new reference scenario.

Construction of the NOAH facility, for which the commissioning application was filed in 2022 and which will ensure part of the treatment of sodium from Phénix and other CEA facilities, made progress in 2024. The operating tests prior to commissioning, which CEA plans for 2028, continued.

The facility continues to report deviations concerning compliance with certain physical-chemical parameters of the aqueous discharges. The licensee plans taking lasting measures to guarantee compliance with the physical-chemical limits of aqueous discharges in 2025.

The 2022 periodic safety review report for BNI 71 is currently being examined by ASNR.

ASN considers that the level of nuclear safety and radiation protection in the Phénix plant is broadly satisfactory. The recurrent actions concerning the periodic inspections and tests and the monitoring of activities performed by outside contractors are broadly satisfactory. The licensee must nevertheless make sure that it meets its commitments within the deadlines it has set.

## 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 (LLW), or low- and intermediate-level short-lived waste (LL/ILW-SL) whose characteristics – especially the dose rate – mean they cannot be accepted as-is by the existing disposal facilities.

One inspection was carried out in 2024 focusing primarily on the methodology and performance of the fall qualification tests of the future storage containers.

ASN considers that the CEA's efforts to fulfil its responsibilities as nuclear licensee have enabled it to take over project management, but further improvements are required in the identification of the actions and expectations of the Protection-Important Activities (PIAs), and in the qualification of the equipment items and the technical control of the PIAs. Moreover, the control and verification criteria for the specified requirements need to be more clearly defined.

ASN points out that this facility is destined to play a key role in the CEA's overall decommissioning and waste management strategy, insofar as it is the only facility planned for the interim storage of "intermediate-level long-lived" (ILW-LL) waste packages and LL/ILW-SL waste.

### Assessment of the CEA Marcoule centre

ASN noted during its inspections in 2024 that the organisation and measures put in place by the licensee to guarantee control of the risks associated with external hazards are broadly satisfactory. The organisational setup for managing emergency situations can be improved. Improvements are required in the defining of emergency management functions and the associated requirements, the tracking of documentation and equipment, and the formalising and tracking of the actions decided upon on the basis of feedback from the exercises.

ASN considers that the Marcoule centre has taken ownership of the policy for the protection of CEA's interests by adapting and applying it to its local particularities. Improvements are required in the allocation of resources, the prioritising of actions, and complying with the indicators of its action plan. Improvements are also required in the assessment of the measures to correct deviations.

In the area of TSR, ASN considers that packaging maintenance is carried out correctly.

In 2020, the CEA submitted its study on the sanitary and environmental evaluation of the liquid and gaseous chemical discharges from the Marcoule platform. Through resolution CODEP-MRS-2023-013061 of 9 March 2023, ASN has required CEA, in association with the other licensees of the Marcoule platform installations, to have an independent organisation perform a third-party assessment focusing on CEA's methodology for evaluating the impact on health and the environmental caused by the liquid and gaseous discharges from all the nuclear activities on the Marcoule site. CEA presented the results of this assessment in November 2024 and they will be examined by ASNR.

The technical-economic study of the measures to avoid or reduce the discharge of potentially polluted stormwater and its impact on the environment was submitted to ASN in late 2020. The licensee finalised deployment of the measures adopted following the study in 2022. ASN expects the licensee to give it feedback concerning their effectiveness.

ASN authorised updating of the On-site Emergency Plan (PUI) of the CEA Marcoule centre in December 2024. As the PUI is common to the BNIs and to the individual facilities of the DBNI, its implementation is also subject to the approval of the Defence Nuclear Safety Authority (ASND).

With regard to the conformity of the emergency management building – Centralised Surveillance of Marcoule (SCM) – the examination focuses on the substantiating elements provided by CEA to demonstrate compliance with the safety requirements defined for the "hardened safety core" equipment in ASN resolution 2015-DC-0481 of 8 January 2015. ASNR shall be expecting to receive additional information.

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

The request to modify the Creation Authorisation Decree, concerning the change of package closing technology and the increase in the facility commissioning time frame, is currently being examined, as is the facility commissioning authorisation application.

ASN considers that CEA must continue its efforts in the management of the worksite and the work remaining to be done to allow the much-awaited commissioning of this key facility.

## MELOX PLANT

**Created in 1990 and operated by Orano Recyclage, 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 is broadly satisfactory in the areas of pressure equipment, external hazards, safety management, maintenance, waste, design and constructions, and fraud. An inspection on the follow-ups to the periodic safety review, for which the concluding report was submitted in September 2021, found that the safety review action plan is implemented satisfactorily and it is well tracked.

The effectiveness of the containment barriers is maintained at a satisfactory level. Breaks in containment, which can occur under normal operating conditions, are subject to specific monitoring and measures to limit them, such as using specific reinforced gloves.

In the last few years the licensee has had difficulties in producing the planned quantities of fuel conforming to the safety specifications of the nuclear reactors. This situation has led to the production of a large quantity of manufacturing rejects, which are sent to the La Hague site for interim storage, resulting in a risk in the short term of reaching the maximum capacity of the plant's plutonium-bearing material storage areas. The entire "fuel cycle" and French nuclear power generation could be destabilised by these problems. Making up for several years of degraded operation of the facility moreover induces substantial maintenance requirements in the Melox plant. The numerous maintenance activities have consequences in terms of radiation protection, with a growing reliance on outside contractors and a very high collective dosimetry.

To overcome the production difficulties, the licensee qualified a new uranium oxide powder in 2022 which has, since 2023, enabled the quantity of rejects generated to be reduced. This improvement must be maintained and confirmed over the longer term. This new powder, produced by a new supplier – the Orano site of Malvési (*see chapter 12 of the full ASN Report*) – is currently being qualified.

Several other actions are implemented to ensure that the improvement in the plant's productivity and the radiation protection of its workers lasts over the long term. First, the licensee is deploying a project called "GOMOX" which includes, among other things, the doubling of certain key elements of the plant production line. The secondary dosing station installation work was thus authorised by resolution CODEP-MRS-2024-040128 of 26 July 2024. The licensee also cleans out the glove boxes regularly and very thoroughly to reduce the ambient dose levels. Lastly, it is deploying a major maintenance programme ("PPRM" project) which aims to restore the production equipment availability rates. This programme continued in 2024. The maintenance teams were reinforced by Orano personnel in 2024.

