ENVIRONMENTAL PROTECTION

CHAPTER 5

1 PROTECTING THE ENVIRONMENT

Nuclear safety, radiation protection and environmental concerns all share the same goal of protecting workers, patients, the public and the environment against the risks linked to nuclear activities and to ionising radiation.

In the field of environmental protection, law 2006-686 of 13 June 2006 on Transparency and Security in the Nuclear Field clarifies the areas of intervention of the Nuclear Safety Authority (ASN).

With regard to environmental monitoring, ASN organises a permanent radiation protection watch nationwide. With regard to regulations, it gives its opinion on the regulatory requirements for BNIs and submits technical decisions concerning application of the regulations. With regard to licensing, it defines the provisions applicable to the installations. The decisions defining the discharge levels from basic nuclear installations must be approved by the Ministers.

This legislative change reinforces the importance attached to considerations of safety, radiation protection and the environment. ASN therefore tackles them in a global manner, using the same tools and the same requirements of stringency, competence, transparency and independence.

With regard to the environment, ASN actions are primarily focused on 3 areas:

- monitoring radioactivity in the environment with a view to informing the population of the health impact of nuclear activities in France;
- minimising the dispersal into the environment of radioactivity and toxic materials from the nuclear industry. This involves strict control of effluent discharges and waste management. ASN is responsible for supervision of discharges of radioactive and chemical, liquid and gaseous effluents from basic nuclear installations (BNIs);
- preventing and mitigating detrimental effects and risks resulting from BNI operations and which could inconvenience neighbours, or affect health, safety, public salubrity, agriculture, protection of nature and the environment or conservation of sites and monuments.

Generally speaking, ASN policy regarding environmental protection tends towards that applied to conventional industrial activities. Thus numerous rules concerning discharges or control of their impacts are comparable to those used in industry.

To support this approach, ASN has for several years been developing inspections focused on effluent and waste management and on environmental protection. It is responsible for following-up the significant events declared to it by the licensees, based on the criteria harmonised in 2005 (guide of 21 October 2005).

2 MONITORING ENVIRONMENTAL RADIOACTIVITY

Article R. 1333-11 of the Public Health Code provides for the creation of a national network of environmental radioactivity measurements, in order to help estimate the doses to which the population is exposed as a result of nuclear activities as a whole.

This network is being deployed for two main reasons:

- to implement a quality policy in the measurement of radioactivity, by setting up a system of approvals;
- to develop transparency in information concerning the health impact of nuclear activities in France. Reaching this goal entails a regulatory obligation on most of those involved in the measure (including the nuclear licensees) to transmit their measurement results to the network.

On the advice of a steering committee, ASN is responsible for setting guidelines for this network, which is managed by the Institute for Radiation Protection and Nuclear Safety (IRSN). It approves the laboratories that submit data to it.

The members of the steering committee are in particular representatives of the Ministries concerned, agencies in charge of health and environmental issues, and representatives of the measurement laboratories from both the industrial and the non-profit sectors. They are designated by a ministerial order of 12 September 2005.

Article R. 1333-11 of the Public Health Code is currently being revised in order to improve its clarity and bring it into line with the requirements of the law of 13 June 2006. Laboratory approvals can henceforth only be granted by decision of ASN.

2 | 1

Guaranteeing and improving the quality of environmental measurements

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The approval procedure

To guarantee the quality of the measurements published, an approval procedure was set up. The order of 27 June 2005 organising a national network of environmental radioactivity measurements and setting criteria for approval of laboratories defines this procedure. It in particular comprises:
- presentation of an application file by the laboratory interested;
- review of it by ASN;
- review of the application files by a pluralistic approval commission which issues a decision on anonymous files.

Two guides concerning the conditions for presentation of approval applications and conditions for remedying an unfavourable opinion from the approval commission respectively, were prepared and published in 2006.

2 | 1 | 2

Approval conditions

Laboratories wishing to obtain approval must set up an organisation meeting the requirements of standard NFC 17-025.

In order to demonstrate their technical competence, they must take part in inter-laboratory tests organised by IRSN. The four-year programme of intercomparison tests is updated annually. It is reviewed by the approval commission and published on the national network's website (www.mesure-radioactivite.fr).

The intercomparison tests organised by IRSN cover up to 40 laboratories per test, including some from abroad.

To ensure that the laboratory approval conditions are fully transparent, precise assessment criteria are used by the approval commission. These criteria are published on the national network's website.

Following the intercomparison tests organised since 2003, approval was granted to about forty laboratories for certain activity measurements in water and about twenty laboratories for measuring the activity of gamma emitters in biological matrices. The detailed list of approved laboratories and their scope of technical competence was defined in the order of 11 August 2006. It is now kept up to date in the ASN's official Bulletin on www.asn.fr.

The intercomparison tests held in 2006 concerned the measurement of:
- gamma emitters, ^{90}Sr and artificial alpha emitters in soils;
- ^{14}C, isotopes of plutonium and americium, total alpha, total beta and ^{3}H in water;
- isotopic U, weighted U, ^{226}Ra in a biological matrix.

In all, by the end of 2006, 29 types of intercomparisons had been organised.

2 | 2

Developing transparency in information about environmental radioactivity

The Public Health Code set up the national network for environmental radioactivity measurement in order to contribute to informing the public about the doses to which they are exposed.

Two aspects are involved in setting up this network:
- development of a data bank containing the environmental radioactivity measurements;
- publication of these results and relevant information on this subject.

TELERAY radiation monitor for surveillance of the ambient dose rate

2 | 2 | 1

Data management

Database development was undertaken by ASN and IRSN, under the supervision of the steering committee. This development was guided by the need to take account of the concerns of all stakeholders who will be contributing to the national network for environmental radioactivity measurements.

The work done in 2006 led to a definition and comparison of the various technical solutions possible. The choice of solution should enable data management system development to start in 2007.

