1 FIELD OF ACTION

Under decree 2002-255 of 22 February 2002, which created the Directorate General for Nuclear Safety and Radiation Protection (DGSNR), the Directorate is in particular responsible for:
- organising a permanent radiation protection watch, in particular through radiological monitoring of the environment nationwide;
- supervising gaseous and liquid effluent discharges and waste from basic nuclear installations.

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.

The changes to the regulations introduced by the above-mentioned decree of 22 February 2002, confirms the wider view of nuclear safety. The ASN therefore tackles the issues of nuclear safety, radiation protection and the environment from a general standpoint, using an integrated approach and the same tools - particularly inspections - and the same demands of stringency, competence, transparency and independence.

With regard to the environment, the ASN's 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 substances from the nuclear industry. This involves strict control of effluent discharges and waste management. The ASN is responsible for supervision of discharges of radioactive and chemical, liquid and gaseous effluents from basic nuclear installations (BNIs);
- the prevention and limitation of detrimental effects and hazards resulting from the operation of basic nuclear installations (BNIs), and of inconvenience to the neighbourhood or for public health, safety and hygiene, agriculture, nature and environment protection purposes, or for 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. As an illustration, concerning the prevention of risks linked to the spread of legionella, the revised ministerial order of 31 December 1999 refers to the provisions applicable to installations classified on environmental protection grounds.

In line with this policy, the ASN has for several years been developing inspections focused on effluent and waste management and on the implementation of environmental protection measures. In 2005, it also harmonised significant event declaration criteria.

2 MONITORING RADIOACTIVITY IN THE ENVIRONMENT

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.

Revision of this article of the Public Health Code has been initiated, in particular to improve its legibility.

Environmental radioactivity measuring station

This article of the Public Health Code is modified by the order of 27 June 2005 which organises a national network for environmental radioactivity measurements and sets the procedures for laboratory approval. This text abrogates the previous requirements and its preparation entailed wide-ranging discussions with the players in the national network.

These new regulatory provisions led in particular to a separation between the laboratory approval process and the process for transmission of the environmental radioactivity measurements to the national network, as well as the introduction of interim measures giving the laboratories a certain time to bring their practices into conformity with the requirements of standard NF EN ISO/CEI 17025.

After obtaining the opinion of a Steering Committee, the ASN is responsible for defining the orientations of this network, which is managed by the IRSN. It prepares the laboratory approval orders, in particular on the basis of the results of the intercomparison tests organised by the IRSN and on receipt of the opinion of an Approvals Board.

The members of these two bodies (Steering Committee and Approvals Board), appointed by joint order of the ministers for Health and the Environment, are primarily representatives of the Ministries for Health, the Environment, Consumer Affairs, Agriculture, and Defence, representatives of national agencies with responsibility for health and environmental issues, such as the InVS, AFSSET and AFSSA, as well as representatives of measurement laboratories from the industry and from the associative world. Abrogation of the 17 October 2003 order organising a national network of environmental radioactivity measurements led to the renewal on 12 September 2005 of the two orders appointing the members of the Steering Committee and the Approvals Board.

In 2005, the Steering Committee met on 26 May and the Approvals Board met on 12 April and 22 November.

2 | 1 Laboratory approval

In 2003, the ASN took over the laboratory technical qualification duties previously performed by the Ministry for Health, with the technical support of the OPRI, and in 2004, it set up measures for laboratory approval in conditions defined by the above-mentioned order of 17 October 2003. Together with the IRSN, to deal with aspects concerning the organisation and processing of the intercomparisons between laboratories, the ASN concentrated on defining the table of approvals and the criteria for issue of approval, which were accepted by the Approvals Board. Two types of criteria, one technical resulting from statistical processing of the intercomparison results, and the other concerning the quality system implemented in the laboratories, are used to assess the technical and organisational competence of each laboratory.

To ensure that the conditions for laboratory approval are fully transparent, these criteria supplementing the general procedures specified in the ministerial order were published on the ASN web site. These measures came into full effect for approvals issued as of 2005.

The Approval Board also declared itself in favour of the planned 4-year programme of intercomparison tests which, with about fifty tests split into eight campaigns (two per year) will provide virtually exhaustive coverage of all artificial and natural radionuclides likely to be measured in the environment (water, air, soil and foodstuffs).