## CENTRACO PLANT

**The Centraco plant (BNI 160), was created in 1996 and is operated by Cyclife France, a 100% subsidiary of EDF. The Centraco plant sorts, decontaminates, reuses, treats and packages - particularly by reducing their volume - waste and effluents with low and very low levels of radioactivity. The waste resulting from its process is then routed to the Aube repository (CSA) of the National Radioactive Waste Management Agency (Andra). The facility comprises:**
**• a melting unit, melting a maximum of 3,500 tonnes (t) of metallic waste per year;**
**• an incineration unit, in which the incinerable waste is burned, with a maximum of 3,000 t of solid waste and 2,000 t of liquid waste per year;**
**• and storage areas.**

ASN considers that the nuclear safety of the facility in 2024 is broadly satisfactory, particularly regarding the management of deviations observed in inspections. This general assessment of the licensee's organisation must however be nuanced by the consecutive notifications of three significant events relating to the preparation of maintenance operations. In effect, major shortcomings in the preparation of these operations were discovered during the reactive inspection conducted by ASN. A new organisation to enhance the reliability of safety-related maintenance operations was to be set up by the end of 2024. Furthermore, a situational exercise leading to deployment of the emergency command post ran satisfactorily.

The facility's periodic safety review concluding report was submitted on 18 February 2021 in accordance with ASN resolution 2014-DC-0446 of 17 July 2014. This file is still being examined. An inspection on the theme of meeting commitments found that tracking of commitments made further to the periodic safety review can be improved.

Moreover, ASNR is finalising the revision of the facility's discharge authorisations to take into account, when justified, the European Industrial Emissions Directive (IED) with regard to industrial emissions from incineration plants in order to attain a high level of environmental protection through the prevention and reduction of pollution.

## GAMMATEC IRRADIATOR

The Gammatec irradiator (BNI 170) is an industrial irradiator operated by the company Steris 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 high-activity cobalt-60 which provide the radiation necessary for the facility's activity.

In October 2024 the licensee provided additional information for the periodic safety review concluding report submitted at the end of December 2023. This file is currently being examined by ASNR.

In addition, the level of nuclear safety and radiation protection remains broadly satisfactory in 2024, particularly on the themes of deviation management and the monitoring of outside contractors.

## ÉCRIN FACILITY

The Écrin facility (BNI 175) is situated in the municipality of Narbonne in the Aude *département*, within the Malvési site operated by Orano, which represents the first step of the "fuel cycle" (excluding extraction of the ores). The transformation process produces liquid effluents containing nitrated sludge loaded with natural uranium. The Écrin BNI consist of two storage basins (B1 and B2) containing the legacy sludge from the plant. These two basins have BNI classification due to the presence of artificial radioisotopes. The entire plant is subject to the system governing Seveso high-threshold Installations Classified for Protection of the Environment (ICPEs).

The Écrin facility was commissioned by ASN resolution 2018-DC-0645 of 12 October 2018. The works defined in the Decree of 20 July 2015, which began in 2019, were completed in 2023 with the finalising of installation of the bituminous cover over the zone of the PERLE cell (PERLE is a French acronym standing for "Project for Reversible Lagoon Storage in the Écrin BNI"), excavated to the south of storage basin B2. The final containment provisions for the storage of waste within the BNI are now in place.

An unannounced inspection held in October 2024 focused in particular on the handling of deviations, the performance of periodic inspections and tests and the monitoring of outside contractors.

Along with this, ASN finalised its examination of the report submitted on 12 February 2021 in application of Article 7 of the Decree of 20 July 2015, describing the state of progress of the studies and investigations to assess the feasibility of the disposal options for the waste currently stored in Écrin. It has made requests that are to be taken into account in the report to be submitted in 2025.

ASN has also examined the periodic safety DOR, for which the concluding report must be submitted no later than 20 July 2025.

ASN considers that the level of nuclear safety and environmental protection of the facility remains satisfactory in view of the risks the facility presents. ASN now expects the licensee to make a firm commitment and efforts to assimilate the regulatory requirements specific to BNIs, notably to improve the implementation and traceability of the technical verification of the activities performed, and the management of deviations.

# Pays de la Loire

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.

**56**
inspections

In 2024, ASN carried out 56 inspections, comprising three in the facilities of the company Ionisos in the municipalities of Pouzauges and Sablé-sur-Sarthe (two on the theme of nuclear safety and one on radioactive substance transport), three concerning approved organisations in radon measurements and 50 in small-scale nuclear activities (20 in the medical sector, 29 in the industrial, research or veterinary sectors, and one in the area of natural radioactivity – radon).

No significant event was rated level 1 or higher on the International Nuclear and Radiological Event Scale (INES).

## IONISOS IRRADIATOR

**The company Ionisos operates two industrial ionisation installations on the sites of Pouzauges (Vendée *département*) and Sablé-sur-Sarthe (Sarthe *département*) respectively, which use high-activity cobalt-60 sealed radioactive sources. These installations constitute Basic Nuclear Installations (BNIs) 146 and 154 respectively.**

The gamma radiation emitted is used for sterilisation purposes or to 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 products for the pharmaceutical and cosmetic industries, packing films) for a pre-determined length of time.

Each installation comprises a pool for underwater storage of the radioactive sources, surmounted by a bunker in which the ionisation operations are performed, premises for storing the products before and after treatment, and offices and technical rooms.

ASN considers that the level of nuclear safety of operation of the Pouzauges and Sablé-sur-Sarthe irradiators is stable compared with the preceding year. Consequently, in 2024 the licensee renewed and reorganised the teams responsible for safety following several concomitant personnel departures in 2023 which had weakened its organisation. The new organisation is now in place and in September 2024 the licensee submitted to ASN an action plan to ensure the facility's conformity with the BNI regulations. In 2025, the Authority for Nuclear Safety and Radiation Protection (ASNR) will be attentive to the fulfilling and completion of the various commitments made by the licensee, who must prioritise them appropriately and apply requirements compatible with the safety risks of the facilities.

