SAFE DECOMMISSIONING OF BASIC NUCLEAR INSTALLATIONS (BNIs)

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 dismantling, 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 2011, 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. They were clarified and supplemented in 2006 by the TSN Act now codified in books I to V of the Environment Code by Order 2012-6 of 5 January 2012. ASN continues to develop the regulatory framework and the applicable doctrine for this phase in the life of basic nuclear installations (BNIs). 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 HCTISN (French High Committee for Transparency and Information on Nuclear Security) in 2009, and published in 2010.

UNDERSTAND

Decommissioning

Decommissioning covers all the technical and administrative activities carried out following the shutdown of a nuclear installation, in order to achieve a final predetermined 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, demolition 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 institutional controls imposing restrictions on use.

1 TECHNICAL AND LEGAL REQUIREMENTS APPLICABLE TO DECOMMISSIONING

1|1 Decommissioning strategies

The 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). The French management policy for very low-activity waste is clear and protective: it does not provide release thresholds for this waste, but, on the contrary, for it to follow a specific disposal route in order to confine it in a single place and ensure its traceability. This is why, 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 material that has or may 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.

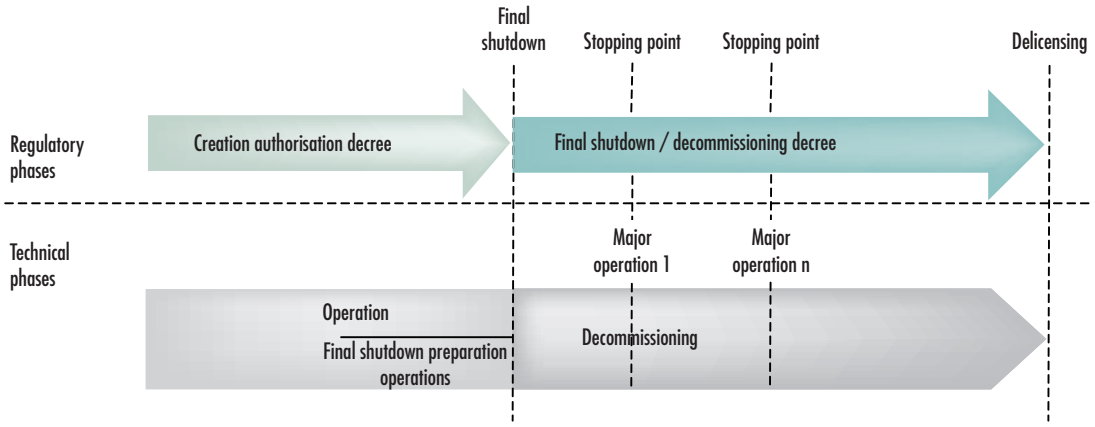
1|2 The legal framework of decommissioning

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 and 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

Diagram 1 : phases in the life of BNI



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. ASN's objective is to check through these periodic reviews that the level of safety of the installation remains acceptable until it is delicensed, with the implementation of measures proportionate to the risks presented by the installation during decommissioning.

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.). Institutional controls 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 controls.

An ASN guide created in 2003 specified the regulatory framework 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, integrating the regulatory changes introduced by the TSN Act and decree 2007-1557 of 2 November 2007, and the work of the association WENRA, was issued in June 2010 (ASN Guide No.6, available on the web site *www.asn.fr*).

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).

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 (now codified in books I to V of the Environment Code) creates a system for securing the nuclear costs involved in the decommissioning of nuclear installations and management of radioactive waste. This article is clarified by decree 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 legacy waste recovery and packaging (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

the 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 had given the Government its opinion on the first three-yearly reports (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. In 2010, ASN and the 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. The licensees submitted their second three-yearly report in 2010. ASN gave its opinion to the DGEC (opinion 2011-AV-0107 of 3 February 2011, consultable on the web site), in which it recommends - as a general rule - better substantiation of assessment robustness and clarification of the uncertainties in the decommissioning and waste management operations that impact costs. Furthermore, as ASN had observed the need to check the tools used by the licensees to evaluate the decommissioning costs, it recommended implementing audits, and assisted the DGEC in defining the audit programme that should be conducted in the 2011-2013 period.

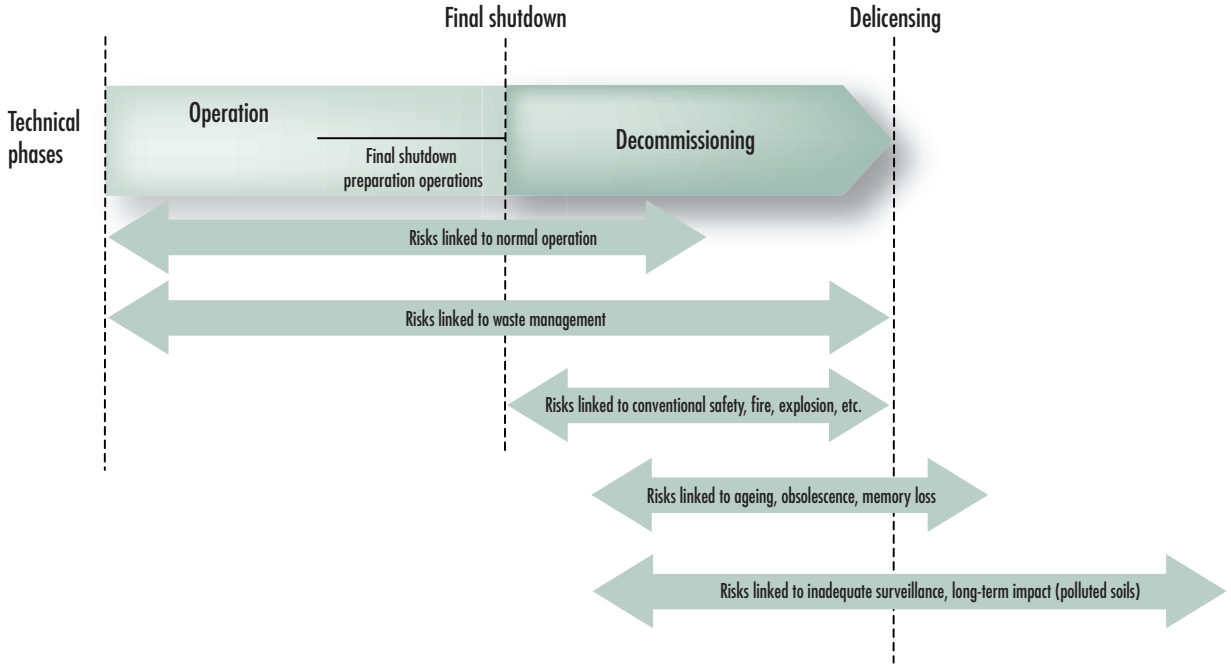
ASN also informed the DGEC of its opinion on decree 2010-1673 of 29 December 2010 amending decree 2007-243 of 23 February 2007 relative to securing of the financial costs of decommissioning. ASN reiterated the importance of maintaining the robustness of the composition of the assets dedicated to covering the decommissioning costs and the asset liquidity level in order to guarantee the effective availability of the funds.

