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CHAPTER 5

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.

In the field of environmental protection, the Nuclear Transparency and Security Act 2006-686 of 13 June 2006 (TSN Act) clarifies ASN's areas of competence:
– with regard to environmental monitoring, ASN organises a permanent radiation protection watch nationwide;
– with regard to regulation, it issues opinions on draft regulations concerning basic nuclear installations (BNI) and takes technical decisions concerning implementation of the regulations;
– with regard to licensing, it defines the provisions applicable to the installations. The decisions defining BNI discharge limits 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 three areas:
– limiting the dispersion of radioactive or chemical materials resulting from nuclear activities. This involves strict control of effluents discharges and waste management.
– preventing and limiting the detrimental effects and risks, resulting from BNI operation, for public health and safety or for the protection of nature and the environment.
– monitoring radioactivity in the environment, in particular to allow an assessment of the impact of the installations on public health and the environment.

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 the non-nuclear industries.

Finally, ASN ensures that the available information concerning the environment is accessible and shared. The creation of the national environmental radioactivity measurement network and of a common database containing all the radioactivity measurements taken by the approved laboratories will make a significant contribution to providing the public with reliable, centralised information.

1 MANAGING EFFLUENTS FROM NUCLEAR ACTIVITIES

In the same way as all other industries, nuclear activities (nuclear industry, nuclear medicine, research installations, etc.) generate by-products, which may or may not be radioactive, regardless of the efforts made in terms of prevention, recycling or re-use. These by-products can be treated before disposal as waste or, when their characteristics so allow, discharged into the environment in the form of effluents.

After efforts are made to reduce these by-products at source, the choice between effluents 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 effluents, as the complexity and cost of the processes used for containment 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.

ASN ensures that the licence application explains the choices the producer envisages making, in particular the necessary decisions between containment or dispersal of materials, and the decision to abandon certain reduction at source or treatment options for safety and radiation protection reasons.

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

The Loire river at Saint-Laurent-des-Eaux (Loir-et-Cher *département*): protecting the natural environment

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.

1 | 1 Regulating BNI discharges

1 | 1 | 1 Application review: an integrated procedure

Since the Nuclear Transparency and Security Act of 13 June 2006 and publication of decree 2007-1557 of 2 November 2007, the authorisation process specific to water intake and discharges stipulated in decree 95-440 of 4 May 1995 has been replaced. The new arrangement requires that the creation, final shutdown or decommissioning authorisations for basic nuclear installations, issued by decree, must adopt an integrated approach including all aspects of nuclear safety, radiation protection and environmental protection. These authorisation decrees are supplemented by individual requirements specified in ASN decisions. The requirements setting the discharge limits also have to be approved by the ministers responsible for nuclear safety (see chapter 3 concerning regulations).

1 | 1 | 2 Determination of limit values

The initial discharge limits were set on the basis of an impact lower than the health effect thresholds in force at the time.

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 0.641 GBq in 2007. This in particular means that the former regulatory limits are no longer representative of the current levels actually discharged.

ASN hopes that even though setting discharge limits values does indeed reflect the very slight health or environmental impact, it will also encourage the licensees to maintain their efforts to optimise and contain discharges. It therefore wants to see the discharge limits set as low as can be made achievable using the best available techniques. For several years, ASN has been reviewing the discharge limits to bring them closer to actual discharges, encouraging the licensees to maintain their efforts to optimise and control their discharges.

The lowering of the discharge limit values leads to a reduction by a factor given in the box below.

1 | 2 Continuing the revision of discharge requirements

Updating the discharge requirements in line with the principles mentioned above on all the sites, requires continuation of the efforts that have been under way for a number of years now (70% of installations are currently regulated in full by measures implementing the abovementioned decree 95-540 or the TSN Act of 13 June 2006). The improvements to be gained from implementation of these provisions are justification for continuation of this process.

The following files are therefore currently being reviewed: with regard to CEA: Saclay site BNIs, RJH, AGATE, MAGENTA installations on the Cadarache site; with regard to EDF: Civaux, Chooz, Cruas, Dampierre, Flamanville.

For the main licensees, the following progress has been made with regard to these procedures:

- EDF installations: at the request of ASN, EDF drew up a programme for requesting revision of the discharge requirements; in 2008, the discharge requirements for the Penly and Tricastin sites were renewed;
- CEA installations on the Saclay, Cadarache and Marcoule sites: these are complex sites on which the installations are usually regulated by different authorities (ASN for BNIs, Defence Nuclear Safety Authority (ASND) for secret BNIs, Regional Directorate for Industry, Research and the Environment (DRIRE) for installations classified on environmental protection grounds located outside a BNI perimeter). For these centres, procedures relating to discharges are in progress and are being coordinated by the various administrations concerned. To make it easier to analyse the files and improve public information, ASN asked CEA and the various licensees on the Marcoule site to draw up a file enabling assessment of the overall impact of the discharges on public health and the environment;
- fuel cycle installations operated by the AREVA group: the discharge limit values and/or the technical requirements concerning discharges from the La Hague and Pierrelatte installations were revised or issued in 2007: ministerial order of 8 January 2007 for the La Hague site, ASN decisions of 6 November 2007 and 4 December 2007 for the GBII, TU5, COMURHEX and SOCATRI installations on the Pierrelatte site.

Limit value reduction factors defined by the discharge orders or approved discharge decisions since 1995:

– for the 900 MWe nuclear power plant:		
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*

1|3 Regulating radioactive discharges from small-scale nuclear installations

The Public Health Code (Article R. 1333-12) states that the regulatory provisions for management of radioactive waste and effluents in installations other than ICPEs or BNIs must be specified in an ASN decision approved by the Minister responsible for health.

Discharges from medical installations were governed by the DGS/DHOS circular of 9 July 2001 concerning the management of effluents 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.

In 2007, ASN carried out a broad consultation with a view to drafting a regulatory text. This led to approval, by an order of 23 July 2008, of ASN decision 2008-DC-0095 of 29 January 2008 laying out the technical rules to be met for the disposal of effluents and waste contaminated or likely to be contaminated by radionuclides, as a result of a nuclear activity, thus implementing the provisions of Article R1333-12 of the Public Health Code.

1|4 The radiological impact of nuclear activities

Under 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 minimising the health impact of nuclear installations in normal operation is to prevent possible effects prejudicial to health associated with exposure to ionising radiations, however slight. This primarily concerns the cancer risk.

The licensee is required to assess the dosimetric impact of its activity. Depending on the case, this obligation arises from Article L. 1333-8 of the Public Health Code, or from the regulations concerning BNI discharges.

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

The impact is estimated in relation to one or more identified reference groups. These are homogeneous groups of individuals receiving the highest average dose from among the population exposed to a given installation according to realistic scenarios. This approach enables the total dose to be compared with the allowable annual dose limit for the public (1 mSv/year) defined in Article R. 1333-8 of the Public Health Code.

