



Activities regulated by ASN

Chapter 16

Radioactive waste and contaminated sites and soils

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This chapter presents the role and actions of ASN concerning the management of waste generated by activities using radioactive substances and the management of sites polluted by radioactive contamination. It in particular describes the steps taken to define and determine the main radioactive waste management orientations and the controls carried out by ASN with respect to nuclear safety and radiation protection in facilities involved in the management of radioactive waste. It also presents the steps taken by ASN concerning sites polluted by radioactive contamination and how they are managed.

The term radioactive waste implies radioactive substances for which no subsequent use is planned or envisaged. These substances may come from nuclear activities or be produced by non-nuclear activities in which the radioactivity naturally contained in the materials, not used for their radioactive or fissile properties, may have been concentrated by the processes employed.

Clean-out of contaminated sites consists in rehabilitating sites on which a nuclear or non-nuclear activities has created pollution from radioactive substances.

1 RADIOACTIVE WASTE

Like any human activity, nuclear activities produce waste. Pursuant to the provisions of the Environment Code and more specifically of Act 2006-739 of 28th June 2006, the producers of waste are responsible for it until disposed of in a duly authorised facility. Waste producers must also constantly endeavour to minimise the volume and activity level of their waste, at the front-end through design and operating provisions and at the back-end through appropriate waste management.

Radioactive waste varies considerably in its activity level, the half-life of the radionuclides it contains, its volume or even its nature (scrap metal, rubble, oils, etc.). Each type of waste requires treatment and a long-term management solution that is appropriate, in order to overcome the risk involved, notably the radiological risk. The latter can be assessed on the basis of two main parameters: the activity level, which contributes to the toxicity of the waste, and the radioactive half-life, which depends on the radioactive decay periods of the radionuclides it contains. Therefore, on the one hand we have very low, low, intermediate or high level waste and, on the other hand, waste known as very short-lived, resulting mainly from medical activities (radioactivity halved in less than 100 days), short-lived (radioactivity halved in less than 31 years) and long-lived, containing a large quantity of long half-life radionuclides (radioactivity halved in more than 31 years).

All the operations associated with managing a category of waste, from production, through sorting, packaging, interim storage to final disposal, are what make up the disposal route. Each disposal route must be adapted to the nature of the waste handled.

The operations within a given route are closely interlinked and all the routes are interdependent. Each party in the route is responsible for the safety of the facilities it operates and the activities it performs.

Experience feedback from the Fukushima nuclear accident

Further to the Fukushima Daiichi accident, ASN launched stress tests of the civil nuclear facilities. These stress tests focused on power reactors in priority, but also on other nuclear installations such as facilities for the storage and disposal of radioactive waste.

ASN issued resolution 2011-DC-0224 of 5th June 2011 instructing the French atomic energy and alternative energies commission (CEA) to perform stress tests on some of its basic nuclear installation (BNI) ASN thus asked that the reports for the two waste storage facilities on the Cadarache site – Pegase and the radioactive waste storage area (BNI 56) - be submitted by 15th September 2012.

1.1 Radioactive waste management regulatory framework

Radioactive waste management falls within the general framework defined in book V, part IV, chapter I of the Environment Code and its implementing decrees. The particular requirements concerning radioactive waste were introduced by Act 91-1381 of 30th December 1991 on research into high-level, long-lived waste, known as the “Bataille Act”, and by the Act of 28th June 2006 giving a legislative framework to management of all radio-active materials and waste (these Acts are extensively codified in book V, part IV, chapter II of the Environment Code). This “Waste” Act sets the new calendar for research into high and intermediate level, long-lived waste and a clear legal framework for ring-fencing the funds needed for decommissioning and for the management of radioactive waste. It in particular requires the production of a national radioactive materials and waste management plan (PNGMDR), which aims to produce a periodic review of radioactive materials management policy. It also reinforces the duties of the French National Radioactive Waste Management Agency (ANDRA).

Council directive 2011/70/Euratom establishing a community framework for the responsible and safe management of spent fuel and radioactive waste

On 19th July 2011, the Council of the European Union adopted directive 2011/70/Euratom establishing a community framework for the responsible and safe management of spent fuel and radioactive waste.

This directive defines a binding legislative framework and in particular requires that each member State set up a regulatory authority with competence for the safe management of waste and spent fuel, given the financial and human resources necessary for the performance of its duties. It sets safety requirements and requires the creation of a system of authorisations for waste and spent fuel management facilities. It also requires those holding these authorisations to devote adequate financial and human resources to waste management.

Moreover, this directive requires the definition of a national programme to implement the waste and spent fuel management policy. This programme, which is based on a national inventory, must concern all waste, from production through to disposal. It must be periodically revised and the Commission notified.

The directive also defines the requirements concerning transparency with regard to the public and requires periodic self-assessment of the regulatory arrangements, supplemented by a peer review. It also requires that there be a system of sanctions.

Finally, it formally stipulates the ultimate responsibility of each member State for the management of its radioactive waste and specifies the possibilities regarding the export of this waste for disposal.

ASN considers the adoption of this directive to be a key event and one that helps strengthen nuclear safety within the European Union, while making the member States more accountable for the management of their radioactive waste and spent fuels.

With regard to France, most of the provisions of this directive are already an integral part of national legislation, notably through the provisions of the 28th June 2006 Act on the sustainable management of radioactive materials and waste (the "Waste" Act), and those of the 13th June 2006 Act on transparency and security in the nuclear field (TSN Act), recently integrated into the Environment Code.

Implementation schedule:

- Publication in the Official Journal of the European Union: 2nd August 2011;
- Transposition in the 27 member States: no later than 23rd August 2013;
- First notification by the member States to the European Commission of their national radioactive waste and spent fuel management programme: no later than 23rd August 2015.

Finally, it prohibits the definitive disposal on French soil of foreign waste, by providing for the adoption of rules specifying the conditions for the return of waste resulting from reprocessing in France of spent fuel or waste from abroad.

1 | 1 | 1 Production of radioactive waste in basic nuclear installations

In France, radioactive waste management is such that there are no predetermined release thresholds below which a very low level waste from a nuclear facility can be considered as manageable by a conventional waste disposal route. In concrete terms, this doctrine leads to the defining of waste zoning which, in basic nuclear installations (BNIs), separates zones producing contaminated, activated or potentially activated waste, from zones producing conventional waste. Waste that is contaminated, activated or potentially activated must be managed in dedicated radioactive waste routes and it can only be reused in the nuclear field.

Waste from conventional waste zones, once confirmed as free of radioactivity, is sent to routes dedicated to conventional waste. Waste zoning and changes to this zoning are subject to approval by ASN. The order of 31st December 1999 on the general regulations applicable to BNIs stipulates the creation of this zoning. This order also asks the licensees to carry out a study on the management of their waste, specifying their objectives with respect to reducing the production and harmfulness of the waste produced in their facilities and optimising its management, taking account of the reprocessing routes, as disposal is reserved solely for ultimate waste. Summaries of these studies are submitted to ASN for approval. As from 1st July 2013, the order of 7th February 2012 setting the general rules applicable to BNIs will repeal the provisions of the order of 31st December 1999 without substantially changing the provisions concerning waste. More particularly, the development of waste zoning and the performance of waste studies constitute the regulatory requirements taken up in part VI relative to waste management. An ASN resolution currently under preparation will specify the content of the required waste studies and the general principles

under which the zoning must be established and can be modified.

1 | 1 | 2 Production of radioactive waste by other facilities using radioactive materials

The provisions mentioned in decree 2002-460 of 4th April 2002 concerning the general protection of persons against ionising radiation have been incorporated into the Public

Health Code. Article R. 1333-12 of this Code states that the management of effluents and waste contaminated by radioactive substances originating from all nuclear activities related to medicine, human biology, or biomedical research and entailing a risk of exposure to ionising radiation must be examined and approved by the public authorities. ASN resolution 2008-DC-0095 of 29th January 2008, approved by the Ministers responsible for the Environment and Health, lays out the technical rules to be met for the disposal of effluents and waste contaminated or potentially contaminated by radionuclides owing to a nuclear activity. ASN published a guide (guide No. 18) to the application of this resolution in January 2012. It can be consulted on www.asn.fr.



Guide no.18: Disposal of effluents and waste contaminated by radionuclides, produced in facilities licensed under the Public Health Code.

1 | 1 | 3 The national inventory of radioactive materials and waste

Article L.542-12 of the Environment Code tasks ANDRA with “establishing, updating every three years and publishing the inventory of radioactive materials and waste present in France, along with their location on the national territory”.

The national inventory was last published in June 2012 and presents information concerning the quantities, nature and locations of radioactive materials and waste as at the end of 2010, plus the forecasts for the end of 2020 and the end of 2030. A prospective exercise was also conducted considering two contrasting scenarios for France’s long-term energy policy. ASN takes part in the steering committee of the national inventory of radioactive materials and waste. This inventory constitutes input data for the national radioactive materials and waste management plan.

Preparation of the national radioactive materials and waste management plan (PNGMDR) 2013-2015

The third PNGMDR, covering the 2013-2015 period, was prepared during 2012. This new version of the plan integrates the recommendations made in the evaluation report of the PNGMDR 2010-2012 by the OPECST (Parliamentary Office for the Evaluation of Scientific and Technological Choices). The structure of the PNGMDR has thus been revised to group the information relative to a given route and to propose several reading levels in a single document. Furthermore, as part of the approach fostering transparency, consultation and discussion, the major disagreements between the stakeholders are traced back in this new version.

The PNGMDR 2013-2015 also takes account of the provisions of directive 2011/70/Euratom establishing a community framework for the responsible and safe management of spent fuel and radioactive waste adopted on 19th July 2011, in which Article 12 defines the content of the national waste and spent fuel management programmes. It thus provides a description of the financial implications, with information concerning the costs and financing mechanisms, the concepts and plans for the period after closure, as well as indicators.

The PNGMDR 2013-2015 continues the actions engaged in the preceding plan and places emphasis on the need to develop global industrial schemes for waste management, to develop recycling routes for the very-low-level waste in order to preserve the disposal volume as a resource, and to continue studies for the low-level long-lived and high and intermediate-level long-lived waste.

The PNGMDR 2013-2015 was transmitted to Parliament by the General Secretary of the Government on 28th December 2012.

1|1|4 The national radioactive materials and waste management plan

Article L.542-1-2 of the Environment Code requires the production of the National Radioactive Materials and Waste Management Plan (PNGMDR), revised every three years, the purpose of which is to review the existing management procedures for radioactive materials and waste, to identify the foreseeable needs for storage and disposal facilities, to clarify the necessary capacity of these facilities and the storage durations and, for radioactive waste for which there is as yet no final management solution, to determine the objectives to be met. The main provisions of the plan and the studies required by the PNGMDR are set by a ministerial decree implementing Article L.542-1-2 of the Environment Code.

This plan is produced within the pluralistic working group co-chaired by ASN and the DGEC (General Directorate for Energy and Climate) of the Ministry of Energy as described in chapter 2.

1|2 ASN's role in the radioactive waste management system

The public authorities, ASN in particular, are keen to ensure that this radioactive waste is managed in safe conditions at each step (from production in the BNIs through to disposal) and that there is a management route for all the waste. ASN thus considers that the development of management routes appropriate to each waste category is of vital importance and that any delay in the search for waste disposal solutions will increase the volume and size of the storage areas in the facilities, with all the attendant risks. Within the context of the PNGMDR, ASN is particularly vigilant in ensuring that the system made up by all these routes is optimised as part of an overall, consistent approach to the management of radioactive waste. This approach must take account of safety, radiation protection, traceability and waste volume minimisation issues. Finally, ASN considers that this management must be transparent to the public. The PNGMDR



Meeting of the PNGMDR working group at the French National Assembly - June 2011

is thus produced by a pluralistic working group (see chapter 2, point 2|6). Furthermore, the publication on ASN's website of the PNGMDR and its summary and of the ASN opinions issued as part of the development of the Plan, help inform the public about the main issues associated with radioactive waste management.

In order to fulfil its duties, ASN can call on the services of the Institute for Radiation Protection and Nuclear Safety (IRSN).

1|2|1 Checks and inspections

With regard to radioactive waste management, the checks and inspections which lie at the heart of ASN's duties consist, on the one hand, in checking correct application of the regulations regarding waste management on the production sites and the safety of facilities dedicated to radioactive waste management (waste processing, packaging, storage and disposal facilities). On the other hand, the checks carried out by ASN must ensure correct implementation of the defined conditions for production of the waste packages intended for the waste disposal facilities. These measures are described in this chapter as well as in chapters 8 and 13.

1|2|2 Drafting of recommendations and prescriptions for sustainable waste management

Referred to by the DGEC, ASN issues opinions¹ on all the studies submitted in application of the decree setting the requirements of the PNGMDR. During 2012, ASN thus issued seven opinions in application of the decree and order of 23rd April 2012 establishing the requirements of the PNGMDR 2010-2012. These opinions were used in the preparation of the third PNGMDR (2013-2015 version).

More generally, ASN enacts the requirements relative to waste management (waste packaging, for example) in the forms provided for in Article 18 of the decree of 2nd November 2007 relative to BNIs. The requirements form the subject of ASN resolutions that can be consulted on its web site.

ASN also gave the Government its recommendations concerning the disposal projects for long-lived radioactive waste. ASN is also focusing on verifying that the conditions in which these projects are developed will guarantee the operational and long-term safety of the future facilities.

1|2|3 Production of the legislative and regulatory framework

ASN was a key player in the drafting of the 28th June 2006 Act on the sustainable management of radioactive materials and waste. Furthermore, following the passage of the "TSN" Act on transparency and security in the nuclear field, ASN also engaged in a process to overhaul the regulations applicable to BNIs. ASN is particularly attentive to the reinforcing of oversight of radioactive waste management.

1. The ASN opinions are available on the website www.asn.fr, in the section "Regulations", "ASN Official Bulletin", "ASN Opinions".

The order of 7th February 2012 defining the general regulations applicable to BNIs thus makes specific provisions for the management of waste which will be detailed in the ASN resolutions on the themes of waste management in BNIs, storage of radioactive waste, waste packaging and radioactive waste disposal facilities.

1|2|4 Evaluation of the nuclear financial costs

The regulatory framework designed to secure the financing of nuclear facility decommissioning costs or, for radioactive waste disposal facilities, the final shutdown, maintenance and surveillance costs, in addition to the cost of managing spent fuel and radioactive waste, is described in chapter 15.