In 2011 ASN started drafting a guide for the licensees, to specify what is required in application of the regulatory provisions relating to cost assessments.

1|4 The implications of decommissioning

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

Diagram 2: principal risks encountered during decommissioning



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 or general working safety (numerous contractors working together, falling loads, work at height, and so on) gradually become predominant. The same goes for the fire or explosion risks (technique of breaking down the structures by "hot points", that is to say those generating heat, sparks or flames).

Similarly, the risks associated with human and organisational factors (change in organisation with respect to the operating phase, frequent use of outside contractors) must be taken into account.

For complex nuclear installations such as NPP reactors, decommissioning work often lasts for more than a decade. This follows on from an operating period that often lasts several decades. Consequently, the risk of loss of the design and operational memory of the nuclear installations must be taken into consideration. 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 to replace, either temporarily or lastingly, the centralised means of operating surveillance by other more appropriate means of surveillance. 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, areas for which clean-out is technically impossible under acceptable technical and economic conditions, etc. In this case, prior to delicensing of the installation, the licensee must present and justify the envisaged means of ensuring the surveillance of the installation or site. In such cases, institutional controls are imposed to restrict the use of the site.

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 be delicensed on completion of any necessary simple clean-out operations (cleaning 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. The analysis has shown that, in spite of certain technical difficulties, the complete clean-out approach to civil engineering structures has proved its worth. Having listened attentively to the arguments of the various stakeholders, in June 2010 ASN published a new version of the 2006 guide (ASN guide no.14) which aims to specify the requirements in terms of modelling, delicensing of very large structures, use of innovative decontamination techniques, adoption of 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 2011

2|1 EDF NPPs

In 1996, EDF's strategy was deferred decommissioning of its shutdown nuclear installations, namely the six gas-graphite 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 dismantling programme and identifies the forthcoming major milestones. Current thinking on the decommissioning strategy for the PWR reactors in operation is presented.

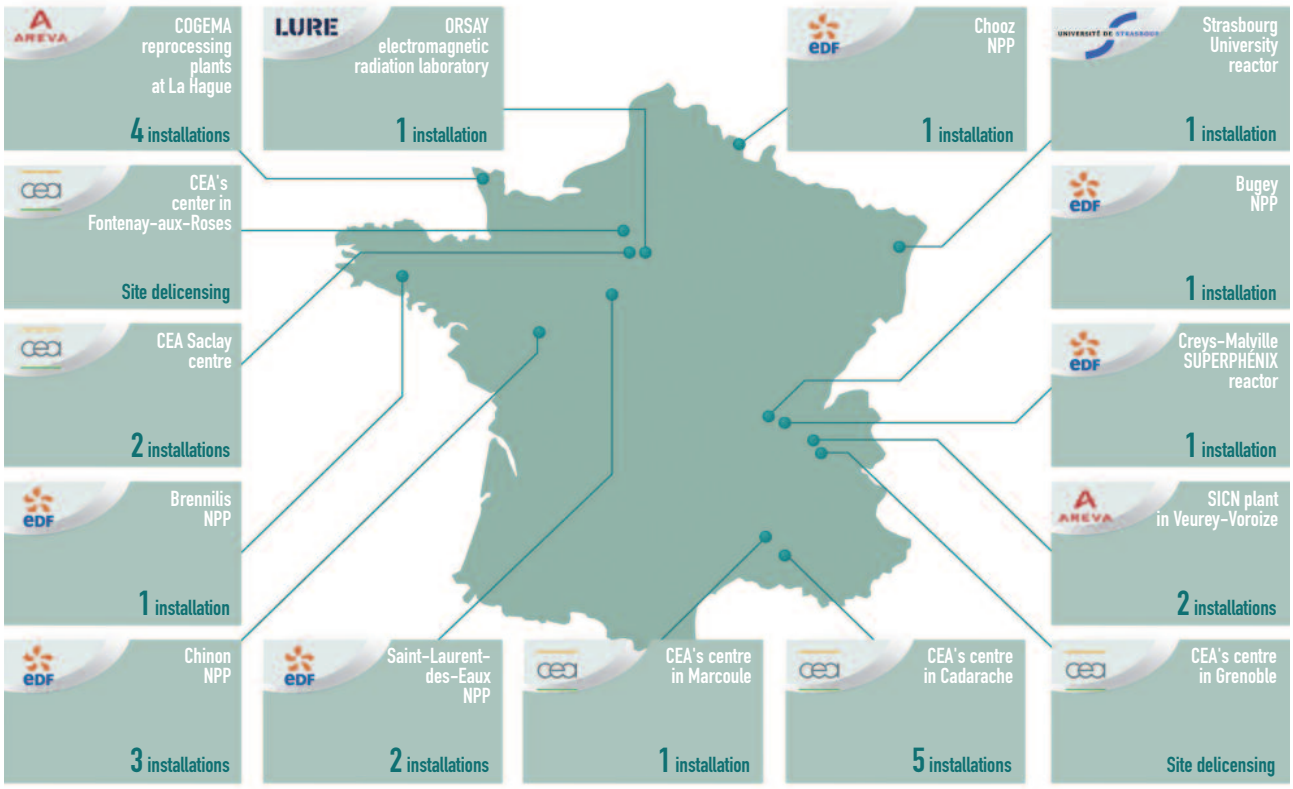
The conclusion after examining the file is that the principles of the strategy are basically satisfactory, but some additions are required, particularly with regard to alternative solutions for the management of graphite waste.

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 system of internal authorisations is now governed by decree 2007-1557 of 2 November 2007 (see chapter 3) concerning BNIs and the regulation of the nuclear safety of the transport of radioactive substances. ASN decision 2008-DC-106 of 11 July 2008 specifies the ASN requirements for implementation of the provisions of the above decree relative to internal authorisations. Pursuant to article 3 of this decision, EDF submitted a file to ASN presenting an update of its internal authorisation system, concerning the decommissioning operations, with a view to having it approved by the ASN Commission. This file is being examined by the ASN.