2 | 2 | 2

Public information

The second aspect of the national network is linked to informing the public, by developing a web portal through which the radioactivity measurement results and their interpretation in terms of radiological impact will be available. It will also offer documentation of use to network participants and to anyone who is not a specialist in radiation protection and the environment.

This portal is accessible via the ASN and IRSN websites and is a way of monitoring current development of the national network. It will be the main source of information, in particular concerning approvals. Until such time as the measurements database is ready, scheduled for 2008, this site contains links to the websites of network players and other institutional sites dealing with environmental radioactivity.

2 | 3

Supervising the radiological quality of water intended for human consumption

The new programmes for radiological monitoring of public mains water and non-mineral bottled waters (see point 1|5 of chapter 3) provide a complete picture of the radiological quality of water intended for human consumption, based in particular on measurement of total alpha and beta radioactivity and of tritium. The corresponding data is being gradually integrated into the DDASS health/environment information system (SISE-Eau). It will give a picture of the natural radioactivity of the water distributed.

The 24 January 2005 order sets the conditions for approval of laboratories which are to take samples and conduct health monitoring analyses of water. The list of approved laboratories (6) is defined by an order of 28 June 2006. In 2006, 2 new laboratories submitted an application file for this approval.

3 REGULATING BNI DISCHARGES

Like any other industry, basic nuclear installations (BNIs) generate by-products, whether or not radioactive, and despite the efforts made for prevention, recycling or reuse. These by-products can be treated before disposal as waste or, when their characteristics so allow, discharged into the environment in the form of effluent.

After efforts are made to reduce these by-products at source, the choice between effluent discharge and production of waste is the result of an optimisation process specific to each installation. It in particular depends on the feasibility of recovering the radionuclides present in the effluent. The complexity and cost of the processes used for confinement in the form of waste tend to increase, the lower the concentration of radionuclides. Below a certain level, the radionuclides can no longer be reasonably recovered, in particular because the containment operations imply a radiological impact on the workers that it totally disproportionate to the anticipated gain for the public. They are then discharged into the environment after verification that their impact on the public and the environment is acceptable.

This approach means that the radioactivity discharged in effluents represents a marginal fraction of that contained in waste.

At the end of this process, the choice of the form of discharge (liquid or gaseous) also plays a part in the approach designed to minimise the overall impact of the nuclear installation.

3 | 1

Regulating effluent discharge

3 | 1 | 1

Review of applications

Water intake and discharges of liquid or gaseous effluent, whether or not radioactive, are regulated by ministerial order implementing decree 95-540 of 4 May 1995 concerning BNI liquid and gaseous effluent discharges and water intake.

This decree defines the conditions in which the discharge and water intake licence applications are to be reviewed. It in particular stipulates that:

- the licensee's licence application must be backed up by an impact assessment;
- this application is the subject of a public inquiry;
- review of this application entails consultation of the parties concerned (administrative conference, opinion of local authorities, of the departmental environment and health and technological risks council, and so on).

This decree also enables the Ministers responsible for nuclear safety to revise the existing licences at any moment, irrespective of any applications from the licensees. Finally, this decree confirms ASN as the body with competence for review of the licence applications submitted by the licensees.

This decree constituted a key step in improving control of the administrative procedures regulating BNI effluent discharges into the environment.

3 | 1 | 2

Towards an integrated procedure

The above-mentioned law of 13 June 2006 significantly modified the conditions in which BNI discharge licences can be granted.

The purpose of the modification is to take greater account of environmental considerations alongside those concerning safety and radiation protection. From now on therefore, the licensee will be required to submit an application common to all these aspects. The nature of the application and the procedure to be followed will be defined by a specific decree.

In the event of a favourable outcome, the application leads to the installation creation authorisation decree. Technical aspects of discharges (limit values, surveillance, information, etc.) will then be stipulated in technical requirements defined by ASN. More specifically with regard to the discharge limits, the ASN decision is subject to approval by the Ministers responsible for nuclear safety.

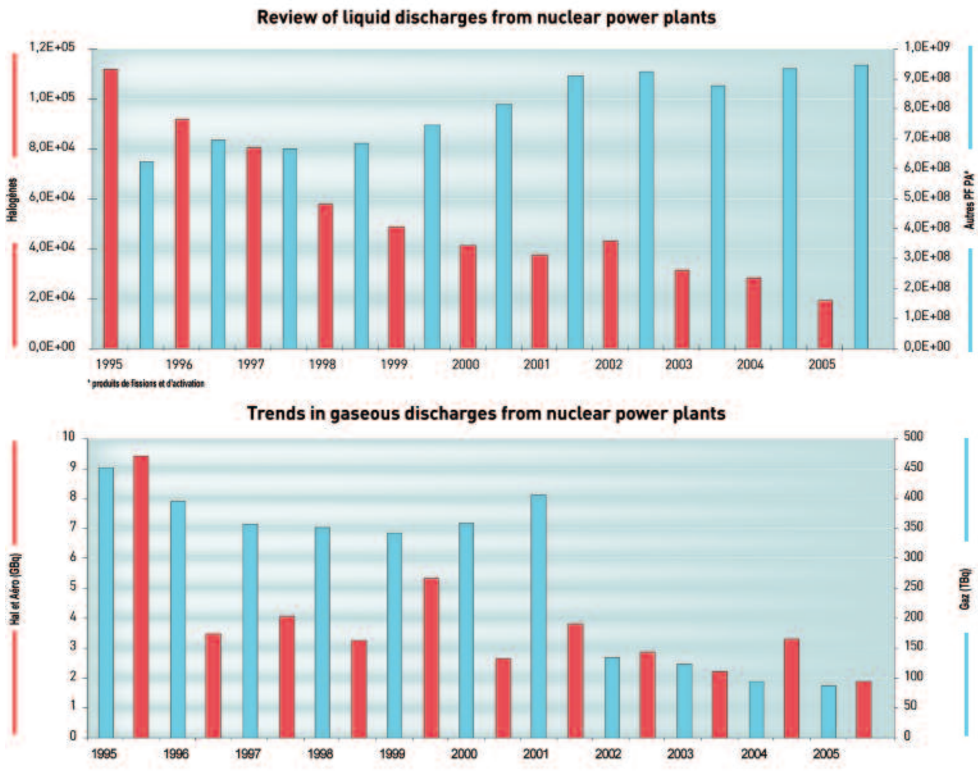
3 | 1 | 3

Determination of limit values

The first discharge limits were set in order to guarantee an impact below the health effect thresholds in force.