In 2012, ASN sent the DGEc its opinion on the annual updating notices submitted by the nuclear operators to describe the evaluation of the nuclear costs and ways and means chosen to create the assets needed to cover these costs, since the latest three-yearly reports submitted in 2010.

ASN also informed the DGEc of its opinion on decree 2010-1673 of 29th December 2010 amending decree 2007-243 of 23rd February 2007 concerning the ring-fencing of the financial costs of decommissioning (see chapter 15 point 1|3|2).

1|2|5 ASN's contribution to international works

One of the missions of WENRA² is to develop a common approach to nuclear safety and regulation. Set up on a voluntary and informal basis, WENRA has implemented a process aiming at developing reference safety levels in order to harmonise nuclear safety practices in Europe. Working groups were set up in 2002 in order to draft these reference levels. One of them, the WGWD (Working Group on Waste and Decommissioning), was more specifically tasked with defining reference levels concerning the safety of storage of radioactive waste and spent fuel and of nuclear installation decommissioning operations. In 2010, this group extended its work to include the defining of reference levels applicable to radioactive waste disposal facilities.

In 2010, the WGWD finalised the reference levels for the storage of radioactive waste and spent fuels. In 2012, the reference levels concerning the safety of decommissioning operations were all completed in turn.

The WENRA member countries are required to produce national action plans for the transposition of these reference levels. ASN is thus drafting an action plan to meet the WENRA requirements.

These reference levels will moreover be valuable input data for the authoring of ASN resolutions which will specify the application of the order of 7th February 2012 defining the general regulations applicable to BNIs.

Finally, at an international level, ASN is a participant in the International Atomic Energy Agency's (IAEA) Waste Safety

Standards Committee (WASSC), whose role is to draft and then approve the international standards defined by IAEA, particularly concerning the management of radioactive waste. It also takes part in the work of ENSREG group 2 which is assigned to subjects relative to radioactive waste management.

In addition to this, the fourth three-yearly review meeting of the Convention on the safety of spent fuel management and the safety of radioactive waste management (called the "Joint Convention") was held from 14th to 23rd May in Vienna. Prior to this meeting, France had sent IAEA its national report on the implementation of the obligations of the Common Convention in 2011. ASN coordinated the authoring of this report.

Finally, ASN actively contributed to the interministerial work of transposing directive 2011/70/Euratom of 19th July 2011 establishing a community framework for the responsible and safe management of spent fuel and radioactive waste; this directive must be transposed into national law by 23rd August 2013.

ASN's international actions are presented more generally in chapter 7 covering international relations.

1|3 Management of waste from nuclear licensees

Before final disposal, certain categories of radioactive waste undergo processing to reduce their volume or harmfulness and, whenever possible, to recover reusable materials. This processing can produce secondary waste. After processing, the waste is packaged and then, depending on its nature, placed in a storage facility or sent to a disposal facility. ASN asks the licensees to define a management strategy for all the radioactive waste produced in their facilities. The following sections clarify the waste management procedures adopted by the main producers of waste.

1|3|1 CEA waste management

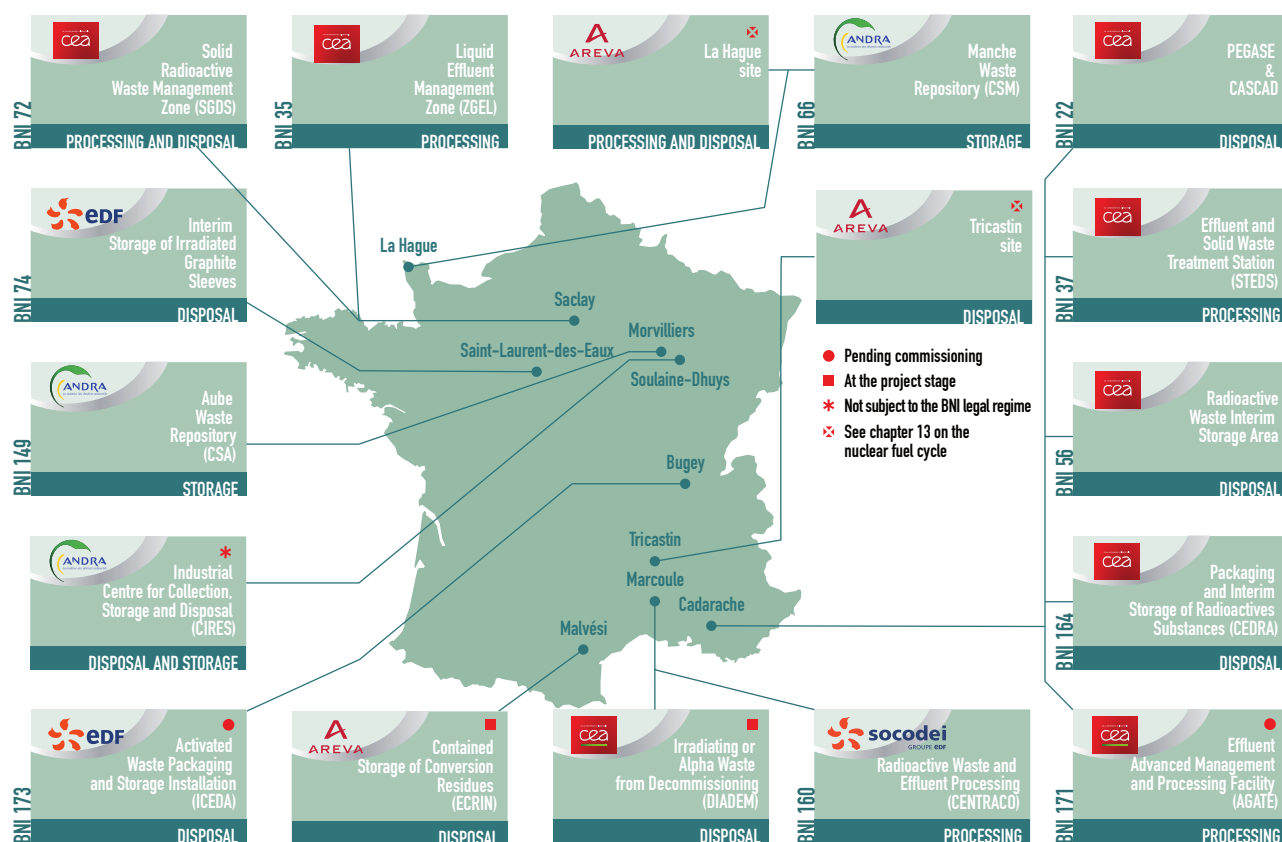
a) CEA's waste management strategy

CEA has processing, packaging and storage facilities for the waste it produces. The solid wastes for which there are operational routes (processing, treatment by incineration or melting, packaging, storage, disposal in approved surface repositories) are managed accordingly (installations of the CEA, CENTRACO, ANDRA repositories, etc.). Long-lived intermediate and high level waste is stored by CEA in dedicated storage facilities with a lifespan limited to a few decades, pending creation of a long-term disposal route.

Very Low Level (VLL) waste, of which the CEA generates a large volume, particularly through the decommissioning of its old installations, is stored on site before being taken to the CIRES (industrial centre for collection, storage and disposal) operated by ANDRA in Morvilliers (Aube département). Liquid waste is processed, solidified and packaged.

2. "WENRA": Western European Nuclear Regulators' Association that groups the heads of nuclear safety authorities from 17 European member countries (see chapter 7).

Diagram 1: Radioactive waste management facilities (excluding facilities regulated by ASN)



Other waste packages, depending on their category, are either disposed of in the Aube repository operated by ANDRA for low and intermediate-level short-lived waste, or stored in CEA facilities pending definitive disposal.

CEA is also in possession of legacy solid and liquid waste for which there could be certain processing problems, owing to its physical-chemical nature or the fact that there is currently no disposal route. Nuclear fuel without further use from the CEA civil facilities is placed in interim storage, either dry (pit) such as in the CASCAD facility, or in a pool, pending definition of a final management route (reprocessing or storage).

In view of the changes to the CEA's waste management strategy, both in terms of organisation and plans for new facilities or upgrades to existing facilities, ASN asked CEA in late 2008 to present its management strategy for solid waste, liquid effluents, sources and spent fuel from CEA civil uses in the coming decades, as well as the means necessary to implement this strategy (facilities, transport containers, etc.). In March 2010, CEA submitted the corresponding file. Jointly with the ASN, ASN stated that it wished that this file be examined by the competent Advisory Committee of experts.

The Advisory Committee of experts on waste (GPD) submitted its opinion further to the meeting of 15th February 2012. ASN sent the CEA a letter containing the main conclusions of the Advisory Committee's investigation and the required actions.

Examination of the CEA's strategy has shown that waste management on the whole had improved since the previous examination, which was in 1999. The CEA's organisation and the implementation of management tools must enable it to evaluate the movements of waste produced in the coming years, and in particular to forecast the storage and transport packaging needs.

The CEA must nevertheless manage extremely diverse projects, and disparities have been observed in the quality of the results. Examination of the file has revealed shortcomings in the robustness of the CEA's strategy, particularly with regard to the management of intermediate-level long-lived solid waste and low or intermediate-level short-lived liquid waste.

The CEA must also implement measures relating to the 34 commitments it took, and answer the demands expressed by ASN in its follow-up letter.

The next review of the CEA's waste management strategy will be in about ten years.

b) Issues associated with CEA waste management

The two main issues for CEA with regard to radioactive waste management are:

- bringing new waste processing and storage facilities on-line within a time frame compatible with its commitments to shut down old installations whose level of safety no longer complies with current requirements;
- running projects for removal of certain legacy waste from storage.

As in previous years, ASN observes that CEA is experiencing persistent difficulties with managing these two issues. For 2012, ASN noted, however, that there had been occasional progress with some projects, in line with the licensee's commitments and especially concerning the licensee's "major commitments" on nuclear safety and radiation protection. ASN for example noted that the project for removal from storage of the drums containing plutonium in the PEGASE facility (BNI 22) is currently being run satisfactorily by the Cadarache centre, with a scheduled completion date of late 2013. ASN also observes that in recent years, CEA has strengthened the organisation of the project to recover waste from BNI 56 in Cadarache but nonetheless notes significant delays in the performance of the operations, owing to the many unexpected technical uncertainties the licensee has to deal with.

ASN also points out the technical difficulties and project management problems encountered by CEA in running the new facility projects and the delays in upgrading of the existing facilities dedicated to radioactive waste management.

New facility projects

STELLA project

Basic nuclear installation (BNI) 35, notified by CEA in a letter of 27th May 1964, is located on the CEA Saclay site. Its purpose is the processing of radioactive liquid effluents. Decree 2004-25 of 8th January 2004 authorises CEA to create an extension in BNI 35, called STELLA, for reprocessing low-level aqueous effluents from the Saclay centre, using an evaporation concentration process with the concentrates then blocked in a cement matrix, to produce packages that can be accepted in an ANDRA surface repository. STELLA commissioning is seriously behind schedule owing to technical problems with qualification of the waste packages. Given the problems with producing satisfactory packages without cracks, CEA decided in 2010 to opt for commissioning of the STELLA facility in stages. In its resolution 2010-DC-0198 of 9th November 2010, ASN authorised this staged commissioning to enable CEA to run tests on the evaporation process and concentrate the effluents present in the facility. In its resolution 2011-DC-041 of 22nd September 2011, ASN authorised commissioning of the cementation and chemical pre-treatment processes. ASN did however ask CEA to provide the necessary justifications concerning management of the effluents containing complex substances and to continue its work to qualify the reference packages known as "12H".

DIADEM project

In November 2007, CEA sent ASN a file of safety options concerning a new project, known as DIADEM, to be located in Marcoule for storage of irradiating waste, plus decommissioning of the PHÉNIX facility. This storage would be for a period of 50 years, pending the arrival of an appropriate disposal route. ASN issued its position on this report on 1st July 2008, indicating that it had no objection to continuation of the process leading to creation of the facility, subject to the provision of a certain amount of additional information. In April 2012 the CEA submitted the creation authorisation application file for DIADEM. At present, commissioning of this facility is scheduled for the end of 2016.

AGATE project

ASN also observes delays in the commissioning of the AGATE facility, the creation of which was authorised by decree 2009-332 of 25th March 2009. The AGATE installation is intended for evaporation treatment of radioactive liquid effluents mainly from the CEA/Cadarache nuclear installations, comprising primarily beta and gamma radionuclides. The file on commissioning of the AGATE installation was examined by the Advisory Committee in the spring of 2010. After this examination, ASN observed that the safety measures adopted by CEA were satisfactory. It nonetheless asked CEA to present and justify the strategy adopted for processing of the concentrates produced by the AGATE facility, taking account of any problems with handling of these concentrates by the Marcoule effluents treatment station. At its session of 16th November 2011, the CSLUD (safety commission for laboratories and plants and for waste management, reporting to ASND³) noted the technical feasibility of bituminisation of the AGATE concentrates in the Marcoule liquid effluents treatment plant (STEL). It did however remind CEA of the need to continue research on development of packaging of these same concentrates by cementation in the liquid effluents treatment plant, once it has been renovated and the waste treatment processes modified. Commissioning of the AGATE facility, which has been postponed several times, is now planned for the first half of 2013. Meeting this timeline is now a priority for CEA, further to an ASN request.

In view of the issues associated with the commissioning of these facilities, ASN considers it essential for CEA to meet its commitments in order to have operational waste management routes, and will ensure that the necessary measures are implemented.

Retrieval of legacy waste

On the Saclay site

Zone for management of solid radioactive waste

The decree of 14th June 1971 authorises CEA to modify the facilities in the Saclay nuclear research centre by building a zone for management of radioactive solid waste (BNI 72). BNI 72 provides waste storage and packaging as well as waste recovery from small producers (sources, scintillating liquids, ion exchanger resins) and storage of radioactive sources. At the beginning of 2009, at the request of ASN, the competent

3. Safety commission for laboratories and plants, reporting to the ASND.

Advisory Committee examined the periodic safety review file for the solid waste management zone. At that time, CEA made a number of commitments, in particular to shut down the installation's waste treatment units within a period of 10 years and, within the same time-frame, to retrieve and package the waste stored in the pool and the waste stored in the blocks.

At the request of ASN, CEA transmitted the BNI 72 decommissioning plan in 2011. CEA should be submitting its final shutdown and decommissioning (MAD-DEM) authorisation application file in 2017, as requested by ASN following the facility's periodic safety review in 2009. At its request, CEA also sent ASN the calendar of removal from storage of waste, fuels, sources and materials with no further use in the facility. These projects will require considerable technical and human resources.