The Approval Board is also responsible for proposing to the ministers for the Environment and Health those laboratories for which the ministerial approval is to be issued. The Board's decision is based on an approval application file and an analysis of the intercomparison test results obtained by the candidate laboratory.

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

Following the intercomparison tests organised in 2003 and 2004, 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 21 March 2005 and then that of 3 August 2005.

The four intercomparison tests held in 2005 concerned measurement of gamma-emitting radionuclides in water, radionuclides of natural families in sediment, the activity of aerosols on a filter and, finally, pure beta-emitting radionuclides in milk. The approvals obtained further to these tests will be published in 2006.

The list of laboratories approved according to the different matrices can be consulted on the ASN's website at the following address: www.asn.gouv.fr section: actualite/les mesures de radioactivité/.

2 | 2

Deployment of the national network of environmental radioactivity measurement

Development of the national network of environmental radioactivity measurement is one aspect of the ASN's mission to organise monitoring of radioactivity in the environment. The IRSN participates in this function through its contribution to radiological monitoring of the entire country and through its management of this future national network.

This national network will use a data bank to collect, manage and process the results of environmental radioactivity measurement analyses performed by the approved laboratories or the IRSN's laboratories.

One of the first tasks performed by the ASN, jointly with the IRSN, was to identify the leading players involved in measurement, optimising identification of their measurement framework, their environmental monitoring field and the sensitivity of their analyses, in order to propose a management strategy for these data as a whole.

In 2005, the initial work done into the presentation of radioactivity data on the Internet led to the drafting of a guideline note concerning the orientations of the national network, which was submitted to the Steering Committee at its meeting of 26 May 2005. The Steering Committee is currently working on setting up the national network of environmental radioactivity measurements information system which will eventually offer access to all environmental radioactivity data.

Work on inventorying and characterising the measurement results is continuing, in order to define the conditions for creation of the data bank and the corresponding IT tools. In addition, under the aegis of the ASN, the IRSN is conducting a survey among the national network players (industry, public services, CLIs, associations, representatives of the public, etc.), to gain a clearer understanding of the constraints on the "data suppliers", but also what they expect in turns of data retrieval. The aim of these personalised interviews with the database "users" is to lead to drafting of the functional specifications for the national network, scheduled for the beginning of 2006.

2|3

Public information

The second part of the national network is linked to its communication-information aspect, with the development of a web portal common to the ASN and the IRSN, on which the radioactivity measurement results and their interpretation in terms of radiological impact will be available, along with documentation of interest both to the network players and to members of the public, who do not need to be environmental radiation protection specialists.

The ASN and the IRSN have developed a web portal devoted to the national network. It will be accessible from the ASN and IRSN websites. This portal constitutes a doorway to information about the national network currently being developed and comprises a number of parts dealing with the regulatory status of the network, the various parties involved, the organisations carrying out the initial radioactivity measurements and laboratory approvals respectively. Until such time as it is given its own measurements database, planned for 2008, this constantly evolving site will contain links to the websites of network players and other institutional sites dealing with environmental radioactivity.

2|4

The radiological quality of water intended for human consumption

The new radiological inspection programmes for public mains water and non-mineral bottled waters (see point 1|5 of chapter 3) will eventually lead to a complete picture being produced of the radiological quality of water intended for human consumption, primarily on the basis of total alpha and beta and tritium radioactivity measurements. These new programmes, which are entrusted to the DDASS, have been mandatory since 1 January 2005. 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. Since 2004, 21,000 samples have been taken to measure the radioactivity of water distributed. The SISE-Eau database today contains more than 14,000 data on total alpha and beta radioactivity indicators. A results summary will be produced in 2006.

The 24 January 2005 order, modified by the order of 11 March 2005, sets the conditions for approval of laboratories which are to take samples and conduct health monitoring analyses of water.

In 2005, 7 laboratories submitted an application file for this approval. The file examination procedure is in progress and the list of laboratories thus approved will be published in the *Official Gazette*, in an order to be finalised in January 2006.

3 BNI EFFLUENT DISCHARGES

Like any other industry, basic nuclear installations (BNIs) generate by-products, whether or not radioactive, and despite the efforts made for 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 process of containment in the form of waste becomes increasingly cumbersome and costly as the radionuclide concentration diminishes. Below a certain level, the radionuclides cannot be reasonably recovered and they are then discharged into the environment if their impact is acceptable. The radioactivity discharged in effluent represents a marginal fraction of that which is confined in the 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. The actual discharges from the installations are presented in the corresponding chapters.

