SAFE DECOMMISSIONING OF BASIC NUCLEAR INSTALLATIONS

CHAPTER 15

The term "decommissioning" generally covers all the technical and administrative activities performed after shutdown of a nuclear installation in order to achieve a predetermined final status. These activities may in particular include equipment disassembly, clean-out of premises and soils, demolition of civil engineering structures, processing, packaging, removal and disposal of radioactive and other waste.

As many nuclear installations were built between the 1950s and the 1980s, a large number of them are being gradually shut down and then decommissioned, particularly over the past fifteen years. In 2010, about thirty nuclear installations of all types (electricity generating or research reactors, laboratories, fuel reprocessing plants, waste treatment facilities, etc.), were shut down or were undergoing decommissioning in France. Ensuring the safety and radiation protection of the decommissioning operations in these installations is a major concern for ASN.

The specific aspects of decommissioning activities (change in the nature of the risks, rapid changes in the installation status, duration of the operations, etc.) make it impossible to implement all the regulatory principles that were applied during the installation operating period. The regulations concerning the decommissioning of nuclear installations have progressively changed since the 1990s. These were clarified and supplemented in 2006 by the TSN Act. ASN continues to develop the regulatory framework and the applicable doctrine for this phase in the life of basic nuclear installations. In 2008, it made public a report presenting its decommissioning strategy for BNIs, based primarily on the choice of the immediate decommissioning strategy and the need to achieve final status after decommissioning in which all hazardous material had been removed. This report was presented to the High Committee for Transparency and Information on Nuclear Security (HCTISN) in 2009 and was officially published in 2010.

1 TECHNICAL AND LEGAL REQUIREMENTS APPLICABLE TO DECOMMISSIONING

1 | 1 Decommissioning strategies

IAEA has defined three strategies for decommissioning nuclear installations following their final shutdown:

– deferred decommissioning: the parts of the installation containing radioactive materials are maintained or placed in a safe state for several decades before actual decommissioning operations begin (the "conventional" parts of the installation can be decommissioned as soon as the installation is shut down);
– safe containment: the parts of the installation containing radioactive materials are placed in a reinforced containment structure for a period that is long enough to reach a radiological activity level sufficiently low to envisage release of the site (the "conventional" parts of the installation can be decommissioned as soon as the installation is shut down);
– immediate decommissioning: decommissioning is started as soon as the installation is shut down, without a waiting period, although the decommissioning operations can extend over a long period of time.

The decision to opt for one decommissioning strategy rather than another is influenced by many factors: national regulations, social and economic factors, financing of the operations, availability of waste disposal routes, decommissioning techniques and qualified personnel, exposure of the personnel and the public to ionising radiation as a result of the decommissioning operations, etc. Consequently, practices and regulations differ from one country to another.

In compliance with IAEA recommendations, French policy today aims to induce French BNI licensees to opt for immediate decommissioning strategies.

This strategy moreover avoids placing the technical and financial burden of decommissioning on future generations. At present, the leading French licensees have all made a commitment to immediate decommissioning of the installations currently concerned by the decommissioning process.

ASN also believes that management of the waste resulting from decommissioning operations is a crucial point that determines the correct running of the ongoing decommissioning programmes (availability of disposal routes, management of waste streams). In this respect, the waste management procedures are systematically assessed as part of the review of the overall decommissioning strategies adopted by each licensee.

Decommissioning operations can therefore only begin if appropriate disposal routes are available for all the waste liable to be created. The example of the decommissioning of EDF's first generation reactors is a good illustration of this problem (see point 2.1.2). With regard to the possible recycling of the waste resulting from decommissioning, ASN is attentive to the application of French waste doctrine, which states that contaminated waste or waste that is liable to have been contaminated in the nuclear sector may not be reused outside this sector. Waste from decommissioning may not therefore be used outside the nuclear sector. However, ASN supports initiatives to recycle this waste in the nuclear sector, and the National Radioactive Material and Waste Management Plan (PNGMDR - see chapter 16) includes a recommendation to this effect.

1 | 2 Legal requirements

The technical provisions applicable to installations to be shut down and decommissioned must comply with general safety

and radiation protection rules, notably regarding worker external and internal exposure to ionising radiation, the criticality risk, the production of radioactive waste, the discharge of effluents to the environment, and measures to reduce the risk of accidents and mitigate their consequences. Issues relating to safety and the protection of persons and the environment can be significant during active clean-out or decommissioning operations, and must never be neglected, including during passive surveillance phases.

Once the licensee has decided to proceed with final shutdown and decommissioning of its installation, it can no longer be covered by the regulations set by the creation authorisation decree nor the safety specifications associated with the operating phase. In accordance with the provisions of the TSN Act, final shutdown followed by decommissioning of a nuclear installation is authorised by a new decree, issued on the advice of ASN (see diagram 1). The final shutdown and decommissioning authorisation procedure for a nuclear installation is described in chapter 3.

In order to avoid fragmentation of the decommissioning projects and improve their overall consistency, the file submitted to support the final shutdown and decommissioning application must explicitly describe all the planned work, from final shutdown to attainment of the target final status and, for each step, must explain the nature and scale of the risks presented by the installation as well as the envisaged means of managing these risks. The decommissioning phase may be preceded by a final shutdown preparation stage, provided for in the initial operating licence. This preparatory phase allows removal of all or part of the source term, as well as preparation for the decommissioning operations (readying of premises, preparation of worksites, training of staff, etc.). It is also during this preparatory phase that installation characterisation operations can be carried out: production of radiological maps, collection of pertinent data (operating history) with a view to decommissioning and so forth.

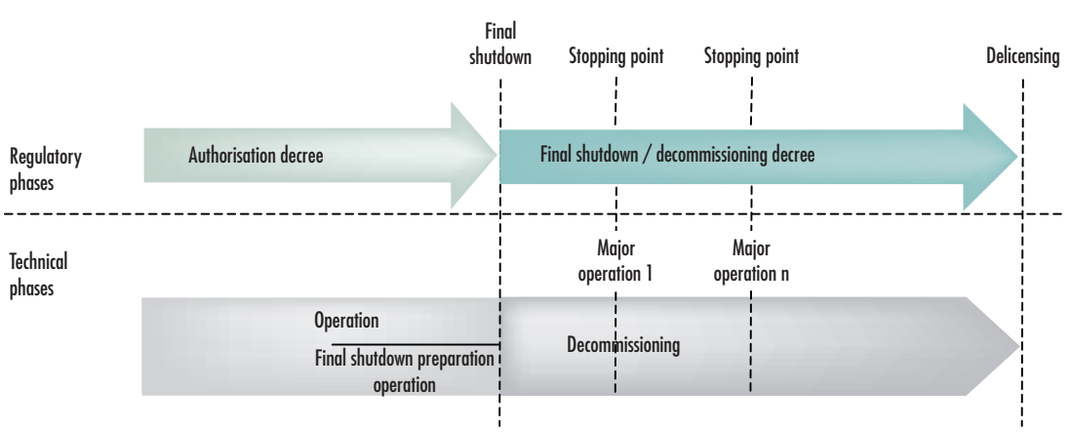
The TSN Act requires that the safety of an installation in the decommissioning phase be periodically reviewed. The frequency of these reviews is normally 10 years. When such safety reviews are performed, ASN's goal is to ensure that the installation's level of safety remains acceptable until it is delicensed. Compensatory measures proportional to the risks presented by the installation during decommissioning will be taken if necessary.

Following decommissioning, a nuclear installation can be delicensed. It is then deleted from the list of BNIs and is no longer attached to the BNI system. To support its delicensing application, the licensee must provide a file demonstrating that the envisaged final status has indeed been reached and describing the state of the site after decommissioning (analysis of the state of the soil and remaining buildings or equipment, etc.). Public protection restrictions may be implemented, depending on the final status reached. These may set a certain number of restrictions on the use of the site and buildings (use limited to industrial applications for example) or precautionary measures (radiological measurements to be taken in the event of excavation, etc.). ASN may make delicensing of a BNI dependent on the implementation of such restrictions.

A 2003 ASN guide specified the regulations for BNI decommissioning operations, following major work designed to clarify and simplify the administrative procedure while at the same time giving greater importance to safety and radiation protection. A fully revised version of this guide, designed to incorporate the regulatory changes brought about by the TSN Act and decree 2007-1557 of 2 November 2007, as well as the work done by the WENRA association, was finalised in 2008 and published at the beginning of 2009.

This guide is intended for nuclear licensees and its main objectives are:
– to explain the regulatory procedure laid down by the decree implementing the TSN Act;
– to clarify what ASN expects with regard to the content of certain items of the final shutdown and decommissioning authorisation application files, particularly the decommissioning plan;
– to explain the technical and regulatory aspects of the various phases of decommissioning (preparation for final shutdown, decommissioning, delicensing).

