NUCLEAR RESEARCH FACILITIES AND VARIOUS NUCLEAR INSTALLATIONS

CHAPTER 14

Nuclear research facilities and installations not directly linked to the nuclear electricity generating industry cover all the basic nuclear installations (BNIs) of the civil part of the French Atomic Energy Commission, the BNIs of other research organisations, and a few other BNIs which are neither power reactors, nor nuclear fuel cycle facilities.

1 ATOMIC ENERGY COMMISSION INSTALLATIONS

The centres of the French Atomic Energy Commission (CEA) include various basic nuclear installations devoted to research (experimental reactors, laboratories, etc.) as well as support installations (waste storage, effluent treatment plants). Research at CEA in particular covers subjects such as the lifetime of operating plants, future reactors, nuclear fuel performance and nuclear waste.

Point 1|1 below lists the generic subjects which marked the year 2009. Point 1|2 describes topical events in the various CEA installations currently operating. The installations currently undergoing clean-out or decommissioning are dealt with in chapter 15 and those devoted specifically to the interim storage of waste and spent fuel are covered in chapter 16.

1|1 Generic subjects

Through inspection campaigns and analysis of the lessons learned from operating experience, ASN identifies generic topics on which it queries CEA. These topics can lead to requests on the part of ASN and possibly to a stance being adopted following review of a file. The subjects on which ASN focused more particularly in 2009 were the criticality risk, the management of nuclear safety and radiation protection at CEA and the management of the civil engineering operations in the installations under construction or renovation.

On 23 June 2009, the ASN Commission gave a hearing to the CEA General Administrator, as was the case in 2008. CEA took this opportunity to present the contents of its "risk management" study published in June 2009 and its new three-year plan for improving safety and security. ASN detailed its assessment of safety at CEA in its annual report, published in April. CEA presented an updated version of its major nuclear safety commitments, officialised in 2007 following a request by ASN.

1|1|1 Management of nuclear safety and radiation protection at CEA

ASN controls CEA safety management at several levels:
– working with the General Administrator, ASN verifies CEA's compliance with its main undertakings, in particular with regard to planned new installations, upgrading of older installations and waste management, especially in terms of compliance with the specified time-frames and handling of the safety and radiation protection issues in CEA's overall management;
– with respect to the Nuclear Safety and Protection Division (DPSN) and the General and Nuclear Inspection Division (IGN), ASN develops a national global approach to "generic" subjects concerning several installations or certain centres; ASN also examines how the DPSN defines CEA's safety and radiation protection policy and assesses internal supervision work performed by the IGN;
– within the CEA centres, and as and when necessary, ASN reviews the safety analysis files specific to each of the CEA BNIs, paying particular attention to their integration into the more general framework of CEA's safety policy. In this respect, it examines the conditions in which safety management is carried out. The main points of contact are the director of the centre and the head of the installation concerned.

In 2009, CEA submitted its nuclear safety and radiation protection management dossier. This dossier will be assessed by the Advisory Committees in 2010.

In its 2008 annual report, ASN mentioned that it wanted CEA to strengthen the inspection duties of its General and Nuclear Inspection Division and give it greater independence, so that it can express its assessment of the safety of CEA installations at the highest level. ASN noted the guarantees provided by CEA on this point in 2009, while continuing to deplore the fact that the hierarchical position of the General and Nuclear Inspector had not changed and does not correspond to the announced duties and level of independence. This subject will be examined during the review of CEA's above-mentioned safety and radiation protection management dossier.

1|1|2 Monitoring of CEA's compliance with its main nuclear safety and radiation protection commitments

In 2006, ASN stated that it wanted to see effective monitoring of CEA's compliance with its safety and radiation

protection commitments, by means of an efficient control tool that offered transparency for the nuclear regulator, in particular with regard to the decision-making process. CEA therefore presented ASN in 2007 with a list of twenty major safety and radiation protection commitments.

These commitments in particular include:

For the Cadarache site:
– inclusion of particular site effects in the seismic risk.

For the experimental reactors:
– upgrading of CABRI and construction of its new water loop;
– the MASURCA safety review, including major seismic conformity and fire protection work.

For the laboratories:
– the renovation work and in particular the seismic reinforcement work on the LEFCA subsequent to its periodic safety review;
– compliance with the deadline for commissioning MAGENTA, designed to replace the MCMF.

For waste storage and processing installations:
– removal from storage of certain wastes and effluents and safe transfer to other installations (PEGASE, ZGEL, STEDS);
– commissioning of the installations scheduled to replace the older ones, in particular STELLA and AGATE.

CEA reports to ASN on compliance with its commitments, on a formal, regular basis and during meetings. In a letter dated 21 September 2009, ASN reminded CEA that it considered the major commitments approach to be worth continuing because it is virtuous and should lead to better management of complex project with high nuclear safety and radiation protection stakes, and that one of the main benefits of this approach is to provide protection for a certain number of projects against the vagaries of budget cuts.

1|1|3 Internal authorisations

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

This type of system has been in place at CEA since 2002. ASN therefore allowed the CEA centre directors, with the assistance of the centre safety units and, as applicable, safety commissions, to apply this "internal authorisations system" to certain operations that were particularly sensitive from the safety and radiation protection viewpoints, but which did not compromise the installation's safety case. The framework of this internal authorisations system and the procedures for updating the safety requirements for the installations concerned were clarified in two ASN guides (SD3-CEA-01 and SD3-CEA-02).

ASN has been regularly monitoring the system since it entered service and it has proven to be satisfactory. However, ASN considers that CEA must further improve its awareness of the safety issues involved in the various modifications made to its installations. Continued efforts need to be devoted to justifying that the planned operations remain within the framework of the safety case and to ensuring that the various files are consistent with the reference documents and the life of the installation.

The internal authorisations system is now regulated by decree 2007-1557 of 2 November 2007 concerning basic nuclear installations and the supervision of the transport of radioactive materials with respect to nuclear safety and by ASN decision 2008-DC-106 of 11 July 2008 which specifies ASN requirements on the subject of internal authorisations. Pursuant to Article 3 of this decision, CEA submitted a file in March 2009, supplemented in September 2009, presenting its internal authorisations system. The decision approving CEA's internal authorisations system should be signed by the ASN Commission at the beginning of 2010.

1|1|4 Periodic safety reviews

Many current CEA installations began operating at the beginning of the 1960s. These installations, designed to meet former requirements, contain timeworn equipment. They have also undergone modifications on various occasions, sometimes without any overall review from the safety standpoint. In 2002, ASN had informed the licensees that it considered a review of the safety of the older installations to be necessary every 10 years. This provision is now contained in the 13 June 2006 Act on transparency and security in the nuclear field (TSN Act). The periodic safety reviews for CEA's installations have been

scheduled according to a calendar approved by ASN. Finally, all the installations for which the periodic safety review has not yet been programmed will need it to be scheduled for no later than 2017 and then every 10 years thereafter.

In 2005, ASN also detailed its expectations with regard to the safety reviews of CEA installations, in terms of responsibility, content and schedule, in the form of an ASN guide (SD3-CEA-05). These measures will be integrated into an ASN decision concerning all BNIs. This decision is currently being drafted.

The latest periodic safety review of a CEA effluent and waste treatment facility concerned the solid radioactive waste management zone at Saclay (ZGDS). ASN noted CEA's undertaking to finally shut down the facility by 2017. ASN also asked for an action plan to be defined so that appropriate disposal routes would be available by 2019 for all the sources stored in this facility.

For the CEA laboratories, the latest periodic safety review concerns the STAR facility, which is part of the LECA-STAR BNI. In the light of the safety improvement work planned, ASN raised no objection to its continued operation and to the envisaged modification of its scope of operations (repackaging of new types of fuels).

For the research reactors, the latest periodic safety reviews concerned the CABRI and ORPHEE reactors.

The CABRI periodic safety review and examination of the modification of its experimentation loop took place in 2004. Upgrade work is in progress and the installation was the subject of three presentations to the Advisory Committee for reactors in 2008 and 2009, one of which concerned the driver core. ASN will rule on restart of the renovated installation and commissioning of the new water loop in 2010.

In 2009, CEA transmitted its periodic safety review file concerning the ORPHÉE facility, so that ASN could adopt a stance in 2010, on the advice of the Advisory Committee for reactors in 2010.