3 | 1

The regulatory context of BNI effluent discharges

Until 1995, liquid and gaseous radioactive discharges from nuclear installations were regulated separately by interministerial order. The chemical characteristics of these discharges were regulated by prefectoral order.

The first authorised discharge limits had been set in such a way that they were lower than the health effect values in force.

The optimisation efforts required by the authorities and made by the operators, led to these emissions being 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. One particular consequence of this reduction was that the former regulatory limits were no longer representative of the actual discharges situation.

For these two reasons, new effluent discharge regulations became necessary:

- concerning procedural aspects, decree 95-540 of 4 May 1995 concerning liquid and gaseous effluent discharges and water intake by BNIs;

- for discharge limits, monitoring conditions and ASN information procedures, with the order of 26 November 1999 setting the general technical requirements concerning the limits and procedures for water intake and effluent discharges subject to authorisation and carried out by basic nuclear installations.

3 | 1 | 1

Examination of discharge licence applications

The above-mentioned decree of 4 May 1995 defines the conditions in which discharge and water intake licence applications must be examined. It in particular stipulates that:

- the operator's licence application must be backed up by an impact assessment;

- this application is the subject of a public inquiry;

- examination of this application provides for consultation of the parties concerned (administrative conference, opinion of the local authorities, of the departmental health council, etc.).

After this procedure, a single order issued by the ministers for Health, Industry and the Environment, now regulates all effluent discharges and water intakes.

The above-mentioned decree of 4 May 1995 also enables the administration to revise existing licences at any moment, without any request from the operator being necessary. Finally, this decree confirms the ASN as the body with competence for examination of the licence applications submitted by the operators.

This decree constituted a key step improving control of the administrative procedures regulating BNI effluent discharges into the environment. Its application to all BNIs is gradually leading to a clearer picture of BNI impacts on their environment and how they are understood by the public.

3 | 1 | 2

The ministerial order of 26 November 1999

The above-mentioned ministerial order of 26 November 1999, implementing the above-mentioned decree of 4 May 1995, to a large extent defines the procedures regulating BNI discharges.
Its requirements must be included by the administration when drafting of discharge and water intake licences. These orders therefore systematically stipulate:
- the limits on the intake and the chemical and radioactive discharges the operator is authorised to make;
- the analysis, measurement and inspection resources for the facilities, installations, works or activities authorised, and the means for monitoring their effects on the environment;
- the conditions in which the operator notifies the public authorities of its discharges, along with the results of the monitoring of their effects on the environment;
- the inspections carried out by the public authorities;
- the methods to be used for public information.

3 | 2

ASN policy concerning BNI discharge licences

The combined implementation of these two texts has prolonged and indeed strengthened the permanent progress being achieved by the ASN in its efforts to reduce the impact of nuclear installations on both man and the environment, to a level as low as reasonably achievable.

In addition to implementation of these regulatory requirements, the procedures through which the ASN regulates discharges are guided by various other principles.

To put an end to the previous situation in which the discharge limits were far higher than the actual discharge levels, the ASN aims to ensure that the new licences do not comprise a large margin which could potentially mask incident situations. The ASN hopes that setting these limits will not only guarantee that there are no health or environmental impacts, but will also encourage the operators to maintain their efforts to optimise and reduce discharges. The discharge limit values are thus defined as low as reasonably possible using the best available techniques and taking account of the fluctuations linked to normal changes in the process.

The efforts to reduce discharge limits lead to the following reduction factors:

Limit value reduction factors 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 + tritum):	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
	- alph emitters	10

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

Even if the provisions defined by the above-mentioned decree of 4 May 1995 are already relatively old, their application to all sites requires that the effort that has been under way for a number of years needs to be continued (60% of installations are currently fully regulated by provisions implementing this text). The improvements to be gained from implementation of these provisions are justification for continuation of this process.

Finally, the ASN duly notes 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 substances into the North-East Atlantic, so that the concentrations in the marine environment fall to close to zero by 2020 for artificial substances, and close to background values for NORM.

As an illustration, and in order to ensure that the best available technologies are employed, the order licensing the spent fuel reprocessing installation at La Hague requires that new measures concerning discharges are to be defined 4 years after its publication, in other words on 10 January 2007.