Installations shut down or undergoing decommissioning in 2011



Experience feedback from the Fukushima nuclear accident

To take into account the experience feedback from the nuclear accident that occurred at the Fukushima Daiichi NPP in Japan, ASN took decision 2011-DC-0213 of 5 May 2011 instructing Electricité de France (EDF) to carry out a complementary safety assessment of some of its BNIs in the light of the Fukushima Daiichi accident

This decision applies equally well to the EDF reactors in operation, the reactors undergoing decommissioning mentioned below, and the fuel evacuation facility (APEC, situated on the EDF Creys-Malville site in the Isère *département*). ASN has asked that the reports for the EDF reactors under decommissioning and the APEC be submitted by 15 September 2012.

The report presenting the methodology EDF will use for the reactor complementary safety assessments was examined by the Advisory Committee of Experts on 6 July 2011.

2|1|1 The Brennilis NPP

The Brennilis NPP is an industrial prototype of a heavy water-moderated, carbon dioxide-cooled NPP, 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 electro-mechanical components, demolition of non-nuclear buildings, etc.).

The decree 2006-147 of 9 February 2006 authorising EDF to proceed with the complete decommissioning of the installation was abrogated by the State Council on 6 June 2007 on the grounds that the impact study, in application of directive 85/337/CEE of 27 June, amended, should have been made available to the public before the Government delivered the authorisation. The operations that could be carried out, notably repackaging and removal 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 nevertheless considered that EDF should be authorised, as of now, to complete the inventory of the initial radiological and chemical status of the site, to complete the effluent treatment station (STE) decommissioning operations, to clean out and fill in the effluent discharge channel leading to the river Ellez, to clean out the diffuse pollution areas, and lastly, start decommissioning of the heat exchangers following their radiological characterisation. After hearing EDF and the local information committee (CLI) of the Monts d'Arrée, the ASN commission gave the Government a favourable opinion (opinion 2011-AV-0122 of 5 July 2011) to the draft partial decommissioning decree, authorising performance of the operations described above, in accordance with the commission's opinion.

The partial decommissioning decree 2011-886 of 27 July 2011 was published in the *Official Gazette* of 28 July 2011. EDF engaged a new procedure for complete decommissioning by submitting an application file in December 2011.

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.

Furthermore, through decisions 2011-DC-0239 and 2011-DC-0240 of 1 September 2011, and after receiving a favourable opinion from the CODERST (Departmental Council for the Environment and for Health and Technological Risks), ASN has regulated the conditions and limits of water intakes and effluent discharges.

2|1|2 Natural Uranium Graphite Gas Reactors (UNGG)

During the investigation of the file submitted by EDF in June 2009 concerning updating of the strategy for NPP decommissioning, ASN reaffirmed its strong support for an immediate decommissioning strategy. It nevertheless notes that where UNGGs are concerned, the question of the disposal route for graphite waste complicates 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 storage site for graphite waste in order to continue the decommissioning of the UNGGs.

Bugey 1 reactor

The final shutdown and work continued until the end of 2008, when the complete decommissioning decree for 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. The compartment was found to be in good condition with relatively low dust loading. The file concerning the integrity of the reactor internal structures will be examined by ASN.

The decommissioning preparation work, excluding the reactor vessel, started in November 2010 and continued in 2011. This work consisted in freeing up the premises necessary for the installation of the reactor vessel decommissioning "support" functions.

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.

Views of the Saint-Laurent-des-Eaux NPP before and after the works

The work to characterise the rubble in the underground premises was completed in December 2010. The first observations showed that the majority of the underground rooms are empty or partially backfilled. The first analysis results confirm the presence of contamination in certain rooms.

The additional sampling operations on the Chinon A2 reactor were completed in March 2011.

The studies prior to the work to decontaminate the ground between the Chinon A2-A3 reactors are continuing.

The complete decommissioning of the Chinon A3 reactor vessel was authorised by decree 2010-511 of 18 May 2010. The main work carried out in 2011 was the preparation for decommissioning of the heat exchangers (the first step in the decommissioning of the installation).

Furthermore, in December 2010, under article 26 of decree 2007-1557 of 2 November 2007, EDF lodged a file with ASN applying for the modification of certain prescriptions of the ministerial order of 20 May 2003, amended by the order of 17 August 2005, authorising EDF to continue the water intakes and liquid and gaseous discharges for the operation of the Chinon site. This file aims at modifying the atmospheric discharge conditions to allow the decommissioning work on the Chinon A3 heat exchangers to be performed. This file, which is currently being examined, was made available for public consultation in July 2011.

Furthermore, pursuant to article 37 of the Euratom Treaty, on 20 December 2011 the European Commission gave a favourable opinion for the project to discharge radioactive effluents resulting from the first phase of decommissioning of the Chinon A3 reactor.

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.

The work to renovate the instrumentation of the discharge stacks and reorganise the waste storage areas continued in 2011.

For Saint-Laurent A1 reactor, the pre-clean-out work on the pool and its structural reconstitution were carried out in 2011 with a view to using the pool for the decommissioning of the reactor compartments.

2|1|3 CHOOZ A reactor (Ardennes NPP)

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 27 September 2007.

By decision 2010-DC-0202 of 7 December 2010, ASN authorised the start of primary system decommissioning, apart from reactor vessel, subject to compliance with a number of technical requirements, and thus lifted the stopping point mentioned in paragraph III of article 2 of the Chooz A decommissioning decree.

Two steam generators were dismantled in 2011.

Removal of a steam generator at Chooz – October 2011

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. The four reactor coolant pumps were decommissioned in 2010, while the decommissioning of the intermediate heat exchangers, authorised by ASN on 3 August 2010, is in progress and should be completed in 2012.

ASN has authorised EDF to put the sodium treatment facility (TNA) into service, and to store the blocks of soda concrete produced by TNA through decision 2010-DC-0187 of 6 July 2010. The sodium treatment process is carried out by hydrolysis and leads to the production of 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 removal.

The treatment of sodium from the primary and secondary cooling systems in TNA is in progress and should end in 2016. More than a quarter of the total sodium has been treated to date.

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 facility now includes within its bounds the storage area for the soda concrete packages produced by the sodium treatment plant.

EDF plans submitting the periodic safety review file at the end of 2012.