The periodic safety reviews often entail extensive upgrading work in areas where the safety regulations and requirements have changed significantly, in particular compliance with seismic loading requirements, fire protection and containment. ASN oversees all the work and the subsequent post-maintenance qualification procedures, in accordance with principles and a schedule that it itself approves. Finally, after the periodic safety reviews, ASN can define requirements pursuant to the TSN Act of 13 June 2006.

1|1|5 Monitoring of sub-criticality

Following the significant events and failures identified during inspections between 2004 and 2006 regarding prevention of the criticality risk, and considering that this issue needed to be examined in greater detail, ASN intensified its controls in this field in 2007 by carrying out more detailed inspections in the Saclay and Cadarache centres and by asking an expert third-party to review the organisation of criticality risk prevention in the CEA installations.

ASN was pleased to note that CEA had cooperated during the third-party review of its organisation and asked for an audit of the General and Nuclear Inspection Division on this subject. Efforts have been made, in particular with respect to staffing of key functions. However, an incident notified on 6 October 2009 in the ATPu facility currently being decommissioned (see chapter 15) showed that CEA needed to further intensity its efforts in criticality risk prevention.

The organisational consolidation and the improvements made will be reviewed in 2010 by the Advisory Committees for plants and for reactors during their examination of the dossier on "nuclear safety and radiation protection management at CEA".

1|1|6 Management of sealed sources of ionising radiations

At the request of ASN, CEA updated its ionising radiation source management rules in 2007. These new rules, which apply in all CEA facilities, incorporate the regulations in force, in particular the fact that, since 2002, CEA has no longer enjoyed exemption from the need to hold a licence for possession and utilisation of sources of ionising radiations.

In 2007, CEA also submitted several files per centre, for extension of the sealed source utilisation period beyond the regulation 10 years. ASN should complete its review of these files in 2010.

Other more generic files dealing with sources are still to be finalised. These mainly concern updating of the installations safety requirements and formalising ionising source registration with IRSN.

1|1|7 Revision of water intake and discharge licenses

The process to revise the CEA Saclay water intake and effluent discharge licenses, which began in July 2006

under decree 95-540 of 4 May 1995, was completed in 2009 with the publication of the decisions of 15 September 2009 and their approval by orders of 4 January 2010.

The water intake and effluent discharge on the Cadarache site are covered by 3 government orders of 25 April 2006 and orders of the *préfet** dated 12 August and 12 September 2005 allowing consistent regulation of all radioactive and chemical discharges from the centre. In 2009, CEA asked for a number of changes to be made to these orders, relating in particular to the new facilities in the centre. Although the changes concerned are not significant, the corresponding impact assessment was nonetheless the subject of a local debate organised by the licensee over a one-month period. This approach, implemented for the first time on an experimental basis, reflects the desire for transparency on the part of ASN and the licensee. It supplements the administrative consultations required by law. The decisions replacing the 2005 orders will be finalised in 2010.

With regard to the Marcoule site, the file modifying the INBS discharge licenses (which currently cover all the liquid discharges from the site) was submitted at the beginning of 2009. The same applies for the ATALANTE facility. These files should be supplemented before the end of the year by an overall impact assessment of the discharges from the CEA site and the CENTRACO and MELOX facilities, for which the licenses have been or will also be modified.

1|1|8 Assessment of seismic risk

ASN devotes constant attention to the potential seismic risk. This risk is especially re-assessed during the periodic safety reviews conducted on each installation, in order to take account of scientific progress in characterising the risk and of changes in the design rules.

In 2003, ASN had asked CEA to improve its knowledge of the seismic risk for the Cadarache centre, by initiating a programme to study any particular site effects. In response, CEA presented a study program run jointly with the Laue Langevin Institute of Grenoble, with the collaboration of several international partners and experts. The results of this research were transmitted to ASN in 2009 and are currently being examined in order to determine the operational applications. Together with IRSN and the licensees concerned, ASN in 2009 also initiated a complete and comprehensive study of how the seismic risk is taken into account on the Cadarache and Marcoule nuclear sites.

1|1|9 Management of civil engineering projects

A number of projects for the construction of new installations or renovation of existing installations continued during the course of 2009, in particular at the Cadarache centre. This is why ASN, jointly with ASND, conducted an in-depth inspection of the projects in progress at Cadarache. For a 4-day period, this involved 10 ASN inspectors and 2 ASND inspectors, with the help of 7 experts from IRSN.

This inspection enabled ASN to confirm the mobilisation and responsible attitude of the teams concerned. The inspectors noted that a dedicated project management structure had been set up for supervision of the construction sites and that technical inspection agencies were frequently used in certain phases of the operations. These practices are helping to improve ASN's level of confidence in the performance of the work in question.

Nonetheless, the adequacy and effectiveness of the internal checks carried out by CEA, both on its project management structure and on the outside companies, need to be improved. During the course of the inspection, the inspectors identified nonconformities which had not been detected, despite the various levels of supervision. Moreover, the traceability of CEA's control of the companies in charge of some of the work must be reinforced.

ASN will verify that CEA takes account of its requests and observations subsequent to this inspection. Oversight of the performance of the civil engineering work will also be continued until the completion of each project.

1|1|10 Research reactor cores and experimental systems

The cores of some experimental reactors are regularly modified, owing to the experiments conducted in them. Others are fitted with specific experimental systems for carrying out certain types of experiments. One of the issues for ASN is to allow the regular performance of new experiments, while ensuring that they take place in appropriate conditions of safety.

The design, performance and irradiation licensing conditions for the experimental equipment have in recent years been extensively discussed by ASN and CEA. This led to the creation of a technical guide defining a number of requirements.

In 2010, ASN intends to analyse implementation of this technical guide on an experimental device which will

*In a *département*, representative of the State appointed by the President.

have recently undergone a periodic safety review. The provisions and requirements concerning experimental equipment will also be reassessed on the basis of the design of that intended for irradiation in the future Jules Horowitz reactor in Cadarache.

1|2 Topical events in CEA research facilities

This part only deals with CEA installations still in operation. Installations currently undergoing clean-out and decommissioning are dealt with in chapter 15 while those devoted primarily to storage of waste and spent fuel are covered in chapter 16.

1|2|1 CEA centres

a) Cadarache centre

The Cadarache Centre is located at Saint-Paul-lez-Durance, in the Bouches-du-Rhone *département**. It employs about 4,500 people (all contractors included) and occupies a surface area of 1,600 hectares. As part of CEA's strategy of specialising its centres as "centres of excellence", the Cadarache site deals mainly with nuclear energy. It comprises 20 BNIs, including two for the industrial operator AREVA (ATPu and LPC), while two others, operated by CEA, are used for IRSN research programmes (CABRI and PHEBUS). The purpose of these Cadarache centre installations is R&D to support and optimise existing reactors and design the new generation of systems. The Cadarache centre also takes part in launching new projects and will in particular be the site of the Jules Horowitz future experimental reactor, for which the creation authorisation decree was published in 2009. The ITER international facility, for which commissioning is scheduled in 2018, will be located nearby.

In recent years, ASN has noted progress in safety management at the Cadarache centre. Although these efforts need to be continued, ASN observed that the safety unit has adopted a more critical view of the safety of the site's installations and of the necessary priorities. ASN also observed that the Administrator General's "major commitments" were being implemented in the centre and satisfactorily assimilated by the staff, despite the difficulties sometimes encountered. Particular vigilance will however be required with regard to oversight of the subcontractors, in particular owing to the increasing use made of them. In addition, the malfunctions observed in the management of the ATPu incident notified on 6 October 2009 will have to be analysed and the lessons learned.

ASN observes the fragility of the centre's electrical installations. Their renovation is under way and sufficient efforts will be needed if this is not to fall behind schedule.

The construction of new facilities and the renovation of older installations, currently in progress at the centre, will also be a key issue for CEA in the coming years. ASN will continue to exercise close monitoring and control over this point.

b) Saclay centre

The Saclay centre is located about 20 km from Paris in the Essonne *département*. It occupies an area of 223 hectares, including the Orme des Merisiers annex. In 2006, CEA head offices moved from their Paris premises and relocated at CEA Saclay.

This centre has been devoted to material sciences since 2005 and therefore plays an active role in the Saclay plateau development as part of the Île-de-France regional development and planning master plan.

The centre's activities range from fundamental research to applied research in a wide variety of fields and disciplines, such as physics, metallurgy, electronics, biology, climatology, simulation, chemistry and ecology. The purpose of nuclear applied research is to optimise the operation and safety of the French nuclear power plants and to develop future nuclear systems.