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 practice, only traces of artificial radioactivity are detectable in the vicinity of the nuclear installations. As soon as one moves away from the installation, the activity levels fall below the sensitivity threshold of the measuring instruments and cannot therefore be used for dose estimates. It then becomes necessary to use models of radioactivity transfer to man, fed by installation discharge measurement data. Nonetheless, programmes to monitor the radioactivity present in the environment (water, air, earth, milk, grass, agricultural produce, etc.) 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 3|4).

An estimation of the doses from BNIs is presented in table 1. This table constitutes a step towards complying with one of the recommendations expressed by IRRS: "ASN should consider inclusion of doses to the critical group from Basic Nuclear Installations in its Annual Report as well as descriptions of their meaning in terms of public health protection, and should assess the cause for differences between sites and different operational years". The doses presented are estimated by the licensees using methods that need to be harmonised. Some licensees for example overstate the impact of their site by taking the measuring instrument sensitivity threshold into account in their calculations. As this estimate was not required in the past, the data concerning certain years or certain sites are not available.

For each of the nuclear sites presented, the radiological impact remains far lower than one percent of 1 mSv per year. ASN is therefore of the opinion that in France, the discharges produced by the nuclear industry have an extremely small health impact.

Table 1: radiological impact of BNIs since 2002 calculated by the licensees on the basis of the actual discharges from the installations and for the most exposed reference groups (data provided by the nuclear licensees)

Licensee/Site	Most exposed reference group (population/distance from site in km)	Estimation of received doses, in mSv					
		2002	2003	2004	2005	2006	2007
AREVA/La Hague	Digulleville (Child/2.6) Fisherman, Goury (Adult/7.5)	1.10^{-2} 6.10^{-3}	1.10^{-2} 7.10^{-3}	1.10^{-2} 6.10^{-3}	1.10^{-2} 6.10^{-3}	1.10^{-2} 6.10^{-3}	1.10^{-2} 6.10^{-3}
EDF/Flamanville	La Berquerie (Adult/0.8)	3.10^{-3}	3.10^{-3}	3.10^{-3}	5.10^{-3}	5.10^{-3}	1.10^{-3}
CEA/Saclay	Fishermen, Christ de Saclay (Adult/1) Farmers, Christ de Saclay (Adult/1)	6.10^{-3} 3.10^{-3}	4.10^{-3} 1.10^{-3}	4.10^{-3} 7.10^{-4}	4.10^{-3} 5.10^{-4}	5.10^{-3} 5.10^{-4}	9.10^{-4} 4.10^{-4}
GANIL/Caen	IUT (Adult/0.6)	2.10^{-3}	2.10^{-3}	3.10^{-3}	2.10^{-3}	3.10^{-3}	$< 6.10^{-3}$
EDF/Cattenom	Garche nord (Adult/2.15)	2.10^{-3}	2.10^{-3}	2.10^{-3}	2.10^{-3}	3.10^{-3}	3.10^{-3}
EDF/Paluel	Le Tôt (Adult/1.45)	2.10^{-3}	2.10^{-3}	2.10^{-3}	2.10^{-3}	2.10^{-3}	2.10^{-3}
AREVA/Tricastin (Areva NC, Comurhex, Eurodif, Socatri)	Les Prés Guérinés (Adult (2005: child)/ 3 ; 3.1 ; 2.16 ; 1.3)3	3.10^{-3}	2.10^{-3}	2.10^{-3}	2.10^{-3}	1.10^{-3}	1.10^{-3}
EDF/Nogent-sur-Seine	Port Saint-Nicolas (Adult/2.25)	5.10^{-4}	5.10^{-4}	6.10^{-4}	7.10^{-4}	8.10^{-4}	9.10^{-4}
ANDRA/Manche	Hameau de La Fosse (Adult/2.5) Fisherman, Goury (Adult/8)	8.10^{-4} 2.10^{-7}	9.10^{-4} 6.10^{-8}	9.10^{-4} 7.10^{-8}	8.10^{-4} 7.10^{-7}	8.10^{-4} 8.10^{-8}	7.10^{-4} 9.10^{-8}
EDF/Penly	Saint-Martin Plage (Adult/1.05)	9.10^{-4}	4.10^{-3}	1.10^{-3}	9.10^{-4}	5.10^{-4}	6.10^{-4}
CEA/Marcoule (Atalante, Centraco, Phénix, Mélox, Cis-Bio)	Codolet (Adult/2)	3.10^{-4}	4.10^{-4}	4.10^{-4}	4.10^{-4}	4.10^{-4}	5.10^{-4}
EDF/Golfech	Pascalet (Adult/0.85)	2.10^{-4}	2.10^{-4}	2.10^{-4}	2.10^{-4}	2.10^{-4}	5.10^{-4}
EDF/Blayais	Le Bastion (Adult/1.1)	6.10^{-5}	3.10^{-4}	3.10^{-4}	4.10^{-4}	4.10^{-4}	4.10^{-4}
EDF/Gravelines	Petit-Fort-Philippe (Adult/1.45)	6.10^{-5}	5.10^{-5}	2.10^{-4}	2.10^{-4}	3.10^{-4}	3.10^{-4}
EDF/Chinon	Le Neman (Adult/1.25)	6.10^{-5}	2.10^{-4}	3.10^{-4}	3.10^{-4}	3.10^{-4}	2.10^{-4}
EDF/Belleville-sur-Loire	Neuvy-sur-Loire (Adult/1.3)	2.10^{-4}	2.10^{-4}	2.10^{-4}	2.10^{-4}	2.10^{-4}	2.10^{-4}
EDF/St-Laurent-des-Eaux	Port au Vin (Adult/0.7)	9.10^{-5}	2.10^{-4}	7.10^{-5}	7.10^{-5}	9.10^{-5}	2.10^{-4}
CEA/Cadarache	Saint-Paul-Lez-Durance (Adult/2)	8.10^{-3}	8.10^{-3}	8.10^{-3}	8.10^{-3}	3.10^{-4}	8.10^{-5}
EDF/Cruas-Meysse	Ferme de Grimaud (Adult/1.25)	4.10^{-5}	6.10^{-5}	2.10^{-4}	2.10^{-4}	2.10^{-4}	8.10^{-5}
EDF/St-Alban	Les Crès (Adult/1.45)	8.10^{-5}	9.10^{-5}	9.10^{-5}	2.10^{-4}	2.10^{-4}	7.10^{-5}
EDF/Tricastin	Clos du Bonneau (Adult/1.25)	9.10^{-5}	2.10^{-5}	7.10^{-5}	7.10^{-5}	6.10^{-5}	7.10^{-5}
EDF/Creys Malville	Ferme de Chancillon (Adult/0.85)	*	*	*	*	*	1.10^{-5}
CEA/Fontenay-aux-Roses	Fontenay-aux-Roses (Child/1.5)	2.10^{-5}	2.10^{-5}	2.10^{-5}	2.10^{-5}	2.10^{-5}	9.10^{-6}
ANDRA/CSA	Pont du CD24 (Child/2.1)	5.10^{-6}	8.10^{-5}	8.10^{-6}	6.10^{-6}	5.10^{-6}	3.10^{-6}
CEA/Grenoble	Fontaine (gaseous discharges); Saint-Egrève (liquid discharges) (Baby (2003, 2004: adult)/1; 1.4) Saint-Egrève (liquid and gaseous discharges) (Baby (2004,2007: adult) / 1.4; 3.9)	3.10^{-6} 2.10^{-6}	2.10^{-5} 2.10^{-6}	7.10^{-6} 3.10^{-6}	7.10^{-7} 4.10^{-7}	2.10^{-6} 8.10^{-7}	7.10^{-7} 3.10^{-7}