By means of periodic meetings, ASN checks the licensee's progress with regard to its undertakings.

In view of the repeated changes in the schedule for the updating of the safety report, ASN, through its resolution 2012-DC-0319 of 18th October 2012, ordered the CEA to submit its update of the safety report for BNI 72 no later than 31st December 2012. The CEA must incorporate in it the answers to the commitments it gave further to the periodic safety review of this facility.

The liquid effluents management zone

The progress of the operations to recover and package legacy effluent stored in BNI 35, pending initial processing and then clean-out of the facility's old buildings, are among CEA's priorities concerning this facility. The first operations were performed to recover the organic radioactive effluent stored in tank HA4 and a part of the effluent was removed sent to the ATALANTE treatment facility. The end of the clear-out operations is scheduled for 2013. The decree of 8th January 2004 states that the radioactive effluents contained in the HA4 tank and in the MA 500 tanks of building 393 must be recovered before 8th January 2014. At the request of ASN, the CEA is now submitting 6-monthly updates of the schedule for recovering the effluents from the MA500 tanks.



Waste storage hall in BNI 72

On the Cadarache site

The radioactive waste storage area

The radioactive waste storage area (BNI 56) in Cadarache was the subject of notification SJC 68/036 of 8th January 1968 to the Ministry responsible for scientific research and atomic and space questions, under the title "Final disposal area for solid waste" concerning the solid waste disposal area and the trenches disposal area. The main purpose of this facility is storage of legacy radioactive solid waste (ILW-LL) from operation or decommissioning of CEA facilities and which cannot be sent to the Aube surface repository. The waste is stored there in pits, in trenches, in warehouses and, for the VLL waste, in a dedicated area.

A part of the Cadarache interim storage facility consists of five trenches which, between 1969 and 1974, were filled with a variety of low and intermediate level solid waste, then covered with earth. The facility was at the time an experimental waste disposal facility. An ASN inspection on 17th March 2011 revealed shortcomings in CEA's surveillance of the contractors responsible for waste retrieval. CEA then took the initiative of suspending the work to retrieve the waste from this trench T2 in order to integrate ASN's observations. The T2 retrieval work restarted on 23rd May 2011.

Retrieval of waste from the other trenches will require major modifications to the facility.

In its old pits, BNI 56 also stores intermediate level waste in conditions which no longer meet current safety standards. In April 2009, ASN also approved the retrieval operations from pits F5 and F6, provided that certain reservations are taken into account. In order to address the problems encountered when retrieving waste from pits, CEA intends to make major modifications to the facility. ASN has informed CEA that these modifications must be examined as part of the MAD-DEM file which is to be submitted no later than the second half of 2015. This file will be submitted along with the periodic safety review file for BNI 56.

The PEGASE facility

The PEGASE reactor in BNI 22 entered service in 1964 and was then operated for about ten years. By decree of 17th September 1980, CEA was authorised to reuse the PEGASE facilities to store spent fuel elements.

PEGASE is now an installation mainly storing spent fuel elements under water or dry and radioactive substances and equipment. Retrieval of the spent fuels from storage began in January 2006. By the end of 2013, CEA is required to retrieve all the drums of plutonium-bearing by-products stored in the PEGASE premises, along with fuel elements.

In the decree of 4th September 1989, CEA was authorised to modify the PEGASE facility to create a dry storage facility for CASCAD spent fuel. On the basis of the facility's periodic safety review file, and based on the opinion of IRSN, ASN in June 2010 approved the continued operation of the CASCAD facility, provided that a number of measures were taken. ASN moreover ensures at the periodic meetings that the measures identified following the periodic safety review are implemented and that the associated deadlines are met.

The CEDRA facility

Decree 2004-1043 of 4th October 2004 authorised CEA to create the CEDRA (packaging and storage of radioactive waste) BNI 164 on the Cadarache site. The purpose of the facility is to treat low and intermediate level, long-lived waste and store packages of low and intermediate level, long-lived waste. This storage is planned for a period of 50 years, pending the commissioning of an appropriate disposal route.

In April 2006, ASN authorised the commissioning of the first section of the storage facility for low-level waste (two storage buildings) and intermediate level waste (one storage building).

The ASN inspections of the CEDRA facility mainly concern the conditions of package acceptance, of their transfer to the ANDRA repositories, where applicable, and the conditions of operation of the facility (for example, the change in main contractor which took place in 2011). These inspections highlighted the rigorous management of waste on the facility

Saturation of hall FI is forecast for 2025, and that of hall MI for 2023. As the main provider of packages is BNI 56, the revising of the movements from this facility has a direct impact on the CEDRA facility. Nevertheless, ASN still draws CEA's attention to the need to plan the strategy for building and commissioning new sections in the CEDRA facility, so that the capacity needed to store the amount of waste to be managed is available on time.

Renovation or shutdown of old facilities

Effluent and waste treatment station

The effluent and waste treatment station (BNI 37), notified by CEA in a letter of 27th May 1964, processes and packages liquid and solid radioactive waste from the Cadarache centre.

In 2008, ASN examined the safety options file for the reinforcements programmed by CEA to ensure the continued operation of part of the solid waste treatment stations (STDS) in BNI 37. In 2011, CEA informed ASN that further analysis of the seismic risk at the location of the facility meant that it was modifying its strategy. Given the central role of the STDS in BNI 37 for management of CEA radioactive waste, technical discussions were held in 2011 between ASN and the licensee in order to clarify the strategy chosen by CEA for this facility. These discussions in particular concerned the programme to reinforce the facility, the technical conditions envisaged by the licensee and the administrative conditions for their implementation. ASN observes that CEA's strategy with regard to this facility has been changing over the past two years. The CEA submitted the review file for the waste treatment station (STD) of BNI 37 in March 2012. The periodic review launch meeting was held on 29th June 2012 and the kick-off meeting on 4th October 2012. Particular attention will be devoted to the facility reinforcement proposals during this review.

In accordance with ASN resolution 2011-DC-0208 of 27th January 2011, as of 1st January 2012 the effluent treatment station (STE) no longer receives radioactive effluents.

ASN has also stipulated that use of the STE's treatment units must have ended no later than two years after the facility



CEDRA storage hall

stops receiving radioactive effluents, that is to say on 31st December 2013.

The waste treatment stations on the CEA sites at Fontenay-aux-Roses (BNI 73) and Grenoble (BNI 79) ensure the storage of fuel elements or high level waste in pits or blocks. CEA has engaged itself in a programme to recover this waste as part of the delicensing of the Grenoble and Fontenay-aux-Roses sites (see chapter 15).

13 | 2 AREVA waste management

a) AREVA waste management strategy

The spent fuel reprocessing plant at La Hague produces most of AREVA's radioactive waste. The fuel cycle installations are described in chapter 13. The waste present on the La Hague site comprises on the one hand the waste that resulting from reprocessing of the spent fuel, which generally comes from the nuclear power plants, but also from research reactors, and on the other, the waste resulting from operation of the facilities of the La Hague plant itself. Most of this waste remains the property of the licensees who have their spent fuel reprocessed (whether French - such as EDF, or foreign).

b) The issues and implications

The main issues relating to the management of waste from the licensee AREVA concern:

- the safety of the storage facilities for the legacy waste present on the La Hague site. ASN had effectively noted recurrent delays in the retrieval of legacy waste from La Hague and the lack of an integrated view within the establishment for ranking of the legacy waste retrieval projects in the light of the safety issues surrounding storage (see Chapter 13);
- the definition of solutions for waste packaging, in particular for legacy waste.

It must be recalled that the "Waste" Act of 28th June 2006 requires that ILW-LL waste produced before 2015 be packaged no later than the end of 2030. ASN therefore reminded AREVA of the need to define and finalise solutions for packaging this waste within a time-frame enabling the 2030 deadline to be met. These solutions will have to be approved by ASN beforehand. Moreover, on the basis of the recommendations from the Advisory Committee issued

during examination of the decommissioning conditions for BNIs 33, 38 and 47, ASN reminded AREVA of the need to continue the qualification studies for the packaging processes for the waste resulting from reprocessing of gas-cooled reactor fuels (UNGG) in order to meet the decommissioning schedules for the facilities concerned.

In September 2008, subsequent to the meeting of the Advisory Committee dealing with the BNI 118 periodic safety review, ASN issued a resolution banning bituminisation of the sludges from STE2 and asked AREVA to continue to look for an alternative process for sludge bituminisation. These sludges, representing 3,400 tons of salts, were produced between 1966 and the late 1990s and are the result of processing of radioactive effluents from the UP2-400 plant units or the CEA research centres. AREVA presented ASN with a project for an alternative package (known as C5) consisting of pellets of compacted waste, placed in a container filled with an inert material. After obtaining the opinions of IRSN and ANDRA, ASN asked AREVA, in resolution 2011-DC-0206 of 4th January 2011, to enhance its studies and demonstrations regarding the properties of the package, in order to demonstrate its acceptability for subsequent disposal. An annual assessment of the state of progress of R&D is presented to ASN. ASN remains attentive to the proposals made by AREVA concerning the development of the C5 package.

Moreover, in its resolution 2010-DC-0176 of 23rd February 2010, ASN required AREVA to present by February 2012 at the latest the progress of its work to define an alternative to the package known as S5 for packaging alpha technological waste, produced primarily by the La Hague and MELOX plants. AREVA proposed a new method of processing this waste which is rich in alpha emitters. Two incineration/melting/vitrification processes are currently being studied, processes that allow the manufacture of packages that enhance the safety of their storage and disposal. In 2013, ASN will state its position on the follow-ups to give for managing the development of this new package. In the framework of the PNGMDR 2013-2015, ASN has asked AREVA to check the feasibility of implementation of the chosen thermal process.

c) ECRIN facility

The waste that used to be produced by COMURHEX Malvési facility is stored on-site in former settling ponds named B1 and B2. This waste chiefly contains natural radionuclides. However, some traces of artificial radionuclides, as a result of reprocessing of spent fuels, carried out in the facility until 1983, have been detected in these ponds. This storage facility consequently fall under the BNI regime.

AREVA NC has submitted a creation authorisation application file for the ECRIN BNI. ASN and its technical support organisation are currently examining this file. The decree regularising the administrative situation should be available in 2014.

In the framework of the PNGMDR 2010-2012, COMURHEX (the former licensee) submitted a study to the Ministers of Energy, Nuclear Safety and Radiation Protection, proposing safe long-term management routes for the waste currently stored in the B1 and B2 settling ponds on its Malvési site, along with the management procedures for waste that will be produced in the



ASN inspection of the settling ponds at Malvési – September 2012

future by the COMURHEX Malvési facility. ASN's opinion on the submitted study underlines the need to distinguish the long-term management of the waste produced (since 1960) from the management of the waste produced between now and 2050. The PNGMDR 2013-2015 requires AREVA to continue characterising the legacy waste in order to refine the radiological and chemical study and the feasibility studies concerning the disposal options for this legacy waste.

1|3|3 EDF waste management

a) EDF waste management strategy

The waste produced by EDF nuclear power plants is activated waste (from reactor cores) and waste resulting from plant operation and maintenance. To this can be added the legacy waste and waste resulting from ongoing decommissioning operations. EDF is also the owner - for the share attributed to it - of long-lived high level and intermediate level waste from the spent fuel reprocessed in the AREVA plant at La Hague.

Activated waste

This waste comprises control rod assemblies and poison rod assemblies used for reactor operations. This is intermediate level long-lived waste produced in small quantities. It is currently stored in pools in the power plants, pending storage in the future centralised ICEDA facility planned on the Bugey site, the creation of which was authorised by decree 2010-402 of 23rd April 2010. The purpose of this installation will be to process and store activated waste from the BNIs currently being operated by EDF, from the decommissioning of the first generation reactors and from decommissioning of the Creys-Malville fast neutron reactor. The civil engineering operations are 90% completed but at present have been suspended. In its judgement of 6th January 2012, the administrative court of Lyon cancelled the building permit for the facility. This cancellation will induce a delay of at least one year in the forward-looking schedule for commissioning the facility, which EDF had planned for early 2014. The town council of Saint-Vulbas has revised its local urban development plan, which enabled EDF to file a new building permit application for ICEDA. In the decree of December 2011 reforming the impact studies for the works, civil engineering structures or development projects, the filing of a building permit application is subject to the case-by-case review procedure carried

out by the environmental authority, which decides whether or not an impact study is required. The environmental authority thus asked for the ICEDA impact study to be updated. EDF indicates that this procedure leads to a postponement of the resumption of work, which will not take place until the end of summer 2013.

Operating and maintenance waste

Some of the waste is processed by the Centraco facility in Marcoule in order to reduce the volume of ultimate waste. The other types of operating and maintenance waste are disposed of in the Aube disposal facility for low-level and intermediate-level short-lived waste in Soulaïnes, and in the CIRES repository in Morvilliers for very low level waste. This waste contains beta and gamma emitters, and few or no alpha emitters.

b) The issues and implications

The main issues related to the EDF waste management strategy concern:

- *the management of legacy waste.* This primarily concerns structural waste (graphite sleeves) from the gas-cooled reactor fuels. This is low-level, long-lived waste (LLW-LL) which is eventually to be disposed of in the corresponding ANDRA repository currently being planned. This waste is primarily stored in semi-buried silos at Saint-Laurent-des-

Eaux. Graphite waste is also present in the form of stacks in the gas-cooled reactors currently being decommissioned.

In the light of the postponed opening of the repository which was to take the graphite waste, ASN asked EDF to look at a possible intermediate graphite storage programme to accompany the gas-cooled reactor decommissioning programme (see chapter 15). At the end of 2012, ANDRA submitted a report presenting the long-term management scenarios for the LLW-LL waste. EDF is studying the possibilities of processing graphite waste in order to update in 2014 its strategy for the decommissioning of first-generation electrical production facilities;

- the graphite sleeves containing gas-cooled reactor fuel elements and technological waste were stored in the silos at Saint-Laurent-des-Eaux (BNI 74) from 1971 to 1994. These silos consist of two semi-buried reinforced concrete bunkers, made leak-tight by a steel liner. In 2003, following the periodic safety review of the facility, and bearing in mind EDF's undertaking to empty the silos by 2010, ASN authorised continued operation of the silos. Given the delay in the search for a site for the graphite waste repository and in response to ASN's request to define an alternative strategy to guarantee the safe management of this waste, EDF presented in July 2007 a solution which was to place a containment barrier around the silos. In July 2008, ASN approved the principle of a geotechnical containment around the silos, subject to the provision of a certain amount of additional data, which was subsequently made available by EDF in 2009. The geotechnical containment installation work was carried out in 2010. Following transmission by the licensee in January 2010, ASN referred the facility's periodic safety review file, modified accordingly, to IRSN. ASN in particular wanted IRSN to analyse the data concerning the effectiveness of the geotechnical containment and associated equipment. In 2013 ASN will state its position concerning the possibility of submitting a final shutdown and decommissioning (MAD-DEM) application file for the Saint-Laurent-des-Eaux silos.
- *changes linked to the fuel cycle.* EDF fuel use policy (see chapter 12) has consequences for the fuel cycle installations (see chapter 13) and for the quantity and nature of the waste produced. This subject was examined by the Advisory Committees for reactors (GPR), for plants (GPU) and for waste (GPD) at the end of 2001 and early 2002. ASN asked that the "cycle consistency" file be updated. The revised file was sent by EDF to ASN at the end of 2008. This file was examined on 30th June 2010 by the GPU and GPD. Following this examination, in its letter of 5th May 2011, ASN asked EDF to implement a more rigorous policy for managing its storage capacity for substances before their disposal or their treatment or reprocessing. More specifically with regard to waste, EDF must for example ensure that the available packaging containers can meet the disposal needs.