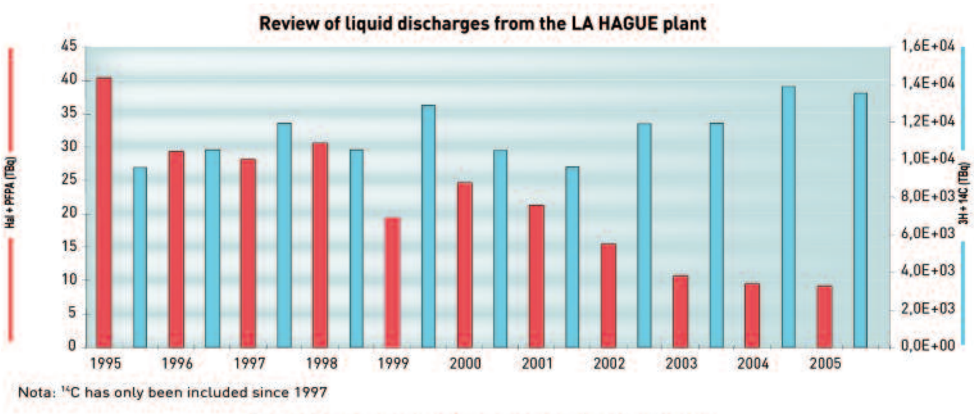
The optimisation efforts required by the authorities and made by the licensees, led to these emissions being considerably reduced. For example, liquid discharges from the Flamanville nuclear power plant, concerning radionuclides other than tritium and carbon 14, fell from 151 GBq in 1986 to 1.2 GBq in 2003. This means in particular that the former regulatory limits are no longer representative of the current levels actually discharged.

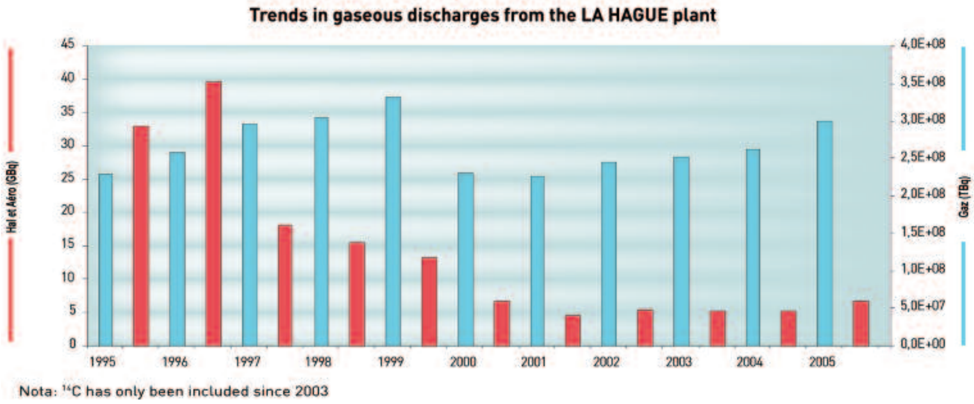
**Changes in BNI discharges since 1995
under the new accounting method introduced in 2002**



ASN hopes that setting these limits will not only guarantee that there are no health or environmental impacts, but will also encourage the licensees to maintain their efforts to optimise and reduce discharges. It therefore hopes to see the discharge limits set as low as can be achieved using the best available techniques, taking account of the fluctuations linked to the normal changes in the process and that these limits do not offer any significant margin which could potentially mask an incident situation.

ASN has undertaken a revision of the discharge licences so that the limits are set close to the real discharge situation, thus maintaining pressure on the licensees to comply.





The lowering of the limit values leads to a reduction by the factors given in the following box:

Reduction factors of limit values defined by the discharge orders

-for the 900 MWe nuclear power plants:			
	Gaseous discharges:	-gases (rare gases + tritium):	28
		-halogens + aerosols:	23
	Liquid discharges:	-tritium:	1,4
		-other radionuclides	2,3
-for the 1300 MWe nuclear power plants:			
	Gaseous discharges:	-gases (rare gases + tritium):	32
		- halogens + aerosols	34
	Liquid discharges:	-tritium:	1,3
		-other radionuclides	2,6
-for COGEMA La Hague:			
	Gaseous discharges:	-gases (other than tritium)	1
		-tritium:	15
		-halogens + aerosols:	9
	Liquid discharges:	-tritium:	2
		-other radionuclides:	12
		-alpha emitters:	10

3 | 1 | 4

The radiological impact of basic nuclear installations (BNIs)

In application of the principle of optimisation, the licensee is required to reduce the radiological impact of its installation to values as low as reasonably achievable, based on economic and social factors.

The purpose of assessing the health impact of nuclear installations in normal operation is to prevent the possible appearance of effects prejudicial to health associated with slight exposure to ionising radiation. This primarily concerns the risk of inducing cancers.

This assessment takes account of the discharges through the identified outlets (stack, discharge pipe to river or seawater). It also includes diffuse liquid and gaseous emissions and the sources of irradiation present in the installation. These elements are the "source term".