* Information not supplied by the licensees.

Source: Annual reports from the licensees concerned when this is required by the discharge licenses (data rounded up to the higher unit).

1 | 5 The other impacts of discharges

1 | 5 | 1 The impact of installation chemical discharges

The radioactive materials emitted can also have an impact on the environment and the population owing to their chemical characteristics. This is for example the case of uranium, which is included in the toxic substances registry because of its chemical properties.

Basic Nuclear Installations also discharge chemicals with no radiological properties but which are used in industrial processes.

ASN considers that in this respect, BNIs should be regulated in the same way as other industrial installations.

Through an integrated approach placing the issues of safety, radiation protection and protection of the environment on an equal footing, the TSN Act now enables the environmental impact of chemical effluents discharges to be fully taken into account. This integrated approach is little used abroad, where chemical discharges are often regulated by an authority different from that in charge of radiological matters.

ASN hopes that, in the same way as for radioactive materials, discharges of chemicals and their impact on populations and the environment will be as low as possible, on the one hand through the use of the best available techniques and on the other through a process of continual progress with periodic review of the operating conditions and discharge limit values.

1 | 5 | 2 The impact of BNI thermal discharges

Some BNIs, in particular the nuclear power plants operated by EDF and the EURODIF facility on the Pierrelatte site, discharge cooling water effluents, 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.

The chemical and radiological toxicity of uranium

Uranium is a metal that occurs naturally in the environment. Its chemical symbol is U. It can be found in variable quantities in rocks, water, air, plants, animals and humans. For example, there are 1 to 2 mg of uranium per kg of soil, a few nanograms per litre to a few micrograms per litre of uranium in surface water and sometimes far more in certain mineral waters, with levels of up to several tens of micrograms per litre.

Natural uranium takes the form of a mixture of three radioactive isotopes: U-238 (99.3% by mass), U-235 (0.72%) and U-234 (0.0055%). Uranium 235 is the only naturally fissile element. This property is used by nuclear power plants to produce energy.

The toxicity of uranium is related to its chemical and radiological properties.

The chemical toxicity of uranium is comparable to that of other heavy metals. Chemical toxicity is the primary concern for uranium with a U-235 enrichment of less than 7%. Although the entire organism would seem to be potentially affected by the toxicity of uranium, the kidneys are particularly susceptible to the harmful effects. The WHO recommends a guideline value of 15 µg/l for drinking water, based on the chemical toxicity of uranium rather than on its radiological toxicity.

The radiological toxicity of uranium is linked to the isotopic composition of the compound and its specific activity. The absorbed effective doses following the ingestion of one gram of uranium of different compositions are as follows:
– natural uranium: 1.18 mSv
– uranium 3.5% enriched with U-235: 4.1 mSv

For one gram of uranium ingested, the concentration in the kidney is 3.7 µg/g and the equivalent dose received by this organ is 6.8 mSv. The corresponding radiological risk remains slight compared with the risk of the appearance of acute kidney toxicity.

Source: IRSN information note

ASN inspectors collecting samples at the Gravelines plant (Nord *département*) – July 2007

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 thus subject to regulation.

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 installation.

The measures taken following the 2003 heat wave and drought meant that the 2005 drought episode was dealt with in good conditions, in particular ensuring full compliance with the discharge licences applicable. The summer of 2008 did not lead to any severe low-water situations or any very high temperatures in the watercourses concerned by the BNIs.

1 | 6 Monitoring discharges

1 | 6 | 1 Discharge surveillance

Surveillance of discharges from an installation is essentially the responsibility of the licensee. The provisions regulating discharges stipulate the minimum checks that the licensee is required to carry out. These checks in particular concern effluents (monitoring of discharge activity, characterisation of certain types of effluents prior to discharge, etc.). They also contain provisions for monitoring in the environment (checks at mid-discharge, sampling of air, milk, grass, etc.). Finally, related parameters must also be measured whenever necessary (in particular meteorology).

The results of the regulatory measurements must be stored in registers which, in the case of BNIs, are forwarded on a monthly basis to ASN, which checks them.

BNI licensees are also required regularly to transmit a number of discharge samples to an independent laboratory for analysis. The results of these "cross-checks" are communicated to ASN. The cross-check programme, specified by ASN, is designed to bolster the conviction that the results obtained by the licensees are in fact accurate. 2008 saw formal confirmation of the cross-check programmes on most of the installations.

Finally, ASN uses a system of unannounced inspections to ensure that the licensees abide by the regulations. During the course of these inspections, inspectors – assisted when necessary by technicians from a specialised, independent laboratory – check compliance with the regulation requirements, take samples from the effluents or the environment, and have them analysed by this laboratory. Since 2000, ASN has carried out 10 to 30 inspections - with sampling - every year (19 in 2008).

With regard to the measurements:

– The decision threshold (SD) is the value above which the measurement technique guarantees that a radionuclide is present.

– The detection limit (LD) is the value above which the measurement technique gives a reliable result.

In practice LD ≈ 2 x SD

1 | 6 | 2 Accounting of BNI discharges

The lowering of the activity level of the radioactive effluents discharged by BNIs, the changes made 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 change the radioactive discharge accounting rules in 2002.

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;
- compulsory detection limits are defined for each type of measurement;
- for each BNI and for each type of effluents, 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 operating experience feedback from the analyses carried out. When the activity is lower than the decision threshold, then the latter value is used;
- other radionuclides, which are occasionally present, are considered if their activity concentration is higher than the decision threshold.

These rules are now applied in all nuclear power plants and in most laboratories and 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. Other countries around the world use different accounting methods. This diversity makes it difficult to compare the results published by the various national authorities.

