SAFE DECOMMISSIONING OF BASIC NUCLEAR INSTALLATIONS

CHAPTER 15

The term decommissioning generally covers all the technical or 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 shutdown and then decommissioned, particularly over the past fifteen years. In 2008, 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. The safety and radiation protection of the decommissioning of these installations therefore gradually became major issues for ASN.

With the specific aspects of decommissioning activities (changing nature of the risks, rapid changes in the installation status, duration of the operations, etc.) ruling out implementation of all the regulatory principles that were relevant during the installation operating period, the nuclear installation decommissioning regulations have evolved gradually since the 1990s. This situation was recently clarified and supplemented by the TSN Act.

Decommissioning is a major issue for ASN, which has gradually built up the regulations and the policy applicable to this phase in the life of basic nuclear installations. In 2008, it released a memo presenting its nuclear installation decommissioning policy. This memo will be finally published in 2009 after incorporation of the comments it has received (see chapter 6). It also devoted an issue of its "*Contrôle*" magazine to the subject of decommissioning. This issue was presented at a press conference in November 2008. On these various occasions, ASN was able to observe the keen interest in decommissioning, on the part of both the public and the media. ASN will be continuing its actions with the aim of stimulating a debate around this subject. It informed the French National Public Debates Commission that it was in favour of organising a public debate on decommissioning, as requested by a number of associations.

1 TECHNICAL AND LEGAL REQUIREMENTS APPLICABLE TO DECOMMISSIONING

1|1 Decommissioning strategies

The International Atomic Energy Agency (IAEA) has defined three decommissioning strategies for nuclear installations, following 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 allow release of the site (the "conventional" parts of the installation can be decommissioned as soon as the installation is shut down);
– immediate decommissioning: in this case, decommissioning is started as soon as the installation is shut down, with no waiting period, although these decommissioning operations can be spread out over a long period of time.

The decision to opt for one or other of the decommissioning strategies is influenced by a large number of 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 radiations as a result of the decommissioning operations, etc. International practices therefore differ from one country to another.

In compliance with IAEA recommendations, ASN today recommends that the French BNI licensees choose immediate decommissioning strategies.

This strategy in particular avoids placing the technical and financial burden of decommissioning on future generations. At the present time, 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 produced by decommissioning is a crucial point that determines the correct running of the decommissioning programmes in

progress (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 reuse of the waste resulting from decommissioning, ASN is attentive to the correct application of French waste policy, 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 does support moves to make use of this waste within the nuclear sector. A number of studies are under way along these lines.

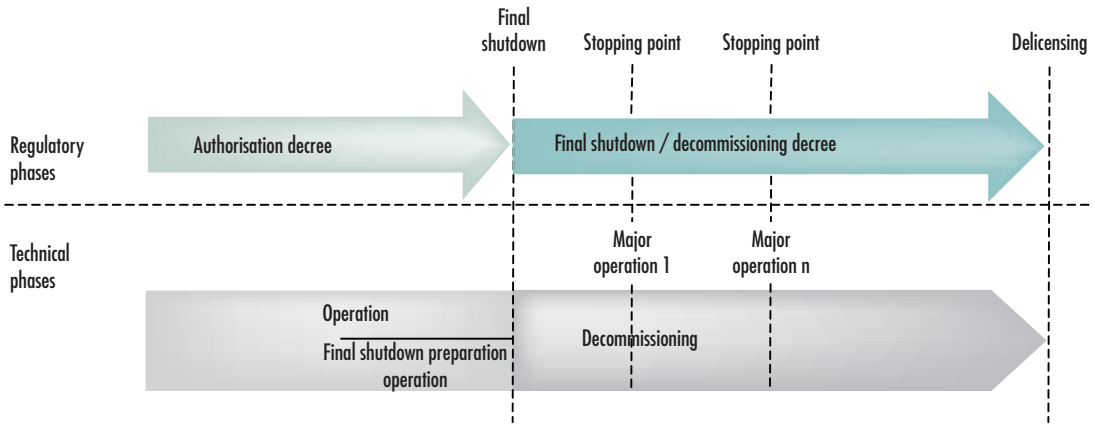
1|2 Legal requirements

The technical provisions applicable to installations to be shut down and decommissioned must obviously be in compliance with general safety and radiation protection rules, notably regarding worker external and internal exposure to ionising radiations, criticality, the production of radioactive waste, discharge to the environment of radioactive effluents and measures designed to reduce the risk of accidents and mitigate their consequences. Safety issues, in other words 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 cease operations in its installation in order to proceed with final shutdown and decommissioning, it can no longer be covered by the regulations set by the 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 condition 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 final shutdown and decommissioning phase may be preceded by a final shutdown preparation stage[1], provided for in the initial operating authorisation. This preparatory phase in particular 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.). Installation characterisation operations are also performed during this preparatory phase: production of radiological maps, collection of pertinent data (operating history), for the purposes of subsequent decommissioning.

Diagram 1: phases in the life of a BNI



1. Formerly called "final cessation of operation".

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 up until delicensing. As applicable, compensatory measures proportional to the risks presented by the installation during decommissioning will be taken.