The impact is estimated in relation to one or more reference groups identified in the impact assessment. These are homogeneous groups of persons receiving the highest average dose from among the population exposed to a given installation according to realistic scenarios. To assess the impact of the installation, other neighbouring industrial activities and all sources of exposure must be considered. This approach in particular allows comparison between the total dose and the annual allowable dose limit for the public.

Prior to licensing, the impact is assessed against the specified annual limit, taking account of the radionuclides liable to be discharged. This assessment is checked every year on the basis of the radionuclide activity measured in the discharges, to which should be added irradiation (in particular due to interim storage of waste).

In order to harmonise the means of calculating BNI impacts and make it easier to read the impact assessments, a BNI radiological impact assessment guide was issued (report IRSN/02-24 October 2002).

In practice, the activity levels measured in the environment are generally so low that they cannot be used for dose estimate purposes. Dispersion models fed by installation discharge measurement data therefore have to be used. Nonetheless, programmes to monitor the radioactivity present in the environment (water, air, milk, grass, earth) are imposed on the licensees in order to check compliance with the scenarios postulated in the impact assessment. The laboratories performing these measurements must first be approved (see point 2|1).

The dose delivered to the reference groups (estimated by calculation on the basis of the actual discharges) remains significantly lower than the public allowable dose limit of 1 mSv per year. As an example, in 2005 it reached:
- 11 microsieverts for the COGEMA La Hague site;
- 7 microsieverts for the EDF Flamanville site (most penalising site).

3 | 1 | 5

The other discharges characteristics

a) Discharges of chemical materials

Implementation of the above-mentioned decree of 4 May 1995 led to improved regulation of chemical material discharges. This aspect had for a long time been hidden, but nuclear installations also discharge such materials. ASN wanted to see BNIs regulated in this field in the same way as industrial installations. Monitoring of these recently regulated materials provided a clearer picture of the quantities actually discharged. This helps lead to a real reduction in the discharges, particularly with respect to metals.

b) Thermal discharges from nuclear installations

Some BNIs (in particular the nuclear power plants operated by EDF and the EURODIF facility) discharge cooling water effluent, known as "thermal discharges" into watercourses or into the sea, either directly for those plants operating in "open" circuit, or after cooling in cooling towers, venting some of the heat into the atmosphere.

Thermal discharges from power plants into watercourses lead to a temperature rise, between upstream and downstream of the discharge, of between a few tenths of a degree and several degrees. They are therefore regulated in the nuclear power plant discharge licence orders.

From the environmental standpoint, the regulatory limits aim to prevent a modification of the receiving environment, in particular fish life, and to ensure acceptable health conditions if water is taken for human consumption downstream.

These limits can thus differ according to the environment and the technical characteristics of each plant.

The measures taken following the 2003 heat wave and drought meant that the drought encountered in 2005 was dealt with in good conditions, in particular ensuring full compliance with the discharge licences applicable. The anticipated 2006 drought led the Ministers to issue an order on 22 July 2006 authorising exceptional discharges. In the end, this order was not used (see chapter 12).

3 | 2

Monitoring discharges

3 | 2 | 1

Discharge surveillance

BNI discharge surveillance is first and foremost the responsibility of the licensee. The discharge licences stipulate minimum checks that have to be made by the licensee. These checks in particular concern effluent (monitoring of discharge activity, characterisation of certain effluents prior to discharge, etc.). They also contain provisions for monitoring in the environment (checks at mid-discharge, sampling of milk, grass, etc.). Finally, related parameters must also be measured (in particular meteorology).

IRSN measurement laboratory

The results of the regulatory measurements must be written up in registers forwarded on a monthly basis to ASN, which checks them.

The licensees also regularly send IRSN a certain number of discharge samples for analysis. The results of these "cross-checks" are communicated to ASN.

The nature of the cross-check programme, specified by ASN, is designed to bolster the conviction that the results obtained by the licensees are in fact accurate.

Finally, ASN uses a system of unannounced inspections to ensure that the licensees abide by the provisions of the regulations. During these inspections, nuclear safety inspectors, who may be assisted by a specialist, independent laboratory technician, verify compliance with the licences, have samples taken from the effluent or from the environment and have them analysed by this laboratory. Since 2000, ASN has carried out 10 to 30 inspections - with sampling - every year (17in 2006).

3 | 2 | 2

Accounting

The reduced activity of the radioactive effluent discharges from BNIs, the changes to the categories of radionuclides regulated in the discharge licence orders and the need to be able to calculate the dosimetric impact of the discharges on the population led ASN to set new rules for accounting of radioactive discharges, in particular taking account of activity concentrations lower than the decision threshold.

Accounting principles:

- for each category of radionuclides regulated, the activity levels discharged are based on a specific analysis of the radionuclides rather than on total measurements;
- detection limits to be adhered to for each type of measurement are defined;
- for each BNI and for each type of effluent, a "reference" spectrum is defined, in other words a list of radionuclides whose activity must be systematically considered, whether or not higher than the decision threshold. These evolving reference spectra are based on experience feedback from the analyses carried out. When the activity is lower than the decision threshold, then the latter value is counted;
- other radionuclides, which are occasionally present, are considered once their activity concentration is higher than the decision threshold.

Reference spectra used for EDF

As an example, the following reference spectra are used for EDF:

Liquids: ^{3}H,
^{14}C,
Iodines: ^{131}I,
Other fission and activation materials
^{54}Mn, ^{58}Co, ^{60}Co, ^{110m}Ag, ^{123m}Te, ^{124}Sb, ^{125}Sb, ^{134}Cs, ^{137}Cs.

Gas: ^{3}H,
^{14}C,
Rare gases: – ventilation (permanent discharges): ^{133}Xe, ^{135}Xe
– "RS" tank drainage: ^{85}Kr, ^{131m}Xe, ^{133}Xe
– decompression of reactor buildings: ^{41}Ar, ^{133}Xe, ^{135}Xe.
Iodines: ^{131}I, ^{133}I,
Other fission and activation materials: ^{58}Co, ^{60}Co, ^{134}Cs, ^{137}Cs.