The centre also houses an office of the National Institute for Nuclear Science and Technology (INSTN), whose role is teaching, and two industrial companies: Technicatome, which designs nuclear reactors for naval propulsion systems, and CIS bio international, specialising in medical technologies, especially radioactive marking of molecules, manufacturing of products used in nuclear medicine for therapy and imaging, as well as in vitro medical diagnosis and molecular screening (see point 3|2).

ASN considers that the following points in particular would need to be monitored in the Saclay centre:
– maintaining the nuclear safety performance of the BNIs in a centre focused primarily on non-nuclear activities;
– including nuclear safety in the decisions taken concerning the development of future activities in the centre;
– controlling urban development around the centre, in the context of development of the Saclay plateau, in line with the lifetimes envisaged by CEA for the BNIs in the centre.

ASN expects to see progress in safety management at the Saclay centre, which still houses a large number of different facilities:

*Administrative region headed by a *préfet*.

– research reactors (point 1|2|2): ULYSSE, ORPHÉE, OSIRIS;
– laboratories (point 1|2|3): LECI;
– irradiators (point 1|2|4): POSÉIDON;
– effluent and waste treatment facilities (point 1|2|6): liquid effluent management zone and STELLA project;
– waste storage facilities (chapter 16): solid waste management zone;
– installations undergoing final shutdown or decommissioning (chapter 15): LHA.

c) The Marcoule centre

The Marcoule centre is the centre of excellence for the back-end nuclear fuel cycle and in particular radioactive waste. It plays a major role in the research being conducted pursuant to the Bataille Act of 1991 and the Programme Act of 28 June 2006 on the sustainable management of radioactive materials and waste. It houses civil and defence-related nuclear installations. CEA's two civil installations in Marcoule, ATALANTE (research laboratory) and PHÉNIX (reactor), were called on to make a particularly significant contribution in this field.

The site also houses two other civil BNIs, MELOX (see chapter 3) and CENTRACO (see point 3|6 of this chapter). A third one, the GAMMATEC irradiator, is being planned (see point 3|1).

The process initiated in 2007 with a joint in-depth inspection, to ensure a closer working relationship between ASN and ASND in order to acquire a clearer overview of the site, continued in 2009 on the subject of discharges and environmental monitoring.

d) Fontenay-aux-Roses centre

All the BNIs in this centre are currently being decommissioned (see chapter 15).

e) Grenoble centre

All BNIs in this centre are currently being decommissioned (see chapter 15).

1|2|2 Research reactors

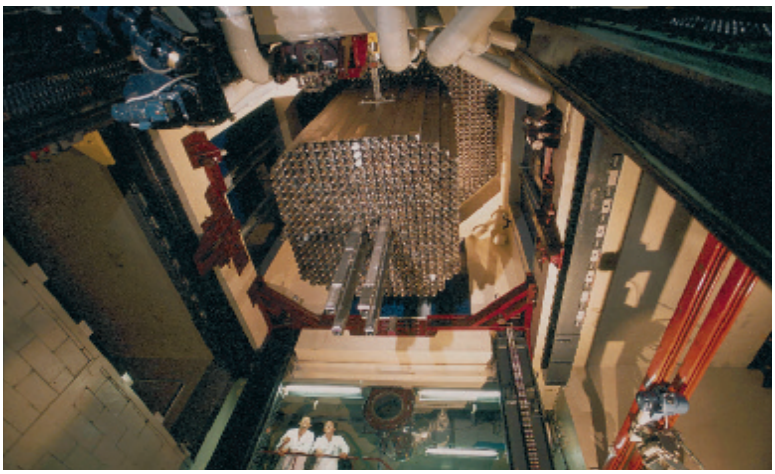
Experimental nuclear reactors make an essential contribution to scientific and technological research and to supporting operation of the country's nuclear power plants. Each one is a special case, for which ASN regulation and surveillance needs to be adapted, while ensuring the development of safety practices and rules. In this respect, a more generic approach to the safety of these installations has been adopted in recent years, based on the rules applicable to power reactors and in particular through the inclusion of operating situations and the classification of the associated equipment, which has led to considerable progress being made in terms of safety. This approach is now used for the periodic safety reviews on existing installations as well as for the design of new reactors.

Despite the ageing of these installations, ASN is keen to ensure that they continue to operate with a high and constantly improving level of safety. Thus all the installations in operation undergo periodic safety reviews. These reviews aim not only to ensure that the installations are in conformity with the safety objectives initially set for them, but also to determine any improvements necessary to take account of changes in know-how and the available technologies.

a) Critical mock-ups

• MASURCA reactor (Cadarache)

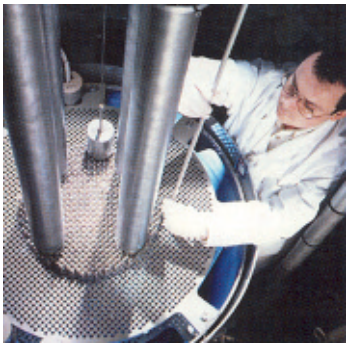
The MASURCA reactor is intended for neutronic studies, primarily on fast neutron reactor cores, and for



Core of the Masurca reactor in Cadarache

developing neutron measurement techniques. This installation, for which the last periodic safety review was discussed at a meeting of the Advisory Committee for nuclear reactors in March 2006, has been shut down for conformity work since 2007. This work however has not yet started, as the licensee hopes to bring down its cost and reassess the lifetime strategy for its various reactors. The reactor core was completely defuelled and the installation is being maintained in a safe condition. It will only be able to restart if authorised by ASN. This authorisation will be given on the basis of a review of the safety analysis report and after consultation with the Advisory Committee for nuclear reactors.

• ÉOLE and MINERVE reactors (Cadarache)



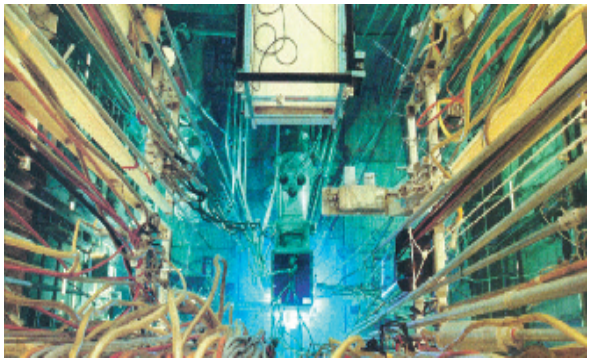
Operator working on the core of the Eole reactor in Cadarache

The ÉOLE reactor is intended for neutronic studies of light water reactor cores. On a very small scale, it can be used to reproduce a high neutron flux using experimental cores representative of pressurised or boiling water power reactors. The MINERVE reactor, located in the same hall as the ÉOLE reactor, is devoted to measuring cross-sections through the oscillation of samples in order to measure reactivity variations. CEA has expressed its intention to continue with long-term operation of the ÉOLE and MINERVE installations and in 2007 ASN reviewed the guidelines file of the periodic safety review. However, the final review file, expected by ASN in 2009, has not yet been transmitted, owing to the strategy assessment currently being conducted by CEA with regard to the service lifetime of its installations. Whatever the choices made by the licensee, they will have to be presented soon and the review completed rapidly if operation of these reactors is to continue.

b) Irradiation reactors

• The OSIRIS reactor and its ISIS critical mock-up (Saclay)

The OSIRIS pool-type reactor has an authorised power of 70 MWth. It is primarily intended for technological irradiation of structural and fuel materials for various power reactor technologies. It is also used for a few industrial applications, in particular the production of radionuclides for medical uses. Its critical mock-up, the ISIS reactor, is today mainly used for training.



OSIRIS reactor pool in Saclay

CEA is committed to finally shutting down the OSIRIS reactor no later than in 2015. To continue with operation until that time, it proposed a programme of renovation and safety improvement works for the installation. This programme should be completed before the end of 2010. ASN will then rule on the continued operation of the installation. This decision will take account of the conclusions of the currently ongoing analysis of the BNI's safety review file that the licensee forwarded to ASN in 2009.