Diagram 1: phases in the life of a BNI



1|3 The financing of decommissioning and radioactive waste management

1|3|1 Reminder of regulatory provisions

Article 20 of Programme Act 2006-739 of 28 June 2006 on the sustainable management of radioactive materials and waste creates a system for securing the nuclear expenses involved in the decommissioning of nuclear installations and management of radioactive waste. This article is clarified by decree no. 2007-243 of 23 February 2007 and the order of 21 March 2007 concerning the securing of financing of nuclear costs.

The legal system created by these texts aims to secure the financing of nuclear costs, through implementation of the "polluter pays" principle. It is therefore up to the nuclear licensees to take charge of this financing, by setting up a dedicated portfolio of assets capable of meeting the expected costs. This is done under the direct control of the State, which analyses the situation of the licensees and can prescribe measures, should it be seen to be insufficient or inadequate. Whatever the case, the nuclear licensees remain responsible for the satisfactory financing of their long-term expenses.

It stipulates that the licensees must make a conservative assessment of the cost of decommissioning their installations or, for radioactive waste disposal installations, their final closure, maintenance and surveillance costs. They must also evaluate the cost of managing their spent fuels and radioactive waste (I of article 20 of the act of 28 June 2006). They thus submit three-yearly reports and annual update memos.

These costs are divided into five categories (defined in paragraph I of article 2 of the decree of 23 February 2007):
– decommissioning costs, except for long-term management of radioactive waste packages;
– spent fuel management costs, except for long-term management of radioactive waste packages;
– cost of recovering and packaging legacy waste (RCD), except for long-term management of radioactive waste packages;
– cost of long-term management of radioactive waste packages;
– cost of surveillance following disposal facility closure.

These categories are detailed in the list contained in the order of 21 March 2007.

The costs involved must be assessed using a method based on an analysis of the options that could be reasonably envisaged for the operation, on a conservative choice of a reference strategy, on consideration of residual technical uncertainties and performance contingencies, and on consideration of operating experience feedback. These cost assessments, if necessary, comprise a breakdown into variable and fixed costs and, if possible, a method explaining the breakdown of the fixed costs over time. They also, insofar as is possible, comprise an annual schedule of costs, a presentation and justification of the scenarios adopted and methods used and, if necessary, an analysis of the operations carried out, the deviations from the forecasts and consideration of operating experience feedback. The licensees must also give a concise presentation of the assessment of these costs, the extent to which the work in progress is in line with forecast schedule, and the possible impact of work progress on the costs.

On 3 January 2008, an agreement was signed by ASN and the General Directorate for Energy and Climate (DGEC) whereby ASN carries out surveillance of these long-term costs. This agreement defines:
– on the one hand, the conditions in which ASN produces the opinions it is required to issue pursuant to article 12, paragraph 4 of the above-mentioned decree of 23 February 2007, on the consistency of the strategies for decommissioning and management of spent fuels and radioactive waste;
– on the other, the conditions in which the DGEC can call on ASN expertise pursuant to article 15, paragraph 2 of the same decree. It in particular stipulates that, as necessary, and under the same conditions as those governing analysis of the three-yearly reports, the DGEC may call on ASN after receiving the annual update memos.

1|3|2 Review of the reports submitted by the licensees

In 2007, all the nuclear installation licensees had submitted their first three-yearly reports pursuant to the provisions of article 20 of the Act of 28 June 2006. ASN then sent the Government its opinion with regard to the consistency of the strategies for decommissioning and management of spent fuel and radioactive waste, presented by the licensees, in terms of nuclear safety (opinion 2007-AV-037 of 20 November 2007).

In 2008 and 2009, ASN examined the new data forwarded by the licensees in their annual update memos, with regard to:
– technical changes (perimeter, strategy, scenario, unforeseen event, etc.);
– ASN opinion 2007-AV-0037 of 20 November 2007.

The points it reviewed include those on which additional information is required in the annual update memos. Although the licensees have made a significant effort, further actions must still be undertaken. Paragraph II of article 2 of decree no. 2007-243 of 23 February 2007 concerning the securing of financing of nuclear costs requires the licensee to evaluate the costs of BNI decommissioning, based on analysis of the various options that can be reasonably envisaged for the operation and a conservative choice of reference strategy. In the reports submitted for the first exercise (2007), not one licensee put forward technical, radiation protection or economic criteria to demonstrate optimisation of the chosen scenario.

On several occasions in 2010, ASN and DGEC verified the methods used by the licensees to prepare the three-yearly reports and the update memos, and reminded them of the regulatory requirements, particularly with respect to article 2 of the decree. In view of the experience acquired in this first exercise, ASN has started to draft a guide intended for the licensees, to clarify what is expected in application of the regulatory provisions, particularly regarding the description of technical scenarios and the evaluation of the corresponding costs.

The second three-yearly reports submitted by the licensees on account of article 20 of the Act of 28 June 2010 were examined by ASN in 2010. ASN will give its opinion in early 2011.

1 | 4 Decommissioning risks

Diagram 2 presents the main risks associated with the decommissioning of a nuclear installation and the periods during which these risks are highest.

The risks involved in waste management and which concern safety or radiation protection (multiplication of the number of waste storage sites, storage of irradiating waste) are present throughout the phases in which large amounts of waste are produced and therefore in particular during the decommissioning phase.

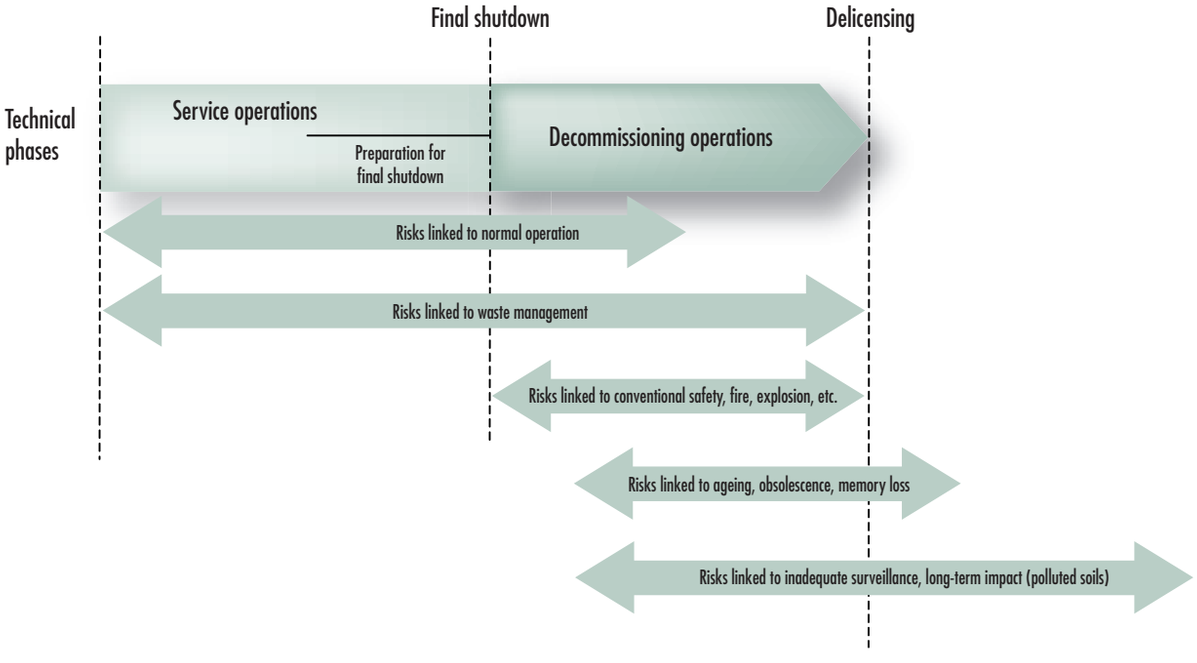
The risks presented by the nuclear installation when in operation change as decommissioning progresses. Even if certain risks, such as criticality, quickly disappear, others, such as those related to radiation protection (gradual removal of containment barriers) or general working safety (numerous contractors working together, falling loads, work at height, and so on) gradually become predominant. The same applies to the risk of fire or explosion ("hot work" technique used in cutting up the structures), as well as, for example, to the risks related to human and organisational factors (organisational changes in relation to the operating phase, frequent reliance on outside contractors).