The licensee submitted two noteworthy modification applications for the Pouzauges site in 2024: one to prolong the use of the sources beyond ten years, the other to modify the pool's demineralised water make-up tank.

**The installations and activities to regulate comprise:**

- **Basic Nuclear Installations:**
  - the Ionisos irradiator in Pouzauges,
  - the Ionisos irradiator in Sablé-sur-Sarthe;
- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 7 external-beam radiotherapy departments,
  - 2 brachytherapy units,
  - 12 nuclear medicine departments,
  - 37 centres practising fluoroscopy-guided interventional procedures,
  - 56 computed tomography scanners,
  - some 2,500 medical and dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - 1 cyclotron,
  - 25 industrial radiography companies, including 7 performing gamma radiography,
  - 16 research units,
  - about 400 users of industrial, veterinary and research devices;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved laboratories and organisations:**
  - 6 organisations approved for measuring radon,
  - 1 head-office of a laboratory approved for environmental radioactivity measurements.

A noteworthy modification application was also submitted for the Sablé-sur-Sarthe site to prolong the use of the radioactive sources. Lastly, a modification of the safety baseline requirements was approved in May 2024.

# Provence-Alpes-Côte d'Azur

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.

**127** inspections

**5** significant events rated level 1 or higher

In 2024, ASN carried out 127 inspections in the Provence-Alpes-Côte d'Azur region, comprising 60 in the Basic Nuclear Installations (BNIs), 60 in small-scale nuclear facilities, five in the area of Radioactive Substance Transport (TSR) and two concerning ASN-approved organisations and laboratories.

During 2024, two significant events rated level 1 on the International Nuclear and Radiological Event Scale (INES) were notified by the nuclear installation licensees.

In small-scale nuclear activities, two significant radiation protection events rated level 1 on the INES scale were reported to ASN, one in the industrial sector and one in the medical sector. One significant event in the area of TSR rated level 1 on the INES scale was notified to ASN.

## 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. A large part of the centre's facilities are moreover involved in conducting the strategy for decommissioning and management of radioactive materials and waste of the Alternative Energies and Atomic Energy Commission (CEA).

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 Plutonium technology facility (ATPu – BNI 32);
- the Solid Waste Treatment Station (STD – BNI 37-A);
- the Active Effluent Treatment Station (STE – BNI 37-B);
- the Masurca research reactor (BNI 39);
- the Éole / Minerve research reactor (BNI 42-U);
- 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 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 (JHR – BNI 172), under construction.

**The installations and activities to regulate comprise:**

- **Basic Nuclear Installations:**
  - the CEA Cadarache research centre which counts 20 civil BNIs, including the Jules Horowitz Reactor (JHR) currently under construction,
  - the ITER installation construction site, adjacent to the CEA Cadarache centre,
  - the Gammaster industrial irradiator;
- **small-scale nuclear activities in the medical sector:** Chapter 7
  - 13 external-beam radiotherapy departments,
  - 3 brachytherapy departments,
  - 16 nuclear medicine departments,
  - 86 centres practising fluoroscopy-guided interventional procedures,
  - 96 computed tomography scanners,
  - some 8,200 medical and dental radiology devices;
- **small-scale nuclear activities in the industrial, veterinary and research sectors:** Chapter 8
  - about 400 industrial and research centres, including 3 cyclotron particle accelerators and 11 companies with an industrial radiography activity,
  - some 600 veterinary surgeries or clinics practising diagnostic radiology;
- **activities associated with the transport of radioactive substances;** Chapter 9
- **ASN-approved laboratories and organisations:**
  - 3 laboratories approved for taking environmental radioactivity measurements,
  - 3 organisations approved for measuring radon,
  - 2 organisations approved for radiation protection controls.

The CEA Cadarache centre operates numerous installations which vary in their nature and their safety implications. At the Cadarache centre, ten installations are in final shutdown status, nine are in operation and one is under construction. ASN has started or is continuing the examination of the Periodic Safety Review Guidance Files (DOR) or the concluding reports for 15 of the 20 installations: Pégase and Cascad, Cabri, Rapsodie, STE, Masurca, ATUe, MCMF, LECA, the storage area, Phébus, Lefca, Chicade, Cedra, Magenta and Agate, and has issued its conclusions on the periodic safety review of Cascad, ATPu, LPC and STAR. 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

**BNI 22 comprises two separate facilities, Pégase and Cascad:**
**• the Pégase reactor entered service on the Cadarache site in 1964 and was operated for about ten years. 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;**
**• 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 Decree of 4 September 1989 obliges CEA to apply to ASN every ten years for authorisation to prolong the dry storage of irradiated fuel in Cascad. Based on the conclusions of the last periodic safety reviews of the facility and the oversight actions conducted by ASN over the last few years, ASN has authorised, through resolution CODEP-DRC-2024-014408 of 6 June 2024, the prolongation of storage for a further period of ten years.

The examination of the Pégase facility decommissioning file continued in 2024 with the analysis of the complementary elements received from the licensee and the opinion of the environmental authority. Concerning the removal of radioactive substances from the facility, which is necessary for its decommissioning, ASN notes that the licensee adheres to the schedule set by ASN Chairman's resolution CODEP-CLG-2017-006524 of 10 February 2017 for the removal from storage of Pégase's araldite-encapsulated fuels, called the "DECAP" project, a French acronym standing for "removal from storage of Pégase's araldite-encapsulated fuels".

ASN considers that the level of nuclear safety and radiation protection is broadly satisfactory as regards the measures taken to prevent external hazards, the management of effluents and the monitoring of the facility's discharges. The implementation of the actions identified during the last periodic safety reviews is also consistent with the information on action plan progress transmitted to ASN.

In 2025, the Authority for Nuclear Safety and Radiation Protection (ASNR) shall remain attentive to the treatment of the cans containing fuel in the DECAP process, to their on-site transportation to Cascad, and to compliance with the associated requirements.

## 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, a test programme called "CIP" (Cabri International Program) is in progress in the facility; this programme began in the early 2000's and necessitated substantial modification and safety upgrading work on the facility.**

The CIP test programme and the electronic component irradiation tests continued in 2024 with the performance of one test.