Following decommissioning, a nuclear installation can be delicensed. It is then removed from the list of basic nuclear installations and no longer has BNI status. In support of its delicensing application, the licensee must submit a file demonstrating that the envisaged final status has indeed been reached, including a description of the condition of the site after decommissioning (analysis of the condition of the remaining soil, buildings or equipment). Depending on the final status reached, public protection restrictions may be implemented, depending on the anticipated subsequent use of the site and/or buildings. This may entail a certain number of limitations on use (for example industrial uses only) or precautionary measures (radiological measurements 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 basic nuclear installation decommissioning operations, following major work designed to clarify and simplify the administrative procedure while at the same time improving the importance given 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 will be published at the beginning of 2009. The main objectives of this guide, intended for nuclear licensees, are:
– to give a detailed explanation of the regulatory procedure established by the TSN Act implementing decree;
– 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 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 2007-243 of 23 February 2007 and the order of 21 March 2007 concerning the secure 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. In any case, the nuclear licensees remain responsible for the satisfactory financing of their long-term expenses.

It stipulates that the licensees must make a prudent 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 submit three-yearly reports and annual update memos.

These costs are divided into 5 categories (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 prudent choice of a reference strategy, on consideration of residual technical uncertainties, on consideration of 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 forecasts, and the possible impact of the progress of work 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 will produce the opinions it is required to issue pursuant to Article 12, section 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, section 2 of the same decree. It in particular stipulates that as necessary, and in the same conditions as those which govern 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 forwarded by the licensees

In 2007, all the nuclear licensees had submitted their first three-yearly reports on implementation of the provisions arising from 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).

One year after the first three-yearly reports were submitted, DGEC – now with administrative authority status – has received an annual update memo from each licensee. Pursuant to Article 10 of the agreement, concerning review of the long-term costs, DGEC called on ASN for its opinion on the relevance of their content from the nuclear safety standpoint (decommissioning operations and schedules, management of spent fuel and radioactive waste) and asked it to identify any inadequacies. Apart from any major modifications, ASN's role is to check that the additional information requested in its opinion 2007-AV-037 of 20 November 2007 has been taken into account and does not cast doubt on the strategies presented by the licensees in their three-yearly reports.

1 | 4 Decommissioning risks

Diagram 2 presents the main risks encountered when decommissioning a nuclear installation and the periods during which these risks are highest.

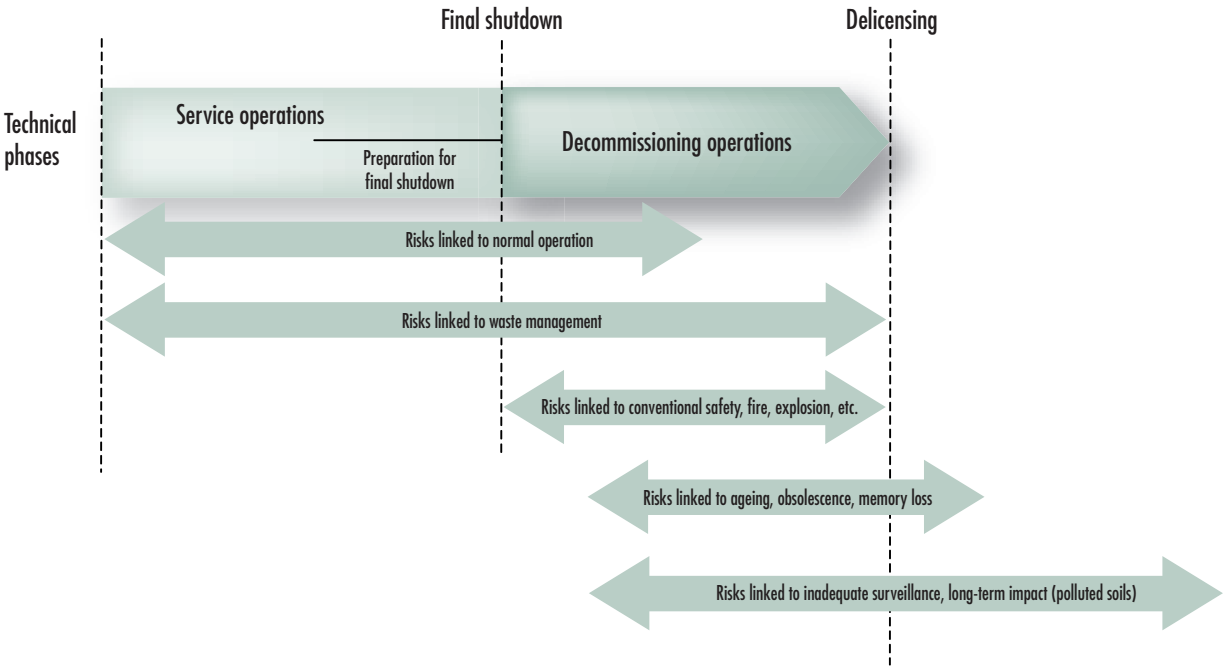
The risks involved in waste management and which concern safety or radiation protection (multiplication of the number of waste storage sites, storage of irradiating waste) are present throughout the phases in which large amounts of waste are being produced and therefore in particular during the decommissioning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

The risks present during operation of the installation 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 conventional safety (numerous contractors working together, falling loads, work at height, and so on) gradually become more important. The same applies to the risk of fire or explosion (hot spot" 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. It follows on from an operating period that often lasts several decades. There is consequently a very real risk of all memory of the design and operation of the nuclear installations being lost. It is vital to be able to collect and thoroughly document the knowledge and memories of the staff involved in the operating phase, particularly as the traceability of the design and operation of the older installations is not always as thorough and reliable as might be desired. 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 in the risks present raise the issue of ensuring that the means of installation surveillance 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 source of risks. Constantly checking the adequacy of surveillance for the rapidly and significantly changing status of the installation is a difficult exercise, and there is a very real risk of failing to detect the onset of a hazardous situation.