For complex nuclear installations such as nuclear power plant reactors, decommissioning work often lasts for more than a decade. This follows on from an operating period that often lasts several decades. Consequently, there is a very real risk of loss of the design and operational memory of the nuclear installations. It is therefore vitally important to meticulously gather and record the knowledge of the persons involved in the operating phase, especially since measures to ensure the traceability of the design and operation of old installations are not always implemented. The length of the decommissioning operations also involves taking account of the risks inherent in the obsolescence of certain equipment (electrical or monitoring networks for example). Depending on the stage reached in the operations, risks linked to the potential instability of partially dismantled structures must also be taken into account.

The sometimes rapid changes in the physical condition of the installation and the risks it presents raise the question of ensuring that the means of surveillance used are adequate and appropriate at all times. It is often necessary, either temporarily or permanently, to replace the centralised operational monitoring and surveillance systems with other more appropriate resources, such as "field" radiation monitoring or fire detection devices, located as close as possible to the potential sources of risks. Given these rapid and significant changes in the installation status, it is difficult to permanently check the adequacy of surveillance, and there is a very real risk of failing to detect the onset of a hazardous situation.

Following decommissioning, depending on the end-status achieved and the specific characteristics of each installation (operational history, incidents, etc.), there may be residual risks: soil pollution with a long-term impact, areas for which clean-out is technically impossible, etc. In this case, prior to delicensing of the installation, the licensee must present and justify the envisaged procedures for continued surveillance of the installation or site. Restrictions on the use of the site may also be imposed.

Diagram 2: principal risks encountered during decommissioning



1|5 Complete clean-out

Nuclear installation decommissioning operations lead to the gradual delicensing of the "nuclear waste zones" to "conventional waste zones". When the licensee is able to prove that there are no activation or contamination migration phenomena in all the structures making up a "nuclear waste zone", this zone can then be delicensed on completion of any necessary "conventional" clean-out operations (cleaning of the walls of an area using appropriate products for example). However, if activation or contamination migration phenomena occurred during the operating phase, complete clean-out – that is to say removal of the artificial radioactivity present in the structures themselves – may require operations involving actual physical removal of the parts of these structures considered to be nuclear waste (removing the skin of a concrete wall for instance).

Operations such as these mean that within the structure concerned, a new limit has to be defined between nuclear waste and conventional waste zones. To ensure consistency with the general waste zoning doctrine, the definition of this new waste zoning limit is based on the implementation of independent, successive lines of defence. The requirements of the ASN technical guide on complete clean-out operations, published in 2006 (guide SD3-DEM-02) have been implemented in a large number of installations of various types: research reactors, laboratories, fuel fabrication plants, etc.

At the end of 2008, ASN obtained national operating experience feedback on complete clean-out. This analysis showed that despite certain technical difficulties, the complete clean-out of civil engineering structures has proven itself and led to a large number of areas in nuclear installations undergoing decommissioning being delicensed to "conventional waste zone" status.

Having listened attentively to the arguments of the various stakeholders, ASN published a new version of the 2006 guide (draft guide no.14) which aims to specify the requirements in terms of modelling, delicensing of very large structures, using innovative decontamination techniques, adopting a suitable approach to the management of deviations and the approval of delicensing, while guaranteeing rigour in the chosen strategy.

2 SITUATION OF NUCLEAR INSTALLATIONS BEING DECOMMISSIONED IN 2010

2|1 EDF nuclear power plants

In 1996, EDF's strategy was deferred decommissioning of its shutdown nuclear installations, namely the six gas-cooled nuclear power reactors (Bugey 1, Saint Laurent A1 and A2, Chinon A1, A2 and A3), the heavy water reactor at Brennilis, the PWR at Chooz A and the fast neutron reactor at Creys-Malville. In April 2001, at the instigation of ASN, EDF decided to change its strategy and adopt a programme for the decommissioning of its first-generation plants, which is now scheduled for completion in 2036.

This new strategy was reviewed by the competent Advisory Committee of Experts in March 2004. On the basis of this review, ASN concluded that the decommissioning strategy for the first generation reactors adopted by EDF, as well as the programme and schedule, are acceptable in terms of safety and radiation protection, provided that a certain number of requests are taken into account and that there is compliance with the undertakings made by EDF with regard to the issues of decommissioning feasibility, safety, radiation protection and waste and effluent management. In July 2009, EDF forwarded a decommissioning strategy update file. In this file, EDF confirmed the position it had adopted in April 2001. The file includes a summary of the progress of the decommissioning programme and identifies the forthcoming major milestones. Current thinking on the decommissioning strategy for the PWR reactors in operation is presented. EDF also specifies its intended orientations in the event of any delay in the availability of the graphite waste disposal route. ASN will adopt a stance in early 2011 on the file forwarded by EDF.

Internal authorisations

In a letter dated 9 February 2004, ASN authorised EDF to set up an internal authorisation system for the installations concerned by the decommissioning programme. This approach addresses a key requirement, namely to keep the safety specifications of an installation permanently up to date.

The internal authorisation system is now regulated by decree 2007-1557 of 2 November 2007 concerning basic nuclear installations and the supervision of the transport of radioactive materials with respect to nuclear safety and by ASN decision 2008-DC-106 of 11 July 2008 which specifies ASN requirements for implementation of the provisions of this decree in the internal authorisation context. Pursuant to article 3 of this decision, EDF submitted a complete file to ASN in October 2009 presenting an update of its internal authorisation system, with a view to having it approved by the ASN Commission. This file is being examined by the ASN.

2|1|1 The Brennilis power plant

The Brennilis power plant is an industrial prototype of a heavy water-moderated, carbon dioxide-cooled nuclear power plant, operated from 1966 to 1985. Partial decommissioning operations were carried out from 1997 to mid-2007 (plugging of circuits, decommissioning of certain heavy water and carbon dioxides circuits and electromechanical components, demolition of non-nuclear buildings, etc.).

Decree 2006-147 of 9 February 2006 authorising EDF to proceed with the complete decommissioning of the installation was cancelled by the *Conseil d'État*[1] on 6 June 2007. The operations that could be carried out, notably repackaging and disposal of the legacy waste, were specified by ASN in decision 2007-DC-0067 of 2 October 2007 (amended), pending the signing of a new decree authorising its complete decommissioning.

A new complete decommissioning authorisation application file was submitted by EDF on 25 July 2008. In March 2010, the investigation commission delivered an unfavourable opinion for the project, on the grounds that no urgent need to decommission the reactor block had been demonstrated and that decommissioning was premature as long as ICEDA – the activated waste packaging and interim storage installation – was not operational. It did nevertheless consider that EDF should be authorized to immediately complete the inventory of the initial radiological and chemical status of the site, complete the STE (effluent processing station) decommissioning operations, clean-out and fill in the effluent discharge channel in the River Ellez, clean out areas of diffuse pollution, and lastly, start decommissioning the heat exchangers following their radiological characterization.

In the opinion it submitted to the Government, ASN recommended authorising EDF to perform the operations to complete phase II of decommissioning - remaining consistent with the opinion of the investigation commission - and that EDF should initiate a new application for complete decommissioning. Pursuant to article 37 of the Euratom Treaty, the European Commission was also consulted with respect to the filed authorisation application, and delivered a favourable opinion in May 2010.

The draft decisions aiming to regulate water draw-offs and effluent discharges were presented by ASN at the CLI meeting of 16 November 2010 and should be presented at the Departmental Council for the Environment and for Health and Technological Risks (CODERST) in early 2011.

The draft decree for partial decommissioning, which only authorises phase II of the decommissioning described above, will be presented to the members of the ASN Commission in the first quarter of 2011.

Lastly, in its decision of 22 December 2009, ASN required that the waste awaiting waivers be removed by 30 June 2010 and that progress reports on the treatment of legacy waste requiring additional analyses be sent periodically to ASN. Since then, EDF has removed all the waste that was waiting for concessions, and now sends ASN a half-yearly on the treatment of legacy waste progress report (characterisation, sorting, repackaging) whose removal in the existing disposal routes requires complementary investigations, such as additional radiological characterisations.

2|1|2 Gas cooled reactors (GCR)

During the investigation of the file submitted by EDF in June 2009 concerning updating of the strategy for nuclear power plant decommissioning, ASN reaffirmed its strong support for an immediate decommissioning strategy. It nevertheless notes that where gas cooled Reactors (GCR) are concerned, the question of the disposal route for graphite waste can complicate implementation of this strategy.

ASN has confirmed that it is in favour of setting up a disposal centre for low-level long-lived waste, and graphite waste in particular, as quickly as possible. It has set 2012 as a first intermediate step to assess the situation regarding the creation of a graphite waste disposal centre, and will make a decision at that time. The progress of this project will then determine ASN's position - to be made known in 2014 at the latest - concerning the need for EDF to build an interim storage site for graphite waste in order to continue the decommissioning of the GCRs.