ASN notified EDF in a letter dated 14th May 2012 of its intention to re-examine its waste management policy. It is planned for the Advisory Committees to examine the EDF file in 2014.



ASN inspection on the suspended ICEDA construction site – December 2012



Graphite cells in the fuel loading zone in a UNGG gas-cooled reactor – Bugey 1 dismantling work site – August 2011

1 | 3 | 4 SOCODEI melting/incineration facility

The CENTRACO low-level waste processing facility, located in Codolet near the Marcoule site (Gard *département*), is operated by SOCODEI, a subsidiary of EDF. This facility was created by an amended decree dated 27th August 1996 and was commissioned in 1999. The purpose of the CENTRACO facility is to process low or very low level waste by melting of metal waste or incineration of incinerable waste such as the clothing worn by staff intervening in nuclear facilities (gloves, suits), oils, solvents, resins, etc. The melting process consists in treating primarily ferrous metal waste (valves, pumps, pipes, tools, etc.) generated by maintenance and by decommissioning of nuclear facilities.

Owing to the many deviations observed in 2008, ASN asked the licensee to draw up a safety improvement plan for its facility. ASN also reinforced its checks to ensure that this plan was effectively implemented. Nine inspections were carried out in 2009, five in 2010, eight in 2011 and eight in 2012.

On 12th September 2011, an explosion in the melting furnace killed one employee and injured four others, including one seriously. A judicial inquiry was opened at the same time as ASN was carrying out its investigations. During the course of this judicial inquiry and then the subsequent criminal investigation for unintentional injury and manslaughter, ASN was requisitioned to provide technical assistance to the court. A copy of the ASN interim technical report was transmitted to the courts at the end of 2011. This information, which is sub judice, could not follow ASN's usual public communication procedures.

Without prejudice to any measures that may be taken under the judicial procedure, ASN in a resolution dated 27th September 2011, stipulated that its authorisation would be required in order to restart the melting and incineration furnaces, which were shut down following the accident.

Pursuant to the provisions of this resolution, the licensee submitted to ASN the information to substantiate that restart would be carried out under satisfactory conditions of safety. More specifically, SOCODEI communicated the initial results of the pre-restart verification operations, focussing in particular on the condition of equipment necessary for the

safety of the incineration furnace and the conclusions of the review of situations inducing an explosion risk in the incineration unit. On completion of the investigation conducted with the assistance of its technical expert and which required the provision of additional technical information by the licensee on several occasions, ASN considered the transmitted elements to be satisfactory.

Moreover, an ASN inspection was carried out on 28th June 2012 to verify that the licensee had implemented the technical and organisational measures for preventing the occurrence of explosion risk situations. The conclusions of the inspection showed that the operations prior to incinerator restarting were carried out satisfactorily.

Consequently, on 29th June 2012, ASN authorised SOCODEI to restart the incineration furnace, subject to the submittal - before introducing waste into the incinerator - of the complete report on the verifications of conformity of the equipment necessary for the safety of the furnace. The first waste was introduced into the furnace in July 2012.

For the melting unit, the prospects of restarting are not known at present, and the judicial inquiry opened further to the accident - in which ASN is participating as a “qualified advisor” - is continuing under the authority of the examining magistrate.

Furthermore, the licensee submitted the periodic safety review file for the facility in February 2011. An end-of-examination meeting between ASN/IRSN/SOCODEI was held on 17th September 2012. In a letter dated 19th October 2012, the licensee indicated the commitments it was taking further to this examination. Following the opinion of IRSN and the commitments made by the licensee, an ASN resolution will be issued in 2013 regarding the continuation of operation of the facility. It will also present the main requirements resulting from the examination.



Incineration furnace at the Centraco facility in Marcoule

1 | 3 | 5 Management of waste from small-scale nuclear activities⁴

a) Management of waste from non-BNI nuclear activities

Issues and implications

The use of unsealed sources in nuclear medicine, biomedical or industrial research creates solid and liquid waste: small laboratory equipment used to prepare sources, medical equipment used for administration, leftovers of meals eaten by patients who have received diagnostic or therapeutic doses, etc. Radioactive liquid effluents also come from source preparation as well as from the patients who eliminate the radioactivity administered to them by natural routes.

The diversity of waste from small-scale nuclear activities, the large number of establishments producing it and the radiation protection issues involved have all led the public authorities to tighten the management of the waste generated by these activities.

Implementation of ASN resolution 2008-DC-0095

ASN resolution 2008-DC-0095 of 29th January 2008 lays out the technical rules to be met by the disposal of effluents and waste contaminated or potentially contaminated by radionuclides owing to a nuclear activity⁵. This resolution incorporates the main provisions of the circular from the Minister of Health (DGS/DHOS No. 2001/323 of 9th July 2001) which only applied to medical activities.

Following consultation of the stakeholders, ASN will publish in early 2012 the guide for application of this resolution, which specifies the good practices for management of effluents and waste produced by nuclear activities other than in BNIs.

b) Management of waste containing enhanced natural radioactivity

Some professional activities using raw materials which naturally contain radionuclides but which are not used for their radioactive properties, may lead to an increase in specific activity in the resulting products, residues or waste. This is known as technologically enhanced natural radioactivity. Most of these activities are (or were) regulated under the regime of Installations Classified on Environmental Protection grounds (ICPE).

Waste containing enhanced natural radioactivity can be accepted in various types of facilities, depending on its specific activity:

- in a waste disposal centre authorised by order of the Prefect, if it can be proven that the waste activity level is negligible from a radiation protection viewpoint. A specific study, complementing the initial impact study, must thus prove that the storage of waste with enhanced natural radioactivity does not jeopardise the protection of the interests mentioned in Article L.511-1 of the Environment Code, particularly from the radiation protection standpoint, for both the operating personnel and the neighbouring population, including over the long term. The circular from the Ministry of the Environment dated 25th July 2006 concerning the acceptance of waste containing enhanced or concentrated natural radioactivity in waste disposal facilities, specifies the conditions of acceptance of this type of waste in such facilities;
- in ANDRA's very low level waste disposal facility;
- in a interim storage facility. Some of this waste is waiting for a disposal route, in particular the commissioning of a disposal centre for long-lived, low level waste.

In 2004 and 2008, ASN tasked the Robin des Bois association with carrying out two surveys, which identified more precisely the potential sources of occupational and general public exposure to ionising radiation associated with enhanced natural radioactivity.

Under the terms of the PNGMDR, ASN in July 2009, forwarded its report on the management solutions for waste with enhanced natural radioactivity to the Ministers of Environment and Health. The conclusions of this report do not call into question the existing management solutions. However, ASN also made recommendations for improvement of management routes for disposal of this type of waste. Most of these recommendations are focused on Installations Classified on Environmental Protection grounds (ICPEs). On these subjects, ASN works together with the Ministry of the Environment. In its 2010-2012 edition, the PNGMDR asked that an assessment of application of the circular of 25th July 2006 be carried out by the end of 2011.

This assessment was carried out by the Ministry of the Environment. Four hazardous waste disposals facilities have been authorised to receive waste containing enhanced natural radioactivity, namely:

- Villeparisis in Ile-de-France, authorised until 31st December 2020, for an annual capacity of 250,000 t/year;
- Bellegarde in Languedoc-Roussillon, authorised until 4th February 2029, for an annual capacity of 250,000 t/year until 2018 and 105,000 t/year beyond this;
- Champteussé-sur-Baconne in Pays de la Loire, authorised until 2049, for an annual capacity of 55,000 t/year;
- Argences in Basse-Normandie, authorised until 2023, for an annual capacity of 30,000 t/year.

4. Small-scale nuclear activities correspond to all installations using ionising radiation but not covered by the BNI regime. Small-scale nuclear activities concern many fields such as medicine (radiology, radiotherapy, nuclear medicine), human biology, research and industry.

5. The nuclear activities concerned by the resolution are those mentioned in Article R.1333-12 of the Public Health Code, that is all authorised or notified nuclear activities (including nuclear activities intended for medicine, human biology or biomedical research) with the exception of those carried out in the following facilities:

- basic nuclear installations mentioned in III of Article 28 of Act 2006-686 of 13th June 2006 concerning transparency and security in the nuclear field (BNI);
- nuclear installations and activities mentioned in III of article 2 of Act 2006-686 of 13th June 2006 concerning transparency and security in the nuclear field (BNI), that is defence-related nuclear activities and installations;
- installations classified on environmental protection grounds (ICPE) subject to authorisation pursuant to Articles L. 511-1 to L. 517-2 of the Environment Code;
- installations subject to authorisation pursuant to Article L153-3 of the new Mining Code.

The operational experience feedback from the Bellegarde and Villeparisis facilities shows there is no marking in the groundwater linked to the presence of waste with enhanced natural radioactivity in the sludge. Oversight of the acceptance of waste containing enhanced natural radioactivity in these centres has been reinforced by prefectural orders imposing particular requirements relative to:

- the implementation of an extended prior acceptance procedure (identification of the naturally occurring radionuclides, evaluation of the cumulative doses over one year);
- radiological surveillance (measurement of naturally occurring and artificial radionuclides in the groundwater, leachates and sludge from leachate ponds, activity concentration of dust in the air);
- the monitoring of personnel exposure (Labour Code).

The PNGMDR 2013-2015 requires the implementation of regulatory changes in order to improve knowledge of the deposits of enhanced naturally radioactive waste and improve its traceability.

c) Management of mining residues and mining waste rock

Uranium mines were worked in France between 1948 and 2001, producing 76,000 tons of uranium. Exploration, mining and processing work was carried out on about 250 sites in France spread over 25 *départements*. Ore processing was carried out in 8 plants. The former uranium mines are now almost all under the responsibility of AREVA NC.

The Mining Code applies to mining activities, both during operation of the mine and when operations cease, until the end of the validity of the mine title. The Environment Code applies to residue disposal areas. Finally, the Public Health Code and the Labour Code guarantee radiation protection of the public and workers.

The uranium mine workings produced two categories of products:

- mining waste rock, comprising the soil and rock excavated to access the minerals of interest; the quantity of extracted rocks can be estimated at 167 million tonnes;
- static or dynamic processing residues, which are the products remaining after extraction of the uranium from the ore. Such residues correspond to process waste, as defined by the Environment Code. In France, treatment residues represent 50 million tonnes spread over 17 disposal sites. These disposal sites can cover surface areas varying from one to several tens of hectares, and enclosing from a few thousand to several million tonnes of residues. The radioactivity measurements carried out on the disposal sites give values of the same order as the measurements taken in the environment of the site.

Regulatory context

The uranium mines and their annexes are covered by the Mining Code. The mining regulator focuses primarily on

operation and on conventional mining risks, without taking specific account of radiation protection issues. It also deals with the site closure conditions. Operation of the French mines is based on a system of concessions, most of which will expire on a common date in 2018, set by the Mining Code.

The mining residue disposal sites are covered by the regime of installations classified on environmental protection grounds (ICPEs). Decree 2006-1454 of 24th November 2006 created a specific section 1735⁶ for these sites.

Management of the former mining sites and residue storage sites is also governed by Article 4.5 of Act 2006-739 of 28th June 2006 and the work of the PNGMDR.

Moreover, the Ministry of the Environment and ASN issued a circular on 22nd July 2009 defining an action plan comprising the following working topics:

- monitor the former mining sites;
- improve understanding of the environmental and health impact of the former uranium mines and their surveillance;
- manage the mining waste rock (better identify the uses and reduce impacts if necessary);
- reinforce information and consultation.

In a letter of 12th June 2009, AREVA NC undertook to implement an action plan to help apply these measures, alongside measures taken under the aegis of the State's services.

Issues, implications and ongoing measures

The long-term behaviour of the mining residue disposal sites

Redevelopment of the uranium processing residues disposal sites consisted in placing a solid cover over the residues to provide a protective barrier to limit the risks of intrusion, erosion, dispersion of the stored products and the risks of external and internal (radon) exposure of the surrounding populations.



The Bois Noirs embankment (Loire *département*)

6. Radioactive substances (depot, storage or disposal) in the form of solid residues of uranium, thorium or radium ore, as well as their reprocessing products containing no uranium with isotope 235 enrichment, the quantity of which is greater than 1 tonne.

Article 4 of Act 2006-739 of 28th June 2006 required that by the end of 2008, an inventory be produced of the long-term impact of uranium mining residue disposal sites, with the implementation if necessary of an enhanced radiological monitoring plan for these sites. On 25th August 2009 (see ASN opinion 2009-AV-0075), ASN sent the Minister of the Environment its opinion on the studies submitted by AREVA.

The PNGMDR 2010-2012 is based on the opinion submitted by ASN and specifies the additional studies to be performed by AREVA over the next few years concerning management of the residues disposal sites and the management of mining waste rock.

The new elements submitted by AREVA relate to:

- water treatment and the impact of discharges, and constitute an inventory of the treatment practices and their radiological and chemical impact on man and the environment;
- the long-term integrity of the embankments surrounding the mining residue disposal sites and allow initiation of the analysis of the requirements necessary to guarantee the long-term safety of these disposal sites in the light of the geomechanical assessment of the embankments;
- the long-term radiological impact of the residue disposal sites and mining waste rock stockpiles, and have brought improvements in knowledge, particularly on the modelling of radon.