Diagram 2: main risks encountered during decommissioning



Following decommissioning, depending on the final condition achieved by the licensee and the specific characteristics of each installation (operational history, incidents, etc), there may be residual risks: unidentified 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.

The technical decommissioning scenarios are chosen by the licensees on a case by case basis, generally as a result of comparative studies. The strategies today chosen by the nuclear licensees are presented in point 2.

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 following any necessary "conventional" clean-out operations (cleaning of the walls of an area using appropriate products for example). However, when activation or contamination migration phenomena occurred during the operating phase, complete clean-out – that is 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).

Nuclear installation at La Hague (Manche *département*) on which complete clean-out operations have been performed

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

The technical problems being experienced by the licensees should be gradually resolved in the future, through the operating experience feedback acquired during the large number of ongoing and future projects. Lessons can also be learned from current examples, for the construction and operation of nuclear installations, particularly concerning operational stringency and traceability (in order to avoid unpleasant surprises during the decommissioning and clean-out phases), as well as the design of the installations (materials used, etc.). The operating experience feedback acquired in 2008 also identified areas where there was significant margin for progress, in certain fields such as understanding contamination migration phenomena in various environments, and improving the way uncertainties are incorporated into the various stages of the complete clean-out approach (from modelling to final radiological inspections).

On the basis of the operating experience feedback received, the ASN technical guide on complete clean-out operations is currently being revised.

2 SITUATION OF NUCLEAR INSTALLATIONS BEING DECOMMISSIONED IN 2008

2|1 EDF nuclear power plants

Since April 2001, and following a request from ASN, EDF decided for all its nuclear installations finally shut down (Brennilis, Bugey 1, Saint-Laurent A, Chinon A, Chooz A and Superphénix) to adopt a new decommissioning strategy, based on complete decommissioning of the reactors, with no waiting period. It thus foresees complete decommissioning of these reactors by 2025. This new strategy was reviewed by the relevant Advisory Committee of experts in March 2004. ASN then considered that there was nothing to compromise the feasibility of the complete decommissioning scenarios envisaged. The conclusions of this review made provision for updating of EDF's decommissioning strategy in 2008. This update was put back to the first half of 2009 so that EDF could examine the consequences on the decommissioning strategy of the postponed opening of the graphite waste disposal facility announced by ANDRA.

Internal authorisations

ASN considers that operations taking place in basic nuclear installations (BNIs) with high stakes in terms of nuclear safety and radiation protection must obtain prior authorisation from it. Conversely, it considers that operations for which the nuclear safety and radiation protection stakes are low or non-existent, must remain the responsibility of the licensee. For intermediate operations, with nuclear safety and radiation protection stakes that are significant but that do not compromise the safety scenarios used in BNI operation or decommissioning, ASN allows the licensee to assume direct responsibility for them provided that it sets up a system of enhanced, systematic internal checks, offering sufficient guarantees of quality, independence and transparency. The decision on whether or not to carry out the operations concerned must be formally authorised by the qualified members of the licensee's staff. The corresponding system is called the "internal authorisations system".

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

The internal authorisations 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

Aerial view of the Brennilis power plant site (Finistère *département*)

specifies ASN requirements for implementation of the provisions of this decree on the subject of internal authorisations. Pursuant to Article 3 of this decision, EDF is required to submit a complete file to ASN by 26 September 2009, presenting its internal authorisations system for approval by the ASN Commission.

2|1|1 The Brennilis power plant

The EL4 nuclear reactor, which was commissioned on 23 December 1966, finally ceased all production of electricity on 13 July 1985. This reactor was an industrial prototype, built and operated jointly by CEA and EDF. For partial decommissioning of this installation, the decree of 31 October 1996 authorised modification of the existing installation, transforming it into an installation for storage of its own equipment left in place, thus creating a new BNI called EL4-D. In the light of its new decommissioning strategy, EDF submitted an application on 22 July 2003 for authorisation for final shutdown and complete decommissioning of the EL4-D installation. Complete decommissioning of the EL4-D installation was authorised by decree 2006-147 of 9 February 2006.

Following a request filed by the "Sortir du nucléaire" association, the *Conseil d'État*[2] on 6 June 2007 cancelled the decree of 9 February 2006. The installation is therefore now subject to the provisions of the decree of 31 October 1996; decommissioning operations have thus ceased. In decision 2007-DC-0067 published in its Official Bulletin of 8 October 2007, ASN specified the regulations applicable to the plant, pending the publication of a new decree authorising its final shutdown and complete decommissioning.

A new complete decommissioning authorisation application file was submitted by EDF on 25 July 2008. This application is being reviewed in the light of the new decree of 2 November 2007 which in particular requires a systematic public inquiry for all complete decommissioning application files.

Article 22 of Act 2006-686 of 13 June 2006 on nuclear transparency and security, requires the creation of a Local Information Committee (CLI) for each nuclear site. Its implementing decree 2008-251 of 12 March 2008 specifies the organisation and operation of these CLIs.

At the end of 2008, the President of the *Conseil général*[3] convened all the representatives of the various committees in order to create the CLI that is to replace the local information body known as the Brennilis decommissioning observatory. The observatory was set up at the end of 1995 by the *préfet*[4] of the *Finistère département*[5], and comprises local and regional elected officials, regional government departments and environmental protection associations, along with trade union organisations from the nuclear sector. The TSN Act states that for any final shutdown and decommissioning application, the CLI must be consulted and provide an official opinion.

2. France's hightest administrative court.
3. *département*-level elected council.
4. In a *département*, representative of the State appointed by the President.
5. Administrative region headed by a *préfet*.