Bugey 1 reactor

The end of final shutdown and site preparation work continued until the end of 2008, when the installation complete decommissioning decree afetr the installation was signed (decree 2008-1197 of 18 November 2008). At the end of 2009, EDF investigated the lower part of the Bugey 1 reactor compartment (taking radiological measurements, photos, dimensions, samples, etc.) to optimally prepare for its future decommissioning. No significant events relating to safety, security or radiation protection were notified further to these investigations. The compartment was found to be in good overall condition with relatively low dust loading. Experience feedback from this intervention will be turned to good account in the similar investigations to be performed in the near future on the Saint-Laurent A and Chinon A3 reactors.

The year 2010 was essentially marked by the successful completion of the preparatory work necessary for installation decommissioning. Repackaging of legacy waste is continuing with a view to its disposal and the decommissioning operations - reactor compartment excluded - are in progress.

Chinon A1, A2 and A3 reactors

The old Chinon A1, Chinon A2 and Chinon A3 reactors were partially decommissioned and transformed into storage facilities for their own equipment. These operations were authorised by the decrees of 11 October 1982, 7 February 1991 and 27 August 1996, respectively as amended on 25 November 2005, respectively.

Complete decommissioning of the Chinon A3 reactor compartment was authorised by decree 2010-511 of 18 May 2010, and will be carried out after decommissioning of the Bugey 1 and Saint-Laurent A2 reactor compartments, benefiting from the experience acquired in these latter operations.

Work is in progress to prepare for decommissioning of the heat exchangers (the first stage of installation decommissioning), which is currently planned for late 2011. This work, which will continue in 2011, consists more particularly in providing an installation that can ensure the dynamic containment of the premises that is necessary for heat exchanger decommissioning.

1. France's highest administrative court

The roads around Chinon A3 and A2 are also undergoing repair, with the prospect of decommissioning the Chinon A3 heat exchangers.

Furthermore, the graphite stack of the Chinon A1 reactor compartment is currently being core drilled to provide further input to the radiological inventory. These operations were carried out on Chinon A2 in 2010.

Saint-Laurent-des-Eaux A1 and A2 reactors

Complete decommissioning of the installation, whose final shutdown was declared in April 1994, was authorised by decree 2010-511 of 18 May 2010. Decommissioning of the Saint-Laurent A2 reactor compartment will follow on from that of Bugey 1, while decommissioning of the Saint-Laurent A1 reactor compartment will come after Bugey 1, Saint-Laurent A2 and Chinon A3.

The works carried out in 2010 consisted in continuing and completing the removal and cutting of the water-steam pipes and the associated equipment (valves, supports and ventilation ducts) situated in the area beneath the reactor compartments of Saint-Laurent A1 and A2. Certain effluent tanks were also decommissioned in 2010.

The work to renovate the instrumentation of the discharge stacks and reorganise the waste interim storage areas, which began in 2010, will be completed in 2011.

Decommissioning of the electromechanical installations situated around the Saint-Laurent A2 reactor compartment to allow installation of the equipment necessary for the subsequent stages of compartment decommissioning will be the main work focus in 2011. For Saint-Laurent A1, the pre-clean-out work on the pool and its structural reconstitution will be carried out in 2011 with a view to using the pool for the decommissioning of the reactor compartments.

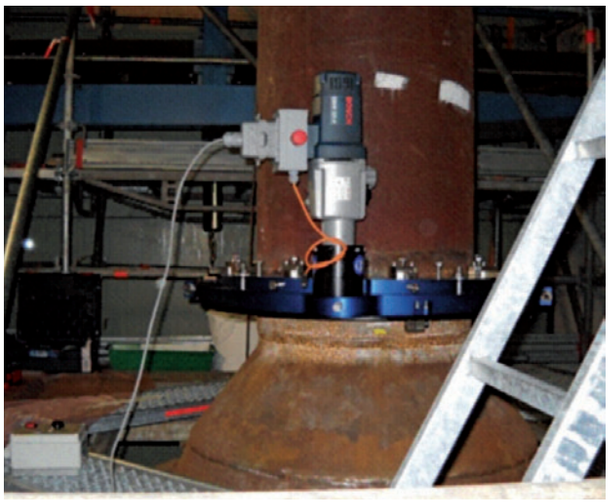
2|1|3 Chooz A reactor

This reactor was the first PWR built in France. It operated from 1967 to 1991.

For the partial decommissioning of the reactor, the decree of 19 March 1999 authorised the modification of the existing installation to convert it into a storage installation for its own equipment left on site and thus create a new BNI called CNA-D. Its complete decommissioning was authorised by decree 2007-1395 published in the Official Gazette on 29 September 2007.

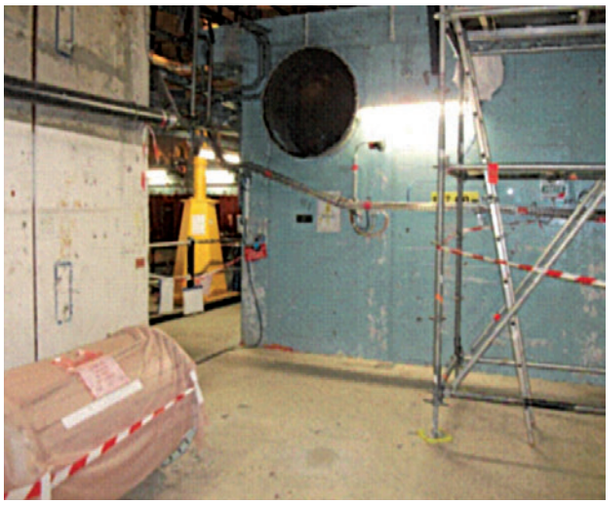
The main operations carried out in 2010 concern the decommissioning of the electromechanical equipment of the vault housing the auxiliaries and the preparatory work for decommissioning of the primary cooling system, excluding decommissioning of the reactor vessel in the reactor vault.

EDF submitted an authorisation application to the ASN to proceed with the actual decommissioning of the primary cooling system, excluding the reactor vessel. The application file was accompanied by an update of the safety report and the general surveillance and maintenance rules (RGSE) for the installation.



Preparation for the extraction of a steam generator at Chooz A – 2010

Site of the HK vault at Chooz A: before work – 2010



Site of the HK vault at Chooz A: after work – 2010

The primary cooling system decommissioning operations constitute a holding point mentioned in paragraph III of article 2 of the Chooz A decommissioning authorisation decree; engaging these operations is therefore subject to prior approval by ASN.

The file was reviewed between March and October 2010, and the examination revealed no technical grounds for refusing authorisation to carry out these works. ASN thus authorized commencement of the works, subject to compliance with a number of technical requirements, by its decision 2010-DC-0202 of 7 December 2010.

ASN also asked EDF to furnish an update of the RGSEs for the installation, incorporating a number of details provided by EDF itself during the technical review.

The significant events of 2011 will thus be the decommissioning of the primary cooling system, of which the main operations comprise the cutting and isolation of the main primary system and the steam generators (SG), the decontamination of the SGs by chemical and mechanical treatment, the decontamination of the pressuriser and the primary system pipes by chemical treatment before removing them from the site as very low-level waste (VLLW); and lastly the cutting without decontamination of the remaining equipment and systems.

Furthermore, after an examination of the corresponding file that lasted a little more than three years, the ministerial order approving ASN decision 2009-DC-0165 of 17 November 2009 setting the environmental discharge limits for the Chooz installations was published in the Official Gazette of the French Republic on 9 December 2009. ASN decision 2009-DC-0164 of 17 November 2009 sets the requirements relating to the conditions of water take-off and consumption and of discharges into the environment.

2|1|4 Superphénix reactor

The Superphénix fast neutron reactor, a sodium-cooled industrial prototype, is located at Creys-Malville. This installation is associated with another BNI, the fuel evacuation facility (APEC), consisting mainly of a storage pool for fuel removed from the Superphénix reactor vessel. The final shutdown authorisation for this reactor was given in decree 98-1305 of 30 December 1998. In early 2003, all the fuel assemblies were removed from the reactor and stored in the APEC. Complete decommissioning of the installation was authorised by decree 2006-321 of 20 March 2006, article 4 of which requires ASN authorisation for the commissioning of the sodium treatment installation, called TNA, and all the systems required for it to operate. The sodium treatment process using hydrolysis consists in injecting liquid sodium into an aqueous soda flow in order to produce soda. This soda is then used as the primary component of the concrete packages to be produced in the cement encapsulation facility and stored for a period on the site to allow decay prior to disposal.