The OSIRIS reactor is part of the chain producing artificial radionuclides for medical uses, in particular technetium 99, and ASN felt that the potential repercussions of its shutdown in 2015 needed to be anticipated as early as possible. This is proving to be all the more necessary as the events which, in 2008 and 2009, led to the shutdown of other reactors abroad, such as HFR in Petten (Netherlands) and NRU in Chalk River (Canada), revealed the fragility of the complex production chain for these radionuclides and the risk of problems with supplies to the medical sector. In January 2009, ASN thus organised a seminar on this subject with the foreign nuclear regulators concerned and with the participation of health authorities. This seminar led to recommendations aimed at the stakeholders concerned (governments, health authorities, medical world, industrial operators, etc.) and safety authority decisions regarding improved sharing of information, including the operating experience feedback from existing or planned installations. ASN is continuing to play an active role in the international initiatives concerning the production of radionuclides for medical uses and the ageing of the irradiation reactors.

• The RJH (Jules Horowitz reactor) project (Cadarache)

The construction of a new reactor was deemed necessary by the CEA, with the support of a number of foreign partners, in view of the ageing of the currently operating European irradiation reactors, which will be shut down in the medium- or short-term.

The RJH will in particular be able to carry out activities similar to those performed today with the OSIRIS reactor.

Computer-generated image of the RJH reactor project in Cadarache

It will however comprise a number of significant changes with regard to both the possible experiments and the level of safety.

Following the positive outcome of the public inquiry in 2006 and the review of the preliminary safety analysis report for the planned installation, ASN issued a draft creation authorisation decree for the BNI, which was signed in October 2009. After initial preparatory earthworks, the first concrete was poured in August 2009, as granting of the creation authorisation decree is not a precondition for this first concrete. During the course of a prior inspection, the organisational principles presented for staffing, supervising and controlling the RJH construction site appeared on the whole to be satisfactory.

ASN checks the quality of construction and its conformity with the creation authorisation decree and the elements of the safety case presented. It also undertook regular exchanges with CEA in order to facilitate monitoring of the measures requested following the review of the preliminary safety analysis report and in preparation for the review of the future commissioning authorisation application.

c) Neutron source reactors

• ORPHÉE reactor (Saclay)

The ORPHÉE reactor, with an authorised power of 14 MWth, is a pool-type research reactor. It is equipped with nine horizontal channels, tangential to the core, enabling 20 neutron beams to be used. These beams are used as "material probes" to conduct experiments in fields such as physics, biology and physical chemistry. The reactor also has nine vertical channels for the introduction of samples to be irradiated in order to produce radioisotopes or special materials and to carry out analysis by activation. The neutron radiography installation is used for non-destructive testing of certain components.

ASN is satisfied with the current operation of the reactor. With the aim of ensuring long-term operation, the licensee submitted to ASN the file for the second periodic safety review in April 2009. A meeting of the Advisory Committee for reactors should be called in mid-2010 by ASN, which will then rule on this file.

d) Test reactors

• CABRI reactor (Cadarache)

The CABRI reactor is mainly used for experimental programmes aimed at better understanding nuclear fuel behaviour in the event of a reactivity accident. The reactor is operated by CEA for the purposes of tests designed by IRSN and involving a number of French and foreign partners (nuclear licensees, safety authority technical support organisations, etc.).

For the new research programmes, the reactor's sodium loop was replaced by a water loop. The CABRI reactor will be used to carry out tests to determine the behaviour of high burnup fuels in accident situations representative of those which could be encountered in a pressurised water reactor. In parallel with this modification, CEA conducted a safety review of the installation with a view to continued operation for a further twenty years. First criticality of the modified installation and performance of the first experimental test will be two steps that require ASN authorisation. Before doing so, ASN will examine the conditions in which the commissioning tests are to take place and will then ensure that their results confirm the installation's conformity with its safety case. The licensee must therefore have responded satisfactorily to any requests made

View of the interior of the pressurised water loop of the CABRI reactor in Cadarache

Building housing the PHÉBUS reactor in Cadarache

following the review of the safety analysis report. In 2009, ASN reminded CEA that it must transmit the required files early enough so that they can be examined within a time-frame compatible with its scheduling objectives.

• PHÉBUS reactor (Cadarache)

The PHÉBUS reactor is one of the tools used by CEA to study severe accidents that could potentially affect pressurised water reactors (PWR) through tests designed and financed by IRSN. The latter has nonetheless announced its intention to cease any new testing programmes with this reactor. Since 2004, clean-out and decommissioning of the experimental systems used in the last experiment has been continuing.

ASN asked CEA to inform it rapidly of its strategy concerning the fate of this BNI, so that the regulation and safety procedures with regard to either decommissioning or a modification of the installation to allow new activities could be initiated.

e) Teaching reactors

• ULYSSE reactor (Saclay)

The ULYSSE reactor was mainly devoted to teaching and practical work. In February 2007, the installation entered the final shutdown preparation phase. The decommissioning application for the facility, submitted in the summer of 2009, is being examined by ASN.

f) Prototype reactors

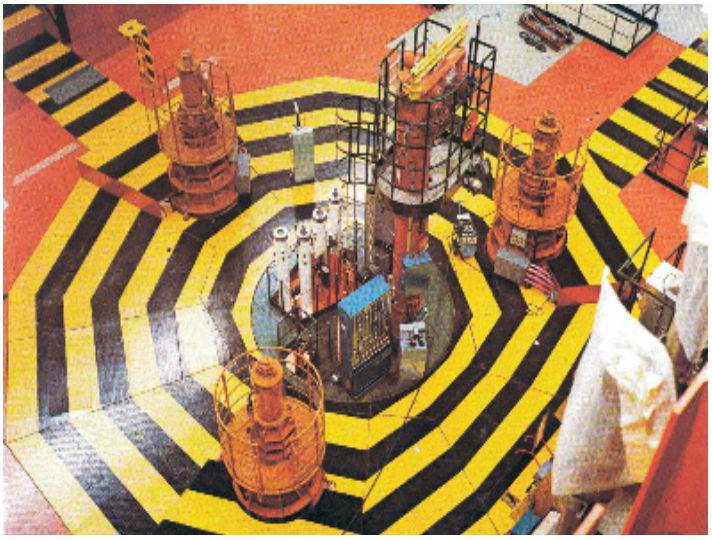
• PHÉNIX reactor (Marcoule)

The PHÉNIX reactor, built and operated by CEA jointly with EDF, is a fast neutron demonstration reactor. It is located in Marcoule (Gard *département*). Its construction began in 1968 and first criticality occurred on 31 August 1973. Its rated power is 563 MWth.

The characteristics and performance of this installation are such that it is considered by CEA to be an indispensable tool for the completion of research programmes on plutonium combustion (CAPRA programme) and actinide incineration (SPIN programme). These research programmes come under Articles L.542-1 to L.542-14 of the Environment Code concerning radioactive waste research.

In 2002, following major reactor renovation work, ASN informed CEA that it considered the answers provided on subjects concerning the installation's periodic safety review to be satisfactory and that it had no objection to reactor operations resuming at partial power of 350 MWth, for the 6 burnup cycles still to be carried out (i.e. 720 equivalent full-power days (EFPD)). On 6 March 2009, the plant finally ceased grid-coupled power operations, after 706 EFPD. The rest of 2009 was devoted to carrying out "end of life" tests, lasting 14 EFPD. The purpose of these tests is to enhance understanding of the sodium-cooled fast neutron reactors, with a view to developing a "4th generation" of power generating reactors. These tests are also part of the installation prototype studies mentioned in Article 3 of the 2006-739 Act of 28 June 2006 on the management of radioactive materials and waste. They must be authorised by ASN, pursuant to decision 2009-DC-0131 of 17 February 2009.

ASN considered that the licensee needed to be particularly attentive to the ventilation of the facilities and to compliance with its safety requirements, particularly with regard to performance of the checks and periodic tests. Human and organisational factors (HOF) also remain an important consideration when running the end of life tests and carrying out the future decommissioning of the



PHÉNIX reactor platform in Marcoule

reactor. These steps require significant mobilisation of staff, significant organisational modifications in order to carry out unusual operations, and a change in culture. The reactor decommissioning plan was sent to ASN in 2008 and revised in 2009. The decommissioning authorisation application should be submitted to ASN in 2010. The decommissioning programme will include the use of installations for processing the sodium from Phénix and possibly other CEA installations. However, prior to the decommissioning decree, preparatory work will be needed in compliance with the current safety requirements.

1 | 2 | 3 Laboratories

a) The irradiated materials and spent fuel assessment laboratoires

These laboratories, also called "hot laboratories", are key experimental tools for the main nuclear licensees. There used to be a large number of these laboratories but they are now concentrated in two centres: one, in Saclay, devoted to irradiated materials and the other, in Cadarache, dealing with fuel. From the safety viewpoint, these installations must meet the standards and rules of the large fuel cycle nuclear installations, but this safety approach has to be proportionate to the specific risks.