2 | 1 | 2 Gas-cooled reactors (GCR)

Performance of the gas-cooled reactors (GCR) decommissioning programme in accordance with the schedule reviewed during the 2004 Advisory Committee meeting is based on the availability of waste disposal routes. ASN ensures that no decommissioning operation is undertaken until the licensee has proposed sustainable management of the waste resulting from the operation. Therefore, opening of the GCR compartments is dependent on commissioning of the activated waste storage facility and the irradiated graphite disposal centre (CSG). The 28 June 2006 Act on the sustainable management of radioactive materials provides for opening of the graphite repository in 2013, a timeframe that is compatible with the decommissioning programme as initially proposed by EDF. This provided for opening of the compartment at Bugey 1, the lead reactor for GCR decommissioning, in 2009.

However, given the time needed, inter alia, for discussion and siting, ANDRA envisages commissioning a graphite repository by about 2019. ASN therefore reminded EDF of its responsibility as waste producer and asked it to submit in its decommissioning strategy update the consequences of postponing opening of the graphite repository on the safety of the installations being decommissioned and the envisaged compensatory measures. Assuming early opening of the compartments for safety reasons, and pending the commissioning of a repository, the possibility of building a graphite waste temporary storage facility enabling Bugey 1 decommissioning operations to begin, should be examined.

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. These installations are now kept under surveillance, and the main operations carried out in 2008 were removal of the "shell" packages from Chinon A3 to the CSTFA and demolition of the site's former pumping stations. On 29 September 2006, EDF submitted an application for authorisation for final shutdown and complete decommissioning of the Chinon A3 installation. This request is currently being reviewed. A public inquiry was held in March 2007 and its conclusions were favourable.

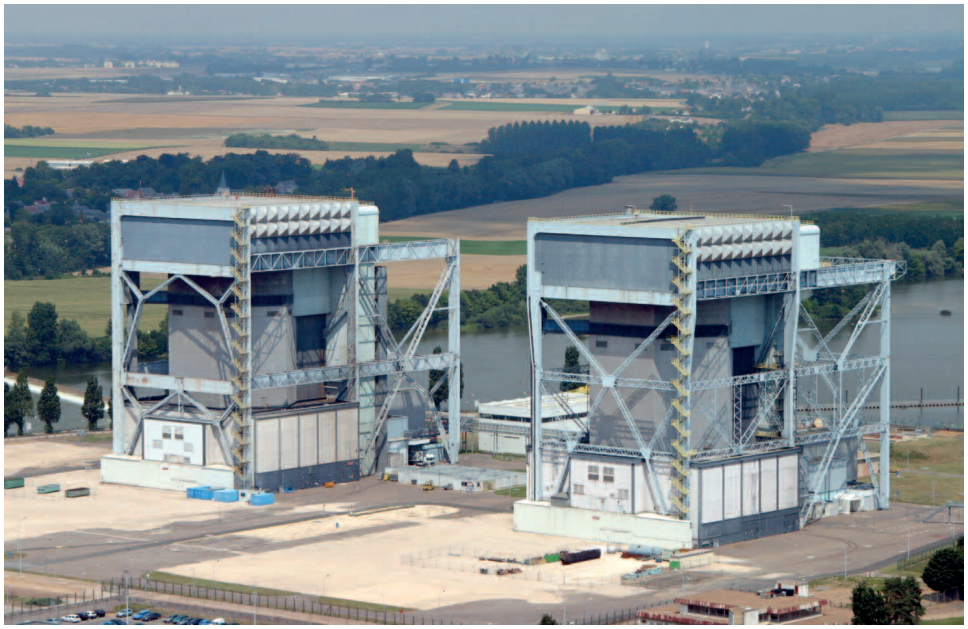
Saint-Laurent-des-Eaux A1 and A2 reactors

The final shutdown operations currently being performed are covered by the provisions of the decree of 11 April 1994.

On 11 October 2006, EDF submitted an application for a complete decommissioning authorisation for the Saint Laurent A1 and A2 reactors. This application is currently being reviewed. A public inquiry was held in February 2007 and its conclusions are favourable.

Removal of the electrical cables is now complete. Work is continuing on water-steam piping disassembly, radiological characterisation of the sludges in the K tank prior to processing and removal from storage and evacuation of legacy waste.

View of the Chinon nuclear power plant site (Indre-et-Loire *département*)



The two gas-graphite reactor units in the Saint-Laurent-des-Eaux nuclear power plant (Loir-et-Cher *département*)

In 2007, ASN observed a drift in the time-frame for the final shutdown operations in progress and problems with the work, in particularly the recovery and packaging of sludges and treatment of pool water. It proved impossible to correct this drift during the course of 2008.

The decommissioning authorisation application was also submitted in September 2008 and is currently being reviewed.

A file applying for renewal of the site's effluent discharge and water intake licences, covering the Saint-Laurent A and Saint-Laurent B installations, was submitted in January 2007, in other words before publication of decree 2007-1557 of 2 November 2007 and is therefore being reviewed in accordance with the requirements of decree 95-5401 of 4 May 1995. Additional information will need to be included in the file before it is submitted to the public inquiry.

Bugey 1 reactor

The decree authorising final shutdown operations was signed on 30 August 1996. In 2006, EDF completed the file enclosed with the application for authorisation for complete decommissioning submitted in 2005. Decommissioning of the Bugey 1 reactor is the first of the GCR decommissioning operations. The decommissioning application file transmitted by EDF was reviewed by the Advisory Committee for plants on 24 October 2007. The conclusions of this Advisory Committee enabled work to begin on drafting of a complete decommissioning decree for the installation.