These rules are now applied in all nuclear power plants and in most laboratories and other plants (CENTRACO, the COGEMA and ANDRA La Hague establishments, FBFC in Romans-sur-Isère, CEA centre at Cadarache, and so on). They will be applied to the other sites as their discharge licence orders are renewed.

3 | 3

Informing the public about discharges

The public is associated with running the licensing procedure, through the system of public inquiries.

During the life of the installation, ASN ensures that the licensees send it an annual report on the environmental impact of their installations. This report (whose content is defined by the ministerial order of 26 November 1999 setting the general technical requirements concerning the limits and procedures for sampling of BNI discharges subject to licensing) presents all relevant information for the past year. It is sent to the local information committee for review.

3 | 4

Joining an international movement

3 | 4 | 1

"Oslo-Paris" or OSPAR Convention

France has ratified the OSPAR international convention which entered into force on 25 March 1998. This convention replaces and follows on from the previous Oslo and Paris conventions.

ASN duly noted the Sintra declaration of 23 July 1998 by the ministers of the States who signed the OSPAR Convention, which aims to reduce the discharge of radioactive and other hazardous materials into the North-East Atlantic, so that the concentrations in the marine environment fall to close to zero by 2020 for artificial materials, and close to background values for NORM.

In 2006, the OSPAR "radioactive materials" committee reviewed France's four-year report on implementation of the best available techniques (which is one of the provisions of the convention). Following this review, the Commission confirmed that France had met its obligation.

The commission also carried out a review of implementation of the "discharges" part of the "radioactive materials" strategy. This report states that the comparison between discharges in recent years and the reference baseline indicates a fall in most of the characteristics included. It also indicates that the shortage of available data cannot enable this trend to be statistically proven.

3 | 4 | 2

Euratom treaty

Chapter III of part II of the Euratom treaty deals with health protection as linked to ionising radiation. Articles 35 (implementation of means for checking the basic standards by the member states), 36 (information to the Commission on environmental radioactivity levels) and 37 (information to the Commission on planned effluent discharges) directly concern the impact of BNIs.

Pursuant to article 35, France agrees to verification by the European Commission. A verification within this context was conducted at the *La Hague* installation and the IRSN's laboratories in October 2005. The international team in charge of the verification brought to light no significant deviation and

The checks carried out at La Hague by the European Commission

underlined the quality of the supervisory system in place. The corresponding report is currently in the process of being published by the Commission.

3 | 4 | 3

The IAEA

In 2006, the International Atomic Energy Agency reactivated work aimed at creating a global database of nuclear installation discharges. ASN is contributing to this work.

3 | 5

Continued revision of discharges licences

Updating the discharge licences in line with the principles mentioned in point 3.1.3 on all the sites, requires continuation of the efforts that have been under way for a number of years now (55% of installations are currently regulated in full by measures implementing the above-mentioned decree 95-540). The improvements to be gained from implementation of these provisions are justification for continuation of this process.

Against this background, 13 dossiers are currently being reviewed (CEA: Saclay site, RJH, AGATE, MAGENTA, ILL, CENTRACO, GBII, EDF: Dampierre, Tricastin, Flamanville, Creys Malville, Penly, Chooz).

For the main licensees, the following progress has been made with regard to these procedures:
- EDF installations: at the request of ASN, EDF prepared a schedule for production of the licence renewal dossiers;
- CEA installations: the CEA centres are complex sites on which the facilities are usually under the control of different authorities: ASN for the BNIs, the Delegate for nuclear safety and radiation protection for defence-related activities and installations (DSND) and secret BNIs, the Regional Directorate for Industry, Research and the Environment (DRIRE) for the ICPEs located outside the BNI perimeters. For these centres, discharge licence renewal procedures are in progress and are being coordinated

between the various administrations. To make analysis of the dossiers easier and inform the public better, ASN asked CEA to produce a dossier for each centre enabling the overall environmental impact of the site's discharges to be assessed. 2006 in particular saw the publication of the orders regulating discharges from the Cadarache site. CEA also submitted applications for three new facilities on this site (AGATE, RJH and MAGENTA). 2006 was also an opportunity to begin the procedure concerning the Saclay site;

- fuel cycle and radioactive waste disposal installations: the site mainly concerned is that of La Hague, operated by COGEMA. This installation was regulated by an order of 10 January 2003 which stipulated that the licensee was required to submit certain studies into limitation of its discharges by 1 January 2006. These studies were submitted and led to new technical discharge rules, as laid down in the order of 8 January 2007.

4 MANAGEMENT OF RADIOACTIVE DISCHARGES FROM SMALL-SCALE NUCLEAR INSTALLATIONS

The Public Health Code requires that radioactive waste and effluent regulations for installations other than ICPEs or BNIs be stipulated in an order signed by the Ministers responsible for Health and the Environment. This is why ASN, together with the professionals handling radioactive sources and the administrations concerned, is drafting a text on this subject. The main requirements will be taken from the DGS/DHOS circular of 9 July 2001 concerning management of effluent and waste from health care activities contaminated by radionuclides. Problems with application of this circular by research and health professionals were mentioned, in particular during meetings on preparation of the national plan for management of radioactive materials and waste. A working group was set up to propose solutions for inclusion in the draft text on the management of radioactive waste and effluent. The professionals concerned and various stakeholders were consulted on this subject in 2006.