ASN's examination of the periodic safety review reports, for which the concluding report was submitted in 2017, continued in 2024, and ASN transmitted its conclusions to the licensee in November 2024. The requirements are essentially linked to control of the seismic and fire risks, but also to the ageing of the facility.

ASN considers that the level of nuclear safety and radiation protection is broadly satisfactory, particularly regarding the tracking of commitments made to ASN, equally well in the context of the periodic safety review as in the tracking of corrective actions implemented further to the inspections.

The licensee must be more rigorous in the performance of periodic inspections and tests and the analysis of their results. Lastly, the licensee must put in place a management strategy along with a projected schedule for retrieval of the sodium-containing waste and the contaminated sodium still present in the BNI.

Furthermore, ASNR is awaiting information from the CEA on the long-term continuation of the reactor's activities beyond the ongoing test programme. CEA has thus started a process to guarantee resources with the specific skills necessary to operate the Cabri reactor. This continued operation is notably conditional upon the repair of a reactor deficiency due to the presence of corrosion on the canal containing the hodoscope.

## Rapsodie research reactor – CEA CENTRE

**The Rapsodie reactor (BNI 25) is the first sodium-cooled Fast-Neutron Reactor (FNR) 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.**

**The fuel has been unloaded from the core and evacuated from the facility. Furthermore, a large part of the radioactive fluids and 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 Decommissioning Decree was signed on 9 April 2021. This Decree sets the perimeter of the facility and regulates, until 2030, the operations for treating the sodium from the reactor through to introducing air into the vessel containing it. An authorisation application file will be submitted to ASNR for the reactor vessel washing operation. The decommissioning operations, such as decommissioning of the reactor block and of the civil engineering structures, shall be covered by an update of the decommissioning file.

The decommissioning work involving the characterising, repackaging and removal of waste packages continued in 2024. In order to be able to start the operations to treat the secondary sodium from the Raspodie Reactor, baptised "Recure Na", CEA has submitted an authorisation request to ASN in application of Article R. 593-70 of the Environment Code. CEA has nevertheless announced changes in the scenario of this operation, which would imply extending its duration by more than 20 years. CEA will therefore be unable to meet the deadline of 2030 for completion of these operations as prescribed in the Decree. The licensee must submit a request to modify this Decree, which will be examined by ASNR.

Operation "Pétole", which consists in placing in final shutdown status and removing the equipment involved in the dynamic containment of the cleaned-out hot cells, continued. The work should be completed in 2025.

The licensee submitted its DOR at the end of December 2022. Further to the examination of this file, ASN asked the licensee to take certain additional points into account in the periodic safety review report, whose submission is planned for 2025.

ASN considers that the level of nuclear safety and radiation protection of this facility in 2024 is broadly satisfactory with regard to the monitoring of the condition of the systems, equipment and buildings, external hazards and the management of fire loads, themes that were inspected in 2024.

## Solid Waste Treatment Station

**– CEA CENTRE**

**BNI 37 of CEA Cadarache historically comprised the Active Effluents Treatment Station (STE) and the Waste Treatment Station (STD), grouped into a single installation. As the CEA wishes to ensure continued operation of the STD and proceed with the final shutdown of the STE, BNI 37 was divided into two BNIs: 37-A (STD) and 37-B (STE) by ASN resolutions CODEP-DRC-2015-027232 and CODEP-DRC-2015-027225 of 9 July 2015. These records were made further to the Orders of 9 June 2015 defining the perimeters of these two BNIs.**

**At present, the STD is 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.**

In early 2024, several renovation operations were carried out in the facility as planned under the "Pagode" project, with duplication of the equipment for measuring discharges at an outlet, and the installation of minipiles. Continued operation of the STD is conditional upon full accomplishment of the Pagode project work.

However, a significant event was notified in 2024 concerning the discovery of civil engineering defects in the structure of the buildings. The discovery of these defects resulted in the stoppage of operation of the facility and of the renovation work. In particular, the treatment of intermediate-level waste (ILW) and the compacting of low-level waste (LLW) and ILW are suspended. The activities of waste package reception, measurements, cement injection and shipments of LLW waste which are not impacted by the discovered defects are continuing, within the limit of the available storage areas. Restarting the suspended activities is conditional upon conducting additional studies to assess the resistance of the facility's civil engineering structures. The results of these studies are expected in the first quarter of 2025. The elements examined in the first investigations on the concrete structures do not, at this stage, enable a conclusion to be reached regarding the facility's resistance in an accident situation. In view of the significance of the civil engineering defects, ASN rated this event level 1 on the INES scale.

The end-of-works deadline for the Pagode project, set at 30 June 2028, should thus be called into question in view of the investigations and compensatory measures to implement.

The inspections ASN conducted in July and October 2024 show that the situation appears to be broadly under control. However, further information is required, more specifically concerning the implementation of the compensatory measures decided upon, the safety analysis carried out further to this significant event and the consolidated schedule for planned resumption of operating activities.

In view of the facility's degraded mode of operation necessary for management of the civil engineering defects, and a reassessment of the safety case, ASN considers that it is vital to restore the level of safety and radiation protection of the facility. The other themes inspected in 2024 concerning equipment qualification, meeting commitments and fire protection, are broadly satisfactory.

## Active Effluents Treatment Station

**– CEA CENTRE**

**The Active Effluents Treatment Station (STE – BNI 37-B) has been shut down since 1 January 2014. The CEA submitted the decommissioning file for this facility in December 2021.**

Examination of the facility decommissioning file continued in 2024. The public consultations required by the regulations should be held in 2025 on the basis of a file integrating ASN's demands resulting from its examination of the file's admissibility. The complementary information requests concern the licensee's financial capacity, skills management, the decommissioning plan, the impact study and the safety case.

As part of the Decommissioning Preparation Operations (DECPROs), the licensee is continuing the removal of waste and preparing the worksite for repairing the basemats of building 322.

ASN resolution CODEP-DRC-2024-024338 of 9 October 2024 sets the applicable requirements in view of the conclusions of the periodic safety review of 2017. CEA has thus renovated the domes of the tanks in building 322, commissioned a new system for measuring atmospheric discharges and is preparing the new fire control panel installation worksite.