The draft decree was presented to a plenary session of the BNI Consultative Committee (CCINB) on 22 February 2008 as well as to the ASN Commission on 31 March 2008. These two bodies issued a favourable opinion on the project.

However, ASN considers that some operations involved in complete decommissioning will need to be authorised by ASN, owing either to their importance, or to the need for additional information in the file presented by EDF. This does not call into question the site decommissioning strategy.

Decree 2008-1197 of 18 November 2008 authorises complete decommissioning of the Bugey 1 reactor.

2|1|3 CHOOZ AD reactor (Ardennes nuclear power plant)

The Ardennes nuclear power plant, which was coupled to the grid on 4 April 1967, finally ceased all electricity generation on 30 October 1991. This reactor was the first PWR built in France. For the purposes of partial decommissioning of the reactor, the decree of 19 March 1999 authorised modification of the existing installation, transforming it into an storage facility for its own equipment left on the site, thereby creating a new BNI called CNA-D. As a result of the changes to its decommissioning strategy, EDF on 30 November 2004 filed a final shutdown and decommissioning authorisation application for the CNA-D installation. Decree 2007-1395 of 27 September 2007 authorising EDF to carry out final shutdown and

Operators working on decommissioning the CHOOZ reactor ventilation duct (Ardennes *département*)

A stack section being placed on a semi-trailer during decommissioning of the SUPERPHÉNIX reactor (Isère *département*)

complete decommissioning of the reactor was published in the Official Gazette on 29 September 2007. The installation must now be decommissioned within forty years from the date of publication of the decree. EDF has started decommissioning work (preparation for decommissioning of the equipment in the nuclear auxiliaries cavern and in the reactor cavern, upgrading of the fire detection system, modification of the ventilation).

A file applying for renewal of the effluent discharge and water intake licences for the site, covering the CHOOZ A and CHOOZ B installations, was submitted in October 2006, before publication of decree 2007-1557 of 2 November 2007 and is thus being reviewed in accordance with the provisions of decree 95-5401 of 4 May 1995. Following the review of its acceptability, additional information will need to be added to the file before it can be submitted to the public inquiry.

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. At present, the reactor vessel only contains special assemblies and the lateral neutron protections which present no criticality risk.

Complete decommissioning of the installation was authorised by decree 2006-321 of 20 March 2006, Article 4 of which states that commissioning of the sodium treatment installation, referred to as TNA, and of all the systems necessary for its operation, will require prior authorisation based on an updated decommissioning safety analysis report and of the corresponding general surveillance and maintenance rules. This file was submitted in April 2007 and is currently being reviewed. Industrial commissioning of the TNA will only be possible after the requests and recommendations made by ASN have been taken into account. 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 on the site to allow decay prior to disposal. The TNA commissioning tests began in September 2008 and should continue until March-April 2009.

Construction of the MDG facility, dedicated to decommissioning operations on the large removable components of the reactor vessel, is now complete. The safety analysis of the corresponding operations was transmitted to ASN and requests for additional information are under review.

The new order authorising water intake and effluent discharge for the site was signed on 3 August 2007.

Fuel evacuation facility (APEC)

This facility was commissioned on 25 July 2000 by the Ministers for Industry and the Environment. Spent fuel removed from the Superphénix reactor and washed is placed in the APEC pool.

The APEC modification was authorised by decree 2006-319 of 20 March 2006. The main modifications made are extension of the perimeter of the installation, so that it now contains the site's main electrical substation, the new water pumping station and the future storage area for the sodium concrete packages created by reprocessing of the sodium contained in the SUPERPHÉNIX reactor. The civil engineering works for this storage area began in 2007.

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 5 years.

2 | 2 | 1 The 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. With the goal of delicensing and clean-out of the centre, planned for 2015, CEA decided to group its nuclear activities together. The boundaries initially covering four BNIs were modified, resulting in two BNIs: the Process BNI (BNI 165) and the Support BNI (BNI 166), authorised by decrees published in the Official Gazette on 2 July 2006. These decrees also authorised final shutdown and decommissioning of these two installations. These decrees became applicable on 24 September 2007, once the buildings outside these new boundaries were delicensed, with this delicensing taking place between November 2006 and September 2007.

ASN considers that the BNI clean-out operations carried out so far, were on the whole satisfactory. Before administrative delicensing of the centre's BNIs, ASN will be required to adopt a stance on the overall radiation status of the site, for which the licensee has undertaken major work to identify radiation traces arising from past experimentation and to rehabilitate the soil.

The Process installation (BNI 165)

This installation will be the first to be decommissioned. Since 2000, 104 glove boxes have been cleaned-out and removed and a further 14 are still in operation to support the clean-out operations. The main complex and time-consuming clean-out operations continued, with initial pumping of the high-level effluents from the Pétrus B tank.

The Support installation (BNI 166)

The purpose of this installation is initially to support the decommissioning operations of 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 irradiating drums pending evacuation and storage of drums of low and very low level waste awaiting shipment to a repository.

Raising of the CIRCE packaging containing high-level effluents began in 2008 after authorisation by ASN and benefited from the operating experience feedback from the Pétrus B tank.

Decontamination of the plutonium chemistry laboratory in Fontenay-aux-Roses (Hauts-de-Seine *département*) by an operator in a ventilated vinyl suit with respiratory protection

In 2008, in order to optimise the use of the available space, CEA also obtained ASN approval for operation of a new VLL waste storage area.