5 PREVENTING POLLUTION, RISKS AND DETRIMENTAL EFFECTS RESULTING FROM BNI OPERATION

5 | 1

Maintaining an appropriate regulatory framework

5 | 1 | 1

The order of 31 December 1999

The 13 June 2006 law on Transparency and Security in the Nuclear Field identifies three categories of installations within the perimeter of a BNI, depending on their use and the nature and scale of the risks they present:

- the BNI itself, according to the definition given in article 28 of the law;
- the equipment and installations required for its operation;

- the other installations entered on one of the lists specified in articles L. 214-2 (water) and L. 511-2 (ICPE) of the Environment Code.

Owing to the possible risks or drawbacks that the first two category of installations can entail for safety, health and public salubrity, or for protection of nature and the environment, they are subject to specific rules set by ministerial order.

The third category of installations remains subject to the requirements of the Environment Code. ASN is responsible for individual decisions and for supervision as specified in these requirements.

This requirement of the law enables the specific particularities of nuclear activities to be taken into account. It guarantees consistency between the rules applicable to BNIs and their equipment and those applicable to installations governed by common law, in particular with regard to prevention of pollution, detrimental effects and non-radioactive hazards.

The order of 31 December 1999 sets the general technical regulations designed to prevent and mitigate detrimental effects and off-site risks arising from BNI operations. It is supplemented by the texts specific to each installation. More particularly, and in addition to the onsite emergency rules (staff training, safety instructions, maintenance of installations, etc.), the order specifies objectives for protection against fire, lightning, noise, or the risks of accidental pollution of the environment (water and atmosphere).

5 | 1 | 2

Recent modifications

The order of 31 December 1999 led to progress in the way that detrimental effects and off-site risks resulting from BNI operations are dealt with. It represented an innovative breakthrough in 1999, and contained a number of intrinsic limits, concerning both the regulatory fields covered and the nature of its requirements.

The order of 31 January 2006 amending the order of 31 December 1999 led to adaptation of this order as follows:
- the procedures applying to fires were reformulated to concentrate on specific objectives;
- a special section was created for installations and equipment which do not significantly differ from classified installations and to which general rules can be applied;
- the possibility of calling in an expert third-party at the expense of the licensee was introduced;
- a system of waivers to the resource deployment obligations contained in the order was introduced in order to deal with certain particular situations, although the objectives to be reached naturally remain unchanged.

5 | 2

Taking account of the various risks

5 | 2 | 1

Prevention of water pollution

The order of 31 December 1999 sets measures designed to prevent or, in the event of an accident, to minimise direct or indirect release of toxic, radioactive, flammable, corrosive or explosive liquids into the natural environment and the sewers. It leads to:
- review of the design of storage, loading and unloading zones, with effective leak collection areas being required;
- implementation of an organisation able to deal with accidental spillage of liquids before they can transfer into the natural environment;

- installation of confinement tanks in particular for collecting and treating fire-fighting water.

Application of these measures by the licensees led to significant progress in preventing pollution. Pipeline routes and conditions were checked, as was the condition of retention areas. Resources and organisational measures for fighting water pollution were put in place and tested.

5 | 2 | 2

Noise protection

The order of 31 December 1999 sets acceptable limits for noise. It requires a check on compliance with the specified noise limits. Implementation of these provisions showed that in certain operating configurations, installations exceed the emergence levels specified in the order of 31 December 1999.

Within the specified time, EDF therefore presented studies into the noise generated by the installations for which it was the licensee. These studies led EDF to take steps to reduce the emergence generated by its installations. When reviewing these conformity dossiers, ASN noted that river weirs could be a significant contributory factor to the emergence generated by the sites. The characteristics of the noise created by these structures are in particular comparable to the noise created by the watercourse itself and are not therefore the cause of any additional detrimental effects. The above-mentioned modifying order of 31 January 2006 now excludes the noise generated by river weirs from the measurement of the emergence generated by the sites.

5 | 2 | 3

Protection against the microbiological risk (legionella, amoebae)

The presence of bacteria in the water is linked to the existence of the nutrients and minerals they need in order to grow. Temperature also plays an important role in their growth. Most natural surface water (lakes, rivers) naturally contain large amounts of bacteria. Some of these bacteria are pathogenic. This is particularly the case with legionella and amoebae such as Naegleria fowleri, for which particular measures are specified.

Micro-organisms can therefore be found inside the installations: sanitary installations (showers, taps, etc.), air-conditioning installations and cooling systems (cooling towers, industrial cooling circuits), ponds and fountains, spa waters and medical equipment producing aerosols.

a) Legionella

Legionnaire's disease is an infectious pathology caused by legionella bacteria. The germ responsible is a bacilli living in freshwater, for which the optimum proliferation temperature is between 35 and 40 °C. It can therefore be found in both natural and artificial aquatic environments. Transmission to man is exclusively as a result of inhaling contaminated water aerosols.

This bacterium can grow in all installations with characteristics that are favourable to the development of these micro-organisms:
- warm water between 25 and 45 °C;
- the presence of nutrients and elements essential for growth;
- an aerobic environment;
- the possible existence of hosts (amoebae, etc.).

Some industrial installations, particularly cooling towers, are therefore favourable to their development. In certain cases, these same installations can generate aerosols: cooling towers (TAR), washing with water sprays, etc.

The relationship between the level of contamination of the water from which the aerosol is produced, and the risk of legionnaire's disease has not yet been established. Given current knowledge, ASN considers that owing to the complexity and size of BNIs, if a system is contaminated, then it will remain so and there will be a risk. Curative treatment can therefore be nothing more than temporary.

The recent cases of legionnaire's disease in wet cooling towers led the Ministers for Health and the Environment to combine their efforts to improve prevention of the health risk linked to these installations, as part of the 2004-2008 (June 2004) legionella prevention plan.

Therefore, to be able to react appropriately to a possible outbreak of legionnaire's disease, the authorities defined the required organisation in circular DGS/DPPR/DGSNR/DRT/2006/213 of 15 May 2006 concerning how to organise the State's departments in the event of an outbreak of a cluster of cases of legionnaire's disease.