The TNA installation commissioning review was carried out in compliance with article 20 of the decree of 2 November 2007, that is to say, on the basis of the examination of an update of the safety report, of the general surveillance and maintenance rules (RGSE), of the waste study and of the on-site emergency plan for the installation.

In parallel with this, the TNA installation operating tests, which were completed in 2010, were reviewed and inspected by the ASN services.

The various reviews revealed no technical points preventing industrial start-up of the TNA or storage of the soda concrete blocks produced by the sodium treatment. Consequently, ASN authorised EDF to put these two installations into service by decision 2010-DC-0187 of 6 July 2010.

After treating the secondary sodium for almost five months, EDF began treating the primary sodium in the TNA in late November 2010. These operations are still in progress.

Treatment of the secondary pumps in the MDG facility dedicated to decommissioning of the large removable components of the reactor vessel was completed in September 2009, and treatment of the primary pumps - authorised by ASN letter of 15 January 2010 - was completed in October 2010. Treatment of the intermediate heat exchangers, authorised by ASN letter of 3 August 2010, is in progress.

Furthermore, all the lateral neutron protections in the vessel have been removed and transferred to the APEC storage pool.

Fuel evacuation facility (APEC)

This facility was commissioned on 25 July 2000 by the Ministers for Industry and the Environment. The spent fuel assemblies removed from the Superphénix reactor are treated and placed in the APEC pool.

The installation now accommodates the TNA that treats the sodium contained in the Superphénix reactor, and the storage area for the soda concrete packages produced by the TNA, the siting of which was authorised by decree 2006-319 of 20 March 2006 and the commissioning by decision 2010-DC-0187 of 6 July 2010.

2|2 CEA installations

In December 2006, the Advisory Committees for plants and for waste issued their opinions on the overall decommissioning strategy for CEA's civil installations. This was considered to be on the whole satisfactory from the safety standpoint. The decommissioning schedules for the installations concerned are consistent with the strategy adopted. ASN considers that they should enable an acceptable level of safety to be maintained in these installations until they are delicensed. The documents outlining CEA's decommissioning strategy will be updated and reassessed every five years.

2|2|1 Fontenay-aux-Roses centre

CEA's first research centre, located in Fontenay-aux-Roses (Hauts-de-Seine *département*) is continuing to move away from nuclear activities to concentrate on research into the life sciences. Since January 2008, the laboratories clean-out and installations decommissioning programme has been built around a project called Aladin. This project will use the experience feedback from the Grenoble Passage project. Initially

forecast to last some ten years, the CEA has already informed ASN that it will be unable to meet this schedule due to the presumed presence of radioactive contamination underneath Building 18. ASN has asked the licensee to reassess the duration of the operations and produce a new schedule. Decommissioning of the two installations present on the site, the Process BNI (BNI 165) and the Support BNI (BNI 166), was authorised by decrees published in the Official Gazette of 2 July 2006. ASN considers that the BNI clean-out operations carried to date have run in accordance with their decommissioning decree. Before administrative delicensing of the centre's BNIs, ASN will be required to adopt a stance on the radiation status of the site as a whole, for which the licensee has undertaken major work to identify areas displaying radiological activity resulting from past experimentation and to rehabilitate the soil.

The Process installation (BNI 165)

Of the two BNIs, this will be the first to be decommissioned. Operations to raise tank B on the "Pétrus" line, which contained high-activity effluents, began in March 2007 and ended in September 2009.

The clean-out operations on the shielded lines are continuing: CEA submitted a file for the decommissioning and clean-out of one of the largest shielded lines in Building 18, which should start in 2012.

The SUPPORT installation (BNI 166)

The purpose of this installation is initially to support the decommissioning operations to decommission the Process BNI, before being decommissioned in turn.

This BNI is used for storage and evacuation of radioactive effluents from the site as well as the treatment of solid waste, storage in a decay pit of irradiated drums pending evacuation and storage of drums of low and very low level waste pending shipment to a repository.

Raising of the Circe container of high-level effluents should have begun in September 2008 but finally did not start until June 2009 due to containment problems.

With a view to improving the organisation of its activities and hence the safety of its installation, the CEA has installed a new waste drum characterisation line. In July 2010, it submitted a file for its entry into service.

2|2|2 The Grenoble centre

The CEA Grenoble centre was inaugurated in January 1959 and the site's nuclear activities grew in line with the development of reactor technologies. As its research activities were gradually transferred to other centres, the Grenoble centre turned its focus to fundamental and technological research into the field of non-greenhouse gas emitting energies (solar, fuel cell), health (biotechnologies) and communications (micro and nanotechnologies).

CEA Grenoble then launched its site denuclearisation project "Passage", which aims at ending nuclear activities in 2012.

The site housed six nuclear installations which since then have been gradually phased out, moving to the decommissioning phase with the ultimate aim of delicensing. After delicensing of the Siloette reactor (BNI 21) in 2007, decommissioning and clean-out of the CEA Grenoble nuclear installations continued in 2010.

ASN considers that clean-out and decommissioning of the installations in the Grenoble centre are proceeding correctly, with good control over the risks inherent to decommissioning worksites.

During its inspections, ASN noted that CEA Grenoble was making increasing use of outside companies, whether for operation of the installations, the engineering studies linked to the decommissioning work, or the work itself. In spite of the gradual reduction in the risks in terms of worker safety and radiation protection, ASN asked CEA Grenoble to maintain a level of resources enabling it to ensure complete control of its installations.

Radioactive effluent and solid waste treatment station and decay storage (BNI 36 and 79)

Decommissioning of the radioactive effluent and solid waste treatment station (STEDS - BNI 36) was authorised by decree 2008-980 of 18 September 2008 published in the Official Gazette. The decommissioning operations should continue until 2012. A part of the installation is now dismantled and its North zone is used for characterisation and collection of the decommissioning waste pending shipment for disposal.

BNI 79 (STED), which is within the boundary of BNI 36, is a decay storage facility for high level (HL) waste. Despite the problems encountered with disposal route availability, removal of the HL waste from storage was completed in June 2010, thereby meeting the completion commitment given to ASN (deadline of 31 December 2010). There is now no HL waste stored on the site. Decommissioning of this BNI was authorised by the same decree as that which authorised decommissioning of BNI 36.

Active material analysis laboratory (LAMA - BNI 61)

This laboratory ended its scientific research duties in 2002. It was used to receive experimental fuels with no further purpose, taken from the Siloé and Mélusine reactors following their shutdown. It takes part in the clean-out operations of BNI 36 and 79.

The source term was mainly situated in the very high level (VHL) containments.

Decommissioning of the LAMA was authorised by decree 2008-981 of 18 September 2008 and published in the Official Gazette of 21 September 2008. Two shielded cells remained to be dismantled in the third quarter of 2010. An inspection is planned in 2011 to verify the status of the premises before delicensing the installation.

Mélusine reactor (BNI 19)

Mélusine is a former pool type reactor operated by CEA. Final shutdown was declared in 1994. The decree authorising CEA to modify the Mélusine reactor prior to its decommissioning and

Installation of an internal lining for a decommissioning operation – STED Grenoble – February 2010

delicensing was published in the Official Gazette in January 2004. The clean-out work has been completed and in mid-2009, CEA submitted a file applying for BNI delicensing. ASN consulted the *préfet*[2] of the Isère *département*[3], the municipalities concerned, and the local information committee (CLI), which delivered a favourable opinion in summer 2010.

SILOÉ reactor (BNI 20)

This former research reactor, currently undergoing decommissioning and clean-out, was primarily used for technological irradiation of structural materials and nuclear fuels. Since the decree of 26 January 2005, authorising final shutdown and decommissioning of the installation, operations are continuing but are behind schedule, given that activation of the pool block was greater than had been anticipated in the initial decommissioning scenario. CEA thus submitted an application pursuant to article 32 of the decree of 2 November 2007, requesting extension of the decommissioning work from 5 to 6 years. The corresponding decree was signed on 1 February 2010 and published in the Official Gazette on 2 February 2010. The reactor hall clean-out operations continued in 2010.

2|2|3 The Cadarache centre installations being decommissioned

ASN considers that decommissioning of the Cadarache centre installations is proceeding satisfactorily on the whole. The example of the decommissioning of the Harmonie reactor, delicensed in 2009, illustrates the feasibility of complete decommissioning. However, all relevant lessons must be learned from the incident that occurred in the plutonium technology facility (ATPu) and which was notified by CEA on 6 October 2009. The CEA thus indicated that ways of improving the quality of the information feedback chain had been identified. It pointed out that further to this incident, it has established a new procedure for immediate information feedback, up to General Administrator level if justified by the nature of the incident.