- Active fuel examination laboratory (LECA) (Cadarache)

The LECA is a laboratory carrying out destructive and non-destructive testing on spent fuel taken from various types of nuclear power or experimental reactors and on irradiated structures and equipment from these technologies.

Following its periodic safety review in 2001, an extensive upgrade programme, in particular comprising operations to improve the seismic resistance of the civil engineering works, was carried out at LECA. It was to be completed by the end of 2009 with the dismantling of the "U02" building, thus reducing interactions between buildings. However, technical problems mean that CEA is behind schedule with this dismantling work.

Given the scale of and progress in the renovation work undertaken, ASN indicated that it had no objection to continued operation of the installation with implementation of the new safety requirements. CEA also stated its intention of extending the LECA's operating lifetime beyond this date by carrying out additional anti-seismic reinforcement work. This option will be examined during the next periodic safety review in 2013.

- The LECA's treatment, clean-out and reconditioning station (STAR) (Cadarache)

The STAR installation, designed to stabilise and recondition GCR spent fuel, also carries out destructive and non-destructive testing of PWR-type spent fuel.

The installation's safety review file transmitted to ASN at the beginning of 2008 was examined by the Advisory Committee for laboratories and plants (GPU) in June 2009. This examination also concerned the application for extension of the installation's operating range, to allow CEA to repackage new types of fuels, in particular those currently stored in the PEGASE installation (BNI 22) in Cadarache. Based on the conclusions of this examination, ASN stated that it had no objection to continued operation of the installation and extension of its operating range.

• Laboratory for research and experimental fabrication of advanced nuclear fuels (LEFCA) (Cadarache)

The LEFCA is a laboratory responsible for performing basic engineering studies on plutonium, uranium, actinides and their compounds in all forms (alloys, ceramics or composites) with a view to application to nuclear reactors, the performance of ex-pile studies necessary for the interpretation and understanding of fuel behaviour in the reactor and at the various stages in the cycle, and the manufacture of irradiation test capsules or experimental assemblies.

After the installation's periodic safety review in 2005, LEFCA was authorised to continue operations for ten years.

For budgetary reasons, CEA wanted to postpone the seismic reinforcement work on the building and claimed to have new data obviating the need for a system to prevent the risk of soil liquefaction under the installation. At the request of ASN, in line with its major commitments, CEA has gone back to its initial undertaking to carry out reinforcement work before the end of March 2010. With regard to the liquefaction risk prevention system, a technical review of the new data provided by CEA is in progress.

• Spent fuel testing laboratory (LECI) (Saclay)

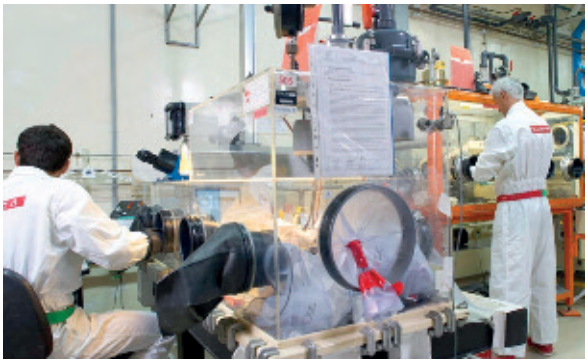
LECI is an installation designed to analyse the various components of the spent fuel from nuclear reactors (components of the radioactive material, components of the assembly cladding, etc.), in order to determine how they behave under irradiation.

In June 2004, ASN authorised pre-commissioning of the LECI extension, subject to compliance with a number of requests resulting from the conclusions of the extension project review by the GPU, which met in April 2004. In 2005, ASN authorised partial commissioning of the LECI extension and then in 2006 its complete commissioning. In July 2008, in response to requests from ASN and in compliance with the undertakings made to it, the licensee transmitted the installation's updated safety analysis report. ASN gave its opinion on this document in 2009, thereby marking the end of the modified installation commissioning phase.

b) Research and development laboratories

• Alpha facility and laboratory for transuranian elements analysis and reprocessing studies (ATALANTE) (Marcoule)

ATALANTE primarily contains CEA's R&D facilities for high-level radioactive waste and reprocessing. These activities were previously distributed over the three Fontenay-aux-Roses, Grenoble and Rhone Valley centres.



Operators working in the LEFCA laboratory in Cadarache

Final commissioning and the safety review were examined by the GPU in 2007 and ASN authorised installation final commissioning, albeit with a number of requirements (decision 2007-DC-0050 of 22 June 2007). As the installation reinforcement work had been carried out, the activity restrictions applied in 2007 were lifted (decision 2009-DC-142 of 16 June 2009).

ASN considers that CEA has put into place effective monitoring of implementation of its commitments subsequent to the Advisory Committee meeting, with respect to ATALANTE.

• The CHICADE installation (Cadarache)

The CHICADE (chemistry, waste characterisation) installation carries out research and development work on low and intermediate level nuclear waste, primarily concerning:
– aqueous liquid waste treatment processes;
– decontamination processes;
– solid waste packaging methods;
– assessment and monitoring of waste packaged by the waste producers.

In March 2007, CEA submitted the BNI safety review file, which however still requires some additional data, owing to the new activities CEA intends to carry out in the installation. ASN will adopt a stance with regard to this review in 2010.

1 | 2 | 4 Fissile material stores

• The central fissile material warehouse (MCMF) (Cadarache)

The MCMF is a warehouse for storing enriched uranium and plutonium. Its main duties are reception, storage and

Operator remote-manipulating radioactive materials in one of the LECI units in Saclay

shipment of non-irradiated fissile materials (U, Pu) pending reprocessing, whether intended for use in the fuel cycle or temporarily without any specific purpose.

In 2009, the licensee continued to remove fissile material from storage in the installation, reporting regularly to ASN. CEA also informed ASN that it was now contemplating removal from storage of all material in the installation by 2016. ASN will adopt a stance on the acceptability of this proposal in 2010.

• The MAGENTA project (Cadarache)

The creation authorisation decree for the MAGENTA installation, which is intended to replace the MCMF by 2010, was signed on 25 September 2008. Construction of the installation is nearing completion. The commissioning authorisation application is being reviewed.

1 | 2 | 5 The POSEÏDON irradiator (Saclay)

The operating principles of irradiators are explained in part 3|1 of this chapter. The POSÉIDON installation is primarily dedicated to studying the strength of the materials used in nuclear power plants and fuel cycle plants. This installation, which was originally owned by CIS bio international, was incorporated into the CEA BNI inventory at the beginning of 2007. One of the current problems with this installation is the definition and implementation of waste zoning, taking account of the specific experiments being conducted (long-term irradiation of samples in the source disposal pool).

1 | 2 | 6 Effluent and waste treatment facilities

CEA's radioactive effluent and waste treatment facilities are distributed between the Fontenay-aux-Roses, Grenoble, Cadarache and Saclay sites. They are generally equipped with characterisation facilities to enable measurement-based checks on the declarations made by the waste producers and verification of the conformity of the waste packaged with respect to the specifications for acceptance prior to routing to the appropriate channel. The processing and packaging facilities primarily handle the liquid and solid waste generated by the CEA centre on which they are located. They occasionally process waste from other sites (CEA or others) owing to their specific nature.

The facilities devoted specifically to storage of waste and spent fuels are dealt with in chapter 16 (point 2).

Operator remote-manipulating radioactive materials in one of the ATALANTE units in Marcoule

View of the MAGENTA facility construction site

ASN inspectors carrying out an inspection on the MAGENTA facility construction site

a) Cadarache centre

The effluent and waste treatment station (STED) processes and packages liquid and solid radioactive waste from the Cadarache centre. Following the periodic safety review of this installation in 1998, ASN had authorised continued operation for a limited period. CEA then proposed creating three new installations with a view to carrying out the duties performed by the STED: the Rotonde, for sorting of solid waste, CEDRA, for treatment of a part of the solid waste and AGATE for treatment of liquid effluents. The Rotonde sorting installation has been operational since September 2007 and primarily interfaces between the solid waste producers and the treatment, storage and disposal installations. Since shutdown of the STED's 250-ton compacting press at the end of 2004, some of the solid waste is being sent directly to ANDRA's Aube waste repository, where it is compacted and packaged. At the beginning of 2007, CEA sent ASN a file proposing to provide seismic reinforcement of that part of the installation containing a 500-ton press (ARCCAD project). The technical details of this project should be supplied by CEA in 2010.