In the amendment to the order of 31 December 1999, ASN defined requirements for preventing and limiting the risk of legionella spreading. These requirements are comparable to those adopted for installations classified on environmental protection grounds. The characteristics of the cooling towers on PWR secondary system cooling systems justified the adoption of special measures. They are presented in chapter 12.

b) Amoebae

The Naegleria fowleri (NF) species of amoebae lives in small quantities in lakes and rivers. This thermophilic species develops primarily at temperatures of between 35 and 40 °C.

Stainless steel condensers in nuclear power plants have been identified as a favourable location for proliferation of NF amoebae. In order to limit their quantities in water to an acceptable threshold, EDF was obliged to treat its systems initially with bleach, and then with monochloramine (see chapter 12). Specific licences were issued to deal with releases linked to these treatments (see point 4|4|1).

5 | 2 | 4

Waste management

The order of 31 December 1999 sets the regulatory procedures for waste management, in particular the obligations with regard to collection and sorting of various categories of waste produced, conditions for interim storage and removal of waste, while ensuring consistency with plans and rules laid down by law, as well as requirements concerning traceability, specific and enhanced management of waste produced in nuclear waste zones and information to the public authorities concerning waste management.

To take account of the existence of radioactive and conventional waste within BNIs and ensure optimum management of it, the order states that the licensee must produce a waste management study, known as the "waste study". This stipulates the licensee's objectives in terms of reducing the volume and chemical, biological and radiological toxicity of the waste produced in its installations and of optimising waste management, with emphasis on reuse and treatment as opposed to final disposal, which is reserved for ultimate waste. The licensee defines the steps it employs in order to achieve these objectives.

The waste studies for the nuclear sites are one aspect of the drive for progress designed to promote improved management of the waste produced on the sites. In particular, the licensee of a nuclear site must control its waste inventory, minimise waste production, recycle and reuse the waste produced, insofar as this is technically and economically possible, and package the residual waste in the form of ultimate waste for disposal. These studies must lead to definition of a waste management framework which can be used for the statutory inspection.

ASN defined the precise requirements to be met by the nuclear licensees in drafting their waste studies and their annual waste inventories, in two instruction notes SD3-D-01 (Nuclear waste study drafting guide) and SD3-D-02 (Specifications for the nuclear installations annual waste inventory), available from the ASN's website.

The problem of waste management is described in greater detail in Chapter 16.

5 | 2 | 5

Prevention of the risk of fire

In its initial version, the order of 31 December 1999 came up against the problem of imposing objectives and resources with regard to preventing the risk of fire. The modification made by the order of 31 January 2006 is the result of the efforts of a working group chaired by ASN and involving IRSN, the DSND and representatives of the licensees. It specified objectives while leaving the choice of the relevant resources up to the licensee. This modification is accompanied by a guide dated 12 May 2006 and available on the ASN's website.

The approach is to restate the responsibility of the licensee, in particular in the definition of the means and organisation to be deployed. It should help it choose the best solution that is technically feasible and economically acceptable. The choices proposed by the licensee should in particular be based on the principle of defence in depth and guarantee a high level of installation safety with regard to the risk of fire.

5 | 2 | 6

Lightning, electrical installations, handling, operations

The order of 31 December 1999 sets requirements designed to prevent the effects of lightning and minimise the risks to electrical installations, handling and operations. For lightning, ASN contacted the DPPR and the DSND in order to monitor the work being done to amend the regulations applicable to ICPEs and secret BNIs. In line with this work, ASN will begin to review the indirect effects of lightning in installation protection systems.

5 | 2 | 7

Criticality, radiolysis

The order of 31 December 1999 sets requirements designed to limit the risk of a criticality accident and hydrogen explosion produced by radiolysis of radioactive materials. Radiolysis is the phenomenon leading to the dissociation of hydrogenated materials (such as plastic) under the effect of ionising radiation. The production of hydrogen in a closed container such as a waste package can in certain circumstances lead to an explosion.

5 | 3

Checking installations conformity

Considerable work has been done by the licensees to check installation conformity with the requirements of the order, to identify deviations, evaluate and implement the conformity work required or propose preventive measures such as to achieve a level equivalent to that of those requirements that cannot be met.

For its part, ASN analysed these requests before ruling on the licensees' proposals. As applicable, it set deadlines for conformity of the installations.

ASN also conducted spot-checks during the site inspections on the completeness and accuracy of the information provided in the dossiers. Among the topics checked as part of its annual programme of inspections, ASN:

- systematically reviews the following topics, in each BNI and at specified intervals: requirements of the order of 31 December 1999 concerning fire, environment, waste, external hazards including lightning;
- in a given year, specifically reviews particular subjects: the waste studies for laboratories and plants and implementation of the provisions concerning fire in PWRs were a priority topic in 2006.

On the basis of the checks it carried out, ASN estimates that most of the work to ensure conformity of the installations with the requirements of the 31 December 1999 order has been taken into account.

"Accidental pollution" exercise carried out during an inspection

6 LEARNING THE LESSONS FROM ENVIRONMENTAL EVENTS

Detecting and processing significant events play a key role in nuclear safety. As soon as an event occurs, the necessary countermeasures must be put in place along with appropriate experience feedback to prevent it from happening again. This first of all implies the existence of a reliable system for detecting events and distributing the relevant information. For some years now, the number of fields in which events must be declared has risen, particularly in the environmental field in accordance with the discharge orders or the order of 31 December 1999.