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. Research activities were gradually transferred to other centres, with focus then being placed on fundamental and technological research into the field of non-greenhouse gas emitting energies (solar, fuel cell), health (biotechnologies) and communications (micro and nanotechnologies).

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 of the CEA Grenoble's nuclear installations continued in 2008 and should in early 2009 lead to the delicensing of the Mélusine reactor (BNI 19). Complete delicensing of the site is scheduled for 2012.

ASN considers that clean-out and decommissioning of the installations in the Grenoble centre are proceeding correctly, with the decommissioning worksites being properly managed.

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. Despite the gradual drop in the level of risk and in operating problems, 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, which was published in the Official Gazette on 21 September 2008. The decommissioning operations should continue until 2012. A part of the installation is now dismantled and its North zone is used for characterisation and for 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. A schedule sets out a programme for HL container sorting, packaging and disposal, which should be completed by 31 December 2010. Decommissioning of this BNI was authorised by the same decree as that which authorised decommissioning of BNI 36 (see above).

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 for the STEDS and is engaged in its own clean-out work.

The small amount of remaining source term is mainly 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.

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 delicensing was published in the Official Gazette in January 2004. Decommissioning of the pool is now complete. Clean-out and decommissioning work is continuing and CEA could apply for delicensing in 2009.

SILOÉ reactor (BNI 20)

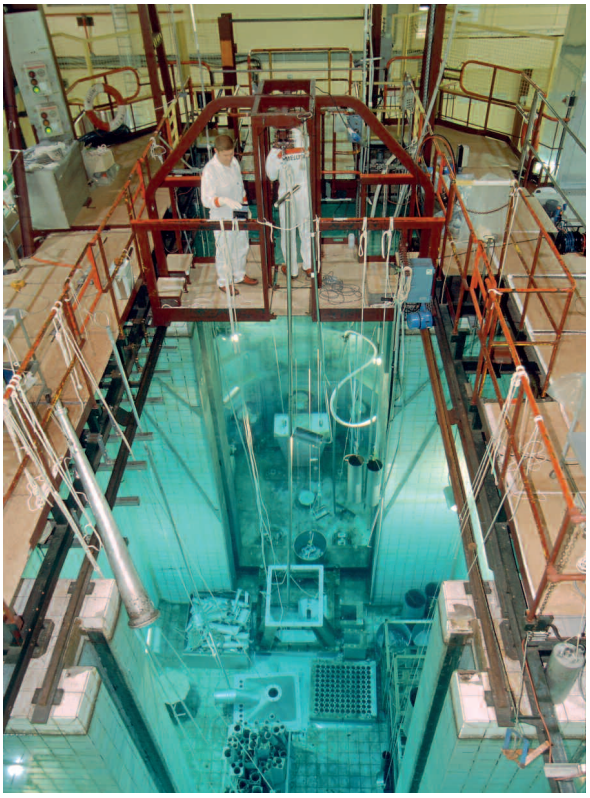
This former research reactor, currently undergoing decommissioning and clean-out, was primarily used for technological irradiation of structural materials and nuclear fuels. Since the decree of 26 January 2005, authorising final shutdown and decommissioning of the installations, operations have been continuing.

2|2|3 The Cadarache centre installations being decommissioned

ASN considers that decommissioning of the Cadarache centre installations is proceeding satisfactorily. The examples of decommissioning of the Harmonie reactor or the ATUe demonstrate that complete decommissioning is feasible. However, in view of the scale of the future decommissioning operations required (ATPu, LPC and RAPSODIE former fast neutron reactor), ASN will make sure that the safety of these operations remains the core concern of CEA's Cadarache centre.

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



Operators working on decommissioning the MELUSINE reactor

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 and refurbishment work has 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.

A revised version of the installation's safety specifications, transmitted to ASN at the beginning of 2006 and covering the operations preparatory to final shutdown, was approved in 2007. These new requirements will enable the licensee to carry out a certain amount of clean-out and disassembly work on reactor auxiliary equipment. In 2008, CEA submitted a file applying for final shutdown and complete decommissioning, in order to obtain the corresponding authorisation by 2010. The reactor decommissioning operations should then take about 7 years.

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 published on 8 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 operations, was subject to complete clean-out in 2006. 2007 and 2008 were mainly devoted to demolition of the building civil engineering works and operations designed to return the site to its natural state.

View of the RAPSODIE reactor building in Cadarache (Bouches-du-Rhône *département*)

View of the HARMONIE reactor building (Bouches-du-Rhône *département*) in Cadarache before decommissioning

View of the HARMONIE reactor building (Bouches-du-Rhône *département*) in Cadarache after decommissioning

In 2008, CEA submitted a delicensing application for this former BNI, which is currently being reviewed.

Enriched uranium processing facilities (ATUE)

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

Operators carrying out cutting operations during decommissioning of the ATUE in Cadarache (Bouches-du-Rhône *département*)

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 structures dismantling and complete clean-out phases continued satisfactorily in 2008. The licensee also began a programme to characterise the soil outside the buildings, in order to detect any traces of pollution, for subsequent treatment.

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 closely 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. Examination of the corresponding application files, sent to ASN in 2006 and updated at the beginning of 2007, is continuing. The application was submitted to a public inquiry at the beginning of the summer of 2008.

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 was in fact necessary in order to reduce the risks inherent in these materials, prior to decommissioning of the installations. The initial schedule set 31 December 2006 as the date for the completion of scrap processing in the ATPu and LPC. 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. The licensee had also evaluated the quantities of materials remaining, mainly related to cleaning of the glove boxes, which will be removed by the year 2015 as part of the decommissioning programme for these two installations.