In 2012, ASN examined these elements and on 19th November 2012 it sent the Minister its opinion on the studies submitted in application of the PNGMDR 2010-2012, with a view to producing the PNGMDR 2013-2015 (see ASN opinion 2012-AV- 0168 of 11th October 2012). ASN considers that the studies carried out by AREVA must be continued in greater depth and supplemented in the coming years, particularly concerning:

- the strategy chosen for the changes in the treatment of water collected from former mining sites;
- the development of a doctrine for assessing the long-term integrity of the embankments surrounding the residue disposal sites;
- the comparison of the surveillance data and the results of modelling to improve the relevance of the systems of surveillance and evaluation of the long-term dosimetric impact of the residue disposal sites;
- the evaluation of the long-term dosimetric impact of the mining waste rock stockpiles and mining waste rock in the public domain in relation to the results obtained in context of the circular of 22nd July 2009.

ASN regularly checks the implementation of the requests of the PNGMDR and periodically conducts joint reviews with AREVA NC to check work progress and identify any difficulties.

Since 2011, the representatives of the Bois Noirs association can participate in the plenary sessions of the PNGMDR working group.

Reuse of mining waste rock in the public domain

Most of the mining waste rock remain on the site where they were produced (mine in-fill, redevelopment work or spoil

heaps). Nonetheless, 1 to 2% of the mining waste rock may have been used as backfill, in earthworks or for road beds on locations near the mining sites. Although since 1984 the transfer of mining waste rock to the public domain has been traced and sometimes carried out in compliance with orders from the Prefect to the quarry operators, the picture is incomplete with regard to transfers prior to 1984. ASN and the Ministry of the Environment, in the framework of the action plan of the circular of 22nd July 2009, asked AREVA to inventory the mining waste rock reused in the public domain in order to verify that the uses are compatible and to reduce the impacts if necessary.

AREVA carried out helicopter-borne measurement campaigns around former French mining sites between November 2009 and the end of 2010. The areas overflowed were the *départements* of Creuse, Corrèze, Saône-et-Loire, Allier, Puy-de-Dôme, Lozère, Loire, Nièvre, Morbihan, Loire-Atlantique and Vendée. The data then underwent statistical processing to identify the geographical areas that require verification on the ground. No situation requiring emergency intervention has so far been identified. The reconnaissance and ground verification phase began in 2011 and will continue until the end of 2013. The inventory of mining waste rock will only be known after completion of all of the ground reconnaissance operations. ASN is remaining particularly vigilant to the monitoring of these various phases and to any situation which could require additional measures.

In 2011, AREVA completed its inventory of mining waste rock in the Creuse and Corrèze *départements*. The inventory charts accessible to the public were transmitted to the DREALs (Regional directorates for the environment, planning and housing) and ASN in March 2012, July 2012 and November 2012 for the Limousin, Bourgogne and Puy-de-Dôme *départements* respectively.

In September 2011, AREVA sent ASN a proposal for a methodology to assess the compatibility with the uses and to manage the mining waste rock that could be removed. ASN considers that this methodology for interpreting the results of ground verifications and for judging the compatibility of the uses of places in the public domains where mining waste rock are reused is on the whole relevant and appropriate for the extent of the inventory on the French territory, and requested additional information in May 2012. AREVA communicated additional information in September 2012. This information is currently being reviewed by ASN.

The Pluralistic Expert Group (GEP), the involvement and the informing of the stakeholders

The Ministry of the Environment, the Ministry of Industry and the Ministry of Health decided back in 2005 to set up and finance a GEP to provide third-party assessment of the redevelopment of the former mining sites in the Limousin.

On 15th September 2010, the GEP Limousin submitted its final report and its recommendations to the Minister of the Environment and the ASN Chairman, concerning the short, medium and long-term management of former uranium mining sites in France. The GEP noted the considerable progress made in recent years on the subject of mining sites, both in the Limousin and nationally. The Group considers that this progress must be continued and be broadened in

order to develop a clear perspective on the sustainable management of these sites over the next ten years or so.

The ASN Chairman and the Minister of the Environment have made a commitment to the GEP to examine the ways and means for implementation of these recommendations and to ensure follow-up as part of the remit of the working group. The Ministry of the Environment and ASN tasked the GEP Chairman in May 2011 with presenting its conclusions and recommendations to the local and national consultative bodies and to evaluate the future implementation of these recommendations.

ASN and the Ministry of the Environment drafted an action plan designed to implement the main GEP recommendations. The main areas of work were presented to the GEP at its December 2011 session. In a letter dated 25th April 2012 addressed to the Chairman of the GEP on the former uranium mines in the Limousin region, ASN and the Ministry of the Environment defined an action plan to take into account the fifteen broad recommendations of the GEP Limousin. This action plan hinges around the following four themes:

- modernising and clarifying the institutional, regulatory and doctrinarian framework;
- improving the knowledge and management of the sites;
- improving scientific and technical knowledge;
- diverse recommendations (informing the Local Information Committees (CLIs) in particular).

ASN considers the public must be involved in the management of mining waste rock in the public domain, and of redeveloped former mining sites. The steps taken pursuant to circular issued by the Ministry of Ecology, Sustainable Development and Energy (MEDDTL) and ASN dated of 22nd July 2009, the PNGMDR and the GEP Limousin, make provision for involving the stakeholders, especially the CLIs, in the deliberations and actions to be taken.

ASN is a member of the steering committee for the national inventory of uranium mining sites MIMAUSA (Memory and impact of uranium mines: summary and archives; www.irsn.fr), under the aegis of the Ministry of the Environment. This inventory will be supplemented by an inventory of mining waste rock by 2014, as well as by a review of the situation of the former mining sites as identified by the AREVA surveys and IRSN's verifications and measurements in the field. The local authorities are kept informed of the results of the actions taken on the former mining sites. The final inspection reports were thus sent to the town councils concerned in May 2012, June 2012 and October 2012 for the Corrèze, Haute-Vienne and Nièvre départements⁷ respectively.

In 2010, experts from the European Commission carried out an independent assessment of the regulatory systems and the organisation put in place in France to check and monitor the radioactive releases from the former uranium mining sites in the Limousin region as well as the radioactivity levels in the

environment around these former mining sites. The experts from the European Commission estimated that the former uranium mining sites in France comply with the European provisions. The high level of expertise in France on this subject and the quality and diversity of the tools used to inform the public were underlined.

d) Management by ANDRA of waste from small-scale nuclear activities

Article L.542-12 of the Environment Code entrusts ANDRA with a public service mission for waste produced by small-scale nuclear activities (e.g.: research laboratories, hospitals, etc.). When ANDRA was created in 1991 as a public organisation independent of the CEA, it did not have its own facilities for managing waste from small-scale nuclear activities. Consequently, ANDRA made agreements with other nuclear licensees, and the CEA in particular, which stores waste on the Saclay site.

ANDRA started reconfiguring the route in 2012 by creating at CIREs (the industrial centre for collection, storage and disposal) situated on the parishes of Morvilliers and La Chaise, a collection centre and a storage facility for waste from small producers other than nuclear power plants. These facilities received their first waste in autumn 2012. It must however be pointed out that these facilities will not be able to receive tritiated waste, owing to its characteristics. For tritiated solid waste, ANDRA has proposed a management solution consisting in shared storage with the waste from ITER, whose commissioning is envisaged for 2024.

ASN considers that the approach adopted by ANDRA will be such as to meet the duties entrusted to it under Article L.542-12 of the Environment Code and that this must be continued. In the framework of the PNGMDR 2013-2015, ANDRA is requested to identify the investments needed to guarantee the sustainability of the waste management solutions for small producers.

1|4 Long-term waste management

1|4|1 Disposal of Very Low Level (VLL) waste at CIREs

CIREs (the industrial centre for collection, storage and disposal) situated in the Aube département on the communes of Morvilliers and La Chaise, includes a disposal facility covering an area of 45 hectares for Very Low Level (VLL) waste. This facility, which comes under the ICPE regulations and is licensed by order of the Prefect dated 26th June 2003, offers a disposal capacity of 650,000 m³ and has been operated since August 2003. Waste treatment operations, such as the compacting or conditioning (solidification) of certain very low level (VLL) waste, are carried out prior to disposal.

ANDRA has requested the modification of the architecture of the centre's disposal vaults in order to optimize the use of the

7. On account of Article 35 of the Euratom Treaty which states that "Each Member State shall establish facilities necessary to carry out continuous monitoring of the levels of radio-activity in air, water and soil and to ensure compliance with the basic safety standards. The European Commission has the right of access to such facilities in order that it may verify their operation and efficiency."

available volume. Thus, for the same ground surface area, the theoretical waste disposal volume per vault is increased by about 58% compared with the initial disposal concept. These provisions are governed by prefectural order of 8th February 2012.

1|4|2 The surface repositories for low and intermediate level, short-lived waste

Most low and intermediate level waste with a short half-life (less than 31 years) is sent for final disposal in the surface waste repositories operated by ANDRA. The principle underlying these repositories is to protect the waste from hazards, notably water circulation, during what is known as the surveillance phase (by convention 300 years) until such time as its activity level has decayed sufficiently to become negligible. There are two such repositories in France.

a) The Manche disposal facility

The Manche disposal facility (CSM) covers an area of about 15 hectares at the tip of the La Hague peninsular and has a total capacity of 527,225 m³ of waste packages. It was commissioned in 1969 and was the first radioactive waste repository to be operated in France. Operations at the CSM came to an end in July 1994 and the centre entered the surveillance phase in January 2003 (decree 2003-30 of 10th January 2003).

Isolated problems with the repository covering were identified a few years ago and required limited consolidation work. After consolidation of the “east embankment” in the summer of 2010, ANDRA proceeded to consolidate the “north embankment” in the summer of 2011, and in mid-2012 it filed a modification application for the consolidation of the central embankment (embankment “112 bis”). This work is the first step in putting a more long-lasting covering into place. In addition, ASN asked that more work be done to understand the long-term behaviour of the repository. An interim review of the modifications made to the repository cover must be presented in three years’ time, as requested by ASN, on the basis of the opinion issued by the Advisory Committee for waste in 2009.

ASN also had this Advisory Committee examine the final safety report, the general monitoring rules, the regulation monitoring plan and the on-site emergency plan. In response to requests from ASN, ANDRA in 2011 submitted a new version of its on-site emergency plan, the regulation monitoring plan and the general monitoring rules, which were the subject of an agreement with ASN. These modifications led ASN to undertake work to revise the technical requirements governing discharges, which will continue in 2013.

Finally, in accordance with the recommendations of the commission assessing the situation of the Manche disposal facility (known as the “Turpin Commission”), ANDRA in March 2008 drafted an interim version of the “Concise History” intended to preserve essential information about the CSM repository for future generations. In 2012, ANDRA conducted

two research appraisals to examine the relevance of the data in the detailed memory in order to ensure firstly the completeness of the detailed memory of the CSM, from its creation until today, and secondly the capability to meet the needs of future generations. The completeness of the elements relating to the detailed memory and the summary memory will be reassessed in 2013.

b) The Aube disposal facility for low and intermediate level short-lived waste

In 1992, the Aube disposal facility (CSA) for low and intermediate level short-lived waste took over from the Manche repository, taking full advantage of the operating experience feedback gained from it. Authorised by the decree of 4th September 1989⁸ and commissioned in January 1992, this facility is located in Soulaïnes-Dhuys (Aube *département*) and has a disposal capacity of 1 million m³ of waste, distributed among 400 disposal structures. The operations performed in the facility include packaging of the waste, either by injecting mortar into 5 or 10 m³ metal containers, or by compacting 200 litre drums.

Waste containment is achieved by three consecutive barriers: the package, the covering of the disposal structures and the ground in which the repository is engineered. The repository’s activities therefore generate a very small quantity of radioactive effluents. These are regulated by the order of 21st August 2006 authorising ANDRA to discharge liquid and gaseous effluents and to intake water for the Aube disposal facility.

In 2010, a health investigation was carried out around the repository by the Health Monitoring Institute (InVS) at the request of the “Citoyens du Coin” interest group and local elected officials. The results of this survey brought to light no link between the repository and any health effects. They were sent to the Soulaïnes CLI in late October 2010.

In 2011, ANDRA submitted a request for modification of the facilities to allow X-ray imaging inspections, tritium degassing checks and destructive tests (core sampling of low level packages) on the site, in addition to the non-destructive checks already carried out (visual, radiological, dimensional, gamma spectrometry checks). ASN is favourable to the idea of ANDRA acquiring its own high-performance inspection resources to ensure the quality of the packages received in its facilities. In relation to this modification request, additional information was requested relative to the justification of the guarantee for the sizing of the civil engineering structures.

In 2011, ANDRA has also made an application for the acceptance of non-standard packages containing lateral neutron protections from the Creys-Malville fast neutron reactor, which received ASN’s agreement in mid-2012.

Article 27 of decree 2007-1557 of 2nd November 2007 provides for the possibility of a nuclear licensee being exempted - for operations of minor importance - from the prior notification procedure provided for in Article 26, subject to the implementation of an internal control system that gives

8. The decree of 4th September 1989 authorising the CEA (French Atomic Energy Commission) and ANDRA (French National Agency for Radioactive Waste Management) to create a radioactive waste disposal facility at Soulaïnes-Dhuys and La Ville aux Bois (Aube *département*).



Chip spreading phase on a disposal structure at the CSA repository

sufficient guarantees of quality, independence and transparency. The requirements for implementation of these provisions are specified in ASN resolution 2008-DC-106 of 11th July 2008, approved by the order of 26th September 2008.

By resolution 2012-DC-0273 of 5th June 2012, ASN authorised ANDRA to set up a system of internal authorisations which sets the criteria for determining which operations can be treated by an internal operation. This resolution also governs the way ANDRA organises the examination of the files that come under an internal authorisation procedure, and the information that ANDRA must communicate to ASN.

1 | 4 | 3 Management of long-lived high and intermediate level waste

The “Waste” Act of 28th June 2006 states that research into the management of long lived, high or intermediate level radioactive waste (HLW/ILW-LL) should be continued in three directions: separation and transmutation of long-lived radioactive elements, reversible deep geological repository and interim storage. ASN considers that studies in these three directions are on the whole proceeding satisfactorily.

a) Separation/transmutation

Separation/transmutation processes aim to isolate and then transform long-lived radionuclides in radioactive waste into short-lived radionuclides or stable elements. The transmutation of the minor actinides contained in the waste is liable to have an impact on the size of the disposal facility, by reducing both the heating power of the packages placed in it⁹ and the repository inventory.