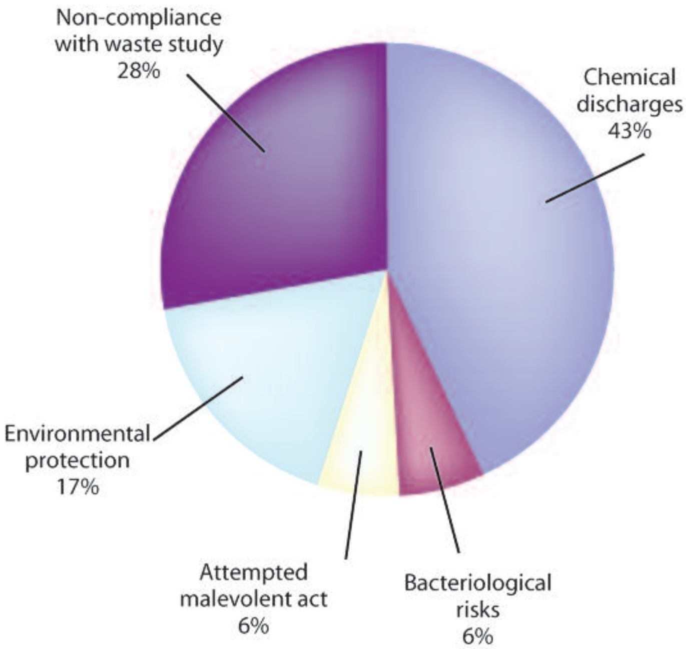
The significant events declaration guide of 21 October 2005 in particular defines declaration criteria for environmental events (see point 1|2|3 of chapter 4). These provisions were implemented as of 1 January 2006. In this document, significant environmental events are dealt with in the same way as those affecting installation safety, transport of nuclear materials or radiation protection. Nine declaration criteria were identified: releases of unauthorised chemical, radioactive or bacteriological materials inducing an impact, non-compliance with a technical or organisational requirement which could have had an impact, malicious or attempted malicious act, discovery of a polluted site, non-compliance with the waste study, etc.

This harmonisation of criteria contributed to achieving uniform declaration conditions and to ensuring that all available lessons are learned.

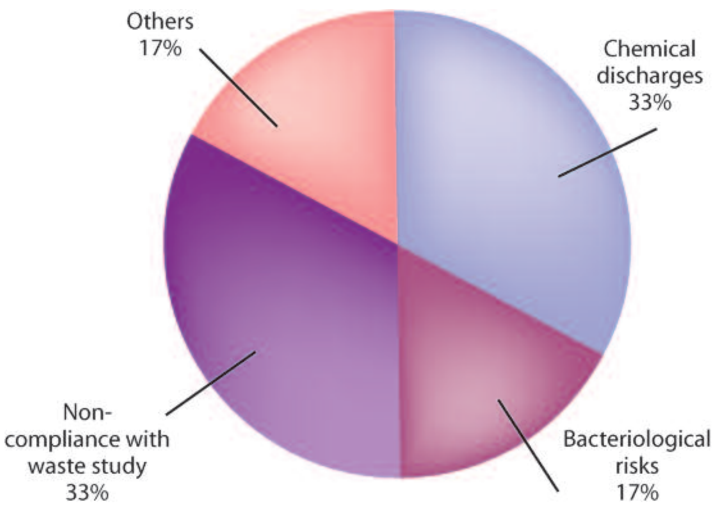
In 2006, 24 significant environmental events (including those relating to waste management) were declared by the licensees, as shown by the breakdown in the following graphics.

Significant environmental events

Nuclear power plants



Other installations



7 OUTLOOK

The law entrusts ASN with the role of carrying out a radiation protection watch. This in particular involves coordinating the work being done to monitor the radiological state of the nation. ASN aims to enhance information in this area.

In this context, ASN oversees the work to set up the national network of environmental radioactivity measurements. A web portal was opened this year: www.mesure-radioactivite.fr. but this is only the first step in the move towards publication of all environmental radioactivity measurements on the internet. ASN is working to ensure that all stakeholders can contribute to the national measurements network.

The need to obtain approval for measurement of environmental radioactivity, which is a counterpart to the national network, is gradually being assimilated by the laboratories. There is no doubt that gradual implementation over the past three years has led to improvements in their practices.

The work of the national environmental radioactivity measurement network steering committee showed that these measurements were many and varied in nature. The committee highlighted the need for efforts to clarify the objectives assigned to this supervisory action. Together with all the measurement stakeholders, ASN thus initiated a redefinition of the nationwide monitoring strategy.

In the same way as any other human activity, nuclear activities can have an effect on the environment. Ensuring that the licensees do all to ensure that this is as low as reasonably achievable is one of the ASN's duties. ASN therefore draws up rules applicable to discharges from these activities and checks the conditions in which they are applied. In particular with regard to basic nuclear installations, it supervises management not only of the radiological impact, but also of chemical, thermal or microbiological effects.

Sustained efforts devoted to supervision and the reduction of the impact of discharges from basic nuclear installations have led to significant falls in certain discharges. These falls mean that the spotlight is now turned more on discharges which in the past may have seemed to be of lesser importance. ASN aims to continue this movement, which will lead to the revision of a number of discharge licences in 2007.

ASN hopes to begin revising the order of 26 November 1999 concerning discharges from basic nuclear installations. This text defines the technical requirements to be guaranteed by the administration in the discharge licences. Its application has already led to a significant change in practices, especially with regard to the consideration given to chemical discharges. However, the lessons learned from implementation of this text show that it could be made even more efficient were the licensee to shoulder its full share of responsibility.

Finally, discharges and waste from small-scale nuclear activities (in particular hospitals) are also the subject of close scrutiny. This will in the short term lead to a decision to regulate them.

With regard to management of non-nuclear risks, much progress has been made by the licensees, particularly through implementation of the order of 31 December 1999. Even if some improvements are still required, what is important today is to ensure that the steps taken will be sustainable on a long-term basis.

Finally, ASN will ensure that the nuclear licensees correctly apply the revised criteria for declaring significant events within BNIs, particularly in the environmental field. This review will be conducted with the goal of maximising the lessons learned from experience.

CHAPTER 5
ENVIRONMENTAL PROTECTION