Quality of measurement is a precondition if the results obtained and published are to be conclusive. The desire to improve this quality has led ASN to set up a system for approval of laboratories measuring radioactivity in the environment. Complex tests were organised and have without doubt improved practices. In the field of effluents measurement, in view of the shortcomings in the available body of standards, ASN supported the creation of a working group by the nuclear equipment standardisation office (BNEN). This programme will eventually produce a set of high-quality methods that are standardised and therefore comparable.

1 | 7 Joining an international movement

1 | 7 | 1 "Oslo-Paris" or OSPAR Convention

France has ratified the OSPAR international convention which entered into force on 25 March 1998. This convention supersedes and updates the previous Oslo and Paris conventions. The work done under the convention is

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, ^{110}mAg, ^{123}mTe, ^{124}Sb, ^{125}Sb, ^{134}Cs, ^{137}Cs.
- *Gases:*
  - ^{3}H,
  - ^{14}C,
  - *Rare gases:*
    - *ventilation (permanent discharges):* ^{133}Xe, ^{135}Xe
    - *"RS" tank drainage:* ^{85}Kr, ^{131}mXe, ^{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.

managed by the OSPAR Commission, which consists of representatives of the governments of the 15 contracting Parties and the European Commission, representing the European Union.

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.

Implementation of the OSPAR strategy for radioactive materials is periodically assessed. The first and second assessment reports, concerning discharge of effluents and concentrations in the environment respectively, were adopted in 2006 and 2007. These assessments were supplemented by two other reports adopted in 2008, one on statistical methods and the other on the impact on marine biotopes. France coordinated the drafting of these reports through a number of small working groups.

In 2008, ASN also took part in the small working groups set up to prepare the next ministerial meeting in 2010 and the third periodic evaluation report. For this latter report, ASN proposed a case study about the use of the best available techniques and the reduction of effluents discharges, reflecting application of the OSPAR strategy in French regulations and its application to the fuel reprocessing plant at La Hague.

OSPAR zone: 15 countries committed to reducing chemical and radiological discharges

1|7|2 The Euratom Treaty

The EURATOM Treaty was signed in 1957 and entered into force in 1958, at a time of energy deficit. Its aim was to allow the development of nuclear power while protecting the population and workers against the harmful effects of ionising radiations.

Chapter III of part II of the Euratom treaty deals with health protection as linked to ionising radiations.

Articles 35 (implementation of means for checking compliance with the basic standards by the member states), 36 (information to the Commission on environmental radioactivity levels) and 37 (information to the Commission on planned effluents discharges) deal with the issues of discharges and environmental protection.

Decree 2007-1557 of 2 November 2007 concerning BNIs, incorporated the obligations regarding information of the European Commission about effluents discharge projects. It is now in particular impossible, before the Commission has given its opinion, to issue the authorisation decrees for the creation of new installations and for final shutdown when, following final shutdown, the installation is likely to discharge radioactive effluents into the environment at levels higher than those discharged before final shutdown.

In 2008, the Flamanville EPR and Cadarache RJH files were presented to the "Article 37" European experts responsible for issuing an opinion on the files transmitted to the Commission by the member States.

1|7|3 IAEA

In 2006, the International Atomic Energy Agency reactivated work on the creation of a worldwide database of radioactive discharges, regardless of the type of radionuclides discharged (natural or artificial) and their origin (nuclear installations, laboratories and miscellaneous industries, medical installations and so on). This was an opportunity for ASN to contribute to this work, calling the participants' attention to the problems with interpreting a database such as this, given the diversity of practices used by the various parties concerned in obtaining their discharge summaries. ASN has so far transmitted the BNI discharge summaries for the period 2002 to 2007.

2 PREVENTING ACCIDENTAL POLLUTION, RISKS AND DETRIMENTAL EFFECTS, RESULTING FROM BNI OPERATION

2|1 Maintaining appropriate legal and regulatory requirements

The TSN Act identifies three distinct categories of installations present within the perimeter of a BNI, according to their use and the nature and scale of the risks they create:
- the BNI itself, according to the definition given in Article 28 of the act;
- 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.

The installations in the first two categories are bound by specific rules covering public health and safety as well as protection of nature and the environment. The general technical regulations that apply to them are defined by orders from the ministers responsible for nuclear safety, clarified by ASN general decisions (ministerial order of 31 December 1999: see chapter 3). Each installation is also subject to individual requirements defined by ASN.

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

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

2|2 Taking account of the various risks

2|2|1 Prevention of accidental 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 led 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 containment tanks in particular for collecting and treating fire-fighting water.

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

Exercice on the subject of "accidental pollution" carried out during an ASN inspection

2|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. During the review of these conformity alignment files, it became apparent that river weirs made a significant contribution to the emergence levels on a site, even though they were not initially targeted by the regulations. To clarify this point, the decision was taken in the amending order of 31 January 2006 to explicitly exclude the noise produced by these works from emergence measurements.

2|2|3 Protection against the microbiological risk (legionella, amoebae)

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.

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.

Micro-organisms can therefore be found inside various 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.

Legionella

Legionnaire's disease is an infectious pathology caused by legionella bacteria. The germ responsible is a bacillus living in freshwater, for which the optimum proliferation temperature is between 35 and 40 °C. It can be found in all natural or 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 conducive to the development of these micro-organisms:
– warm water between 25 and 45 °C;
– the presence of nutrients and elements essential for growth;

Cooling towers of the Nogent-sur-Seine nuclear power plant: the aerosols are liable to contain legionella

– 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, 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 will therefore be of only temporary effectiveness and will need to be regularly repeated.

Cases of legionnaire's disease linked to wet cooling towers led the ministers responsible 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 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 government departments in the event of an outbreak of a cluster of cases of legionnaire's disease.

The requirements concerning prevention and limitation of the risk of the spread of legionnaire's disease, which were enhanced with the modification of the 31 December 1999 order, are similar to those adopted for installations classified on environmental protection grounds, while taking account of the specific characteristics of basic nuclear installations. The characteristics of the cooling towers on PWR secondary system cooling systems justified the adoption of special measures. They are presented in chapter 12.

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.

2 | 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 the 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. Decree 2007-1557 now requires the transmission of a first version of the waste study before the commissioning authorisation.

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.

Waste management issues are described in greater detail in Chapter 16.

2 | 2 | 5 Checking installation conformity

Considerable work has been done by the licensees to check installation conformity with the requirements of the order of 31 December 1999, to identify deviations, evaluate and implement the conformity work required or, if requirements cannot be met, propose preventive measures in order to achieve the same level of safety.

ASN for its part analysed these 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 files.

As part of its annual programme of inspections and among the range of topics inspected, ASN systematically looks at the following aspects in each BNI, according to a predetermined frequency: requirements of the order of 31 December 1999, fire, environment, waste, external hazards including lightning.

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.