2|2 CEA installations

In December 2006, the Advisory Committees of Experts 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. Nevertheless, at the request of ASN, the CEA delivered an interim report on the updating of its decommissioning strategy, justifying the chosen deadlines and explaining the reasons, technical or otherwise, for the many delays with respect to the schedule. In response, ASN reiterated its position concerning the use of institutional controls, the priority given to immediate decommissioning, the clean-out levels to attain, and the schedule objectives for certain decommissioning operations.

2|2|1 Fontenay-aux-Roses centre

CEA's first research centre, dating from 1946 and 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. The decommissioning of the two installations present on the site, the Process installation (BNI 165) and the Support installation (BNI 166), was authorised by decrees 2006-772 and 2006-771 of 30 June 2006 published in the *Official Gazette* of 2 July 2006. Since January 2008, the laboratory clean-out and installation decommissioning programme has been built around a project called Aladin. This project uses the experience feedback from the Grenoble Passage project. These operations were initially planned to last about ten years, but the CEA has already informed ASN that, due to the strong presumptions of radioactive contamination underneath building 18, the decommissioning operations will be extended until 2012 for BNI 165, and 2025 for BNI 166. These dates are announced without allowing for any major contingencies that could arise during the works.

Before the administrative delicensing of the BNIs of the centre, ASN has asked the CEA to characterise the soils and propose a solution for their rehabilitation if necessary. The rehabilitation work sites are continuing, and the results of the hydrogeological study that started in 2009 should be submitted in 2013.

The Process installation (BNI 165)

This BNI, which comprises two buildings (buildings 18 and 52/2), accommodated nuclear fuel reprocessing research and development activities. These activities were stopped in 1985 for building 52/2 and in 1995 for building 18.

The decommissioning file for the PETRUS unit, initially omitted in the safety analysis report, submitted in support of the application for decree 2006-772, was submitted by the licensee in summer 2010 and was the subject in 2011 to decision 2011-DC-0245 of 11 October 2001 subjecting these operations to its authorisation, pursuant to article 4.2 of the abovementioned decree. The decommissioning work for this unit, which contains one of the largest shielded lines of building 18, 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 installation (BNI 165), before being decommissioned in turn.

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

To improve the organisation of its activities and hence the safety of its installation, the CEA has installed a new waste drum characterisation line called SANDRA B. It submitted an application file in July 2010 and ASN authorised its entry into service in March 2011.

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 from the 1980's, the nuclear activities were gradually transferred to other centres. Now the Grenoble centre conducts its research and development in the fields of renewable energies, health and microtechnology.

In 2002 the CEA centre in Grenoble launched a site delicensing process. This project, called "Passage", aims for nuclear activities to be completely over by 2012.

The site housed six nuclear installations which have been gradually phasing out their activities and moving to the decommissioning phase with the ultimate aim of delicensing. Delicensing of the SILOETTE reactor (BNI 21) was declared in 2007.

The CEA Grenoble centre has organised a large-scale event to highlight the progress of the "Passage" project, uniting all the contributing stakeholders. It was held on 1 July 2011 in the presence of the chairman of ASN, who underlined the quality of the work carried out and urged the CEA to continue its efforts in compliance with the regulations.

The departure of part of the CEA teams from the "Passage" project must not negatively impact the running of the operations. ASN thus asked the CEA Grenoble to remain vigilant and maintain the means enabling it to ensure maximum control over the safety of its facilities, in spite of the gradual reduction of the risks in terms of worker safety and radiation protection.

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

The STED decommissioning operations were authorised for a period of eight years by decree 2008-980 of 18 September 2008, published in the *Official Gazette* on 21 September 2008.

The BNI 79 (STED) included in the bounds of BNI 36 is a decay storage facility for high-activity (HA) waste, which was completely emptied in 2010. There is currently no HA waste on the site.

The buildings have either already been destroyed or are undergoing dismantling in accordance with the abovementioned decree. The work to rehabilitate the ground is continuing, and part of the radiologically contaminated soils has been excavated.

Active material analysis laboratory (LAMA - BNI 61)

The active material analysis laboratory (LAMA) entered service in 1961. This laboratory conducted post-irradiation studies of uranium and plutonium based nuclear fuels, and structural materials from nuclear reactors. The scientific research activities ended in 2002.

Decommissioning of the LAMA was authorised by decree 2008-981 of 18 September 2008 and published in the *Official Gazette* of 21 September 2008. The year 2011 was marked by the delicensing of a portion of the premises of the installation by internal authorisation, with the approval of ASN. An inspection carried out at the end of summer 2011 validated the internal authorisation system in order proceed with delicensing of the waste zoning.

The CEA is continuing the clean-out of the very high level (VHL) cells and could use this procedure for the delicensing of the VHL cells by 2013.

MÉLUSINE reactor (BNI 19)

MÉLUSINE is an old pool reactor intended for fundamental research into structures and the production of radionuclides. Final shutdown was declared in 1994. The decree 2004-26 authorising CEA to modify the Mélusine reactor prior to its decommissioning and delicensing was published in the *Official Gazette* on 9 January 2004. The clean-out work has been completed and in mid-2009, CEA submitted a file applying for BNI delicensing. ASN consulted the Prefect of the Isère *département*, the parishes concerned and the local information committee (CLI), which gave a favourable opinion in summer 2010. Nevertheless, owing to the residual presence of three zones that did not comply with the chosen clean-out criteria, ASN asked the CEA to continue its cleaning out in order to achieve complete clean-out or to introduce institutional controls over the areas in question.

The CEA then proceeded with the clean-out of the three particular points in the first half of 2011. Thus, the ministerial order of 15 December 2011 approving ASN decision 2011-DC-250 for the delicensing of BNI 19 was published in the *Official Gazette* of 22 December 2011. Consequently, this installation is no longer subject to the BNI legal system.

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 installations, operations have been continuing. All the internal structures have been dismantled, but the activity level of the pool block turned out to be higher than predicted in the initially envisaged decommissioning scenario. Despite a one year extension to the operations time initially prescribed in decree 2010-111 of 1 February 2010, the CEA reported further difficulties in treating the basemat (migration of low level contamination within the basemat). ASN has asked the CEA to present its strategy for completing the basemat clean-out work.

2|2|3 The Cadarache centre installations undergoing decommissioning

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 on 10 June 2009, illustrates the feasibility of complete decommissioning.

Nevertheless, all the lessons must be drawn from the malfunctions associated with the ATPu incident (discovery of an underestimation of the quantity of fissile materials retained in the

ASN inspection of the delicensing of the SILOE reactor basemat – December 2011

View of the RAPSODIE reactor

glove-boxes) and declared by the 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 CEA 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. ASN reminded the CEA in 2011 that it wanted the decommissioning authorisation application file to be submitted without delay.