Processing of liquid effluents contaminated with intermediate-level alpha emitters, referred to as "special" effluents, ceased on 1 July 2005. CEA is transferring these effluents to the liquid effluent treatment station on the Marcoule site (STEL).

ASN authorised continued operation of the STE in 2007, for processing of liquid effluents contaminated with beta-gamma emitters up to 30 June 2009. In May 2009, CEA submitted to ASN a further application for authorisation to continue operation of the STE until AGATE was able to take over completely in about 2011. This authorisation extension is currently being reviewed. In the meantime, the liquid effluents containing beta-gamma emitters are being sent to the Marcoule centre.

In 2005, CEA decided to restrict the configuration of the AGATE project, which would then be used to concentrate effluents contaminated by beta-gamma emitters produced in the Cadarache centre. The concentrates would then be transferred to the Marcoule STEL for final processing. However the STEL installation is ageing and the DSND only authorised continued operation of the current STEL, with its bituminisation process, for a limited period. CEA therefore launched an installation renovation project and plans to commission the renovated STEL, comprising new buildings and existing buildings given a "long-term" overhaul, between 2012 and 2015. The sludge bituminisation process will be stopped in 2014 and replaced by a cement encapsulation process.

It is only on completion of the 2010 review of the renovated STEL safety case that the DSND will be able to reach a decision on the longer-term operation of the STEL and on the conditions in which the concentrates resulting from treatment in the future AGATE installation could be accepted.

b) Saclay centre

The solid waste management zone handles treatment and storage of solid radioactive residues produced in the centre by the reactors, laboratories and workshops. This installation provides the interface between the waste producers on the Saclay site and the treatment, storage and disposal installations for this waste. It also recovers waste from the small producers (scintillation liquid sources, ion exchange resins) and provides storage of radioactive sources.

In 2009, CEA continued the programme to recover from the fuel assembly blocks the spent fuel elements stored in the solid waste management zone. This programme consists in characterising old containers, stored in the fuel assembly block, so that they can be taken to the STAR installation in Cadarache for reconditioning before storage in CASCAD, pending a final solution (reprocessing or disposal).

CEA's current strategy is to reduce the source term present in the installation and primarily maintain the functions to provide the interface between the producers of solid waste and the appropriate disposal channels. At the beginning of 2009, the GPU examined the safety review file for the solid waste management zone. At the same 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 remove the fuel stored in the pool and the fuel stored in the blocks. The follow-up letter for this examination is available on the ASN website.

Implementation of the action plan created by CEA following the incident on 10 September 2007 (a staff member entered a zone classified as "prohibited" for radiation protection reasons, although with no radiological consequences) was finalised during the course of 2009.

The radioactive liquid effluent management zone (STE) collects, stores and reprocesses the low-level aqueous effluents and stores aqueous and organic effluents. The radioactive aqueous effluents are evaporated and then stored in the tanks of the RESERVOIR facility pending treatment. By a decree of 8 January 2004, CEA was authorised to modify the STE by adding the STELLA extension. The progress of the operations, first of all to recover stored legacy effluents awaiting treatment, and secondly to clean out the old installation buildings, are among CEA's priorities, along with pre-commissioning of STELLA.

In 2007, the safety review file for the "former plant" part and commissioning of the STELLA extension were presented to the GPU. The STELLA inactive tests (without the use of radioactive materials) are currently being finalised. ASN will rule on the commissioning of STELLA in 2010.

c) Fontenay-aux-Roses centre

The main function of the radioactive effluent and solid waste treatment station (STED) is storage of solid and liquid waste prior to removal to the appropriate routes. As part of the site clean-out process, in addition to removal of the waste from storage, the STED will act as the support installation for managing the waste generated by decommissioning.

d) Grenoble centre

The effluent and waste treatment station (STED) will continue with removal from storage and recovery of legacy waste prior to complete decommissioning of the BNIs on the CEA site by 2012.

1 | 2 | 7 Installations undergoing decommissioning

CEA is proceeding with the individual shutdown and decommissioning of some installations which have reached the end of their lives or which it no longer requires, and the more general shutdown and decommissioning of sites located in the immediate vicinity of major urban centres (which is the case of the Fontenay-aux-Roses and Grenoble centres, for which the complete delicensing process is under way). These aspects are dealt with in chapter 15.

STELLA extension building in BNI 35 in Saclay

2 NON-CEA NUCLEAR RESEARCH INSTALLATIONS

2|1 National large heavy ion accelerator (GANIL)

The GANIL, located in Caen (Calvados département) is designed to accelerate all heavy ions (from carbon to uranium) with an energy up to 100 MeV per nucleon.

In order to adapt to the requirements of international research, GANIL issued a safety option file in May 2004 for a new project, called SPIRAL 2 (creation of new experimentation equipment and rooms with a more powerful beam). In July 2005, ASN approved the safety options proposed by the GANIL, provided that a certain number of requests were taken into account. At the same time, ASN asked the GANIL to proceed with the periodic safety review of the installation. In order to monitor the progress of these two files (SPIRAL 2 project and safety review), periodic meetings have been held since 2007 between ASN and the GANIL. The preliminary safety analysis report for SPIRAL 2 was submitted by the licensee in June 2009 and additional data are expected in 2010. The corresponding public inquiry should take place in 2010. The periodic safety review file will be submitted in 2010.

2|2 Laue-Langevin Institute high flux reactor

The high flux reactor (RHF) at the Laue-Langevin Institute (ILL) in Grenoble constitutes a neutron source mainly used for experiments in the field of solid-state physics, nuclear physics and molecular biology. The maximum authorised power for this reactor is 58.3 MWth. The reactor core, cooled and moderated by heavy water, is placed at the centre of a reflector tank, itself immersed in a light water pool.

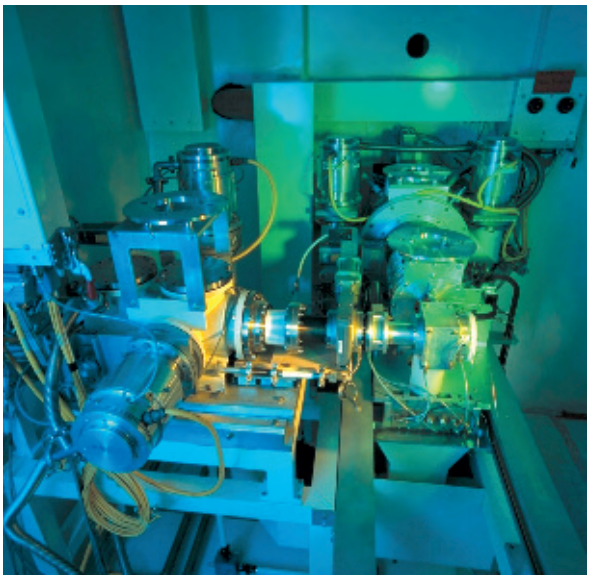
In 2002, ASN asked for seismic reinforcement work on the installation to be carried out. This extensive work was completed at the end of 2007 and was reviewed by the Advisory Committee for nuclear reactors, after which ASN notified the Laue-Langevin Institute that it considered the periodic safety review of the installation, begun in 2002, to be on the whole closed. Some points still however have to be finalised, in particular with regard to the gaseous effluent system and the polar handling crane. Finally, with a view to achieving complete delicensing of the CEA Grenoble centre, located in the immediate vicinity of the RHF, ASN asked ILL to examine the long-term future of the RHF on the existing site during the course of the installation's forthcoming periodic safety review, scheduled to take place in 2017.