Rapsodie reactor and fuel assembly shearing laboratory (LDAC)

Final shutdown of Rapsodie, an experimental fast neutron reactor which ceased operations in 1983, was declared in 1985. The work designed to partially decommission the reactor, which began in 1987, was interrupted in 1994 following a fatal accident during washing of a sodium tank. This accident, which emphasizes the risks involved in decommissioning operations, necessitated rehabilitation and partial clean-out work, which was completed at the end of 1997. Since then, clean-out and decommissioning work limited to certain equipment items has been resumed, along with waste removal. Renovation operations have also been carried out.

The LDAC, located within the same BNI as the Rapsodie reactor, was designed for inspection and examination of spent fuel from the Rapsodie reactor or other fast neutron reactors. This laboratory has been shut down since 1997. It has been cleaned-out, is under surveillance and awaiting decommissioning.

In 2007, ASN approved a revised version of the safety requirements for the operations involved in preparing final shutdown, enabling the licensee to carry out a number of reactor auxiliary equipment clean-out and dismantling operations. In 2008, CEA submitted a file applying for final shutdown and complete decommissioning. ASN informed CEA that its file was incomplete. The decommissioning strategy is currently being revised. A new file will be submitted on completion of this process.

Harmonie reactor

Operation of the Harmonie reactor ceased in 1996. It was a calibrated neutron source used primarily for calibrating detectors and studying the properties of certain materials. The decree authorising CEA to proceed with final shutdown and decommissioning was signed on 8 January 2004 and published in the Official Gazette on 9 January 2004. Following the operations to cut up the reactor block and take away the waste generated by decommissioning in 2005, the reactor slab, which had been activated by the neutron flux during operation, was subject to complete clean-out in 2006. 2007 and 2008 were mainly devoted to demolition of the building civil engineering works and operations that returned the site to its natural state.

The installation was delicensed on 10 June 2009 with publication in the Official Gazette of the ministerial order of 26 May 2009 implementing ASN decision 2009-DC-0133 of 31 March 2009.

Enriched uranium processing facilities (ATUE)

The ATUE provided conversion into sinterable oxide of the uranium hexafluoride from the isotopic enrichment plants. They

2. In a *département*, representative of the State appointed by the President
3. Administrative region headed by a *Préfet*

were also used for the chemical reprocessing of fuel element fabrication scraps to recover the enriched uranium they contain. The facility was also equipped with a low level organic liquid incinerator. Production in the facilities ended in July 1995 and the incinerator was shut down at the end of 1997.

The decree authorising final shutdown and decommissioning of the installation was published in February 2006. The year 2006 saw completion of the decommissioning phase for the process equipment.

The civil engineering structural dismantling and complete clean-out phases continued, in spite of a few stoppages due to technical and economic difficulties associated with clean-out of the structures. Owing to these difficulties, the licensee submitted a decree modification application file in June 2010 requesting a five-year extension of the time scale to complete these works. This request is currently being reviewed. The licensee also implemented a programme to characterise the soil outside the buildings to detect any traces of pollution and determine appropriate depollution methods where necessary.

The plutonium technology facility (ATPu) and the chemical purification laboratory (LPC)

The ATPu produced plutonium-based fuel elements, initially intended for fast neutron or experimental reactors and then, as of the 1990s, for PWRs using MOX fuel. The activities of the LPC were associated with those of the ATPu: physical and chemical checks and metallurgical examination of plutonium-based products, processing of effluents and waste contaminated with alpha emitters. Since 1994, Areva NC has been the industrial licensee operating the ATPu and the LPC. From a regulatory standpoint, CEA nonetheless remains the nuclear licensee for these installations.

Given that it was impossible to demonstrate that these installations were immune to the seismic risk, Areva NC put an end to commercial activities within the ATPu in August 2003. Since then, CEA has been involved in a final shutdown and decommissioning process for the two installations. The corresponding application files, sent to ASN in 2006, were the subject of a public inquiry at the beginning of the summer of 2008 and resulted in the Official Gazette publishing final shutdown and decommissioning decrees 2009-262 and 2009-263 on 6 March 2009.

Following the cessation of commercial production in 2003, Areva NC initiated the recovery and packaging of the fabrication scrap and materials contained in the ATPu and LPC. This phase, which is necessary to reduce the risks inherent in these materials prior to decommissioning of the installations, was to end on 31 December 2006. As it became clear that it would be impossible to meet this deadline, CEA wished to postpone it to 31 December 2008. ASN considered that this was too long and that decommissioning needed to be completed as rapidly as possible and it issued decision 2007-DC-0036 of 21 March 2007, setting 30 June 2008 as the deadline for processing and evacuation of the materials and scrap from the ATPu and LPC. On 1 July 2008, ASN carried out an inspection in these installations, in order to check compliance with the above-mentioned decision. The inspectors were able to see that all the nuclear materials concerned by this decision had been repackaged and evacuated from the installations, mainly to the Areva NC facility at La Hague.

On 6 October 2009, CEA Cadarache informed ASN that the amounts of plutonium in the installation's glove boxes had been underestimated. They were evaluated at about 8 kg during the installation operating period, whereas the quantities recovered on that date stood at about 22 kg, and CEA estimated that the total quantity could reach 39 kg by the end of decommissioning. Following the ASN inspection of 9 October 2009, CEA was sent formal notice of non-compliance with the notification procedures stipulated in the regulations, as the licensee had been aware of this situation since June 2009. ASN also upgraded the incident from the licensee's initial Level 1 rating on the INES scale, to Level 2.

ASN also issued an initial decision 2009-DC-0160 on 14 October 2009 suspending the decommissioning operations in progress in the installation, and a second decision 2009-DC-0161 on 19 October 2009 defining the conditions for resumption of the work.

During 2010, ASN gradually authorised CEA to resume decommissioning activities on the basis of specific safety files examined by its technical support. ASN also decided to issue technical instructions ruling the decommissioning operations, through decisions 2010-DC-0196 and 2010-DC-0197 of 26 October 2010.

ASN will remain vigilant on aspects concerning the estimation of fissile materials and safety-criticality in 2011. It notes that, in 2010, CEA declared three significant events related to incorrect estimates in drums at the ATPu and the LPC, and in a heat exchanger at the ATPu.

2|2|4 The Saclay centre installations being decommissioned

ASN considers that the clean-out and decommissioning operations leading to delicensing of the two Saclay particle accelerators (ALS and Saturne) were carried out in compliance with satisfactory methodology and regulations, which should be extended to the other installations, particularly old installations or parts of installations, the decommissioning of which had been postponed for a considerable time.

High-activity laboratory (LHA)

The high-activity laboratory (LHA) comprises several units equipped for research and production assignments on various radionuclides. Following the decommissioning and clean-out work authorised by decree 2008-979 of 18 September 2008, published in the Official Gazette on 21 September 2008, only two laboratories will probably remain and will be covered by the ICPE system. Dismantling work has begun on the active effluent inter-cells tanks.

Celimene cell

The Celimene cell, adjoining the EL3 reactor, was commissioned in 1965 for review of the fuels from this reactor. This cell is now attached to the spent fuel testing laboratory (LECI). The last fuel rods were removed in 1995 and a number of partial clean-out operations conducted until 1998. Experimental clean-out methods using the Aspilaser technique were tested in this cell in 2009.

Ulysse reactor (BNI 18)

Built in 1961 in the CEA Saclay centre, this reactor was used for teaching and experimental purposes. Operating authorisation was granted on 16 June 1967. The total energy delivered in operation is around 115 MWh. The decision to shut down this reactor was taken on 9 February 2007 and the final shutdown and decommissioning application was submitted to ASN in June 2009. The file is currently being reviewed.

2|3 Areva installations

2|3|1 UP2 400 spent fuel reprocessing plant and associated facilities

The situation in the UP2 400 is described in chapter 13. The former UP2 400 reprocessing plant and the associated facilities (BNI 33, 38, 47 and 80), which have been shut down since 2004, are scheduled for decommissioning. As the final shutdown preparatory work is already well-advanced, ASN had informed Areva NC that it wanted to see the decommissioning application files for the UP2 400 plant installations submitted rapidly. The first final shutdown and decommissioning application file for BNI 80 (HAO) was submitted at the beginning of 2008. This application was subject to a public inquiry in October 2008, and the final shutdown and decommissioning decree no.2009-961 of 31 July 2009 was published in the Official Gazette on 4 August 2010.

In October 2008, AREVA NC submitted three final shutdown and decommissioning authorisation applications for BNIs 33, 38 and 47. These files are currently being reviewed by ASN and were subject to a public inquiry in October 2010.