Enriched uranium processing facilities (ATUEs)

The ATUEs converted the uranium hexafluoride (UF_6) from the isotopic enrichment plants into sinterable oxide. They 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 final shutdown and decommissioning decree for the facility was issued in February 2006, and prescribed work completion within 5 years. The year 2006 saw completion of the decommissioning phase for the process equipment.

The phases of structural dismantling and complete clean-out of the civil engineering continued from that time, but with several interruptions due to technical and economic difficulties. 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.

Because of the significant extension in the duration of the planned decommissioning operations (10 years instead of the 5 years initially planned) and the increase in the quantity of very low level (VLL) waste to be produced, the modifications envisaged by the licensee were considered to be significant and therefore require a new authorisation.

The licensee was thus asked to submit a complete authorisation modification application file as rapidly as possible, so that it can be subject to the public consultations provided for in application of the "TSN" Act.

Pending transmission of this file and its examination prior to the modification of the final shutdown and decommissioning decree for the facility, the provisions of the initial decree of 2006 remain applicable and the clean-out and decommissioning operations continue in this framework

The enriched uranium processing facilities (ATUEs)

Plutonium technology facility (ATPu)

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. AREVA NC has been the industrial operator since 1994, initially in charge of operation and currently in charge of decommissioning. From a regulatory standpoint, CEA nonetheless remains the nuclear licensee for these installations.

Because it was impossible to demonstrate the seismic resistance of these facilities in accordance with the standards in effect[1], AREVA NC ended the commercial activities of 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.

A first phase consisted in recovering and packaging the manufacturing discards and the materials contained in the ATPu and the Chemical Purification Laboratory (LPC.) This phase, which is necessary to reduce the risks inherent in these materials prior to decommissioning of the installations, ended in the first half of 2008. The nuclear materials removed in this phase were repackaged and removed from the facilities, essentially being transferred to the AREVA NC La Hague site.

On 6 October 2009, CEA Cadarache informed ASN that the amounts of plutonium in the installation's glove boxes had been underestimated at about 8 kg during the installation operating period, whereas the quantities recovered to date stood at about 22kg and CEA estimated that the total quantity could even reach 39kg at the end of decommissioning. This significant incident, evidencing deficiencies in the procedures for fissile material accounting and tracking, was rated level 2 on the INES scale by ASN.

Further to this incident, two ASN decisions taken in October 2009 suspended the ongoing decommissioning operations in the facility and defined the conditions for work resumption.

During the years 2010 and 2011, ASN gradually authorised the CEA to resume the decommissioning activities on the basis of specific safety analysis files. Two ASN decisions taken in October 2010 define the technical requirements governing the decommissioning operations.

ASN is very attentive to the integration of experience feedback from the incident of 2009, particularly in the aspects relating to the estimation of fissile material quantities and criticality safety.

The association Les Amis de la Terre, the Collectif Antinucléaire 13, and some private individuals, appealed to the *Conseil d'État* (Council of State) in February 2011 to suspend the ATPu decommissioning activities.

With regard to the summary proceedings aiming at the immediate suspension of the activities, ASN was called upon to draw up the statement of case in defence of the State.

By order of 18 March 2011, the interim relief judge rejected the suspension request, having considered it unfounded.

As for the decree cancellation petition, it will undergo a second examination by the Council of State in the coming months.

Chemical purification laboratory (LPC)

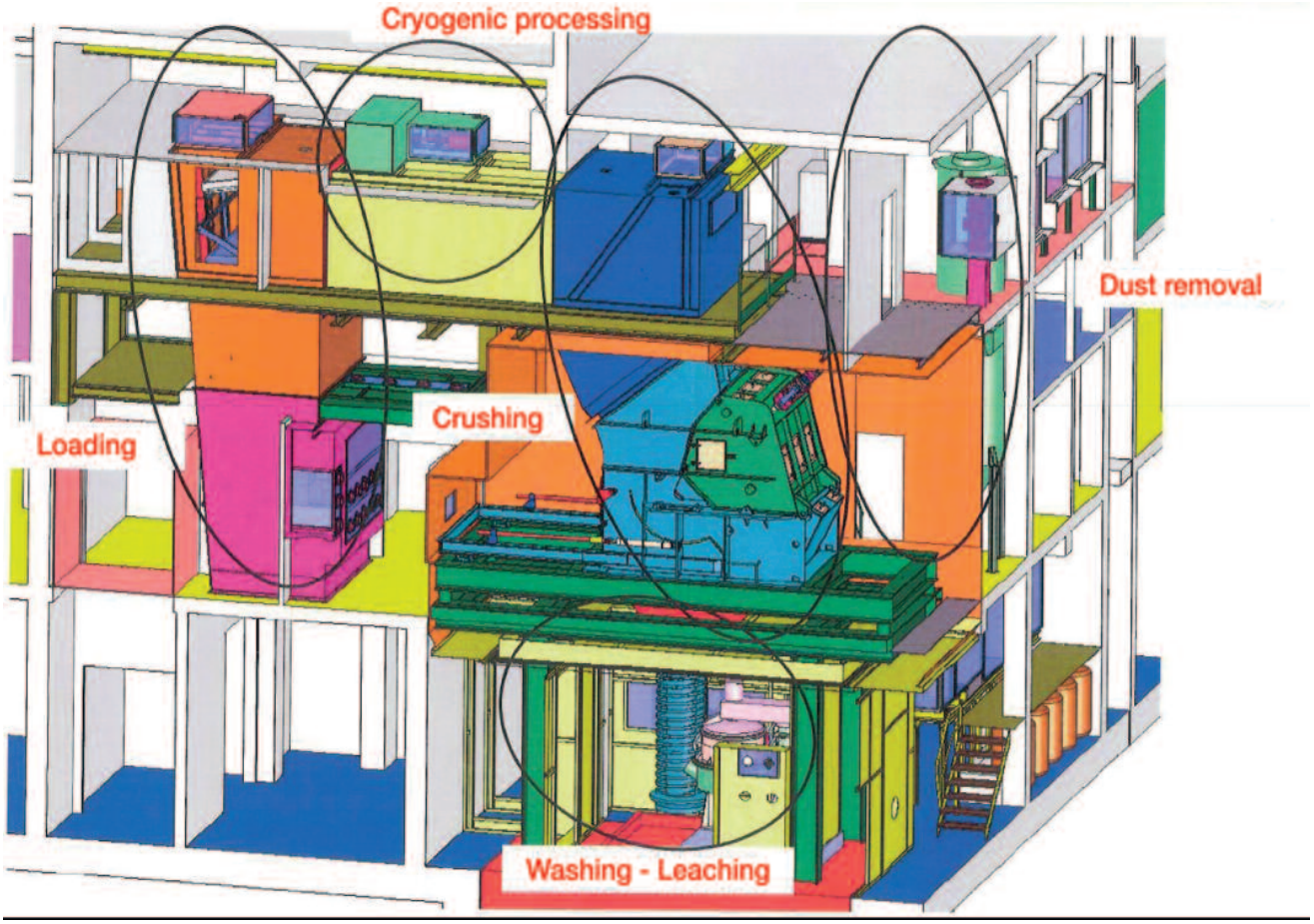
Operation of the LPC, which primarily served for the treatment of effluents and the analysis of the ATPu production, was stopped in 2003. The operations for final cessation of operations carried out as from 2003 consisted notably in removing the radioactive material present in the facilities by emptying and rinsing the effluent tanks and treatment equipment.