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 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.

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 analysis laboratory (LECI). The last fuel rods were removed in 1995 and a number of partial clean-out operations conducted until 1998. Decommissioning operations are scheduled from 2012 to 2015 jointly with those of EL3. In March 2007, CEA sent ASN an updated safety case for CELIMENE.

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 shutdown since 2004, are scheduled for decommissioning. As the final shutdown preparatory work is already well-advanced, ASN informed AREVA NC that it wanted to see the decommissioning application files for the UP2-400 plant installations submitted as rapidly as possible. The first final shutdown and decommissioning application file for BNI 80 (HAO), was submitted at the beginning of 2008. The final shutdown and decommissioning application for BNI 80 is currently being reviewed under the regulatory requirements introduced by the TSN Act and was submitted to a public inquiry in October 2008.

In October 2008, AREVA NC submitted three final shutdown and decommissioning authorisation applications for BNIs 33, 38 and 47.

AT1 pilot reprocessing facility

The AT1 pilot facility reprocessed fuel from the RAPSODIE and Phénix fast breeder reactors from 1969 to 1979. It is part of BNI 38 (STE-2).

Clean-out of this installation began in 1982, and was completed in 2001. In 2001, ASN duly took note of the end of clean-out, exclusive of civil works, and of transition to the surveillance stage. 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 facility (Élan IIB)

The Élan IIB (BNI 47) facility 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 decommissioning operation resumption. All the installation upgrade work and the work preparatory to decommissioning of the installation was carried out during 2004 and 2005. Radiation reconnaissance work was carried out in 2005 and the licensee sent ASN the final shutdown dossier at the end of 2005. The licensee's provisional target is to complete decommissioning in 2013.

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 published in February 2006, thus enabling work to start.

In 2008, equipment decommissioning continued. After the complete clean-out 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 will lead to the demolition of certain buildings on the site, contrary to what had been initially planned in the project.

A review of the file describing the management strategy for the site floors and soil, polluted by former activities, is also continuing. Following this review, steps will be taken to determine the nature of the restrictions to be put into place for administrative delicensing of the BNIs.

2007 had been marked by ASN decision 2007-DC-0040 of 20 April 2007, which set a one-year deadline for evacuation of a large quantity of oils slightly contaminated with uranium, in satisfactory safety conditions. This waste, produced during the operating period, should have been evacuated before decommissioning began. During an inspection carried out in February 2008, the ASN inspectors were able to see that the contaminated oils had indeed been evacuated from the Veurey-Voroize site. These operations were performed in satisfactory conditions.

Inspectors of the ASN Lyon division and the DRD carrying out an inspection for delicensing of SICN building C in Veurey-Voroise (Isère *département*)

ASN considers that the decommissioning of the SICN site at Veurey-Voroize is proceeding satisfactorily, despite the technical difficulties inherent in this type of work.

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 published in the Official Gazette of 22 February 2006. Decommissioning work began in the second half of 2006 and ended in August 2008. Delicensing of the BNI will be reviewed in 2009.

ASN considers that the decommissioning work took place satisfactorily.

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 phase from 2004 to 2008 to prepare for final shutdown, 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 led to a draft decree, approved by the CCINB on 4 June 2008 and the ASN Commission on 11 September 2008. This draft decree is currently before the competent ministers for signature.

3 OUTLOOK

The regulations concerning the decommissioning of nuclear installations have changed considerably since the 1990s. The current legal context, tailored to the issues of decommissioning and to the growing number of nuclear installations undergoing decommission:

– gives an exhaustive picture of the decommissioning of each nuclear installation, from shutdown to delicensing;
– ensures the flexibility and responsiveness necessary for performance of the decommissioning operations, with the stringency that this type of operation demands, in particular through the system of internal authorisations;
– throughout the life of the installations, ensures financing of their decommissioning and management of the associated waste.

Over and above the individual decommissioning of each installation, ASN ensures that the licensees' overall strategies are coherent in taking account of nuclear safety and radiation protection constraints. The scale of the decommissioning programmes in progress (several dozens of installations concerned) demands rigorous planning, taking account of all the parameters related to safety and radiation protection: installation ageing, sequencing of operations, choice of technical scenarios, safety priorities, etc.

Other parameters, on which the decommissioning strategies are based, are also essential: availability of waste disposal routes, waste flow management (in particular according to the capacity of each solution), management of uncertainties and technical difficulties, organisational and 'project' risk management measures, etc. ASN therefore examined the decommissioning strategies of EDF and CEA in 2004 and 2006 respectively. The decommissioning strategy implemented by AREVA NC on the La Hague site will be reviewed in 2009.

Today, even if the decommissioning activities on the nuclear installations have reached the industrial stage, there is still considerable room for improvement. In particular, in the coming years, ASN will focus especially on:

– ensuring the consistency of the decommissioning strategies used by the nuclear licensees;
– developing tools for better assessment of the estimates made by the licensees concerning the cost of decommissioning;
– checking improvements in how human and organisational factors are taken into account during decommissioning operations;
– checking implementation of all the rules introduced by the TSN Act on transparency and public involvement in decommissioning projects.