This resolution also requires the transmission in 2025 of a management plan with time frames for remediating the soils of a field named "La Grande Bastide", containing radiologically contaminated land, and eliminating any source of contamination of the neighbouring stormwater network as quickly as possible. The facility has effectively suffered several stormwater contaminations since 2013, resulting in the presence of artificial radionuclides outside the identified contaminated zones. This has resulted in several significant event notifications to ASN. A stormwater management action plan was implemented to ensure containment of the materials. Nevertheless, in view of the conclusions of the assessment of the effectiveness of this stormwater management action plan, monitoring must be continued and additional measures will have to be taken in 2025, relating to the "Grande Bastide" field management plan.

ASN considers that the level of nuclear safety and radiation protection of BNI 37-B on the inspected themes of ventilation, deviation management and fire protection in 2024 is broadly 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 PWRs using MOX (Mixed OXides) 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.**

ASN finalised its examination of the periodic safety review reports of the two facilities in 2024. It considers that the licensee's analysis of conformity with the regulatory and technical requirements, and re-assessment of control of the risks and drawbacks are satisfactory. The additional information provided by CEA in 2024 concerning the modification of the decommissioning files of the two BNIs was also found to be satisfactory.

ASN's inspections during 2024 focused primarily on the management of the complex decommissioning operations, particularly in the former Waste Treatment Unit (ATD) of the LPC, and the management of the waste resulting from these operations. ASN considers that on these themes, the level of nuclear safety and radiation protection of the facility is broadly satisfactory.

However, one significant event rated level 1 on the INES scale was notified by CEA in 2024 after a rod of non-inventoried fissile material was discovered in the ATPu facility. The presence of fissile material in this location constitutes a deviation from the General Operating Rules (RGEs). Additional information is to be provided concerning performance of the emptiness check in all the rooms of the facility. ASNR will also maintain its vigilance regarding the operations to remove the dispersible inventory remaining in the facility in 2025.

## 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 and in the interim has carried out decommissioning preparation work, such as removal of asbestos from the premises, rehabilitation of buildings, dismantling of nuclear buildings and removal of conventional equipment. The decommissioning file is currently being examined. The public inquiry was held in the first quarter 2024 and the file received a favourable opinion. Removal of the items containing sodium should begin in 2025.

The periodic safety review concluding report for the facility is expected in 2025.

ASN considers that the level of nuclear safety and radiation protection concerning waste management, the organisation and management of emergency resources, and the management of risks arising from hazardous substance risks, all of which were inspected in 2024, is broadly satisfactory.

## Éole and Minerve research reactors

**– CEA CENTRE**

**The experimental reactors Éole and Minerve are very-low-power (less than one kilowatt) critical mock-ups that were used for neutron studies, in particular to evaluate the absorption of gamma rays or neutrons by materials.**

The Éole reactor (BNI 42), whose construction was authorised by a Decree of 23 June 1965, was intended primarily for neutron studies of moderated arrays, in particular those of PWRs and Boiling Water Reactors (BWRs). 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. Decree 2023-1176 of 12 December 2023 brought together the two BNIs 42 and 95 in a single BNI (BNI 42-U) called "Éole / Minerve", and prescribed the decommissioning operations for this facility.

Through resolution CODEP-DRC-2024-049444 of 24 September 2024, ASN approved the decommissioning RGEs transmitted by the licensee further to the issuing of the facilities' Decommissioning Decree 2023-1176 of 12 December 2023. These operating rules integrate both the conclusions of the decommissioning file and the conclusions of the examination of the last periodic safety review. This resolution marks a milestone in the life cycle of these two reactors: pursuant to IV of Article R. 593-69 of the Environment Code, the Decree takes effect on the date ASN approved the RGEs update. It thus enables BNIs 42 and 95 to be brought together in a single BNI (BNI 42-U).

ASN considers that the level of nuclear safety and radiation protection of BNI 42-U is broadly satisfactory. The nuclear material conditioning and removal operations carried out before starting certain decommissioning operations are traced rigorously. These operations continued in 2024 in accordance with the schedule set by the licensee. Progress is also observed in the removal of waste and materials with no disposal route.

ASNR nevertheless remains attentive to the performance of the DECPROs that were not completed before the decommissioning decree came into effect. This concerns in particular the progress of the characterisation and conditioning of the last nuclear materials and the removal of disused sources.

## The Enriched Uranium Processing Facilities – CEA CENTRE

From 1963 to 1995, the Enriched Uranium Processing Facilities (ATUe – BNI 52) converted uranium hexafluoride ($UF_6$) from the Cadarache 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 Decrees in February 2006 and 2021, accompanied by ASN requirements describing the conditions of performance of the future decommissioning operations dated 14 October 2021.

The activities in the facility in 2024 were essentially routine maintenance and periodic and regulatory inspection operations. CEA is currently drafting specifications to contractualise restarting of the decommissioning operations, which is planned for 2028.

ASN considers that the level of safety of BNI 52 (ATUe) in 2024 is broadly satisfactory.

The actions further to the periodic safety review of 2017 have been completed except for the roof leak proofing work, scheduled for completion by the end of 2025. CEA submitted the guidance file for the next periodic safety review in 2024. This file is currently being examined by ASNR.

## Central Fissile Material Warehouse

– CEA CENTRE

Created in 1968, the Central Fissile Material Warehouse (MCMF – BNI 53) was a warehouse for storing enriched uranium and plutonium until its final shutdown and removal of all its nuclear materials on 31 December 2017. Its decommissioning degree was issued on 22 March 2024. It sets 31 December 2034 as the end-of-decommissioning deadline.

ASN considers that the DECPROs continued satisfactorily in 2024. The first phase of commissioning of the simplified ventilation to adapt it to the emptiness of the facility has been completed.

The licensee submitted its periodic safety review report to ASN at the end of December 2024

## High-Activity Laboratory LECA-STAR – CEA CENTRE

BNI 55 combines the Active Fuel Examination Laboratory (LECA) and its extension, the Treatment, Clean-out and Reconditioning Station (STAR). These two units constitute the CEA's expert assessment tools for analysing irradiated 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 improve its earthquake resistance.