AT1 pilot reprocessing plant

The AT1 pilot plant reprocessed fuel from the Rapsodie and Phénix fast breeder reactors from 1969 to 1979. It is part of BNI 38 (STE2).

Clean-out of this installation began in 1982 and ended in 2001, at which time ASN formally acknowledged completion of clean-out, civil engineering structures excluded, and entry into surveillance status. This installation is not however delicensed as its complete decommissioning will be part of the decommissioning application for the UP2 400 plant as a whole.

Caesium 137 and strontium 90 source fabrication installation (Élan IIB)

The Élan IIB (BNI 47) installation manufactured caesium 137 and strontium 90 sources until 1973. The initial decommissioning operations undertaken by the Technicatome firm ended in November 1991. A large number of renovation and maintenance operations took place during 2002 and 2003 (upgrading of the ventilation system, radiation mapping, etc.) with a view to resuming decommissioning operations. All the installation upgrade work and the work preparatory to decommissioning of the installation was carried out during 2004 and 2005. In October 2008, Areva NC submitted a final shutdown and decommissioning application for BNI 47 jointly with BNIs 33 and 38.

2|3|2 SICN plant in Veurey-Voroize

Two nuclear installations, BNIs 65 and 90, located on the site of the SICN company (AREVA group) in Veurey-Voroize, constitute this former nuclear fuel fabrication plant. Fuel fabrication ceased at the beginning of this century. Final shutdown operations took place between 2000 and the end of 2005. The decrees authorising the decommissioning operations were signed on 15 February 2006 and published in the Official Gazette on 22 February 2006, thereby allow the operations to start.

The civil engineering structural clean-out operations continued in 2010. On completion of these operations (see point 1.5), it was possible to delicense a large number of areas from the waste zoning viewpoint. Nonetheless, the licensee had to deal with a number of problems with implementing its complete clean-out methodology, because some of the older design buildings were incompatible with easy and optimum use of this methodology. The strategy therefore changed and entails the demolition of certain buildings on the site, contrary to what had been initially planned in the project.

The review of the file describing the management strategy for the site floors and soils, polluted by the former activities, has resulted in steps being taken to determine the nature of the restrictions that will be put in place during administrative delicensing of the BNIs.

ASN considers that the decommissioning of the SICN site at Veurey-Voroize is proceeding satisfactorily and should allow delicensing of the waste zoning of the last buildings in early 2011. Nonetheless, the inspections carried out in 2010 revealed a lack of rigour in the monitoring of the decommissioning worksites.

Clean-out of a building gallery in the SICN plant – June 2007

2|4 Other installations

2|4|1 The Strasbourg University reactor

Very similar in design and characteristics to the CEA Ulysse reactor at Saclay, the Strasbourg University reactor (RUS - BNI 44) at Louis Pasteur University was mainly used for experimental irradiations and the production of short-lived radioisotopes.

The decree authorising Louis Pasteur University in Strasbourg to proceed with final shutdown and decommissioning was signed on 15 February 2006 and published in the Official Gazette of 22 February 2006. Decommissioning work began in the second half of 2006 and ended in mid-2009. In 2010, ASN continued its review of the file for the installation to be removed from the list of BNIs. Pursuant to the TSN Act, ASN consulted the Government services, the 21 municipalities situated within less than five kilometres of the installation, and the local information committee (CLI) which was instituted in July 2010 by the *Conseil général*[4] of the Bas-Rhin *département*. ASN considers that the decommissioning work was satisfactory and that the clean-out goals were met.

2|4|2 Electromagnetic radiation laboratory (LURE)

The electromagnetic radiation laboratory (LURE), located at the heart of the Orsay campus (Essonne *département*), is an installation producing synchroton radiation (high-power X-rays) for a wide variety of research applications. It comprises six particle accelerators.

In January 2007, following a final shutdown preparation phase that began in 2004, the LURE licensee (CNRS) submitted an application for authorisation to decommission its installation, with the exception of the CLIO and PHIL accelerators, which are to be kept in operation. This review resulted in a final shutdown and decommissioning decree 2009-405 dated 14 April 2009. The licensee removed the main constituents of the accelerator. The decommissioning operations should be completed in 2012 at the latest. After decommissioning of BNI 106, the final status will consist of cleaned-out empty premises returned to the Paris Sud XI University. The LURE has been attached to the local information committee of CEA Saclay.

4. *Département*-level elected council

3 OUTLOOK

In 2010, ASN published a guide to the final shutdown, decommissioning and delicensing of basic nuclear installations (guide no 6 of June 2010) and finalised the draft guide relating to complete clean-out methods acceptable in basic nuclear installations in France (draft guide no. 14 of June 2010).

The main actions ASN will carry out in 2011 will be firstly the continuing development of the regulatory framework for decommissioning, and secondly closer monitoring of certain installations. ASN will thus endeavour to finalise the guide to the clean-out of polluted soils on sites undergoing decommissioning, and, after publication of the BNI order, to finalise the revision of the guide relating to complete clean-out methods.

In 2011, ASN will continue its inspections of installations undergoing decommissioning. It will focus in particular on:
– drafting a proposal decree for partial decommissioning of the Brennilis power plant and drawing up instructions relative to the waste from the installation;
– participating in the writing of drafts for the MAD DEM decree for the nuclear installations of the UP2 400 plant in La Hague;
– examining the safety of the decommissioning operations concerning the active solution treatment equipment and the associated circuits of the LPC;
– drawing up instructions concerning the waste from Chinon A3;
– reviewing the authorisation application submitted by the CEA for the decommissioning of the Pétrus equipment of BNI 165;
– reviewing the preparatory operations for final shutdown of the installations that will soon be shut down and decommissioned (Phénix, Comurhex, Eurodif).

In addition to this, ASN will finalise its review of EDF's decommissioning strategy. It will also review the elements submitted by the CEA for the updating of its decommissioning strategy, justifying the chosen time schedule and explaining the reasons, technical or otherwise, for the observed delays.

UNDERSTAND

Definitions

Decommissioning covers all the technical and administrative activities carried out following the shutdown of a nuclear installation, in order to achieve a final predefined status in which all the hazardous substances, and radioactive substances in particular, have been evacuated from the BNI. These activities can include equipment dismantling, clean-out of premises and soils, destruction of civil engineering structures, and waste management.

In the past, nuclear installations were gradually shut down, then decommissioned. Some installations were thus the subject of final shutdown decrees and transformed into storage BNIs for the waste left in place, pending a decommissioning decree.

Current regulations and the general policy of ASN recommending immediate decommissioning requires that a licensee having decided to shut down its installation must submit a final shutdown and decommissioning authorisation application. To improve the consistency of the operations, the submitted file must explicitly describe all the operations from final shutdown through to the final targeted status. These operations are then authorised by a final shutdown and decommissioning decree.

On completion of the decommissioning operations, the licensee provides proof that the targeted final status has been achieved, after clean-out if necessary. The installation is then delicensed, that is to say "removed from the list of BNIs" and is no longer subject to the BNI regulations. Delicensing may be subject to the public protection restrictions imposing restrictions on use.