4 LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2008

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Final regulatory procedures	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 as ICPE	Decommissioned
ZOÉ FAR*	(former BNI 11)	Reactor (250 kWth)	1948	1975	1978: removed from BNI list and classified as ICPE	Confined (museum)
MINERVE FAR*	(former BNI 12)	Reactor (0,1 kWth)	1959	1976	1977: removed from BNI list	Dismantled at FAR and reas-sembled at Cadarache
EL 2 SACLAY	(former BNI 13)	Reactor (2,8 MWth)	1952	1965	Removed from BNI list	Partially decommissioned, remaining parts confined
EL 3 SACLAY	(former BNI 14)	Reactor (18 MWth)	1957	1979	1988: removed from BNI list and classified as ICPE	Partially 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 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*	BNI 34	Processing of liquid and solid waste	Before 1964	2006	2006: removed from BNI list	Decommissioning in progress
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*	57	Reprocessing pilot	1968	1975	2006: removed from BNI list	Decommissioning in progress
LCPu FAR*	57	Plutonium chemistry laboratory	1966	1995	2006: removed from BNI list	Decommissioning in progress
BAT 19 FAR*	(former BNI 58)	Plutonium metallury	1968	1984	1984: removed from BNI list	Decommissioned
RM2 FAR*	59	Radiometallurgy	1968	1982	2006: removed from BNI list	Decommissioning in progress
LCAC GRENOBLE	(former BNI 60)	Fuels analysis	1975	1984	1997: removed from BNI list	Decommissioned
STEDs FAR*	73	Solid waste storage facility	1989		2006: removed from BNI list	Decommissioning in progress
ARAC SACLAY	(former BNI 81)	Fabrication of fuel assemblies	1981	1995	1999: removed from BNI list	Cleaned-out

4 LIST OF BASIC NUCLEAR INSTALLATIONS DELICENSED AS AT 31.12.2008 (continuation)

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Final regulatory procedures	Current status
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 (***)

(*) Fontenay-aux-Roses – (**) Attila: reprocessing pilot located in a unit of BNI 57 – (***) Restrictions: conventional restrictions on behalf of the State were applied to the plots concerned.

5 LIST OF BASIC NUCLEAR INSTALLATIONS UNDERGOING DECOMMISSIONING AS AT 31.12.2008

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Final regulatory procedures	Current status
CHOOZ AD (FORMER CHOOZ A)	163 (former BNI 1, 2, 3)	Reactor (1040 MWth)	1967	1991	2007: final shutdown and decommissioning decree	Decommissioning in progress
CHINON A1D (FORMER 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, modified to BNI for storage of waste left on-site (museum)
CHINON A2D (FORMER 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, modified to BNI for storage of waste left on-site
CHINON A3D (FORMER CHINON A3)	161 (former BNI 7)	Reactor (1360 MWth)	1966	1990	1996: partial decommissioning decree for Chinon A3 and creation of the Chinon A3D storage BNI	Partially decommissioned, modified to BNI for storage of waste left on-site
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	2005: final shutdown and decommissio-ning decree	Decommissioning in progress
RAPSODIE CADARACHE	25	Reactor (40 MWth)	1967	1983		Preparation for final shutdown
EL 4D (FORMER EL4 BRENNILIS)	162 (former BNI 28)	Reactor (250 MWth)	1966	1985	1996: decree ordering decommissioning and creation of the EL-4D storage BNI 2006: final shutdown and decommissio-ning decree 2007: decision of the *Conseil d'État* cancelling the 2006 decree	Partially decommissioned, modified to BNI for storage of waste left on-site
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	18.09.2008: final shutdown and decommissioning decree	Decommissioning in progress
EFFLUENT AND SOLID WASTE TREATMENT STATION (STE2) AND SPENT NUCLEAR FUELS REPROCESSING FACILITY (AT1) (LA HAGUE)	38	Effluent and waste treatment facility	1969	1979		Preparation for final shutdown

5 LIST OF BASIC NUCLEAR INSTALLATIONS UNDERGOING DECOMMISSIONING AS AT 31.12.2008 (continuation)

Installation Location	BNI	Type of installation	Commis-sioned	Final shutdown	Final regulatory procedures	Current status
HARMONIE CADARACHE	41	Reactor (1 kWth)	1965	1996	2004: final shutdown and decommissioning decree	Decommissioning completed, delicensing procedure in progress
STRASBOURG UNIVERSITY REACTOR	44	Reactor (100 kWth)	1967	1997	2006: final shutdown and decommissioning decree	Decommissioning in progress
BUGEY 1	45	Reactor (1920 MWth)	1972	1994	1996: final shutdown and decommissioning decree	Decommissioning in progress
ST-LAURENT A1	46	Reactor (1662 MWth)	1969	1990	1994: final shutdown decree	Final shutdown in progress
ST-LAURENT A2	46	Reactor (1801 MWth)	1971	1992	1994: final shutdown decree	Final shutdown 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	2003: boundary change	Preparation for final shutdown
ATPu CADARACHE	32	Fuel fabrication plant	1962	2003		Preparation for final shutdown
LPC CADARACHE	54	Laboratory	1966	2003		Preparation for final shutdown
SUPERPHÉNIX CREYS-MALVILLE	91	Reactor (3000 MWth)	1985	1997	2006: final shutdown and decommissioning decree	Decommissioning in progress
LURE	106	Particle accelerators	Since 1956 to 1987	2008		Preparation for final shutdown
PROCESS FAR*	165	Grouping of former process installations	2006		2006: final shutdown and decommissioning decree	Decommissioning in progress
SUPPORT FAR*	166	Waste packaging and processing	2006		2006: final shutdown and decommissioning decree	Decommissioning in progress

(*) Fontenay-aux-Roses: creation of BNIs 165 and 166 to replace BNIs 34, 57 59 and 73 and performance of shutdown and decommissioning operations for BNIs 165 and 166 following grouping of the buildings under the delicensing project for the Fontenay-aux-Roses site.