The periodic safety review concluding report for LECA was submitted in July 2024. In the light of the ongoing examination of this report, ASNR will ask CEA for further information concerning the conformity review it conducted, the reassessment of the control of risks and drawbacks and the associated action plan.

The removal from storage of fissile materials that are not associated with any research programme is continuing in accordance with the schedule set by ASN further to the last periodic safety review.

In 2024, CEA notified one significant event relating to a nonconformity with respect to the welding data packages and the associated design calculation notes, in certain anti-seismic reinforcements in LECA's civil engineering structure incorporated during the 2004-2007 renovation. CEA has implemented an action plan to restore the conformity of the impacted structures and update the associated baseline requirements. CEA must also reassess the adequacy of the internal checks and the provisions for monitoring the activities of outside contractors.

In addition, two significant events occurred in 2024 in LECA, involving two cases of detachment, at the exit of the storage well of LECA's cell 1, of overpacks used for the transfer of ILW-LL radioactive waste. These events had no consequences on nuclear safety or radiation protection. ASNR is waiting for CEA to analyse the lessons learned from these events for the benefit of the other BNIs and propose measures to prevent their recurrence.

Commissioned in 1999, the STAR facility is an extension of the LECA laboratory, designed for the stabilisation and reconditioning of spent fuel.

On completion of the examination of the STAR safety review report submitted in 2018, ASN considered that the analysis of conformity with the regulatory and technical requirements and the reassessment of control of the risks and drawbacks justify continued operation of the facility for the next ten years. CEA must more specifically examine the safety measures to take in the event of an earthquake to avoid an accident induced by electrical problems.

A significant event in June 2024 involving the loss of two of STAR's inverters which led to the ventilation, the radiation protection-related monitoring and the monitoring of the stack discharges being unavailable, is the subject of complementary investigations by CEA. ASNR will the attentive to the follow-ups to this event and to its potentially generic nature.

ASN considers that in 2024 the level of nuclear safety and radiation protection of the LECA-STAR facility is broadly satisfactory, particularly concerning the measures taken by the licensee to ensure static and dynamic containment, the monitoring of outside contractors and the management of nuclear waste. Tracking of the actions further to LECA's periodic safety review is satisfactory, but tracking of the radiological inventory in accordance with the permanent requirements of the resolution of 10 July 2020 needs to be improved. ASNR will also continue to pay close attention to the safety of handling operations in the shielded cells.

## 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 waste from the operation or decommissioning of CEA facilities. BNI 56 is one of the priorities identified by the CEA in its new decommissioning and waste management strategy.**

Examination of the facility decommissioning file continued in 2024. The public consultations required by the regulations started at the end of 2024 and will continue until mid-2025. The licensee has also submitted its strategy for retrieval of waste from the trenches, in accordance with its commitment.

The Waste Retrieval and Packaging (WRP) operations in the BNI continued in 2024. CEA has completed the transfer of all the stainless steel packages of intermediate-level waste from pit 6 to BNI 164 (Cedra); these packages were the subject of a "major safety commitment" (*grand engagement de sûreté* – GES). ASNR will remain attentive in 2025 to the repackaging and removal of the waste resulting from the retrieval of packages whose content was not blocked in a cement matrix.

The inspections carried out by ASN in 2024 focused primarily on management of the waste produced by the facility, the methods of protection against external hazards, radiation protection and the conformity of the facility with its baseline requirements, which were updated further to the last periodic safety review. ASN considers that the organisational setup put in place by the licensee enables a broadly satisfactory level of nuclear safety and radiation protection to be achieved on these themes. It nevertheless remains attentive to the radiological cleanliness of the BNIs's stormwaters and to the progress of the work necessary for the next repackaging operations.

Prior to the next periodic safety review of the facility, CEA submitted a DOR to ASN in 2024 presenting the methodology, the scope of the verifications and studies, and the conditions governing performance of the conformity review and the safety reassessment.

## 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.**

Decree 2024-256 requiring CEA to proceed with the Phébus decommissioning operations was published on 22 March 2024. CEA plans starting the decommissioning operations at the end of the five year surveillance phase following publication of this Decommissioning Decree. The licensee has submitted the safety analysis report and the decommissioning RGEs which were authorised by ASN in August 2024. The periodic safety review file submitted in 2018 is currently being examined by ASNR.

The facility has been empty of all radioactive material since December 2021, in accordance with the priority objectives of the DECPROs. The start-up neutron source is stored in the reactor building pool pending the identification of a disposal route.

ASN conducted an inspection of Phébus in 2024 and considers that the level of nuclear safety and radiation protection of the facility is broadly satisfactory.

## Laboratory for research and experimental fabrication of advanced nuclear fuels – CEA CENTRE

**Commissioned in 1983, the Laboratory for research and experimental fabrication of advanced nuclear fuels (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, Lefca finalised the transfer of part of its research and development equipment to the Atalante laboratories (BNI 148) at Marcoule.**

Now Lefca has only one activity, the characterisation and conditioning of liquid and solid wastes. After having considered shutting down the facility definitively, CEA has been planning – since the end of 2021 – to keep the facility operational and use it for the repackaging and storage of nuclear materials. This new activity will require the facility's authorisation decree to be modified.

The licensee submitted its safety review concluding report in December 2023. It is currently being examined by ASNR and presents the prospect of continued operation of the facility.

ASN estimates that the level of nuclear safety and radiation protection of the facility in 2024 is broadly satisfactory as far as occupational radiation protection and waste management – the two themes inspected – are concerned.

## 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.

CEA had difficulty in 2024 in obtaining concrete of adequate quality to produce the waste packages in the unit for packaging disused sealed sources in packages baptised "870L Vrac Source", a packaging unit authorised by an ASN resolution in 2023. Five packages were packaged in 2024.

Examination of the request to modify the facility's Creation Authorisation Decree (DAC) continued in 2024. This request aims more specifically to change the perimeter of the facility in order to integrate the gravity drainage well, along with outside storage areas and, concerning environmental protection, permit gaseous discharges of radioactive effluents.