The “Waste” Act and the PNGMDR, provide for CEA to coordinate research into the separation-transmutation of long-lived radioactive elements, in relation with the other research organisations, and with ANDRA for questions concerning the potential impact of the use of this technology on the disposal of waste. In this context, CEA is required to submit a “report assessing the prospects of the various industrial separation-transmutation technologies”, including in particular a part on the benefits that separation-transmutation would bring to deep

geological disposal. At the end of 2010, CEA submitted an interim report which, for the various scenarios studied, presented the potential benefits in terms of reducing the harmfulness of the radioactive waste, the impact on the footprint of the future geological disposal facility and the impacts on the cycle installations (fuel fabrication, reactor operation, reprocessing) and on transport operations. The final report was submitted at the end of 2012. These files are currently being examined.

b) Interim storage

The 28th June 2006 Act states that storage studies must be carried out so that “no later than 2015, new storage facilities can be created or existing facilities modified, to meet the needs, particularly in terms of capacity and duration”. The need to extend or create interim storage facilities must be surveyed to ensure provision of adequate storage capacities for waste before its final disposal. The 28th June 2006 Act gives ANDRA responsibility for continuing interim storage studies. On 31st December 2009, ANDRA submitted a file presenting storage options complementing disposal. ASN asked the Advisory Committee for waste to examine this file together with the “2009 dossier” submitted by ANDRA for the high level and intermediate level, long-lived waste disposal project. At this stage, ASN has no particular comments concerning the analysis of storage requirements prior to disposal, as presented by ANDRA. In its opinion 2011-AV 0118 of 28th July 2011 submitted to the Minister of the Environment and the Minister for Higher Education and Research, ASN does however recommend that the studies be continued by ANDRA together with the producers of the waste concerned, so that sufficient storage capacity prior to disposal of intermediate and high level, long-lived waste is available in good time.

c) Deep geological repository / Cigéo (industrial geological repository centre) project

The research work for the deep geological formation waste disposal project is being carried out in the underground laboratory in Meuse/Haute-Marne. The decree of 3rd August 1999 authorised ANDRA to create and operate this underground laboratory within the commune of Bure. This authorisation was renewed in 2011 by decree 2011-1910 of 20th December 2011, authorising ANDRA to continue to operate an underground laboratory within the commune of Bure (Meuse *département*), to study deep geological formations for the disposal of radioactive waste. During the review that led to this authorisation renewal, ASN submitted an opinion on 10th May 2011 in which it recalled the benefits of continuing the research and experimentation in the Meuse/Haute-Marne underground laboratory, considering this to be essential to the acquisition of the knowledge needed to demonstrate the safety of placing high and intermediate level, long-lived radioactive waste in the same geological formation and to demonstrate the feasibility of its construction, its operation and its closure, in compliance with safety requirements. ASN also issued a certain number of recommendations for the continuation of this research and experimentation work.

In accordance with the PNGMDR decree of 16th April 2008, ANDRA at the end of 2009 proposed a zone of interest to the

9. The greater the heat given off by the packages, the further apart they must be spaced in the repository and the larger the disposal footprint.

Minister of the Environment and the Minister of Higher Education and Research, which was suitable for siting a disposal facility and in which it would conduct detailed geological investigations. On 5th January 2010, ASN gave the Government a favourable opinion on the choice of this 30 km² zone of interest for detailed reconnaissance work (ZIRA), with a view to siting of the underground installations of the future disposal facility and potential zones for siting of the surface installations (ZIIS). ASN also recalled the importance of choosing a site for disposal of high and intermediate level long lived waste, for commissioning of the disposal facility in 2025.

At the end of 2009 and pursuant to the PNGDMR decree of 16th April 2008, ANDRA also forwarded a file presenting an update of safety and reversibility options for disposal in the repository, of the inventory model for the waste packages used for design of the repository and the main design principles for the surface facilities envisaged. The file was examined on 30 November 2010 by the Advisory Committees for waste (GPD) and for laboratories and plants (GPU), on the basis of the report presented by IRSN. ASN notified the Ministers for the Environment, Energy and Research of its opinion (opinion 2011-AV 0129 of 26th July 2011). ASN in particular considers that, since its examination of the 2005 file, ANDRA has developed the main elements concerning the design, safety and reversibility aspects ensuring control of the risks during operation of the disposal facility. ASN considers that these elements must nonetheless be specified in the creation authorisation application file for a deep geological disposal facility, requiring good coordination of the experimentation programme planned for the Meuse/Haute-Marne laboratory. ASN considers that the design changes following examination of the “2005 file”, primarily concerning aspects related to the architecture of the facility, are not such as to modify the conclusions with regard to the feasibility of disposal. ANDRA will also need to make a more detailed analysis of some of the risks linked to operation of the facility. With regard to the safety of the repository after its closure, ASN recommends that ANDRA complete the justifications concerning the feasibility and the performance of the structure seals.

ANDRA's deep geological repository project – Cigéo – underwent a project review in May 2011, focusing in particular on the industrial programme input data to allow the initial facility design studies to be performed, on the requirements placed upon the lead contractor, particularly with regard to safety and reversibility, on the flexibility of the project so as to leave room for optimisation, as well as the project management organisation adopted by ANDRA.

ASN also notes that, following the project review, ANDRA continued to make changes to its organisation, in order to improve project management. These changes are also in response to the comments made by ASN during its 2010 inspection at ANDRA head offices concerning the processes used in the running of the Cigéo project.

ANDRA has been continuing its studies and research since the latest milestone file presented in 2009. It submitted three files in 2012, and ASN will issue an opinion on them prior to the public debate:

- the Waste Management Industrial Programme (PIGD) and its changes;
- the results of the “seismic 3D” reconnaissance campaign carried out in 2010 and their integration in the conceptual model of the site;
- the studies on the long-term behaviour of spent fuel under disposal conditions (report submitted within the framework of the PNGMDR);

These files will be examined by the Advisory Committees (GPD and GPU) on the basis of a report presented by IRSN in early 2013, and ASN will issue an opinion on them.

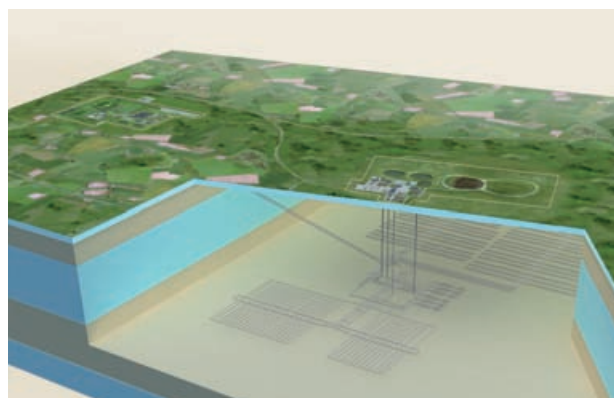
Article L.542-10-1 of the Environment Code provides for the application for authorisation to create a deep geological repository centre for radioactive waste (baptised Cigéo) to be preceded by a public debate.

On 9th October 2012 ANDRA submitted a request to the CNDP (French National Public Debates Commission) asking that this national public debate, which should be organised in 2013, be well coordinated with the debate on the energy transition of France. It will enable ANDRA to present project progress since 2006, and particularly the aspects associated with the industrial design of Cigéo, its safety, reversibility, layout and its surveillance.

ASN, together with its technical support organisation IRSN, defined milestones for the examination of the interim files to be submitted by ANDRA before submission of the repository creation authorisation application, which should take place in 2015. The purpose of these examinations will in particular be to study the progress made with integration of the recommendations made by ASN on the occasion of its review of the previous files submitted by ANDRA.

By means of inspections in the Bure underground laboratory, ASN continues to ensure that the experiments carried out as part of the research required by the 28th June 2006 “Waste” Act are performed in accordance with processes guaranteeing the quality of the results obtained.

In February 2008, ASN published the safety guide for final disposal of radioactive waste in deep geological formations, replacing Basic Safety Rule III.2.f., after receiving a favourable opinion from the Advisory Committee for waste (GPD). In 2008, ASN sets up a working group to look more closely at radiation protection values and the safety demonstration as applicable to long time-scales. Its conclusions were presented to the GPD



Schematic diagram of the Cigéo project

Advisory Committee for waste in March 2010. ASN observed, in particular, that the approach described in the safety guide is consistent with the doctrine applied internationally where these subjects are concerned.

1|4|4 Management of low level long-lived waste

Low Level Long-Lived waste (LLW-LL) comprises two main categories: graphite waste resulting from the decommissioning of the gas cooled reactor (UNGG) nuclear power plants, and radium-bearing waste, from the radium industry and its offshoots.

In June 2008, ANDRA was asked by the Government to begin a campaign to search for a potential site for a LLW-LL radioactive waste repository in areas with suitable geology. ASN sent the Government a favourable opinion concerning ANDRA's approach to analysing the geological context of the communes proposing to host a repository (opinion 2009-AV-0068 of 15th January 2009). ASN stated that there was nothing, from a geological standpoint, to rule out continued investigation into the siting of a LLW-LL waste repository on one of the sites classified by ANDRA as geologically "very interesting" and that the capacity of the sites to host a disposal facility should be confirmed on the basis of the results of detailed investigations.

In 2010, following the failure of the process to search for LLW-LL waste disposal sites, the HCTISN decided to set up an "LLW-LL" working group, tasked with reviewing the available information and the consultation process linked to the creation of the LLW-LL disposal facility. Alongside this, the HCTISN and ANCCLI participated in the WG1 ACN of the Aarhus Convention and Nuclear, which is tasked with diagnosing application of the Aarhus Convention in the context of the LLW-LL disposal project. These two working groups conducted joint audits of all the project stakeholders (actors and institutions, whether local or national).

The recommendations of the HCTISN and of WG1 ACN were presented at the session of the PNGMDR WG of 26th October 2011. The main recommendations of the HCTISN concern the following points:

- start again from the geologically favourable sites identified in 2008 and from the regions on which there are already BNIs, for sociological reasons in particular;
- the level must at least be intermunicipal, with the support of the State and the large communities;
- there must be a consultation for the process deployment schedule;
- the responsibility of the State must be engaged throughout the process;
- the public must be proactively informed before the announcement of the choice of sites, and during the realisation of the project;
- an authority must be created to guarantee consultation and dialogue.

The main recommendations of WG1 ACN are as follows:

- envisage the possibility of reorienting the project at any time;
- in the forward-looking schedule, indicate the financial resources for each step;
- give reasons for the decisions at each stage of the project;

- envisage the signing of a multipartite agreement for the long term.

The PNGMDR 2010-2012 thus set new orientations for the LLW-LL waste disposal project. ANDRA must continue its search for a site for the centre, increasing dialogue with the various stakeholders and considering the various possible disposal scenarios, in particular by more closely examining the possibility of separate management of radium-bearing and graphite wastes. A report presenting the latest advances and ANDRA's strategy was submitted at the end of 2012. At a working group meeting held in 2012 attended by the licensees, ANDRA and IRSN, ASN reminded ANDRA that safety remains the prime element to consider and that the geological characteristics will therefore be examined with great attention.

The PNGMDR 2013-2015 requires ANDRA to submit to the State by mid-2015 a report containing:

- proposals of choices of management scenarios for graphite and bituminous waste, notably with the possibility of relaunching the search for a site for an "Intact Cover Disposal" type repository or not;
- a feasibility file for the project for a "Reworked Cover Disposal" type disposal facility, the types of the waste to be disposed of in it and the schedule for its deployment.

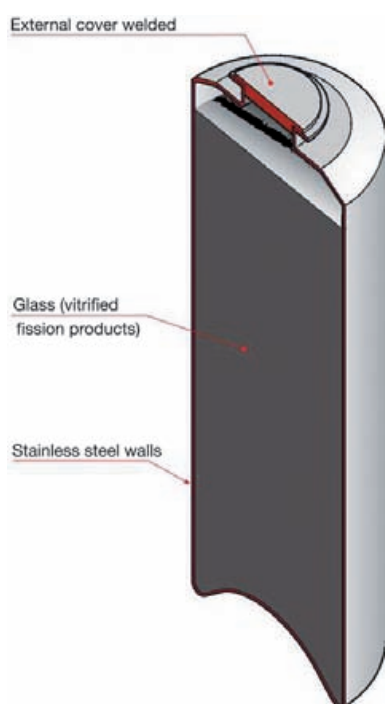
1|4|5 Package acceptance in disposal facilities

In May 1995, in basic safety rule III.2.e, ASN defined requirements concerning approval of the low-level radioactive waste packages in surface repositories. In order to control the quality of the packages it receives on its sites, ANDRA issues package approvals on the basis of a technical file submitted by the waste producer. ANDRA also verifies the quality of the packages by means of checks on the packages received in its facilities and through audits and monitoring missions at the waste package producers. These evaluations can if necessary lead to suspension or withdrawal of approval. Each year, ANDRA sends ASN a summary of the quality of the packages received at the Aube low and intermediate level waste disposal centre (CSA).

In 2007, ANDRA for example detected a quality defect on the packages resulting from pyrolysis mineralisation of organic effluents. Production was then suspended. The appraisal carried out by AREVA showed that a modification to the process was the reason for the anomalies detected. ASN reminded the licensee of the need to carry out impact assessments on the effect of the modifications on the quality of the waste packages. An arrangement such as this is now incorporated into the draft resolution on radioactive waste packaging currently being prepared.

However, ANDRA has not yet defined acceptance specifications for packages of intermediate level long-lived and high level waste. Pursuant to the decree of 12th May 1981, AREVA NC must therefore request ASN's approval of the packaging methods for the various types of waste. In 2011, on the basis of IRSN and ANDRA opinions, ASN approved packaging on the La Hague site:

- of solutions of fission products from the R7 and T7 units resulting from the reprocessing of spent fuels from UNGG type gas-cooled reactors, using the cold-crucible technique (CSD-U);



CSD-V package

- of intermediate level effluents by vitrification (CSD-B);
- of technological waste and structural elements, sheared into small sections and compacted into cakes (CSD-C) containing dissolver bottom residues. ASN resolution 2011-DC-0248 of

25th October 2011 sets out the requirements applicable to the production of this type of CSD-C packages.

By means of its inspections, ASN checks firstly that AREVA complies with the provisions of the resolutions, and secondly that ANDRA takes adequate steps to ensure the quality of the packages accepted in its disposal facilities. In 2012, ASN also carried out an inspection on the quality assurance of the packages from the R7 unit at La Hague. The inspectors carried out spot checks on various package quality and production monitoring indicators. Control of the CSD-V package specifications was considered to be satisfactory.