3 MONITORING ENVIRONMENTAL RADIOACTIVITY

Within a European regulatory context, the required monitoring of the environment is in particular based on:
- surveillance around the nuclear installations by the licensees in accordance with the terms of their discharge licences;
- monitoring of environmental radioactivity by the Institute for Radiation Protection and Nuclear Safety (IRSN);
- the national network for environmental radioactivity measurement, the particular aim of which is to collate the environmental measurements taken nationwide as required by the regulations. The quality of these measurements is guaranteed by an approval procedure for the laboratories taking them.

3 | 1 European context

Article 35 of the Treaty requires the member States to set up permanent installations for monitoring radioactivity in the atmosphere, water and soil, in order to guarantee compliance with the basic standards of health protection for the population and workers against ionising radiation risks.

All member States, whether or not they have nuclear installations, are therefore required to implement environmental monitoring arrangements throughout their territory.

Meeting of the High Committee for Transparency and Information on Nuclear Security, to look at the incident in the SOCATRI plant

Following the incident on 7 July 2008 on the site of the SOCATRI plant in Bollène (see chapter 14, point 3|3 concerning the event itself and chapter 6, point 1|5|1 concerning press relations), The Minister for Ecology, Energy, Sustainable Development and Spatial Planning sent a letter to the High Committee for Transparency and Information on Nuclear Security (HCTISN) asking it for its opinion on:
– the radioecological monitoring of all the nuclear sites;
– management of the former radioactive waste storage sites.

During its session of 23 September 2008, ASN presented two reports on these two subjects, which can be consulted on the websites of ASN and the High Committee (http://www.hctisn.fr/).

Based on the contributions from the various parties, the High Committee submitted its opinion to the minister on 6 November 2008.

With regard to the radioecological condition of the nuclear sites, the High Committee noted that:
"According to the summary reports presented by ASN, ASND and IRSN (...), the radioecological condition of the groundwater under and around the nuclear sites poses no significant environmental or health problems, in other words, such as would require particular precautions to be taken for those in the vicinity or the public at large.
This overall assessment is clarified by a description of the radiological markers identified in the environment of a certain number of nuclear sites.
These markers are mostly linked to former activities, at a time when there was less awareness of environmental concerns and standards were less strict, or to isolated operating incidents. In a few cases, it is impossible to rule out the continuous input of radioactive substances compounding this already existing pollution.
The condition of the groundwater and surface water around the nuclear sites is today generally well-known. The identified pollution or contamination has been the subject of enhanced surveillance for a long time and, if necessary, of investigation and action designed to prevent it spreading or to eliminate it. This is particularly the case on the following sites (mentioned in the reports by ASN, ASND and IRSN): La Hague (ANDRA-AREVA), Marcoule (CEA), Saclay (CEA), Tricastin (AREVA), Veurey-Voroize (SICN), Valduc (CEA), Bruyères-le-Châtel (CEA)."

Moreover, given that diversified expertise is a guarantee of credibility, ASN suggested to the High Committee that it focus on being able to develop a diversified range of expertise for provision to the various stakeholders, in particular the local information committees (CLIs). ASN also invited the High Committee to take part in the task on which it has been working for several months with a view to creating an index for measuring radioactivity in the environment. These proposals were adopted by the High Committee, which, in its report to the minister, made 18 recommendations for improved information, enhanced transparency and greater discussion with the stakeholders.

By virtue of the provisions of this same Article 35, the European Commission also has the right of access to these monitoring installations, in order to check their operation and effectiveness.

Following these checks, the European Commission issues an opinion on the resources put in place by the member States for monitoring of:
– radioactive liquid and gaseous discharges into the environment;
– the levels of radioactivity in the land and aquatic environment around nuclear sites and nationwide.

It in particular gives its opinion on:
– the operation of the measuring instruments;
– the representativeness of the samples and the sampling methods;
– the relevance of the analytical methods:
– management and archival of results;
– reports and procedures;
– quality control of the measurements.

Since 1994, the Commission has carried out the following inspections:
– the La Hague reprocessing plant and ANDRA's Manche repository in 1996;
– Chooz nuclear power plant in 1999;
– Belleville-sur-Loire nuclear power plant in 1994 and 2003;
– the La Hague reprocessing plant in 2005.

From 26 to 30 May 2008, the European Commission visited the Pierrelatte site in order to verify the monitoring arrangements adopted by the EURODIF installation.

The international team in charge of the verification brought to light no significant deviation and underlined the quality of the monitoring system in place. It concluded that France was compliant with the provisions of Article 35 of the EURATOM Treaty.

The conclusions of this verification will be available on the European Commission's website (http://ec.europa.eu).

3 | 2 Environmental monitoring by the licensees

3 | 2 | 1 The purpose of environmental monitoring

Generally speaking, the regulations concerning environmental monitoring are linked to the authorisations or the individual stipulations regarding water intake and effluents discharge by the installations. When the BNI generates no effluents discharge, monitoring may nonetheless be required. This is particularly the case of irradiation installations, for which the environmental monitoring requirements were included in the installation authorisation decree.

The licensees are responsible for environmental monitoring around their nuclear sites, pursuant to the individual requirements defining the measurements to be taken and the measurement intervals (authorisation decree, discharge license, or ASN decisions) and in accordance with any additional steps that may be taken by the licensees for their own monitoring purposes.

This environmental monitoring:
- gives a picture of the condition of the environment through measurement of regulated parameters and substances, whether or not radioactive, in the various compartments of the environment (air, water, soil) as well as in the various biotopes and the food chain (milk, vegetables, etc.): a zero reference point is identified before the creation of the installation and environmental monitoring enables any changes to be tracked;
- verifies that there are no emissions of unauthorised substances;
- assesses the installation's impact on public health and the environment in relation to the impact assessment and verifies that it remains below the impact defined by modelling;
- triggers an alert in the event of any problems on the installation, including by means of checks on groundwater.

3 | 2 | 2 Content of requirements

Virtually all nuclear sites in France carry out systematic environmental monitoring. The nature of this monitoring is proportional to the potential environmental risks or drawbacks of the installation, as presented in the authorisation file, particularly the impact assessment.

The regulatory monitoring of the BNI environment is tailored to each type of installation, depending on whether it is a power reactor, a plant or a laboratory. The nature of the environmental monitoring associated with liquid discharges, which must be stipulated in the authorisation order, is defined in Articles 14, 22 and 23 of the ministerial order of 26 November 1999.

To bring it into line with the progress achieved through the 13 June 2006 Act, ASN has initiated an update of the general technical regulations applicable to BNIs.

In accordance with these regulations, the principle of radiological monitoring of the environment can be summarised as shown in table 2.