ASN considers that the level of nuclear safety and radiation protection is broadly satisfactory. The licensee must nevertheless be vigilant and inform ASNR of the slippage in the prescribed deadlines for the implementation of certain actions identified further to the conclusions of its last periodic safety review.

## Cedra storage facility – CEA CENTRE

Since 2006, the Cedra facility (BNI 164) is used to store ILW-LL waste pending the creation of appropriate disposal routes. The CEA forecasts that this facility will be filled to capacity by 2030. The studies concerning a project to double the storage capacity began in 2020.

CEA presented a first facility extension project to ASN in late 2024 (phase 3) which will be the subject of a noteworthy modification request in order to push back the date by which the storage areas are filled to capacity, today estimated to be approximately 2032.

Complements to the periodic safety review concluding report were submitted to ASN in the course of 2024. The expert assessment of this report has been started and will continue in 2025.

ASN considers that the level of nuclear safety and radiation protection in the facility is broadly satisfactory.

ASN considers that the tracking of the licensee's commitments further to the inspections is satisfactory. Nevertheless, improvements are still required in the monitoring of the work performed in the facilities by outside contractors, particularly as regards the traceability of monitoring, and building on lessons learned from past events, which can be better integrated in the monitoring plans.

## Magenta storage warehouse – CEA CENTRE

The Magenta facility (BNI 169), which replaces the MCMF currently being decommissioned, has been dedicated since 2011 to the storage of non-irradiated fissile material and the non-destructive characterisation of the nuclear materials received.

In 2024, CEA submitted the modification authorisation applications to extend the scope of operation of the facility and in particular the type of material received. These applications have been examined and authorised by ASN.

ASN continued the examination of the periodic safety review concluding report submitted in 2021.

ASN considers that the level of nuclear safety and radiation protection of the facility is broadly satisfactory, particularly on the inspected themes of management of the fire risk and risks of counterfeits, falsifications and suspicions of fraud.

## Advanced effluent management and treatment 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.

In 2024, CEA submitted a new request to modify the facility's DAC, to allow the treatment of new types of radioactive effluents and to have new outlets for treating the concentrates produced, as ASN deemed inadmissible the first request made in 2023. This request is currently being examined by ASNR. CEA also submitted the concluding report of its first periodic safety review to ASN on 25 April 2024.

ASN considers that the level of nuclear safety and radiation protection of the facility is satisfactory. The licensee must nevertheless consolidate and improve the traceability of outside contractor monitoring.

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 (JHR – BNI 172), under construction since 2009, is a pressurised-water research reactor designed to study the behaviour of materials under irradiation and of power reactor fuels. It will also allow the production of artificial radionuclides for nuclear medicine. Its power is limited to 100 MWth.

The year 2024 saw the continuation of the construction and equipment manufacturing activities of many workpackages of the JHR worksite, notably in the reactor building with the launching of the primary heat exchanger repairs, and in the nuclear auxiliary building with the finalisation of the storage pools and the channels, and the work on the hot cell equipment.

ASN conducted four inspections in 2024. The verifications focused in particular on the primary system, including the treatment of deviations on the three primary/secondary heat exchangers, components of the reactor pile block, including the "core inlet" natural convection valve and the reflectors and the control rod drive mechanisms of the core, as well as the chemically-sealed anchorings. The repair of the reactor pool liner also underwent inspections, as did the qualification process for various items of equipment involved in the facility's safety functions, the centralised instrumentation and control system and the fire protection of the electric cable raceways.

The thematic examinations of the facility's safety analysis report revision submitted in 2021, taking account of the modifications made since the start of construction, continued in 2024 in preparation for the future commissioning. The examination of the request to modify DAC 2009-1219 of 12 October 2009 to extend the commissioning date to 14 October 2037 at the latest, taking into account margins for the project, continued in 2024.

ASN considers the project organisation to be broadly satisfactory from the nuclear safety aspect, particularly in the handling of the deviations on the primary heat exchangers and the development of tools to ensure the application and traceability of the defined requirements. The project must ensure that the qualification process for protection important components is carried out conclusively for all the defined requirements. The formalising and application of certain processes must also be improved. Lastly, continued vigilance is required regarding the priority to be granted to the protection of interests, and to the constant efforts to improve the measures taken to protect these interests.

## ITER

**The International Thermonuclear Experimental Reactor (ITER – BNI 174), under construction on the Cadarache site since 2010 and adjacent to the CEA facilities, will be a fusion experimental reactor used for the scientific and technical demonstration of the control of thermonuclear fusion energy obtained by magnetic confinement of a deuterium-tritium plasma during long-duration experiments with a significant power level (500 MW developed for 400 seconds). This international project enjoys financial support from China, South Korea, the United States, India, Japan, Russia and 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.**

ITER Organization (IO) presented a new baseline for the project in 2024 further to the revision initiated in 2022. This new roadmap provides for operation in several phases corresponding to the main sequences of the experimental programme, and contains modifications in some of the facility's design choices, notably the replacement of beryllium by tungsten as the liner material for the first wall of the vacuum chamber.

This new roadmap moreover takes account of the difficulties the licensee has identified in providing a conclusive safety case covering the entire lifetime of the project, and proposes the principle of producing a staged safety case, following the successive phases of commissioning and operation. The reason for this is that the safety case for certain operating phases requires the acquisition of certain information and data that will not be available until the preceding phases have been completed. ASN has taken note of this approach which seems appropriate for the exploratory nature of the ITER project, such as is provided for by its authorisation decree. ASN points out that this approach presents a potential industrial risk for the project should the technical choices made and the knowledge acquired at a given stage finally not enable the licensee to demonstrate control of the nuclear safety and radiation protection risks for the subsequent steps.

ASN observes however that the elements provided in 2024 do not yet make it possible to establish an overall view of the decided changes and their impact on the different project components. This concerns, for example, components that have already been examined but for which some of the hypotheses are being modified. The first revisions of the schedule, integrating more specifically the assessment of the impact of the Covid-19 pandemic, the repair times for the sectors and thermal shields, and the projected modifications to the machine, were submitted in 2024. These elements must still be consolidated with respect to the project's new commissioning strategy and the defining of the technical files to be examined at each stage of the reference scenario. ASNR will be attentive to the assessment of the impact of these modifications on the nuclear safety and radiation protection risks, and to the technical requirements of the amended resolution of 12 November 2013 regulating the design and construction of the facility.