2|3 European Organization for Nuclear Research (CERN) installations

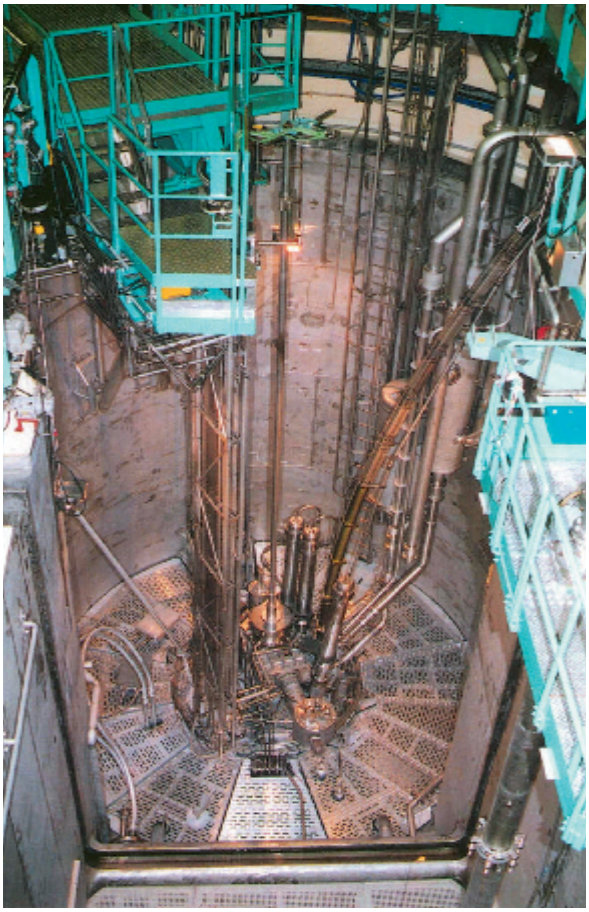
The European Organization for Nuclear Research (CERN) is an intergovernmental organisation established on the basis of a treaty between States for the purpose of carrying out purely scientific and fundamental research concerning high energy particles. CERN site is located near Geneva, on the Franco-Swiss border.

The safety of these installations is regulated by a convention binding the French Government and CERN. The convention currently in force, which dates from July 2000, states that certain provisions of French legislation applicable to BNIs apply to the LHC and to the SPS, two rings which make up part of the CERN's installations. It also designates ASN as the French Government representative to deal with technical matters concerning the treaty. ASN also has a seat on the CERN's radiation protection committee, in charge of all radiation protection problems on the site. ASN however considers that the status of its relations with CERN needs to be clarified. Discussions took place in 2009 to update the tripartite convention of 2000. It should be possible to sign a new convention in 2010.

CERN has completed construction of a hadron collider (Large Hadron Collider, LHC) which should enable progress to be made in particle physics research (search for the "Higgs boson"), notably by producing proton-proton collisions at a beam energy of 7 TeV. In 2006, CERN forwarded the LHC safety documents. On this basis, ASN



Equipment inside the GANIL accelerator in Caen



RHF reactor vessel in Grenoble, with water drained out

indicated that it had no particular remarks to make concerning the safety of this installation, in a letter of 23 October 2007. The operations preceding commissioning of the LHC began in 2008 (cooling of the accelerator to 1K, collision tests, particularly at low energy levels). The accelerator entered service in September 2008, but an incident occurred just a few days later (helium leak from superconductor magnets). Equipment repairs and subsequent requalification took place during the course of 2009.

The accelerator was restarted in November 2009.

2|4 The ITER (International Thermonuclear Experimental Reactor) project

The ITER project concerns an experimental installation, the purpose of which is scientific and technical demonstration of controlled thermonuclear energy with a deuterium-tritium plasma magnetic confinement, during long-duration experiments with a significant power level (500 MW for 400 s). This project is an international one and enjoys financial support from China, South Korea,

Computer-generated image of the ITER reactor project in Cadarache

India, Japan, Russia, the European Union and the United States. After lengthy negotiations, Cadarache was finally chosen at the end of June 2005 to host the facility. The international treaty creating the ILE (ITER Legal Entity) was initialled in May 2006 and ratified by all the parties in September 2007. The Headquarters Agreement between ITER and the French Government, signed on 7 November 2007, was published in the Official Gazette of the French Republic by decree on 11 April 2008.

At the request of ASN, which had noted that the international organisation status of the ITER installation, and in particular the prerogatives linked to the corresponding privileges and immunities, was liable to create a number of problems with respect to the responsibility of the nuclear licensee, it was made clear that, as with the other BNIs located in France, there could be no immunity for individuals and there would be complete freedom of access to premises for the purposes of nuclear safety and radiation protection inspections (Article 16 of the Headquarters Agreement).

The creation authorisation application file for the ITER BNI was transmitted at the end of January 2008. ASN however informed the ITER Organization (IO) that its file was unacceptable in its current form and needed to be clarified on a number of points before the creation authorisation procedure and in particular the public inquiry could be initiated. The revised file should be transmitted at the beginning of 2010. The CLI, created in 2009, will be consulted. ASN will convene the Advisory Committees concerned to review this file and will adopt a stance on the ITER draft creation authorisation decree.

ITER Organization aims to obtain the first hydrogen plasma in 2018 and the first deuterium-tritium plasma in 2026. The platform preparation work is under way (in particular site clearance and earthworks). The civil engineering work involved in construction of the non-nuclear buildings should begin in 2010.

3 IRRADIATION FACILITIES, MAINTENANCE FACILITIES AND OTHER NUCLEAR INSTALLATIONS

3|1 Industrial irradiation facilities

Industrial irradiation facilities provide gamma-ray (mainly cobalt 60 sources) treatment for medical equipment (sterilisation) or foodstuffs. An irradiation facility consists of a concrete bunker inside which the irradiation processes take place. The sealed sources are placed in a pool inside the bunker. They are remotely and automatically extracted from the pool during an irradiation operation. They are lowered into the pool after the operation and prior to any intervention by the operators in the bunker. There is thus no risk of irradiation inside the bunker. The facilities currently operated are the IONISOS Group's installations situated in Pouzauges (Vendée *département*), Sablé-sur-Sarthe (Sarthe *département*) and Dagneux (Ain *département*) and the ISOTRON Group's installation in Marseilles (Bouches-du-Rhône *département*).

The safety problems mainly concern access management, a point on which ASN is extremely attentive, in particular on the basis of the experience feedback from the operation of similar installations in Europe.

In June 2006, the ISOTRON France company submitted to ASN a licence application file for the creation of a BNI called GAMMATEC, on the Marcoule site. The decree authorising the creation of this facility was published in the Official Gazette on 27 September 2008. This new facility would be the ISOTRON Group's second in France. Construction work on this new installation has not yet started.

Local information committees have been set up for the Sablé and Pouzauges sites: the first meetings were held on 8 June 2009 in Sablé and on 14 September 2009 in Pouzauges.

On 22 June 2009, an access door to the irradiation unit in the IONISOS facility in Pouzauges was inadvertently opened, tripping the automatic safety system which lowered the source-holder into the safe position in the pool. The duty staff then intervened. They observed that the staff access door was not fully closed. After checking the installations, no anomaly was identified, the door was closed and the installation returned to operation. The event was brought to light during an unannounced inspection by ASN on 28 July 2009. While the sources were being lowered into a safe position (taking about 4 minutes), someone could have entered the unit and suffered irradiation far higher than the exposure limit set for the public and for workers. Following this incident and after asking IRSN for its opinion, ASN on 24 December 2009 asked the licensee to immediately tighten up the measures concerning access to the irradiation unit. ASN also asked the licensee to conduct an in-depth review of the safety of the facility, to prevent such an event happening again.

3|2 The radiopharmaceuticals production facility operated by CIS bio international

CIS bio international is a key player on the French market for radiopharmaceutical products used for both diagnosis and therapy. Most of these radionuclides are produced in BNI 29 at Saclay. CEA, which traditionally operated the facility in the past, has been progressively withdrawing from its operation since 1996. This facility has been gradually acquired by CIS bio international, which is now the operator. CEA however remained the official nuclear licensee for the facility.

In April 2007, ASN gave a favourable opinion concerning the draft decree transferring nuclear licensee responsibility from CEA to CIS bio international (opinion 2007-AV-0023 of 4 April 2007) but in July 2007, CIS bio international asked for the procedure to be suspended, pending the receipt of aid from the authorities for the recovery of used sources. Following the Government's decision in April 2008 to create a public interest grouping for this activity, CIS bio International reiterated its request on 25 July 2008 to receive the status of nuclear licensee for BNI 29 in place of CEA. The decree authorising the change in licensee was signed on 15 December 2008.

Considerable renovation work has also been carried out in the facility since 2004 and the licensee forwarded its periodic safety review file at the end of June 2008. ASN however considered that in many areas this file needed to be improved and took a decision accordingly (decision 2009-DC-137 of 7 April 2009). The installation's periodic safety review file will be examined in 2010.

Finally, despite progress in certain areas, ASN considered that the safety management system at CIS bio international needed to be improved and that the resources dedicated to nuclear safety and radiation protection in BNI 29 were underestimated. It therefore issued decision 2009-DC-145 of 16 July 2009 requiring CIS bio international to remedy this situation.