3 | 3 The radiological impact of nuclear facilities

Attempting to identify the health impact of nuclear facilities in normal operation consists in detecting the possible appearance of effects that are harmful for health owing to low exposure to ionising radiation, the main risk being inducing cancers. The impact from a nuclear facility does not stem solely from activity discharges through identified outlets (stack, effluent discharge outfall into river or sea). It necessarily includes diffuse liquid and gaseous emissions and the sources of irradiation present in the facility. This allows a correct evaluation to be made of all possible channels for harm to the population, through internal or external exposure.

The impact is determined on the basis of a source term and 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. The impact is in principle assessed on the basis of the annual authorised limit, with a spectrum of radionuclides. The subsequent verification is assessed according to the radionuclide activity measured in the discharges, to which the irradiation (in particular due to interim waste storage) must be added.

According to the principle of optimisation, the operator must reduce the dosimetric impact of its installation to values that are as low as reasonably achievable in the light of economic and social factors.

To guarantee harmonisation in how BNI impacts are calculated and make it easier to read the impact assessments, the ASN and the DGS entrusted the IRSN with the task of drafting a BNI radiological impact assessment guide, which has been a reference document since 2002 (IRSN report / 02-24 October 2002).

In practice, the activity levels present in the environment are generally so low that they cannot be detected by the measuring instruments. Dispersion models fed by installation discharge measure-

ment data therefore have to be used. In any case, programmes to monitor the radioactivity present in the environment (water, air, milk, grass, earth) are imposed on the operators in order to check compliance with the scenarios postulated in the impact assessment. The laboratories taking these measurements must have received ministerial approval.

The radiological impact calculated on the reference group most exposed to the discharges remains far below the allowable limits.

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 illustration, in 2004 it reached:
- 9 microsieverts for the COGEMA La Hague site;
- 7 microsieverts for the EDF Flammanville site (most penalising site).

3 | 4

Work programmes initiated by the ASN

3 | 4 | 1

Continued revision of the discharge licences

Since the above-mentioned decree of 4 May 1995, the ASN has been examining BNI applications for liquid and gaseous discharge and water intake licences. The procedure is a complex one, involving many participants.

The ASN has started a process to revise all the existing licensing orders. 8 dossiers are currently being examined (ANDRA Soulaines, ILL, CENTRACO, EDF: Golfech, Dampierre, Tricastin, Penly, Creys Malville).

For the main operators, the procedures have progressed as follows:
- EDF installations: at the request of the ASN, EDF has prepared a programme for production of the licence renewal applications so that the last nuclear power plant discharge licence application will be submitted in 2009. This schedule was revised in relation to the previous programme, to take account of the need to draft and examine these dossiers, and introduce new or partial additional requests (micro-biological treatment, change in fuel or burnup fraction, etc.);
- CEA installations: the CEA centres are complex sites on which the installations are usually subject to supervision by different authorities: ASN for the BNIs, DSND for the secret BNIs, DRIREs for the ICPEs 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, the ASN asked the CEA to produce a dossier for each centre enabling the overall environmental impact of the site's discharges to be assessed. 2005 in particular saw the completion of preparations for a new discharge licence order for the Cadarache site;
- fuel cycle installations: the main site concerned is that at La Hague. As COGEMA did not wish to submit a discharge licence application for revision of its 1980 and 1984 licences, the ASN, under application of article 13 of the above-mentioned decree of 4 May 1995, carried out a review of these licences. The order is in conformity with ASN policy explained beforehand, leading to a significant reduction in limits.

The following table presents the regulatory situation concerning the main BNIs.

3 | 4 | 2

Improvements to application examination conditions

Taking advantage of the lessons learned from the initial applications, the ASN has begun a series of actions aimed at processing the applications within a reasonable time-frame, set at 2 years, and at improving the transparency of the procedures.