When several installations (BNI or not) are present on the same site, monitoring may be common to all of these

Inspection by the European Commission on the EURODIF site in Pierrelatte (Drôme *département*) – May 2008

Table 2: principle of environmental radiological monitoring

Environment monitored or type of inspection	Nuclear power plant	Laboratory or plant
Air at ground level	• 4 stations continuously sampling atmospheric dust on a fixed filter, with daily measurements of the total β activity (βG). γ spectrometry if βG > 2 mBq/m^3. • 1 continuous sampling under the prevailing winds with weekly tritium measurement (^{3}H)	
Ambient γ radiation	• 4 detectors at 1 km with continuous measurement (ranging from 10 nGy/h to 10 Gy/h) and recording • 10 integrating dosimeters at the site limits (monthly recording) • 4 detectors at 5 km with continuous measurement (ranging from 10 nGy/h to 0.5 Gy/h)	• 4 detectors with continuous measurement and recording • 10 integrating dosimeters at the site limits (monthly recording)
Rain	• 1 station under the prevailing wind (monthly collector) with measurement of βG and ^{3}H on a monthly mixture	• 2 continuous sampling stations including one under the prevailing wind with weekly measurement of βG and ^{3}H
Liquid discharge receiving environment	• Sampling in the river upstream and at mid-discharge, for each discharge (riverside plant) or sampling after dilution in the cooling water and bi-monthly sampling at sea (coastal plant): Measurement of βG, of potassium (K) Continuous sampling of ^{3}H (daily average mixture) • Annual sampling in sediments, aquatic fauna and flora with measurement of βG, K and ^{3}H (γ spectrometry)	• At least weekly sampling of water in the receiving environment with measurement of the total α activity, βG, K and ^{3}H • Annual sampling in sediments, aquatic fauna and flora for γ spectrometry
Groundwater	• 5 sampling points (monthly check) with measurement of βG, K and ^{3}H	• 5 sampling points (monthly check) with measurement of βG, K and ^{3}H • Measurement of total α activity
Soil	• 1 annual sample of topsoil with γ spectrometry	
Plants	• 2 grass sampling points (monthly check) with measurement of βG, K and γ spectrometry. Measurement of carbon 14 (^{14}C) and total carbon (quarterly) • Annual campaign on the main agricultural produce, with measurement of βG, K, ^{14}C and total carbon, and γ spectrometry.	• 4 grass sampling points (monthly check) • Annual campaign on the main agricultural produce, with measurement of βG, K, ^{14}C and total carbon, and γ spectrometry
Milk	• 2 sampling points (monthly check) with measurement of βG activity (except 40K), K and annually ^{14}C	• 1 sampling point (monthly check) with measurement of βG activity and γ spectrometry (+ ^{3}H and ^{14}C periodically)

βG = βGlobal

installations, as was for example the case on the Cadarache and Pierrelatte sites, starting in 2006.

These monitoring principles are supplemented in the individual requirements applicable to the installations by surveillance measures specific to the risks inherent in the industrial processes they use.

The licensees thus carry out nearly 200,000 measurements in all compartments of the environment, every year.

3|3 Environmental monitoring nationwide

IRSN carries out environmental monitoring through a measurement and sampling network dedicated to:

– air monitoring (aerosols, rainwater, ambient gamma activity);
– monitoring of surface water (water courses) and groundwater (aquifers);
– monitoring of the human food chain (milk, cereals, food intake);

– terrestrial continental monitoring (reference stations located far from all industrial installations).

It uses two approaches for this:

– continuous on-site monitoring using independent systems (remote-monitoring networks) providing real-time transmission of results. This includes:
  • the Téléray network (ambient gamma radioactivity of the air) which uses about 180 measurement detectors;
  • the Sara network (radioactivity in atmospheric aerosols);
  • the Hydrotéléray network (monitoring of the main water courses downstream of all nuclear installations, before they cross national boundaries);
  • the Téléhydro network (monitoring of waste water in the sewerage treatment plants in the main French cities);
– processing and measurement in the laboratory of samples taken from the various compartments of the environment, whether or not close to installations liable to discharge radionuclides.

Every year, IRSN takes more than 50,000 measurements in all compartments of the environment (excluding the remote-measurement networks).

Téléray surveillance network: monitor continuously measuring ambient gamma radioactivity in the air

3 | 4 Maintaining the quality of environmental measurements

Articles R.1333-11 and R.1333-11-1 of the Public Health Code make provision for the creation of a national network of environmental radioactivity measurements and a procedure for having the radioactivity measurement laboratories approved by ASN.

This network is being deployed for two main reasons:

– to ensure the transparency of information on environmental radioactivity by providing the public with the environmental radioactivity monitoring results and information on the health impacts of nuclear activities in France;
– to implement a quality policy in the field of environmental radioactivity measurements, by creating a laboratory approval system through an ASN decision, pursuant to Article 4-2 of the 13 June 2006 Nuclear Transparency and Security Act.

The approvals cover all components of the environment, water, soils or sediments, all biological matrices (fauna, flora, milk), aerosols and atmospheric gases. The measurements concern the main artificial or natural, gamma, beta or alpha emitting radionuclides, as well as the ambient gamma dosimetry (see approval chart below).

In total, about fifty types of measurements can be covered by an approval. There are a comparable number of inter-laboratory comparison tests. These tests are organised by IRSN according to a 5-year cycle, which corresponds to the maximum approval validity period.

3 | 4 | 1 A new procedure for laboratory approval

ASN decision 2008-DC-0099 of 29 April 2008, confirmed by the order of 8 July 2008, specifies the organisation of the national network and sets new approval arrangements for the environmental radioactivity measurement laboratories. This ASN decision, which replaced the ministerial order of 27 June 2005, takes account of changes to the Public Health Code (decree n° 2007-1582 of 7 November 2007), the ASN prerogatives defined by Act 2006-686 of 13 June 2006, and the operating experience feedback acquired since 2003.

The approval procedure in particular includes:

– presentation of an application file by the laboratory concerned, after participation in an inter-laboratory test (EIL);
– review of it by ASN;
– review of the application files by a pluralistic approval commission which issues an opinion on anonymous files.

The laboratories are approved by ASN decision, published in its Official Bulletin.

This decision in particular states that the licensees of BNIs must have the required environmental radioactivity monitoring measurements taken by approved laboratories.

3 | 4 | 2 The approval commission

The approval commission is the body which, within the national network for environmental radioactivity measurements, is tasked with ensuring that the measurement laboratories have adequate organisational and technical competence to provide the network with quality measurement results. The commission is responsible for forwarding to ASN its proposed approval, refusal or suspension of approval. It decides on the basis of an application file presented by the candidate laboratory and the results of the inter-laboratory tests organised by IRSN.

Article 21 of ratified ASN decision 2008-DC-0099 of 29 April 2008 defines the composition of the approval commission, the procedures for appointment of the commission's members and how the commission works. ASN decision 2008-DC-0117 of 4 November 2008, constituting appointment to the environmental radioactivity measurement laboratories approval commission, renewed the mandates of the commission's members for a further 5 years.