As part of the revision of the general regulations applicable to BNIs, ASN has begun to draft a resolution specifying the requirements regarding waste packaging and the conditions for issue of approval and for monitoring of the producers by ANDRA. This text was opened to consultation on the ASN website in 2010. It is currently being finalised following publication of the order defining the technical provisions applicable to BNIs.

ASN exercises particular vigilance in ensuring that the packages produced are in conformity with the conditions of the authorisations and approvals issued. It thus considers that the role of ANDRA in the approvals issue process and in monitoring the waste package producers is vital to guaranteeing the package quality necessary to comply with the safety demonstration of the waste repositories. ASN therefore considers that ANDRA must acquire the appropriate means to enable it to carry out destructive checks on waste packages, or have them carried out.

2 MANAGEMENT OF SITES AND SOILS CONTAMINATED BY RADIOACTIVITY

A site contaminated by radioactive materials is any site, either abandoned or in operation, on which natural or artificial radioactive materials have been or are employed or stored in conditions such that the site constitutes a hazard for health and the environment. For several decades now, the public authorities have devoted continuous efforts to the management of contaminated sites and soils.

Contamination by radioactive substances can be the result of industrial, medical or research activities involving radioactive substances. It can concern the places where these activities are carried out, but also their immediate or more remote vicinity. The activities concerned are generally either “nuclear activities” as defined by the Public Health Code, or activities concerned by technologically enhanced natural radioactivity, as covered by the order of 25th May 2005.

However, most of the sites contaminated by radioactive substances and today requiring management in fact concern past industrial activities, dating back to a time when radioactive hazards were not perceived in the same way as at present. The main industrial sectors from which the radioactive contamination identified today originated are: radium extraction for medical and parapharmaceutical needs, from the early 20th century up to the end of the 1930s; the manufacture and application of luminescent radioactive paint for night vision and the industries working ores such as monazite or zircons. A site contaminated by radioactive substances is managed on a case-by-case basis, requiring a precise diagnosis of the site and the contamination.

Several complementary contaminated site inventories are available to the public: the ANDRA national inventory which comprises the sites identified as contaminated by radioactive substances (the June 2012 edition is available on the www.andra.fr website) as well as the databases available on the web portal of the Ministry of the Environment (www.sites-pollues.ecologie.gouv.fr) dedicated to contaminated sites and soils.

In October 2012, ASN completed its doctrine specifying the fundamental principles it has adopted for the management of sites polluted by radioactive substances. It considers that the exposure of individuals to ionising radiation as a result of operations to manage sites polluted by radioactive substances must be kept as low as reasonably achievable in the light of current technology and of economic and social factors. This is why the reference procedure to adopt, when technically possible, is to completely clean out sites contaminated with radioactivity, even if the human exposure induced by the radioactive contamination seems limited.

ASN also believes that the solution involving the contamination being maintained in-situ can only be an interim solution or reserved for cases in which complete clean-out cannot be envisaged owing, in particular, to the volume of waste to be excavated.

ASN also considers that the management of contaminated sites requires public involvement when choosing the solution adopted, in order to create a climate of trust and minimise conflicts.

ASN also points out that in application of the “polluter-pays” principle written into the Environment Code, those responsible for the pollution are responsible for financing the operations to rehabilitate the polluted site and to remove the waste resulting from these operations. If the responsible entities default, ANDRA, on account of its public service remit and by public requisition, ensures the rehabilitation of radioactive contaminated sites.

Lastly, ASN reiterates in its doctrine for the management of radioactive contaminated sites that any stance adopted by ASN is duly justified and presented in complete transparency to the stakeholders and the audiences concerned.

In November 2012, ASN devoted issue 195 of its review *Contrôle* to the management of radioactive contaminated sites in order to detail the changes and progress accomplished in this area.



Contrôle magazine No 195 on the management of sites and soils polluted by radioactivity - November 2012. Available on www.asn.fr

2|1 Regulatory framework

Article 14 of Planning Act 2006-739 of 28th June 2006 on the sustainable management of radioactive materials and waste states that ANDRA has particular responsibility for the

collection, transport and handling of radioactive waste and the rehabilitation of sites displaying radioactive contamination, on request, and at the expense of the parties responsible, or further to public requisition if the parties responsible for this waste or these sites have defaulted. ANDRA thus has a state subsidy which contributes to financing the missions of public interest entrusted to it. The French National Funding Commission for Radioactive Matters (CNAR), was set up within ANDRA in 2007. The commission is chaired by the executive director of ANDRA and includes representatives from the supervising ministries (Ministries in charge of Environment, Energy and Health), ASN, IRSN, the Association of Mayors of France (currently represented by the Mayor of Nogent-sur-Marne), environmental defence associations and qualified key figures. The commission met three times in 2012, notably to decide on the allocation of public funds for management of contaminated sites considered to be high-priority, such as Orflam-Plast, Gif-sur-Yvette, Isotopchim, for monitoring the Radium Diagnosis operation and, occasionally, to take charge of certain waste. Since 2010, a scaled-down CNAR has been in place for day to day management of the Radium Diagnosis operation (see paragraph 2 | 3).

The circular of 17th November 2008 from the Ministry of the Environment, intended for the Prefects, describes the applicable administrative procedure for managing sites polluted by radioactive substances covered by the ICPE regime or the Public Health Code, whether the party responsible is solvent or defaulting. In any case, the Prefect relies on the opinion of its services, ASN and the ARS (Regional Health Agency), to validate the rehabilitation project before it is implemented, the objectives for clean-out and to protect the general public and the workers. Restrictions on use, or other institutional controls may also be recommended.

2|2 Revision of the contaminated sites management methodology guide

The methodological guide for the management of sites potentially contaminated by radioactive substances, drafted by ASN, the Ministry of the Environment and IRSN, was published in late 2011.

It updates the methodological guide for the management of industrial sites potentially contaminated by radioactive substances, published in October 2001. This new guide describes how to deal with the various situations liable to be encountered when rehabilitating sites (potentially) contaminated by radioactive substances. It is consistent with the methodology chosen for chemical pollution (circulars from the Ministry of the Environment to the Prefects, dated 8th February 2007).

In addition to drafting this guide, in 2012 ASN finalised its work to detail the kinds of institutional controls that could be recommended by ASN for the management of sites displaying residual contamination by radioactive substances. ASN has thus produced an inventory of the practices and legal instruments that can be used, and made recommendations concerning possible legislative and regulatory changes and good practices to develop. An action plan has been defined. It is planned to

draft an application guide after obtaining some experience feedback.

2|3 The Radium Diagnosis operation

In October 2010, the State decided to carry out diagnoses in order to detect and if necessary treat any radium pollution resulting from past activities. This operation concerns 84 sites in the Ile-de-France region and 50 sites in the provinces that have accommodated activities associated with radium, and necessitating diagnosis. Discovered by Pierre and Marie Curie in 1898, radium has been used in certain medical (the first cancer treatments) and craftwork activities (clock-making until the 1950s, due to its property of radioluminescence; manufacture of lightning arresters and cosmetic products).

These medical or craftwork activities, which are not linked to the nuclear industry, can have left traces of radium on certain sites. The diagnosis of the sites having accommodated an activity that used radium is a continuation of the many actions engaged by the State in recent years, such as the rehabilitation of sites on which research and radium extraction activities were carried out at the beginning of the 20th century, or the recovery of radioactive objects from private households, etc.

This operation is free of charge for the occupants of the premises concerned: the diagnosis consists in taking systematic measurements to detect the presence of any traces of radium or to confirm the absence of radium. These measurements are performed by a team of IRSN specialists, accompanied by an ASN coordinator, who first of all makes contact with the occupant in order to describe the operation. On completion of this diagnosis, the occupants are informed verbally of the results, with subsequent written confirmation by post. If traces of contamination are detected, rehabilitation operations are performed by ANDRA free of charge, with the agreement of the property owners. Ultimately, each person concerned is given a certificate guaranteeing the results of the operation.

At the end of 2012, nineteen of the 84 sites listed in Ile-de-France have been investigated, and one site in Annemasse. The Annemasse site was diagnosed before the operation was launched in the Rhône-Alpes region, at the owner's request because a real estate transaction was envisaged in the near future.

Five of the nineteen sites in Ile-de-France were excluded outright because the buildings are too recent with respect to the period of potential manipulation of radium, to be liable to have any radioactive contamination.

On the remaining fourteen sites, more than 180 IRSN diagnoses were carried out; indeed, the majority of the sites correspond to one building with many apartments, or to several individual plots. The fact that the occupants were informed and that the operation was free of charge were vital factors in obtaining the occupants' agreement. There was only one refusal out of 180 diagnoses performed.

Five sites in Ile-de-France were found to be free of contamination and nine sites were diagnosed positive (eight in Ile-de-France and one in Annemasse). These nine sites correspond to twenty-two rehabilitation and renovation work sites (eighteen in Ile-de-France and four in Annemasse). This is

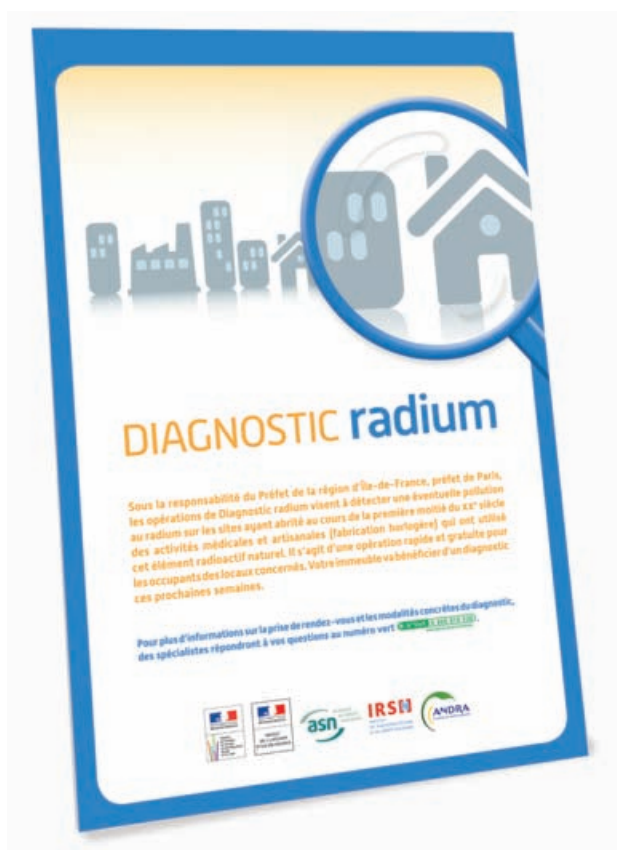
Basic principles of ASN's doctrine in the management of sites contaminated by radioactive substances

The following principles are applicable to all sites contaminated by radioactive substances. They apply without prejudice to the specific provisions, notably those relative to basic nuclear installations and installations classified on environmental protection grounds, those of the Police des Mines (mining police), and those of the radium diagnosis operation.

- 1) Any position statement adopted by ASN relative to the management of a site contaminated by radioactive substances is duly justified, traced and presented in complete transparency to the stakeholders and the audiences concerned.
- 2) The stakeholders and audiences concerned must be involved at as early a stage as possible in the process to rehabilitate a site contaminated by radioactive substances.
- 3) In application of the polluter-pays principle, those responsible for the pollution (if solvent) are also responsible for financing the operations to rehabilitate the contaminated site and to remove the waste resulting from these operations. When those responsible for the sites default, ANDRA rehabilitates radioactive contamination sites further to public requisition pursuant to Article L 542-12 of the Environment Code (Article 14 of Act 2006-739).
- 4) Pursuant to the Public Health Code, the exposure of individuals to ionising radiation during and after operations to manage sites contaminated by radioactive substances must be kept as low as reasonably achievable in the light of current technology and of economic and social factors. Thus, from an operational standpoint, in ASN's opinion, the reference procedure to adopt when technically possible is to completely clean out sites contaminated with radioactivity, even if the human exposure induced by the radioactive contamination seems limited. Assuming that, depending on the characteristics of the site, this procedure would be difficult to apply, it is in any case necessary to go as far as reasonably possible in the clean-out process and to provide elements, whether technical or economic, proving that the clean-out operations cannot be taken further and are compatible with the actual or planned use of the site. On the assumption that complete clean-out has not been achieved, appropriate measures as specified in point "e" below must be implemented.

In practice:

- a. Premises used for housing or sensitive purposes, must be completely cleaned out. If it should arise that residual contamination cannot be removed from premises, it is verified that the level is acceptable and that the premises can be used freely.
- b. In cases where the volumes of waste that would result from a complete clean-out of the site are too large to contemplate disposal in dedicated repositories, it may be acceptable to leave radioactive contamination on the site subject to proof that the residual dosimetric impact remains acceptable for a current and future use of the site, if necessary by applying restrictions on its use. This rule applies for example to phosphogypsum or incineration ash spoil heaps, and to uranium mining rocks stockpiles.
- c. In justified cases where the waste volumes that would result from a complete clean-out of the site remain manageable in dedicated disposal routes, but where the necessary outlets are not available today, partial clean-out may be acceptable. In this case, technical solutions that ensure the ease of future retrievability of the waste must be favoured. Solutions that consist in leaving contamination beneath constructions and managing the impacts by constructive measures are to be prohibited, except in particular duly justified cases.
- d. When a radon risk is identified, it must be managed in accordance with the relevant specific regulations, taking into account the recommendations of the competent international organisations (International Commission on Radiation protection - ICRP, World Health Organisation - WHO).
- e. When the reference procedure cannot be implemented, that is to say when it is decided to accept to leave the site contaminated, one must, insofar as necessary:
 - act on the transfer routes in order to significantly reduce the exposure pathways and ensure that the chosen solution leads to acceptable exposures for the actual or planned use of the site,
 - put in place a surveillance system and specify responsibilities for maintenance and control,
 - inform the public,
 - preserve the memory of the site, and where applicable implement institutional controls, such as restrictions on use,
 - not to compromise retrievability of the materials, by building on top of the site, for example.



Radium Diagnosis operation poster

because for a given site, several apartments or cellars belonging to different owners can be contaminated, each being considered as a separate work site.

Out of the twenty-two rehabilitation work sites, eight are in the renovation phase, five in the course of clean-out, and nine are waiting for additional studies or the agreement of the owner.

More than two years after the operation started, experience feedback shows that it is relatively well accepted by the occupants and environmental protection associations. The vast majority of the premises diagnosed are clear of radiological contamination. The pollution levels recorded are low and confirm that there is no health risk; the maximum dosimetry received is less than 2.4 mSv/year (added value), which is approximately the same order of magnitude as the dose received per year by the French population from naturally occurring sources of radioactivity.