Regulatory situation concerning discharges from nuclear sites

Operator	Site	Regulatory situation
CEA	Cadarache	Order pending signature in application of decree 95-540
	Fontenay aux roses	Licensed according to old procedure
	Grenoble	Order of 25/05/2004 in application of decree 95-540
	Saclay	Licensed according to old procedure (site)
		Order fo 30/12/2002 in application of decree 95-540 (LECI – irradiated fuel test laboratory)
	Marcoule (phenix)	Licensed according to old procedure
	Marcoule (atalante)	Licensed according to old procedure
EDF	Belleville	Order of 08/11/2000 in application of decree 95-540
	Blayais	Order of 18/09/2003 in application of decree 95-540
	Bugey	Licensed according to old procedure
		Order of 26/04/2004 in application of decree 95-540 (units 4 and 5 biocide treatment)
		Order of 11/06/2004 in application of decree 95-540 (thermal discharges)
	Cattenom	Order of 23/06/2004 in application of decree 95-540
	Chinon	Order of 20/05/2003 in application of decree 95-540
		Amendment by the order of 17/08/2005 (biocide treatment)
	Chooz	Licensed according to old procedure
		Amendment by the order of 30/11/2000
		Order of 26/04/2004 in application of decree 95-540 (units 1 and 2 biocide treatment)
	Civaux	Licensed according to old procedure
	Creys-Malville	Procedure in progress in application of decree 95-540
	Cruas-Meysse	Order of 7/11/2003 according to new procedure
	Dampierre	Procedure in progress in application of decree 95-540
		Order of 27/04/2004 according to new procedure (units 1 and 3 biocide treatment)
	Fessenheim	Licensed according to old procedure
	Flamanville	Order of 11/05/2000 in application of decree 95-540
	Golfech	Order of 27/04/2004 in application of decree 95-540 (units 1 and 2 biocide treatment)
		Procedure in progress in application of decree 95-540
	Gravelines	Order of 07/11/2003 in application of decree 95-540
	Nogent	Order of 29/12/2004 in application of decree 95-540
	Paluel	Order of 11/05/2000 in application of decree 95-540
	Penly	Procedure in progress in application of decree 95-540
	St Alban	Order of 29/12/2000 in application of decree 95-540
	St Laurent	Order of 02/02/1999 in application of decree 95-540
	Tricastin	Procedure in progress in application of decree 95-540
COGEMA	Pierrelatte	Licensed according to old procedure
	La Hague	Order of 10/01/2003 in application of decree 95-540
COMHUREX	Pierrelatte	Order of 17/08/2005 in application of decree 95-540
SOCATRI	Pierrelatte	Order of 16/08/2005 in application of decree 95-540
EURODIF	Pierrelatte	Order of 16/08/2005 in application of decree 95-540
MELOX	Marcoule	Licensed according to old procedure
ILL	Grenoble	Procedure in progress in application of decree 95-540
SOMANU	Maubeuge	Licensed according to old procedure Amending order of 16/02/2005
CENTRACO	Marcoule	Order of 07/05/1998 in application of decree 95-540 Revision procedure in progress
FBFC	Romans/Isère	Order of 22/06/2000 in application of decree 95-540
ANDRA	La Hague	Order of 10/01/2003 in application of decree 95-540
ANDRA	Soulaines	Procedure in progress

At the same time, the ASN has made the operators aware of the quality of the application dossiers to be submitted. Exchanges regularly take place on this subject in order to improve the quality of the dossiers presented by the operators, to enable the examination process to go faster.

The ASN also aims to improve the coordination between the numerous central and local administrative departments involved throughout the procedure, in order to keep control of the examination time.

These efforts led to a clear drop in the time needed to examine certain applications (10 months for the Chinon licence dated 17 August 2005 for example).

However, as time went by, it became obvious that certain elements contributing to the time needed to examine the applications were structurally linked to the examination procedure defined by the above-mentioned decree of 4 May 1995. This is why the ASN has initiated a process to revise this text, which should not however alter the general economics of the process and will strengthen the dialogue that is now mandatory.

3 | 5

Accounting and monitoring radioactive discharges

The reduced activity of the radioactive effluent discharges from BNIs (activity level lower than the measurement thresholds), 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 the ASN to set new rules for accounting of radioactive discharges, in particular taking account of activity concentrations lower than the decision threshold. The purpose of these rules was also to avoid very low discharges of radionuclides being declared as null, as they could subsequently build up in certain species taken from the environment (sediments, mosses, etc.).

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 alpha, beta or gamma measurements;
- setting of detection limits to be observed for each type of measurement;
- 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, when calculating the activity discharged. These evolving reference spectra are based on experience feedback from the analyses carried out;
- other radionuclides, which are occasionally present, are considered once their activity concentration is higher than the decision threshold.