3 | 4 | 3 Approval conditions

Laboratories seeking approval must set up an organisation meeting the requirements of standard EN ISO/CEI 17025 concerning the general requirements for the competence of calibration and test laboratories.

In order to demonstrate their technical competence, they must take part in inter-laboratory tests (EIL) organised by IRSN. The EIL programme, which now operates on a five-yearly basis, is updated annually. It is reviewed by the approval commission and published on the national network's website (www.mesure-radioactivite.fr).

Table 3: approval chart and scheduled five-year programme of inter-laboratory tests

		Type 1		Type 2		Type 3		Type 4		Type 5		Type 6	
Code	Radioactive measurements category	Water		Soil matrices		Biological matrices		Aerosols on filter		Gas air		Ambient environment (soil/air)	
.. -01	Radionucléides émetteurs γ > 100 keV	1	1_01	1	2_01	1	3_01	2	4_01	1	5_01		-
.. -02	Radionucléides émetteurs γ < 100 keV	1	1_02	1	2_02	1	3_02		4_02	1	5_02		-
.. - 03	Alpha global	1 2	1_03		-		-	2	4_03		-		-
.. -04	Bêta global	1 2	1_04		-		-	2	4_04		-		-
.. -05	H-3	1 2	1_05		2_05	2	3_05		-	1	5_05		-
.. -06	C-14	1	1_06		2_06	2	3_06		-	1	5_06		-
.. -07	Sr-90/Y-90	1	1_07	2	2_07	2	3_07	2	4_07		-		-
.. -08	Autres émetteurs bêta purs (Ni-63, Tc99,...)	2	1_08	2	2_08	1	3_08		-		-		-
.. -09	U isotopique	1	1_09	1	2_09	1	3_09	2	4_09		-		-
.. -10	Th isotopique		1_10	1	2_10	?	3_10		4_10		-		-
.. -11	Ra-226 + desc.	1	1_11	1	2_11	1	3_11		-	Rn 222: 5_11			-
.. -12	Ra-228 + desc.	1	1_12	1	2_12	?	2_12		-	Rn 220: 5_12			-
.. -13	Isotopes Pu, Am, (Cm, Np)	2	1_13	2	2_13	1	3_13	2	4_13		-		-
.. -14	Gaz halogénés		-		-		-		-	1	5_14		-
.. -15	Gaz rares		-		-		-		-	?	5_15		-
.. -16	Dosimétrie gamma		-		-		-	2	-		-	2	6_16
.. -17	Uranium pondéral	1	1_17	1	2_17	1	3_17		4_17		-		-

2008 2009 2010 2011 2012

*The figures 1 or 2 correspond to the 1st or 2nd half of the year in question.

The EIL organised by IRSN can cover up to 70 laboratories in each test, including a few foreign laboratories.

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.

The EIL results (2007 campaign) on which approvals are based in 2007 and 2008, concerned the measurement of:
– strontium 90 in a sample of water (extension of approval 1_07);
– radioisotopes of iodine trapped in an activated carbon cartridge (approvals 5_01, 5_02 and 5_14);
– carbon 14 in a soda solution, representative of atmospheric carbon samples (approval 5_06);
– total alpha activity of alpha-emitting aerosols collected on a filter (approval 4_03);
– the ambient gamma dose equivalent (approval 6_16).

The 2008 series of tests concerned the measurement of:
– gamma-emitting radionuclides and artificial alpha-emitting radionuclides in a biological sample, for granting or renewing approvals 3_01 and 3_02 as well as 3_13;
– isotopes of uranium, mass concentration of uranium, radium 226 and its daughter-products, and radium 228 in natural water, for granting or renewing approvals 1_09 and 1_11 and approvals 1_12 et 1_17;
– total alpha and beta radioactivity indices, tritium activity and the potassium content of water for granting or renewing approvals 1_03, 1_04 and 1_05;
– carbon 14 in a sample for granting or renewing approval 3_06;
– isotopic uranium and mass concentration of uranium in aerosols on a filter, for granting of approvals 4_09 and 4_17.

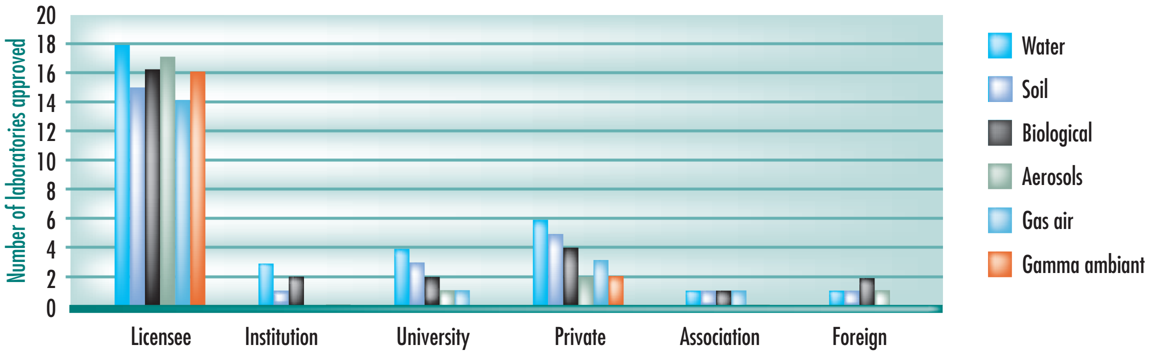
From 2003 to the end of 2008, IRSN organised 25 intercomparison tests covering 40 approval types. Most of the approved laboratories work in the field of water, with more than 30 of them being granted up to 10 different approvals. For the biological matrices (food chain) and in soils, there are about 25 laboratories. Although most of them are competent in all environmental matrices for measurement of gamma emitters, fewer than ten of them are approved for measurement of carbon 14 or transuranic elements. Approvals for measurement of radionuclides of the natural chains of uranium and thorium in water, soil or biological matrices are held by about ten laboratories.

Approvals have also been issued to about fifteen laboratories for atmospheric monitoring of the activity of aerosols and measurement of ambient gamma dosimetry.

In 2008, ASN issued 136 approvals and extended a further 6, while rejecting 59 approval applications and suspending another 17. At the end of 2008, the total number of approved laboratories stood at 39, totalling 535 currently valid approvals.

The detailed list of approved laboratories and their scope of technical competence is available on ASN's website.

Graph 1: breakdown of the number of laboratories approved as at 31 December 2008 by type and by measurement matrix



4 | 1 The national measurement network

The aim of the national measurement network is to provide the public with the results of environmental radioactivity monitoring and information on the health impact of nuclear activities throughout French territory.

On the recommendation 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).