In relation to the initial calendar, the end of the first phase in the Ile-de-France region was delayed for two reasons. On the one hand, the number of diagnoses to be performed proved to be higher than expected. An old address where there was an activity employing radium may now correspond to the location of several private homes. Similarly, a residential building may involve a large number of diagnoses if it comprises numerous apartments and cellars.

In addition, there were delays owing to the pollution clean-up operations, some of which are technically more complex than initially anticipated and which lead to the clean-out objectives having to be adapted. There are no high levels of

contamination, but it does appear to be more diffuse than expected and thus entails work over larger areas, taking more time.

The Radium Diagnosis operation will be continued in the Ile-de-France region in 2013.

2|4 The main subjects examined by ASN

2|4|1 Coudraies district in Gif-sur-Yvette (Essonne *département*)

The review of the files concerning the properties in the Coudraies district in Gif-sur-Yvette, which began in 2002, enabled the Essonne Prefect to propose allocation of technical and financial aid for clean-out of contaminated sites, for the simpler cases.

The aim in this district is to clean out land that can be cleaned and to demolish the two houses that cannot be subject to this type of work. Provisions for the Coudraies district were incorporated in May 2007 into the local town planning document plan for Gif-sur-Yvette. Radiological monitoring was continued in 2011.

Following on from the steps taken by the State to manage the contaminated sites in the district, a house bought up by the State was demolished in September 2010. A technical meeting was held in the Gif-sur-Yvette Town Hall on 26th May 2011 in the presence of the mayor, ANDRA and ASN, at which various redevelopment scenarios were presented, along with their cost. A public meeting, in September 2011, provided an opportunity for ANDRA to present local residents with the future scenario which could be chosen for the fate of this property.

In 2012, two unoccupied sites remained to be rehabilitated. ASN issued two opinions on the clean-out objectives of the rehabilitation for the files presented by ANDRA:

- on 14th February 2012 for the site purchased by the Ministry of the Environment;
- on 27th June 2012 for the second property purchased by ANDRA in June 2010. The file obtained the CNAR's agreement for the financing of the rehabilitation in July 2012.

The work on both these sites should start at the beginning of 2013.



Destruction of a house in Gif-sur-Yvette

2|4|2 Clos rose district in Gif-sur-Yvette (Essonne *département*)

Following a request from a local resident and after analysing the history of the district, ASN began work to clarify the situation regarding a few plots of land in the Clos rose district of Gif-sur-Yvette, near the Federal Mogul industrial site, on which there was radiological contamination.

Of eleven plots investigated, two houses have radon activity concentrations above 400 Bq/m³. Additional investigations were carried out in 2011 to identify the radon transfer pathways in these houses and to take the steps necessary to reduce these radon activity concentrations.

In 2012 the CNAR approved the installation of ventilation systems in the two properties in order to lower the radon concentrations. The work will begin once the owners have given their agreement.

2|4|3 Isotopchim site in Ganagobie (Alpes-de Haute-Provence *département*)

From 1987 to the end of 2000, the Isotopchim Company in Ganagobie (Alpes-de-Haute-Provence *département*), was involved in carbon-14 and tritium labelling of molecules intended for medical and industrial applications. In 2000, the company went into bankruptcy, leaving the environment significantly contaminated, with considerable chemical and radioactive waste remaining on the site.

Since December 2002, ANDRA has been working to clean up the site. Priority refrigerated waste was packaged and removed to CEA's Marcoule centre from March to June 2008. Continuation of clean-out and rehabilitation work is now being examined by the CNAR. Steps were taken to improve security in July 2009.

In 2010, the premises were emptied of their contents and all bulky waste (furniture, papers, etc.) was removed as VLL waste. The sludge contaminated with carbon 14 was routed to the Aube low and intermediate-level short-lived waste disposal facility in Soulaire in December 2012. The solid chemical waste still remains to be inventoried in order to define the disposal methods. Finally, additional analyses have been initiated with a view to defining the disposal routes for the remaining liquid radioactive chemical products. ASN is paying close attention to ensuring that ANDRA initiates as quickly as possible the measures to allow removal of the liquid waste "without a disposal route". ASN considers that it is essential for this removal to take place as rapidly as possible. The continued clean-out and final redevelopment work on the site is in effect dependent on this complete removal of waste.

On 4th July, the CNAR gave its approval for the financing of an operation involving the removal of VLL and LLW-LL waste, early dismantling of the ventilation system, summary repair of the roof and the checking of a neighbouring area. This work was partly carried out in December 2012. Removal of the LLW-LL waste and repair of the roof will be carried out in 2013.

2|4|4 Rehabilitation of the site of the former Pierre et Marie Curie school at Nogent-sur-Marne (Val-de-Marne *département*)

The Pierre et Marie Curie school was built on a former radium extraction site. The land is currently unused.

This matter was referred to the CNAR, and on 8th December 2009 it adopted a rehabilitation project involving partial excavation of the contaminated soils and the construction of public sports facilities on top. At the request of ASN, the CNAR nonetheless felt it necessary to ensure that the redevelopment of the site should not hinder subsequent operations in areas where residual contamination may persist and recommended that the municipality consider the possibility of more extensive extraction of contaminated material to attain more far-reaching clean-out objectives.

ASN was required to validate the various phases of the work and defined check-points after each phase. The first phase, which began on 19th October 2010, consisted primarily in removing the bulky items from the former school premises. It ended in early 2011.

A local information and monitoring committee (CLIS), of which ASN is a member, was set up by the Val-de-Marne Prefect and met for the first time on 6th May 2011. The second phase, which consisted in soil clean-out work, began following this CLIS meeting.

As the excavations progressed on the part of the site intended for complete clean-out, it turned out that the quantities of radioactive waste produced greatly exceeded ANDRA's initial estimates and that the budget would be insufficient to complete the work. In Spring 2012, the Nogent-sur-Marne town council decided to abandon the project to install a gymnasium on the site and studied alternative reuses of the site that were compatible with the clean-out levels already achieved. ASN will state its position on the new project once it is defined.

2|4|5 Établissements Charvet in l'Île Saint-Denis (Seine-Saint-Denis *département*)

From 1910 to 1928, this site housed a plant extracting radium from uranium ore and a laboratory for Marie Curie. The Charvet company (butchery waste transit operations) is the current owner of the site, which is today closed and to which access is prohibited. The Charvet company is eligible for financing under France's recovery plan, and is part of the project to develop an eco-district on the Ile-Saint-Denis island.

The rehabilitation project consists in partial excavation of the contaminated soil, allowing development of a park or equivalent use, and taking account of the possibility of subsequent intervention on a part of the site where the contaminated soil and rubble is to be stored. The clean-out work will take place in two phases, the first under the responsibility of the Charvet SA company, the second after handover to the public establishment for land management of the Ile-de-France region (EPFIF).

During validation of the rehabilitation scenario, in September 2009, the CNAR considered that it was necessary to continue the hydrogeological surveys of the site to decide on the risk of pollution of groundwater and to stipulate appropriate management methods and procedures.

The first phase, completed at the end of 2010, consisted in sorting the contaminated waste from the conventional waste and removing it from the site. Thus 112 containers were removed to the CSTFA repository in early September 2011. The remaining 403 containers were removed between December 2011 and February 2012 to the CIREs disposal facility. Transfer of ownership between Charvet and the EPFIF (Public Land Management Corporation of Ile-de-France) is in progress.

A CLIS has been set up and ASN will sit on it as a member representing the public administrations.

The second phase should begin in 2013 and last 12 months.

2|4|6 Former Curie laboratories in Arcueil (Val-de-Marne département)

By order of the Prefect on 20th August 2004, University Paris VI, the owner of the Curie Foundation's former radioactive materials handling site (Institut du radium) in Arcueil was asked to carry out safeguard, surveillance and decontamination work, which is now under the responsibility of the State since 2006.

In September 2008, ASN therefore validated the waste sorting objectives, designed to ensure their removal via appropriate disposal routes.

After an unauthorised entry to the site in June 2010, site security was reinforced.

Because the budget allocated to the work had been exceeded, the local education authority, which was the work manager on this site, decided to suspend the work and terminated the contracts during the summer of 2010, while security was provided round the clock.

2|4|7 Orflam-Plast in Pargny-sur-Saulx (Marne département)

Since 1934, the Pargny-sur-Saulx site has in turn accommodated lighter flint production by extraction of the thorium contained in imported monazite ore and the production of pure thorium nitrate. After the liquidation of the Orflam-Plast company, the Orflam site was transferred to State ownership on 24th November 2008.

Since early 2008, rehabilitation of the site has been managed by the CNAR. Since the end of October 2008, storages of contaminated legacy waste from the Orflam-Plast plant have been discovered and rehabilitation work was carried out in 2010 and 2011.

At the end of 2009, the CNAR ruled on the rehabilitation scenarios for the contaminated areas both off and on the site. A Local Information Committee (CLI) was set up at the end of 2009.

Plant demolition and development of the containment structure for the waste produced on the plant site should start in spring 2013 and last one year.

ASN and the DREAL are working in close collaboration on this matter, particularly for the application of institutional controls in order to preserve the site memory and the surveillance of the site developments. Thus, specific institutional controls for the sites of the plant, the poplar tree grove and the pond have been put in place in the town planning documents of the town of Pargny-sur-Saulx.

The administrative building, which was in very bad state, was demolished in late November 2012 because of the potential risk of collapse.

At the CNAR meeting of 7th December 2012, it was decided that two contaminated areas situated between the poplar tree grove and the pond would undergo a clean-out, with specific institutional controls being put in place for the areas not treated.

2|4|8 Support for the State's regional services

Pursuant to the circular of 17th November 2008, ASN may be asked by the services of the Prefects (DREAL) for an opinion on the rehabilitation objectives of a site. In 2012, in addition to the sites previously mentioned, ASN responded to the regional directorate for environment and energy in the Ile-de-France region (DRIEE) concerning the plans for rehabilitation of CEAs sites (rehabilitation of part of the former Le Bouchet plant site and clean-out of the sludge storage pits at the Orme des Merisiers landfill site).

Together with the DREALs, ASN also takes part in monitoring the phosphogypsum disposal sites. The phosphogypsum is a residue from the industrial treatment of calcium fluorophosphate ores for the production of phosphoric acid or phosphate fertilizers (synthetic gypsum production).



Radiological characterisation using a mule

2|5 International action concerning management of contaminated sites and soils

In June 2012, ASN took part in the annual conference of the United States of America Environmental Protection Agency (US-EPA) in Long Beach on the subject of sites contaminated

by radioactivity and covered by federal “Superfund” financing. ASN has been regularly invited to these conferences since 2004, which provide the opportunity to share experience about contaminated sites, decommissioning of facilities and emergency situations with its American and other counterparts.

In 2012 it presented the inventory of mining rocks in France, and in particular the methodology used by AREVA to

establish the inventory. The participants underlined the interest of the French presentation, which focused on concrete aspects and application of the methodology on the ground, knowing that France and the United States have similar problems.

The ASN review Contrôle devoted to the management of sites and soils contaminated by radioactivity – November 2012. Available on www.asn.fr.

3 OUTLOOK

Generally speaking, ASN considers that the French radioactive waste management system, built around a specific body of legislative and regulatory texts, a national radioactive materials and waste management plan and an agency dedicated to the management of radioactive waste, is capable of regulating and implementing a structured and coherent national waste management policy.

In 2012, ASN continued with its actions aimed at ensuring that radioactive waste is managed safely, from the moment it is first produced. ASN thus regulates its management within the nuclear installations and periodically assesses the strategies put in place for this purpose by the licensees. ASN in particular remains attentive to ensuring that the licensees recover the legacy waste stored on their sites. ASN effectively observes that the licensees are late in doing this or are experiencing technical difficulties, leading to postponement of the dates for removal from storage of legacy waste on the La Hague and CEA sites. Consequently, in 2013 ASN will continue to scrutinise the retrieval of waste from storage, focusing in particular on the waste presenting the greatest implications for safety.

With regard to the long-term management of radioactive waste, ASN has a positive view of the way in which ANDRA operates its radioactive waste disposal facilities. ASN considers that safe management routes must be developed for all waste. To this end, it is of the opinion that France should be provided with a facility to allow disposal of low level long-lived waste. ASN will therefore continue to closely follow the process to find sites and develop disposal concepts.

With regard to high and intermediate level, long-lived waste, ASN considers that key steps in the development of the disposal project will be reached in the next few years. In the opinion issued on the file submitted by ANDRA in 2009, ASN determined the main lines of work that needed to be taken further prior to the creation authorisation application, which should be submitted at the end of 2015. ASN in particular recommended that ANDRA further analyse certain risks linked to operation of the facility, clarify the technical measures to be taken to manage these risks and use demonstrators to complete its understanding of the damage resulting from the excavation of major structures and to qualify the techniques for sealing the drifts and the connections between the surface and the underground facility.

The public debate that should take place in 2013 will enable ANDRA to detail its progress in the aspects associated with the industrial design of Cigéo, its safety, reversibility, layout and surveillance. Prior to this debate, ASN will issue an opinion on the studies submitted by ANDRA in 2011 and 2012. ASN will take part in the debate, and more particularly describe its role in the examination process and its expectations regarding key subjects, such as safety in operation and in the long term, and its reversibility.

Throughout the procedure ASN will ensure that ANDRA provides the required elements.

With regard to the former uranium mining sites, ASN will ensure that AREVA's measures relative to the management of the mining rocks run smoothly.

As far as contaminated sites and soils are concerned, ASN's increasing action will continue in 2013, in collaboration with the administrations concerned and the other stakeholders. After consultation, ASN issued several opinions in 2012 on contaminated site rehabilitation projects and was particularly closely involved in operational oversight of the Radium Diagnosis operation. At the end of 2012, ASN published its doctrine concerning contaminated site and soil rehabilitation principles. ASN restates its position that the solution involving leaving the contamination in-situ must not be the reference solution for management of sites polluted by radioactive materials and that this option can only be an interim solution or reserved for situations in which the complete clean-out option cannot be contemplated, in particular owing to the volume of waste to be excavated. Finally, in 2013, ASN will continue to oversee the diagnosis operations on sites that could have housed activities utilising radium in the Ile-de-France region.

ASN will also continue its involvement in the international work on these topics, in particular within the IAEA, ENSREG and WENRA - the Western European Nuclear Regulators' Association - and bilaterally with its counterparts.

In 2013, ASN will participate in the transposition of the European directive establishing a community framework for the responsible and safe management of spent fuel and radioactive waste.