Reference spectrum for accounting of discharges from nuclear power plants

Liquids: ^{3}H,
^{14}C,
Iodines: ^{131}I,
Other fission and activation products:
^{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 products: ^{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, COGEMA and ANDRA La Hague establishments, FBFC in Romans, CEA centre at

Cadarache, and so on). They will be applied to the other sites as their discharge licence orders are renewed.

In accordance with the provisions of their discharge licence orders, the operators keep up to date registers which record the results of the various measurements taken on the discharges and in the environment, as well as the conditions in which these discharges take place. These registers are transmitted to the ASN for inspection every month.

At the same time as this self-check, the operators regularly send a certain number of discharge and environment samples to the IRSN for analysis. The results of the analysis of these samples are sent to the ASN which, by comparison, can then judge the quality of the measurements made by the nuclear operators.

Sampling during a nuclear power plant discharge management inspection

Finally, as part of its BNI supervision duties, the ASN conducts unannounced inspections to ensure that the BNI operators follow the regulatory provisions of the licensing orders. This is why, in addition to the existing inspections, the ASN set up a system of unannounced inspections during which, with the possible assistance of a laboratory, BNI inspectors check compliance with the licences, take effluent samples and have them analysed by a specialised independent laboratory. Since 2000, the ASN has carried out 10 to 30 inspec-

Observers from the Paluel-Penly CLI with ASN inspectors during an inspection at Paluel nuclear power plant

tions - with sampling - every year (27 in 2005). This year, for the first time, the ASN carried out inspections with sampling of gaseous effluent, which is technically more difficult.

Under the terms of article 35 of the Euratom treaty, France voluntarily submits to inspection 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 inspection brought to light no significant deviation and underlined the quality of the supervisory system in place.

3.6 The other discharges from nuclear installation

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 leads 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.

A committee for monitoring exceptional thermal discharges from electricity generating plants was set up to monitor the impact of these discharges on the watercourses.

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 organisational, administrative and technical steps taken following the 2003 heat wave and drought mean that the drought encountered in 2005 was dealt with in good conditions, in particular ensuring full compliance with the discharge licences applicable.

4 Discharges from other installations

The Public Health Code states that regulatory provisions for management of radioactive waste and effluent in installations other than installations classified on environmental protection grounds or basic nuclear installations must be specified in an order signed by the ministers for Health and the Environment. This is why the ASN, together with the professionals handling radioactive sources and the administrations concerned, is drafting an order 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 have been identified, in particular during meetings on preparation of the national management plan for radioactive waste and reusable materials. A working group was set up to propose solutions for inclusion in the draft order on management of radioactive waste and effluent.

5 PREVENTION OF DETRIMENTAL EFFECTS FROM BNIS

5.1

Application of the requirements of the order of 31 December 1999 concerning environmental protection

For several years, particular attention has been paid to the chronic or accidental effects on the environment of both conventional and nuclear industries. With respect to the nuclear industry, the interministerial order of 31 December 1999 sets the general requirements to be met by BNIs concerning environmental protection. It supplements the texts specific to each plant on this subject, i.e. the discharge licences or the operating licences for installations classified on environmental protection grounds located on plant. 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).

Most of the requirements were applicable on 15 February 2002, two years after the date of publication in the *Official Gazette*. However, if the operators can prove that they are experiencing difficulties, article 48 of the order of 31 December 1999 provides for extra time allowances, without however exceeding 15 February 2006.

Considerable work has been done by the operators to check the 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, the ASN analysed these requests before ruling on the operators' proposals. The ASN also conducted spot-checks during the site inspections on the completeness and accuracy of the information provided in the dossiers. As and when necessary, dates for installation conformity work were set by the Director General for Nuclear Safety and Radiation Protection.

During the course of this exercise, a number of problems with application of the ministerial order of 31 December 1999 were detected, in fields such as noise, or the capacity of large-volume tank groups for example.

These findings, along with the wish to improve the applicable fire requirements and the desire to introduce provisions into the regulatory texts concerning prevention of the spread of legionella, led the ASN to revise the order of 31 December 1999 (see chapter 3).

5.2

Prevention of water pollution

The ministerial 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:
- revision of the design of storage, loading and unloading areas for toxic, radioactive, flammable, corrosive or explosive liquids, by requiring effective retention facilities;
- 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 operators 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. However, EDF observed that strict application of these requirements to the TER, KER and SEK tank retention areas posed particular difficulties. EDF therefore proposed to implement alternative measures such as to achieve the best possible level of protection of those interests protected by the order.