APPENDIX 1: LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2010

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Latest regulatory acts	Current status
NÉRÉIDE FAR*	(former BNI 10)	Reactor (500 kWth)	1960	1981	1987: Removed from BNI list	Decommissioned
TRITON FAR*	(former BNI 10)	Reactor (6.5 MWth)	1959	1982	1987: Removed from BNI list and classified in ICPE	Decommissioned
ZOÉ FAR*	(former BNI 11)	Reactor (250 kWth)	1948	1975	1978: Removed from BNI list and classified in ICPE	Confined (museum)
MINERVE FAR*	(former BNI 12)	Reactor (0.1 kWth)	1959	1976	1977: Removed from BNI list	Dismantled at FAR and reassembled at Cadarache
EL 2 SACLAY	(former BNI 13)	Reactor (2.8 MWth)	1952	1965	Removed from BNI list	Partielly decommissioned, remaining parts confined
EL 3 SACLAY	(former BNI 14)	Reactor (18 MWth)	1957	1979	1988: Removed from BNI list and classified in ICPE	Partielly decommissioned, remaining parts confined
PEGGY CADARACHE	(former BNI 23)	Reactor (1 kWth)	1961	1975	1976: Removed from BNI list	Decommissioned
CÉSAR CADARACHE	(former BNI 26)	Reactor (10 kWth)	1964	1974	1978: Removed from BNI list	Decommissioned
MARIUS CADARACHE	(former BNI 27)	Reactor (0.4 kWth)	1960 at Marcoule, 1964 at Cadarache	1983	1987: Removed from BNI list	Decommissioned
LE BOUCHET	(former BNI 30)	Ore processing	1953	1970	Removed from BNI list	Decommissioned
GUEUGNON	(former BNI 31)	Ore processing	1965	1980	Removed from BNI list	Decommissioned
STED FAR*	BNI 34	Processing of liquids and solid waste	Before 1964	2006	2006: Removed from BNI list	Integrated into BNIs 165 and 166
HARMONIE CADARACHE	(former BNI 41)	Reactor (1 kWth)	1965	1996	2009: Removed from BNI list	Decommissioned
ALS	(former BNI 43)	Accelerator	1958	1996	2006: Removed from BNI list	Cleaned-out – public protection restrictions***
SATURNE	(former BNI 48)	Accelerator	1966	1997	2005: Removed from BNI list	Cleaned-out – public protection restrictions***
ATTILA** FAR*	(former BNI 57)	Reprocessing pilot	1968	1975	2006: Removed from BNI list	Integrated into BNIs 165 and 166
LCPu FAR*	(former BNI 57)	Plutonium chemistry laboratory	1966	1995	2006: Removed from BNI list	Integrated into BNIs 165 and 166
BAT 19 FAR*	(former BNI 58)	Plutonium metallurgy	1968	1984	1984: Removed from BNI list	Decommissioned
RM2 FAR*	(former BNI 59)	Radio-metallurgy	1968	1982	2006: Removed from BNI list	Integrated into BNIs 165 and 166
LCAC GRENOBLE	(former BNI 60)	Fuels analysis	1975	1984	1997: Removed from BNI list	Decommissioned
STEDs FAR*	(former BNI 73)	Solid waste storage facilities	1989		2006: Removed from BNI list	Integrated into BNI 165 and 166

APPENDIX 1: LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2010 (continued)

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Latest regulatory acts	Current status
ARAC SACLAY	(former BNI 81)	Fabrication of fuel assemblies	1981	1995	1999: removed from BNI list	Cleaned-out
IRCA	(former BNI 121)	Irradiator	1983	1996	2006: Removed from BNI list	Cleaned-out – public protection restrictions***
FBFC PIERRELATTE	(former BNI 131)	Fuel fabrication	1990	1998	2003: Removed from BNI list	Cleaned-out – public protection restrictions***
SNCS OSMANVILLE	(former BNI 152)	Ioniser	1983	1995	2002: Removed from BNI list	Cleaned-out – public protection restrictions***
URANIUM WAREHOUSE MIRAMAS	(former BNI 134)	Uranium bearing materials warehouse	1964	2004	2007: Removed from BNI list	Cleaned-out – public protection restrictions***
SILOETTE GRENOBLE	(former BNI 21)	Reactor (100 kWth)	1964	2002	2007: Removed from BNI list	Cleaned-out – public protection restrictions***

(*) FAR: Fontenay-aux-Roses – (**) Attila: reprocessing pilot located in a unit of BNI 57 – (***) Private law documents have been signed by the State and the licensee for the cleaned out parcels, to conserve a record of the former nuclear activity.

APPENDIX 2: LIST OF BASIC NUCLEAR INSTALLATIONS FINALLY SHUT DOWN AS AT 31.12.2010

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Latest regulatory acts	Current status
CHOOZ AD (formerly CHOOZ A)	163 (former BNI 1, 2, 3)	Reactor (1,040 MWth)	1967	1991	2007: Final shutdown and decommissioning decree	Decommissioning in progress
CHINON A1D (formerly CHINON A1)	133 (former BNI 5)	Reactor (300 MWth)	1963	1973	1982: Chinon A1 confinement decree and creation of the Chinon A1D storage BNI	Partially decommissioned, changed into a BNI for storing waste left in place (museum)
CHINON A2D (formerly CHINON A2)	153 (former BNI 6)	Reactor (865 MWth)	1965	1985	1991: Partial decommissioning decree for Chinon A2 and creation of the Chinon A2D storage BNI	Partially decommissioned, changed into a BNI for storing waste left in place
CHINON A3D (formerly CHINON A3)	161 (former BNI 7)	Reactor (1,360 MWth)	1966	1990	2010: Decommissioning licensing decree	Decommissioning in progress
MÉLUSINE GRENOBLE	19	Reactor (8 MWth)	1958	1988	2004: Final shutdown and decommissioning decree	Decommissioning in progress
SILOÉ GRENOBLE	20	Reactor (35 MWth)	1963	1997	2010: New final shutdown and decommissioning decree	Decommissioning in progress
RAPSODIE CADARACHE	25	Reactor (40 MWth)	1967	1983		Preparation for final shutdown
EL 4D (EX-EL4 BRENNILIS)	162 (former BNI 28)	Reactor (250 MWth)	1966	1985	1996: Decree for decommissioning and creation of the EL 4D storage BNI 2006: final shutdown and decommissioning decree 2007: decision of the *Conseil d'État* cancelling the decree of 2006	Partially decommissioned, changed into a BNI for storing waste left in place
SPENT FUEL REPROCESSING PLANT (UP2) (LA HAGUE)	33	Transformation of radioactive materials	1964	2004	2003: Boundary change	Preparation for final shutdown
STED AND HIGH-LEVEL WASTE STORAGE UNIT (GRENOBLE)	36 and 79	Waste treatment and storage facility	1964/1972	2008	2008: Final shutdown and decommissioning decree	Decommissioning in progress
EFFLUENT AND SOLID WASTE TREATMENT STATION (STE2) AND FORMER PILOT REPROCESSING PLANT FOR SPENT FUEL FROM FAST NEUTRON REACTORS (AT1) (LA HAGUE)	38	Effluent and waste treatment facility	1969	1979		Preparation for final shutdown

APPENDIX 2: LIST OF BASIC NUCLEAR INSTALLATIONS FINALLY SHUTDOWN AS AT 31.12.2010 (continued)

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Latest regulatory acts	Current status
STRASBOURG UNIVERSITY REACTOR	44	Reactor (100 kWth)	1967	1997	2006: Final shutdown and decommissioning decree	Decommissioning in progress
BUGEY 1	45	Reactor (1,920 MWth)	1972	1994	2008: Final shutdown and decommissioning decree	Decommissioning in progress
ST-LAURENT A1	46	Reactor (1,662 MWth)	1969	1990	2010: Decommissioning decree	Decommissioning in progress
ST-LAURENT A2	46	Reactor (1,801 MWth)	1971	1992	2010: Decommissioning decree	Decommissioning in progress
ÉLAN II B LA HAGUE	47	Fabrication of Cs 137 sources	1970	1973		Preparation for final shutdown
HIGH ACTIVITY LABORATORY (LHA) SACLAY	49	Laboratory	1960	1996	2008: Final shutdown and decommissioning decree	Decommissioning in progress
ATUE CADARACHE	52	Uranium Processing	1963	1997	2006: Final shutdown and decommissioning decree	Decommissioning in progress
LAMA GRENOBLE	61	Laboratory	1968	2002	2008: Final shutdown and decommissioning decree	Decommissioning in progress
SICN VEUREY-VOROIZE	65 and 90	Fuel fabrication plant	1963	2000	2006: Final shutdown and decommissioning decree	Decommissioning in progress
HAO (HIGH LEVEL OXIDE) FACILITY (LA HAGUE)	80	Transformation of radioactive materials	1974	2004	2009: Final shutdown and decommissioning decree	Decommissioning in progress
ATPu CADARACHE	32	Fuel fabrication plant	1962	2003	2009: Final shutdown and decommissioning decree	Decommissioning in progress
LPC CADARACHE	54	Laboratory	1966	2003	2009: Final shutdown and decommissioning decree	Decommissioning in progress
SUPERPHÉNIX CREYS-MALVILLE	91	Reactor (3,000 MWth)	1985	1997	2006: Final shutdown and decommissioning decree	Decommissioning in progress
COMURHEX PIERRELATTE	105	Uranium chemical transformation plant	1979	2009		Preparation for final shutdown
LURE	106	Particle accelerators	From 1956 to 1987	2008	2009: Final shutdown and decommissioning decree	Decommissioning in progress
FAR* PROCEDE	165	Grouping of former process installations	2006		2006: Final shutdown and decommissioning decree	Decommissioning in progress
FAR* SUPPORT	166	Waste packaging and processing	2006		2006: Final shutdown and decommissioning decree	Decommissioning in progress

(*) FAR: Fontenay-aux-Roses: creation of BNIs 165 and 166, substituting for BNIs 34, 57, 59, and 73, followed by the shutdown and decommissioning of BNIs 165 and 166 further to the grouping of buildings as part of the Fontenay aux Roses site denuclearisation project.