The final shutdown and decommissioning decree for the LPC, dated 6 March 2009, provides for six steps: The first step, of an estimated duration of seven years, is currently under way.

It consists in removing the first containment barrier within which the nuclear material was prepared.

1. The unsatisfactory resistance of the ATPu to the reference earthquake was confirmed by the complementary safety assessment (CSA) requested by ASN further to the Fukushima accident in March 2011 and submitted by the CEA in September 2011. This CSA confirmed the need to decommission and clean-out this facility as early as possible and plans for additional emergency management measures.

Schematic diagram of the LPC cryogenic processing unit



The decree of 6 March 2009 included two stopping points for this step, subject to the prior agreement of ASN, relative firstly to the decommissioning of the cryogenic processing unit, and secondly to the active tanks and associated equipment.

On 20 October 2011 ASN took two decisions, firstly to partially lift the stopping point concerning decommissioning of the active tanks, and secondly to totally lift the stopping point for decommissioning of the cryogenic processing unit. These decisions also include additional requirements, relating in particular to safety and the prevention of criticality risks in the tank decommissioning operations.

2|2|4 The Saclay centre installations undergoing decommissioning

The site decommissioning plan includes two BNIs that are definitively shut down, two ICPEs (Installations Classified on Environmental Protection Grounds), namely EL2 and et EL3, which were previously BNIs but which have not been completely dismantled due to the absence of a disposal route for HLW-LL waste, and three BNIs in operation but with sections having ceased their activity in which operations to prepare for final shutdown are currently being carried out (BNI 35, BNI 72 and BNI 50).

High activity laboratory (LHA) (BNI 49)

The high level activity laboratory (LHA) comprises several laboratories intended for research into or production of various radionuclides. On completion of 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 should remain under the ICPE system by 2018.

Dismantling work on the active effluent inter-cell tanks is continuing.

ASN has asked the licensee to improve monitoring of the outside contractors who are carrying out all the decommissioning work.

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, which is low. The end of reactor

operation was declared on 9 February 2007, and the final shutdown and decommissioning application was filed with the MSNR (Nuclear Safety and Radiation Protection Mission) in June 2009. ASN gave its opinion in 2010, considering that the file was admissible, but asked that some additional information be integrated before the public inquiry. The file is currently being reviewed.

CELIMENE cell (BNI 50)

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.

2|3 AREVA installations

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

UP2 400 spent fuel reprocessing plant and associated facilities

HAO / Sud (High Activity Oxide / South) (BNI 80):

The situation of 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.

The final shutdown and decommissioning application file for BNI 80 (HAO) was submitted at the beginning of 2008. The final shutdown and decommissioning decree for this facility, dated 31 July 2009, was published in the *Official Gazette* on 4 August 2009. This decree provides for three steps. The first step, planned to continue until the end of 2015, is in progress. It aims at carrying out the majority of the decommissioning operations of the HAO / South facility, while the HAO / North facility, still in operation, is to be decommissioned in a second phase.

The abovementioned final shutdown and decommissioning decree of 31 July 2009 provides for four stopping points that are subject to prior ASN agreement.

The first of these stopping points concerns the recovery and packaging operations for the waste contained in the HAO silo and in the organised disposal of hulls (SOC). Between July and December 2010, the licensee sent ASN a set of files relative to the safety of these operations, which are subject to a technical examination.

A first draft decision on the partial lifting of this stopping point is currently being prepared.

BNI 33, 38 and ELAN IIB (BNI 47):

– 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, radiological 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 three final shutdown and decommissioning authorisation applications for BNIs 33 (UP2 400), 38 (STE2 and AT1 facility) and 47 (ELAN IIB). Further to the examination conducted by ASN, these files were judged inadmissible by the ministers in charge of nuclear safety[2]. AREVA thus made a number of additions to its files in November and December 2009.

In a letter dated 13 January 2010, the ministers in charge of nuclear safety, on the basis of ASN's proposal, judged these files admissible. The public inquiry was held from 27 September to 27 October 2010, and concluded with a favourable opinion from the inquiry commissioners.

On completion of the technical examination of the files submitted by the licensee, the Advisory Committee of Experts for plants (GPU) examined the possible conditions for authorising decommissioning of these facilities, at its meeting of 23 March 2011. The GPU indicates in its opinion sent on 20 April 2011 that the decommissioning measures defined by AREVA NC display nothing unacceptable from the point of view of safety, radiation protection or the management of waste and effluents. The opinion of the GPU nevertheless reveals the need for the operator to provide a large number of complementary studies, particularly with respect to the risks associated with earthquakes and the feasibility and safety of certain legacy waste recovery and packaging operations.