ASNR is thus waiting for conclusive elements to redefine the scheduling of its examinations and to adopt a position regarding the acceptability of the impact of the intended modifications. IO should submit a new application for authorisation to lift the hold point concerning assembly of the vacuum chamber in 2026.

Work on the site and equipment manufacturing continued in 2024, notably with the repair of the first sectors of the tokamak to correct the dimensioning differences and to resolve the problem of stress corrosion affecting the heat shield cooling systems. The quality of manufacture of the tokamak is of major importance for safety because of its role in radioactive substance containment, which must be ensured for all the phases of operation planned for in the reference scenario of the facility.

In 2024, ASN continued the technical examination of the new authorisation application for water intakes and discharges of non–radioactive effluents for the facility construction phase submitted in 2023.

Five inspections were carried out on the site in 2024, focusing in particular on the design and construction and the monitoring of outside contractors. These inspections included checks of the repair of the vacuum chamber sectors, the facility's fuel supply systems and the equipment of the Vacuum Vessel Pressure Suppression System (VVPSS).

### Assessment of the Cadarache site

ASN considers that the level of nuclear safety of the CEA Cadarache centre in 2024 remains broadly satisfactory.

With regard to meeting commitments, ASN observes – as in the preceding years – that some deadlines tend to get pushed back. This concerns in particular the action plans established after the periodic safety reviews of the facilities, and certain decommissioning operations.

A large proportion of the activities important for the protection of interests are subcontracted, as much in preventive verification and maintenance operations as in waste management operations. These activities are identified, listed and monitored applying a proportionate approach. ASN noted that it was still necessary to standardise the monitoring programmes to a greater extent, and to update them to better integrate the lessons learned from preceding years. Moreover, ASN underlines the progress in the review of the maintenance process sheets, which must be continued.

Concerning the safety baseline requirements, CEA is continuing its harmonisation between the various BNIs of the centre, particularly as regards management of the fire risk and the periodic inspections and tests, after recasting the radiation protection, waste and transport chapters.

Along with this, the facilities of the centre are making progress in prevention of the impacts associated with external hazards, thanks in particular to the actions taken further to the periodic safety reviews. These actions aim essentially at bringing the facilities back into conformity with respect to the seismic, lightning and flooding risks. However, improvements are still required in the analysis of risks associated with extreme temperatures, particularly the taking into account of intense heatwave episodes, the frequency and intensity of which are increasing.

ASN considers that improvements are still required in environmental protection. Some projects are going more slowly than planned, notably the work to improve the representativeness of the radiological measurements and monitoring of the water tables in the risk-prone areas. Although efforts have been made in the last few years to restore the conformity of the piezometric structures on the perimeter of the BNIs, ASN's inspections this year again found nonconforming structures. The updating of the impact studies must also progress further in the integration of the various projects being conducted simultaneously on the site. Nevertheless, the progress made in several areas merits being underlined, such as bringing the Chemical Analysis Laboratory (LCE) into compliance with standard NF EN ISO 17025, and the updating of the alarm thresholds for gaseous discharge monitoring.

The decommissioning and waste management strategy deployed by CEA remains a subject on which ASN is extremely vigilant. This vigilance concerns in particular the prioritizing of the different projects, and above all its sensitivity to unexpected events affecting the availability of key facilities involved in the various waste management routes, and the availability of transport packagings. The civil engineering defects that appeared on BNI 37-A and led to the LLW and ILW waste drum production stoppage, expose this waste route to storage capacity problems to which the licensee must propose solutions. CEA also receives regular requests concerning the retrieval of the waste currently classified as "waste with no immediate disposal route", with the aim of limiting the volumes stocked in the facilities.

With regard to the new projects, in parallel with the ongoing examination of the new construction time frames for the JHR, CEA informed ASN in late 2024 of persistent difficulties with the construction of the new emergency centre baptised "CIRCE", a French acronym standing for "Response centre resistant to extreme conditions". CEA must thus present to ASNR the causes of this situation, the possible compensatory measures, and new robust and substantiated milestones, for which the existing requirements will have to be modified.

A joint inspection with ASND on the theme of radioactive substance transport confirmed compliance with the reception procedure, in accordance with the packaging utilisation manuals.

Lastly, ASN conducted an unannounced inspection in 2024 to test the CEA Cadarache centre's emergency organisation. ASN considers that the organisation in place is broadly satisfactory. Several areas for progress were identified for the centre, more specifically in the overall management of maintaining the main emergency centre in operational condition, in the formalising and traceability of the actions, information and request resulting from activation of an On-site Emergency Plan (PUI) at the centre, and in the inventorying of the material and human resources that can be involved in the missions of the Nuclear Rapid Intervention Force (FARN).

The inspections also checked the tests on the cryostat compensation bellows and the rapid discharge units, and the networks of galleries for routing the electric cables necessary for operation of the facility. One inspection was also dedicated to the general organisation and how it took the risk of fraudulent practices into account.

On the basis of its inspections, ASN notes that improvements must still be made in the handling of deviations, particularly in the defining of appropriate corrective actions and the cause analysis. Greater integration of the safety risks and application of the defined requirements are also expected, particularly in the equipment qualification processes, in document traceability, and in the continuation of the work relative to control of the risk of fraudulent practices. ASNR will be attentive to the effects of the organisational changes decided by IO in 2024 with a view to improving interfacing between safety, integration and construction, and to increase the independence of the internal inspection body and the integration of internal reviews and experience feedback.

## GAMMASTER IRRADIATOR

**Since 2008, the company Steris has been operating an industrial irradiator called "Gammaster", situated on the land of 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 high-activity cobalt-60 sealed sources which produce the radiation necessary for the facility' operations.**

ASN considers that the level of nuclear safety and radiation protection in 2024 is broadly satisfactory.

ASN carried out two inspections in 2024, one focusing in particular on the management of modifications and deviations, which found management to be fairly satisfactory, with certain traceability aspects needing to be improved, while the other inspection focused on the transport of sources, which was found to be satisfactory.

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