5 | 3

Protection against noise

Article 48-II-2 of the order of 31 December 1999 requires that by 15 February 2004, a check be carried out on compliance with the specified noise limits. Most of the dossiers submitted by the operators were examined by the ASN.

It became apparent that in certain operating configurations, installations were exceeding the emergence levels specified in the order of 31 December 1999. These overshoots were in particular due to the noise of falling water, for example generated by river weirs. The order of 31 December 1999 as amended makes it possible to take account of these situations when the operator can demonstrate that the provisions implemented do not generate any significant detrimental effects.

5 | 4

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.

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

The cooling installations in certain nuclear facilities are particularly large and in that respect differ from conventional cooling systems. The exchange surface area can be up to 5,000,000 m².

5 | 4 | 1

Legionella

Legionnaire's disease is an infectious pathology caused by legionella bacteria. The germ responsible is a bacillus that lives in fresh water, with an optimum proliferation temperature of 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 favourable to the development of these micro-organisms:
- warm water between 25 and 45 °C;
- the presence of nutrients;
- the presence of Fe^{+++} essential to 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. As a preventive measure, a heightened vigilance threshold has been set for ICPEs at 1000 CFU/l (1000 Colony Forming Units per litre), with 100,000 CFU/l leading to shutdown of the installations. The concentration in water can vary widely in just a few hours and the bacterium in question can be found in biological deposits (biofilm) on the walls of the installation (hot water tanks, pipes, valves, shower heads in sanitary hot water installations, or heat exchangers, tower basin and cooling tower exchanger body in cooling circuits), or in a host organism (protozoa: amoebae, etc.) which in bursting can release large quantities of legionella. Current trends are to consider that if a circuit is contaminated, then it is definitive and the risk exists. Curative treatment will have only a temporary impact, because the water feeding the loop is usually contaminated.

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. The nomenclature of installations classified on environmental protection grounds was modified so that these installations are now included within its scope of application. Requirements aimed at preventing and limiting the risk of the spread of legionella were defined within this framework (orders of 13 December 2004 concerning prevention of the risk of the development of legionella in installations subject to authorisation and declaration respectively).

Similar measures were taken within nuclear installations. However, the ASN wished to reinforce their regulatory framework by modifying the ministerial order of 31 December 1999. The modification made to this text explicitly refers to the technical requirements applicable to classified installations, which henceforth constitute the common rule.

Prior to modification of the order, EDF had notified the steps it was taking with respect to nuclear power plant cooling towers, as their particular characteristics (size, cooled flow throughput, etc.) could mean that the usual treatment methods would have a considerable effect on the environment. The cha-

Inspectors checking the cooling towers

racteristics of these installations (in particular their height), enabled EDF to put forward an argument highlighting the very slight health risk.

The Director General for Nuclear Safety and Radiation Protection, the Director General for Health and the Director for the Prevention of Pollution and Risks referred the matter to the French agency for environment and labour health safety (AFSSET) for an assessment of this situation (see chapter 12).

Despite these precautions, it must be possible to respond appropriately to the possible occurrence of legionella clusters, so the public authorities (DGS, DPPR, ASN) formally defined the organisation to be set up in this case, through an interministerial circular shortly to be issued.

5|4|2 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 licenses were issued to deal with releases linked to these treatments (see point 3|4).

6 Waste studies

Article 20 of the above-mentioned order of 31 December 1999 states:

"The operator drafts a study on the management of its waste, known as the "waste study", indicating its objectives concerning reduction of the volume and the chemical, biological and radiological toxicity of the waste produced in its installations, and optimisation of its management with emphasis on reuse and treatment for final disposal in an ultimate waste repository. It defines the steps it employs in order to achieve these objectives".

Articles 20 to 27 of the order of 31 December 1999 give the regulatory procedures linked to the waste studies and waste management.

These articles were the subject of two instruction notes from the ASN: SD3-D-01 (Guide for the production of nuclear waste studies) and SD3-D-02 (Specifications for the annual nuclear installation waste balances), available on the ASN's website, which were designed to constitute specifications to which the nuclear operators would refer when drafting their waste studies and their annual waste balances.