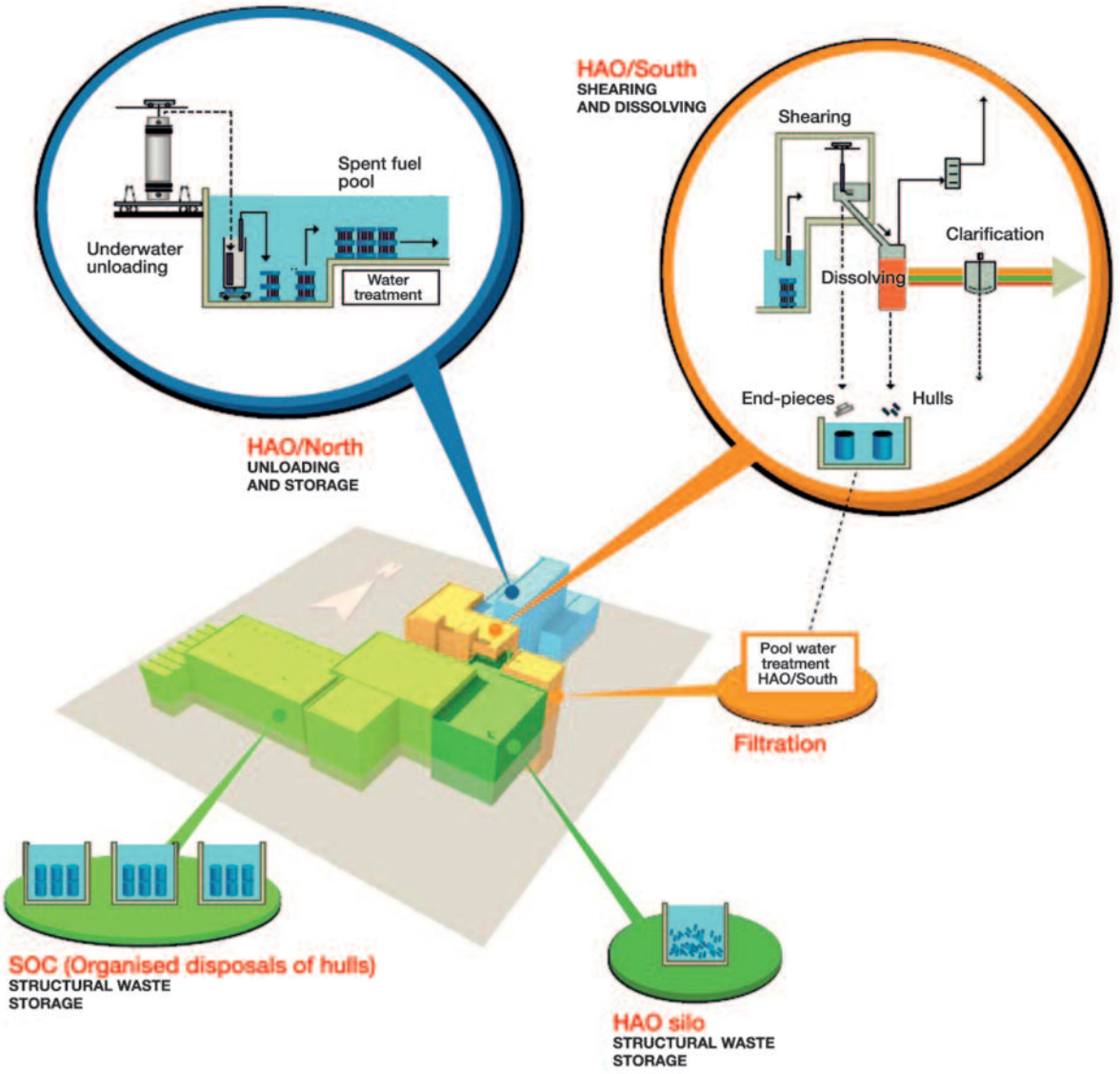
These decommissioning files are currently being examined.

COMURHEX plant of Pierrelatte (BNI 105)

Since 1961, the activity of the COMURHEX Pierrelatte plant on the Tricastin nuclear platform has been the chemical conversion

2. It is the MSNR (Nuclear Safety and Radiation Protection Mission) within the Ministry of Ecology, Sustainable Development, Transport and Housing, that delivers the decisions, based on the ASN proposal.

The HAO facility (AREVA)



of uranium (fluorination of uranium tetrafluoride, UF_4, into uranium hexafluoride, UF_6). This step precedes the enrichment of UF_6 carried out by EURODIF.

The COMURHEX Pierrelatte plant comprises several facilities with different administrative statuses: there are ICPEs ensuring the fluorination of natural uranium, and BNI 105 which fluorinates reprocessed uranium. This BNI definitively stopped operation at the end of 2008.

A project for the creation of a new BNI to take over from BNI 105 is being studied.

In May 2011, at the request of ASN, the BNI 105 licensee submitted a final shutdown and decommissioning application file. ASN judged this file inadmissible, mainly due to the inadequacy of the impact study.

Moreover, the coexistence on the same site of a BNI and various ICPEs displaying associated risks and possessing a number of common equipment items, considerably complicates administrative tracking and regulation of the facilities, currently ensured by the DREAL (Regional Directorate for the Environment, Planning and Housing) for the ICPEs, and ASN for the BNI. In addition, this situation is not in conformity with the provisions of the TSN act, which in such cases provides for all the facilities to be included within the perimeter of the BNI, and for ASN to regulate all the facilities, including the ICPEs.

Consequently, to bring the administrative situation of BNI 105 into conformity with the applicable requirements, ASN decided in October 2011 to propose a draft decree to the ministers responsible for nuclear safety, modifying the perimeter of BNI 105 in order to include all the site's facilities in it.

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

definitively at the beginning of the years 2000. 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 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 has therefore changed and entails the dismantling 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 institutional controls that will be put in place during administrative delicensing of the BNIs.

The inspections carried out by the ASN in 2010 revealed a lack of rigour in the monitoring of the decommissioning worksites.

During the inspections carried out in 2011, ASN had samples taken from the soils and ground water in order to assess the level of radiological and chemical contamination of the areas outside the site. These analyses are in progress.

During one of these inspections, pipes that still contained contaminated effluents were discovered, necessitating additional work to eliminate these structures. At the request of ASN, the licensee notified a significant event further to this discovery.

As the decommissioning work has not been completed, ASN considers that delicensing of the facilities cannot be envisaged in their present state. Delicensing could be envisaged in 2012 after completing the works, subject to confirmation by appropriate radiological measurements that the clean-out objectives have been achieved.

2|4 Others 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 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 CLI which was instituted in July 2010 by the *Conseil Général* of the Bas-Rhin *département*. An institutional control to maintain a record that a BNI was operated on the land, should be signed before delicensing of the facility is declared.

2|4|2 The Electromagnetic radiation laboratory

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 lasted from 2004 to 2008, the LURE licensee, the CNRS (French National Centre for Scientific Research) 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. Review of this application resulted in MAD-DEM (final shutdown and decommissioning) decree 2009-405 dated 14 April 2009.

The decommissioning operations were completed in 2010, though two particular areas present residual activity linked to the presence of the electron converters and have not been completely cleaned out, to maintain the stability of the building. The licensee submitted its decommissioning file in spring 2011. ASN performed a delicensing inspection of the waste zoning which revealed the presence of radiological activity in a pipe. ASN asked the licensee to completely remove this piping. The work was carried out during the 4th quarter of 2011.