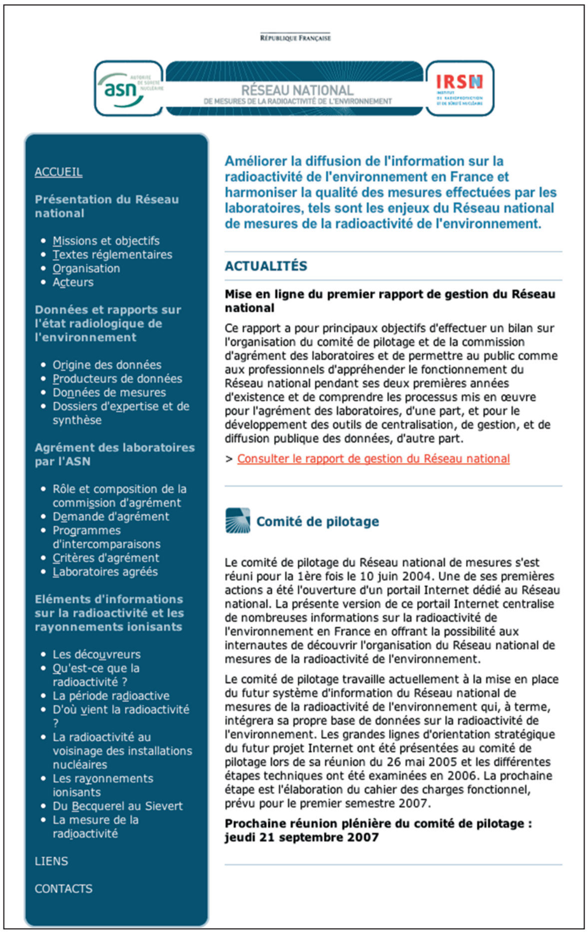
The steering committee also publishes the radioactivity data specified in Article R.1333-11 of the Public Health Code. In addition it issues opinions on the summary reports on the radiological condition of the environment and the radiological impact of the main nuclear activities, whether they are submitted by IRSN or any other organisation.

Article 3 of ratified ASN decision 2008-DC-0099 of 29 April 2008 defines the composition of the steering committee, the committee members appointment procedures and its operating processes. ASN decision 2008-DC-0116 of 4 November 2008, concerning appointment of the steering committee for the national environmental radioactivity measurement network, renewed the composition of the committee for a further 5 years.

The results of environmental radioactivity monitoring and information about the health impact of nuclear activities nationwide are made available to the public because of the legal obligation placed on the institutional stakeholders and nuclear licensees to communicate the regulation environmental monitoring results on the national network's website. The non-regulation measurements taken by approved laboratories may also be transmitted on the national network's website.

In 2009, the national network will also comprise a database on the radiological condition of the environment, in which the measurements will have been taken by approved laboratories or by IRSN.

The work done in 2007 enabled the specifications of the data management tools to be defined. They were evaluated by a large number of those involved in the national network (government departments, licensees, associations, etc.). These specifications led to development of the database during the course of 2008, so that transmissions could start on 1st January 2009.



Web portal of the national network for environmental radioactivity measurements

The purpose of this database is to contribute to public information via the development of a web portal through which the results of radioactivity measurements will be accessible, along with an interpretation of the data in terms of radiological impact. The portal's content will be developed and validated in 2009, with public access scheduled for 2010.

Documentation of use to the network stakeholders, as well as to non-specialists in environmental radiation protection, is already available on the national network web portal. It is also accessible via the ASN and IRSN websites. The national network portal constitutes a window onto the national network currently being developed and is the main source of information, in particular concerning approvals. Pending the opening of the new website to the public, including a monitoring database for radioactivity levels nationwide, this portal contains links to the websites of the network stakeholders and to other institutional sites dealing with radioactivity in the environment.

4 | 2 Informing the public about discharges

ASN feels that a key issue for regulation of discharges is to allow appropriate involvement of the stakeholders.

The public is involved in the authorisation procedures via the public inquiry. ASN ensures that this public inquiry process enables the public and the associations interested to make their points of view heard.

Furthermore, in the event of a significant change in an installation leading to a rise in the discharge limit values, decree 2007-1557 of 2 November 2007 makes provision for consultation of the local information committee (CLI) and the Departmental Council for the Environment and for Health and Technological Risks (CODERST) about the new requirements and does not stipulate the need for direct public consultation. In 2008, ASN therefore decided to propose that the licensees in certain cases experiment with a public consultation procedure in which the licensee would make its project impact assessment available.

Finally, 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 (CLI) for review.

4 | 3 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 operating experience feedback to prevent it from happening again. 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 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 helped to achieve uniform declaration conditions and to ensure that all available lessons are learned.

In 2008, 23 significant environmental events (including those relating to waste management) were declared by the BNI licensees.

5 OUTLOOK

ASN is of the opinion that in France, the radioactive discharges produced by the nuclear industry, medical activities and other industrial and research activities, have an extremely small health impact.

Nonetheless, in order to respond to public expectations, ASN feels that the reduction in radioactive discharges in France must continue. It will contribute to this by setting discharge authorisation limits, by encouraging the producers to use the best available techniques and by ensuring fully transparent regulation and promoting the creation of a system focused more on the calculated health impact (doses in micro-sieverts) than simply on the accounting of discharges (measurements in becquerels).

ASN will check that the producer assumes its responsibilities from the design of the installation onwards, and throughout its operation. It will be attentive to optimising discharges and reducing their impact.

ASN considers that the implementation of the national measurement network, with the creation of the common database from 1 January 2009, designed to collate all the environmental radioactivity measurements taken nationwide by the approved laboratories, is a significant step forward in terms of the quality of the measurements produced and their public accessibility.

ASN also hopes to create a specific radioactivity measurement index for cases of environmental radiological pollution, giving the public a clearer picture of the results of the environmental radioactivity measurements taken. In its recommendations to the Minister for Ecology, Energy, Sustainable Development and Spatial Planning, the High Committee for Transparency and Information on Nuclear Security expressed its desire to see ASN's work on this subject rapidly seen through to completion. In 2009, ASN will concentrate on sharing its work by creating a working group that will include the High Committee, in order to reach a finalised radioactivity measurement index project in the second half of 2009.

ASN will also ensure that the public and CLIs are better informed:
– of installation modification plans liable to have an environmental impact, by promoting the adoption of a public consultation procedure;
– by the producer concerning discharges and their impact, in accordance with the obligations of the Nuclear Transparency and Security Act (TSN).

With regard to discharges from BNIs and the prevention of detrimental effects, the revision of the ministerial orders of 26 November 1999 and 31 December 1999, which was started in 2008, will be continued, in order to update the requirements applicable to the licensees, so that they reflect the innovations brought about by the TSN Act.