3|3 Maintenance facilities

Three BNIs specifically handle nuclear maintenance activities in France:

– the SOMANU (Société de maintenance nucléaire) facility in Maubeuge (Nord *département*), which specialises in the repair, maintenance and evaluation of equipment taken mainly from PWR main primary systems and their auxiliaries, with the exception of fuel elements;
– the clean-out and uranium recovery installation of the Société auxiliaire du Tricastin (SOCATRI) in Bollène (Vaucluse *département*) which handles maintenance, storage and clean-out of equipment from the nuclear industry and storage of waste on behalf of ANDRA. Following the event of 7 July 2008, the former effluent treatment station was finally shut down, the tanks were drained and closed and the collection tank in question was repaired. All this equipment is kept under surveillance until such time as the ongoing legal investigation is completed. With regard to the consequences of the event on the environment, the broader monitoring programme set up has enabled the following conclusions to be drawn:
  • at present there would seem to be no environmental contamination as a result of this incident; however, SOCATRI is required to continue monitoring the groundwater below the site and the river Lauzon with which it communicates;
  • in a sector bounded by the Donzère-Mondragon canal and the Gaffière, Lauzon and Rhone rivers, historical or natural contamination of the groundwater – unrelated to this incident – was identified; about thirty private wells are thus monitored by AREVA NC.

  The study in progress, monitored by CLIGEET and conducted by IRSN, the Vaucluse *département* DDASS and AREVA NC, concerning the origin of this uranium contamination of the Tricastin groundwater, will allow more precise identification of the scale and scope of the phenomenon. This study will take over the monitoring of the private wells.

  In 2009, the SOCATRI licensee initiated a periodic safety review of its installation.
– the Tricastin operational hot unit (BCOT), also in Bollène, which carries out maintenance and storage of contaminated PWR equipment, except for fuel elements. In 2009, the BCOT licensee initiated a periodic safety review of its installation.

3 | 4 Chinon irradiated material facility (AMI)

This installation, located on the Chinon nuclear site (Indre-et-Loire *département*), is operated by EDF. It now primarily carries out examinations and appraisals of activated or contaminated materials from the PWRs.

2006 was marked by a change in strategy on the part of the licensee with regard to the future of the installation. As ASN considered that the renovation project presented in 2004 did not enable long-term continued operation to be envisaged, EDF presented a new strategy, in particular including final shutdown of the installation no later than 2015. The studies concerning the construction of a new assessment laboratory were initiated following this new strategy orientation. In 2008, EDF indicated its aim of commissioning this new laboratory for 2011. Preparatory work began in 2009. If the schedule presented is followed, AMI appraisal activities will gradually come to a halt over the same time-frame and decommissioning of the installation could then begin.

In 2007, EDF also presented ASN with the measures contemplated to guarantee the safety of the installation until final shutdown. ASN declared itself to be in favour of implementation of these measures, which in particular included upgrading of the installation with regard to the fire risk (improved sectorisation and fire detection). The corresponding work was completed in 2009. Operation of the sorting and packaging unit for the installation legacy waste, currently stored in pits, is continuing. Some of this waste was thus taken away to the disposal centres.

3 | 5 Inter-regional fuel warehouses (MIR)

EDF has two inter-regional fuel warehouses, on the Bugey site in the Ain *département* and at Chinon in the Indre-et-Loire *département*. EDF uses them to store nuclear fuel assemblies (only those made of uranium oxide) pending loading into the reactor. Accessibility considerations and a just-in-time fuel management policy have led EDF to indicate that it intends to close down the Chinon warehouse in the near future.

3 | 6 CENTRACO waste incineration and melting facility

The CENTRACO low-level waste processing and packaging centre, located in Codolet near the Marcoule site (Gard *département*), is operated by SOCODEI.

SOCODEI aims to become a key player in waste processing. It has therefore begun to look at ways of expanding its scope of operations, given the need to reposition itself in the low-level waste management sector, particularly since ANDRA's very low-level waste repository opened. This strategy required a modification to the creation authorisation decree (DAC) and a revision of the discharge and water intake licence (ARPE). A number of jointly reviewed applications led in 2008 to the signing of a modification decree and then in 2009 to the publication of decisions concerning effluent discharge and water intake.

So that it could take charge of the leaching effluents resulting from treatment of the EDF steam generators, SOCODEI submitted a request for addition of equipment in compliance with Article 26 of the decree of 2 November 2007. The planned process aims to concentrate the activity contained in these effluents, with a view to extracting a concentrated part for incineration and using the remainder to replace the raw water consumed for cooling of the smoke. This request was approved by ASN on 23 February 2009. This process is being experimented with and operating experience feedback is expected at the beginning of 2010.

Other potential changes in the waste accepted and the use of replacement products, allowing reduced consumption of uncontaminated products are currently being examined.

Against this backdrop, ASN noted that new projects were often developed to the detriment of the daily monitoring of the installation. The ASN Director-General was concerned by the excessive number of events in the installation, by the high number of problems detected during ASN inspections and by the inadequacy of the files transmitted by CENTRACO, and therefore summoned the CENTRACO Director-General in November 2008, asking him to look at ways of implementing an action plan to remedy this situation. The action plan presented in February 2009 clearly shows that the licensee is now well aware of the shortcomings in security, safety, radiation protection and the environment. The first applications of this plan show an improvement in the management system, which was the subject of enhanced monitoring by ASN, in particular through a greater number of inspections.

4 OUTLOOK

The research and other installations regulated by ASN differ widely but are usually small in size. ASN concentrates on regulating the safety and radiation protection of these installations as a whole and on comparing practices per type of installation in order to choose the best ones and thus encourage operating experience feedback. These installations include experimental reactors, hot laboratories, accelerators and irradiators, as well as research support installations (material and waste warehouses, effluent treatment facilities, etc.). In addition to CEA, there is a large number of licensees, each operating a small number of installations.

In 2007, ASN noted with satisfaction that CEA had presented it with a tool allowing the highest-level management of the decisions concerning both the upgrading of older installations and the new projects, thus guaranteeing greater transparency and visibility for ASN with regard to the processes liable to delay complex projects with high nuclear safety and radiation protection stakes. This concerned about twenty major commitments, enabling priority focus to be given to those areas where the risk is greatest. In 2008, budgetary concerns led CEA to request the postponement of certain milestones. ASN considers that by offering protection for a limited number of high-stakes project, the "major commitments" approach, which is officially checked by CEA every six months, aims precisely to avoid the postponement of commitments for reasons other than justified technical contingencies. It is important that CEA devote the budgetary and human resources to the correct performance of these "major commitments". It hopes that this approach will be a virtuous self-reinforcing one, which implies its rigorous implementation. This is why in 2009, ASN asked CEA to continue with this approach, which should lead to improved project management.

Furthermore, as a result of concerns expressed by ASN, CEA has initiated a process to control operations relating to civil engineering on its BNIs and criticality in these same installations. In 2010, ASN will continue to focus on management of the civil engineering operations on the construction sites for new installations and on renovation work for existing installations. With regard to the criticality risk, ASN noted that CEA has initiated a process to remove unused sources, in particular neutron sources, and to check the conformity of its installations with their safety requirements. In 2009, CEA thus brought to light discrepancies in the management of fissile materials, leading to the notification of significant events. In 2010, ASN will be particularly attentive to the continuation of this process and to the corrective measures proposed by CEA.

At the request of ASN, ten years after the last review on this topic, CEA submitted a report on the management of safety and radiation protection at CEA. ASN will adopt a stance on this report in 2010, based on a review by the Advisory Committees for laboratories and plants and for reactors. This review will in particular look at skills management, the role of the various players at CEA and, in particular, the powers and independence of the General and Nuclear Inspection Division, and the management of safety and radiation protection in the projects. Aspects linked to safety management by subcontractors will be looked at especially closely, as ASN attaches great importance to:

- clarification of the interfaces between CEA and its subcontractors;
- management and monitoring by CEA of its subcontractors;
- reinforcing the safety culture of subcontractors.

CEA will also be required to analyse the problems observed in its management of the ATPu incident notified on 6 October 2009 and the necessary lessons will have to be learned.

In 2010, ASN will continue its field inspections of CEA's internal authorisations system. This monitoring will concern the process as a whole, the justification of compliance with the criteria for implementation of the decision formally approving the system proposed by CEA, but also a check on the level of independence, within CEA, between the applicants, the support services and the first and second level inspectors.

Finally, ASN will in 2010 be continuing to take steps to promote international harmonisation on the safety of research reactors, particularly within the European WENRA framework.