At the same time, institutional controls to restrict access to specific areas have been engaged with the Essonne *département* prefecture.

3 OUTLOOK

The main actions ASN will carry out in 2012 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 methodologies.

In 2012, ASN will continue its inspections of installations undergoing decommissioning. It will focus in particular on:
– examining the complete decommissioning authorisation application for the Brennilis NPP;
– continue examining the decommissioning applications and finalise its opinion concerning the draft final shutdown and decommissioning (MAD DEM) decrees for the nuclear facilities of the UP2 400 plant at La Hague;
– reviewing the preparatory operations for final shutdown of the installations that will soon be shut down and decommissioned (PHÉNIX, COMURHEX, EURODIF).

The announcement of the pushing back of several decommissioning deadlines has led ASN to ask the CEA for an interim report on the updating of its decommissioning strategy (see point 2|2). ASN will endeavour to examine the information communicated by the CEA as part of this update.

APPENDIX 1: LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2011

Installation Location	BNI	Type of installation	Commissioned	Final shutdown	Last regulatory acts	Current status
NEREIDE FAR* CENTRE	(former BNI 10)	Reactor (500 kWth)	1960	1981	1987: Removed from BNI list	Decommissioned
TRITON FAR* CENTRE	(former BNI 10)	Reactor (6.5 MWth)	1959	1982	1987: Removed from BNI list and classified as ICPE	Decommissioned
ZOÉ FAR* CENTRE	(former BNI 11)	Reactor (250 kWth)	1948	1975	1978: Removed from BNI list and classified as ICPE	Confined (museum)
MINERVE FAR* CENTRE	(former BNI 12)	Reactor (0.1 kWth)	1959	1976	1977: Removed from BNI list	Dismantled at FAR* and re-assembled at Cadarache centre
EL 2 SACLAY CENTRE	(former BNI 13)	Reactor (2.8 MWth)	1952	1965	Removed from BNI list	Partielly decommissioned, remaining parts confined
EL 3 SACLAY CENTRE	(former BNI 14)	Reactor (18 MWth)	1957	1979	1988: Removed from BNI list and classified as ICPE	Partielly decommissioned, remaining parts confined
PEGGY CADARACHE CENTRE	(former BNI 23)	Reactor (1 kWth)	1961	1975	1976: Removed from BNI list	Decommissioned
CÉSAR CADARACHE CENTRE	(former BNI 26)	Reactor (10 kWth)	1964	1974	1978: Removed from BNI list	Decommissioned
MARIUS CADARACHE CENTRE	(former BNI 27)	Reactor (0.4 kWth)	1960 in Marcoule, 1964 in 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* CENTRE	BNI 34	Processing of liquids and solid waste	Before 1964	2006	2006: Removed from BNI list	Integrated into BNI 166

APPENDIX 1: LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2011

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Last regulatory acts	Current status
HARMONIE CADARACHE	(former BNI 41)	Reactor (1 kWth)	1965	1996	2009: Removed from BNI list	Destruction of ancillaries building
ALS	(former BNI 43)	Accelerator	1958	1996	2006: Removed from BNI list	Cleaned-out – institutional controls***
SATURNE	(former BNI 48)	Accelerator	1966	1997	2005: Removed from BNI list	Cleaned-out – institutional controls***
ATTILA** FAR*	(former BNI 57)	Reprocessing pilot	1968	1975	2006: Removed from BNI list	Integrated into BNIs 165 and 166
LCPu FAR* CENTRE	(former BNI 57)	Plutonium chemistry laboratory	1966	1995	2006: Removed from BNI list	Integrated into BNIs 165 and 166
BAT 19 FAR* CENTRE	(former BNI 58)	Plutonium metallurgy	1968	1984	1984: Removed from BNI list	Decommissioned
RM2 FAR* CENTRE	(former BNI 59)	Radio-metallurgy	1968	1982	2006: Removed from BNI list	Integrated into BNIs 165 and 166
LCAC GRENOBLE CENTRE	(former BNI 60)	Fuels analysis	1975	1984	1997: Removed from BNI list	Decommissioned
STEDs FAR* CENTRE	(former BNI 73)	Radioactive waste decay storage	1989		2006: Removed from BNI list	Integrated into BNI 166
ARAC SACLAY CENTRE	(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, institutional controls***
FBFC PIERRELATTE	(former BNI 131)	Fuel fabrication	1990	1998	2003: Removed from BNI list	Cleaned-out, institutional controls***
SNCS OSMANVILLE	(former BNI 152)	Ioniser	1983	1995	2002: Removed from BNI list	Cleaned-out, institutional controls***
MAGASIN D'URANIUM MIRAMAS	(former BNI 134)	Uranium bearing materials warehouse	1964	2004	2007: Removed from BNI list	Cleaned-out, institutional controls***
SILOETTE GRENOBLE CENTRE	(former BNI 21)	Reactor (100 kWth)	1964	2002	2007: Removed from BNI list	Cleaned-out, institutional controls***
MÉLUSINE GRENOBLE CENTRE	(former BNI 19)	Reactor (8 MWth)	1958	1988	2011: Removed from BNI list	Cleaned-out

(*) 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 UNDERGOING DECOMMISSIONING AS AT 31.12.2011

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Last 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 decree	Decommissioning in progress
SILOÉ GRENOBLE	20	Reactor (35 MWth)	1963	1997	2010: Modification of final shutdown and decommissioning decree	Decommissioning in progress
RAPSODIE CADARACHE	25	Reactor (40 MWth)	1967	1983		Preparation for final shutdown
EL 4D (FORMERLY-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 / State Council cancelling the decree of 2006 2011: Partial decommissioning decree	Partially decommissioned, changed into a BNI for storing waste left in place. Decommissioning in progress again.
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 UNDERGOING DECOMMISSIONING AS AT 31.12.2011

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Last 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 progres
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		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	2009 : 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* CENTRE PROCESS	165	Grouping of former process installations	2006		2006 : Final shutdown and decommissioning decree	Decommissioning in progress
FAR* CENTRE SUPPORT	166	Waste packaging and processing	2006		2006 : Final shutdown and decommissioning decree	Decommissioning in progress

(*) Fontenay-aux-Roses : création des INB 165 et 166, en substitution aux INB 34,57,59 et 73 et mise en œuvre des opérations de mise à l'arrêt et de démantèlement des INB 165 et 166 suite au regroupement de bâtiments dans le cadre du projet de dénucléarisation du site de Fontenay aux Roses.