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 operator 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 reference framework which can act as a reference for the statutory inspection.

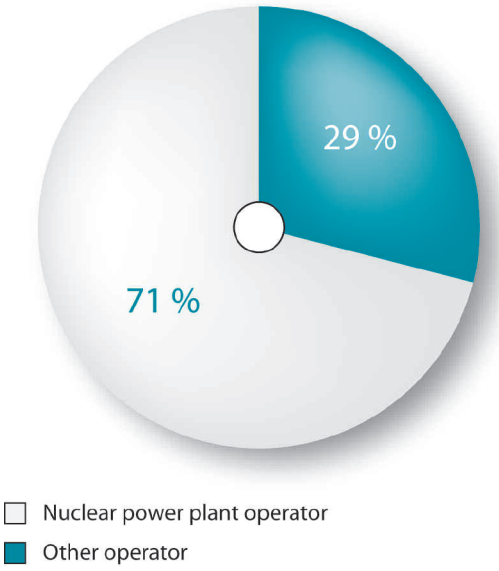
The problem of waste management is described in greater detail in Chapter 16.

7 SIGNIFICANT ENVIRONMENTAL EVENTS

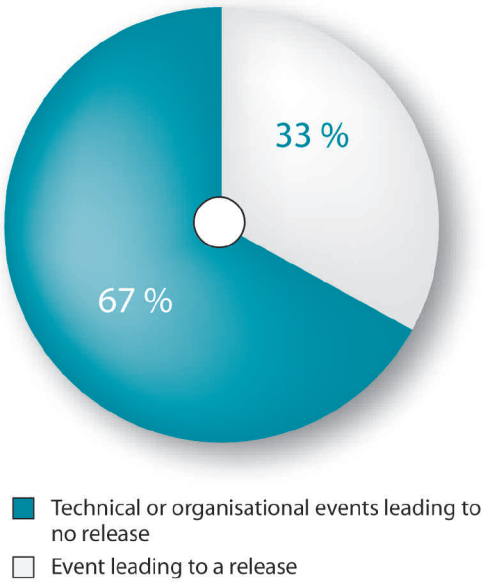
Detecting and processing significant events play a key role in nuclear safety. As soon as an event occurs, the necessary countermeasures must be put in place along with appropriate experience feedback to prevent it from happening again. This first of all implies the existence of a reliable system for 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.

During the course of 2005, the ASN produced a guide for declaring significant events affecting all fields of activity in the nuclear industry (BNIs, Transports) (see point 1|2|1 of chapter 4). This will come into use on 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 substances inducing an impact, non-compliance with a technical or organisational require-

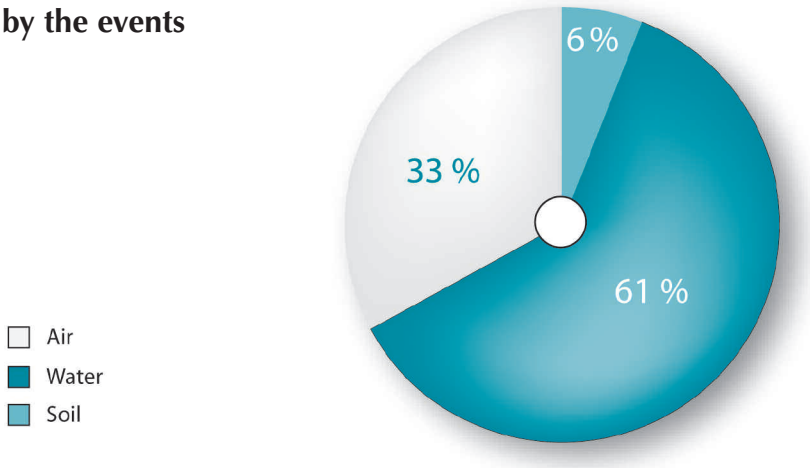
Breakdown of events per type of installation



Type of events



Matrix concerned by the events



ment 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 should in particular help achieve uniform declaration conditions and ensure that all the available lessons are learned.

In 2005, 52 environmental events were declared by the operators, as shown in the breakdown given in the previous graphs.

8 Outlook

With regard to environmental supervision, 2005 was marked by improvements to the regulatory requirements concerning the national network of environmental radioactivity measurements (above-mentioned order of 27 June 2005). This process is reaching its conclusion with the modification in progress to article R. 1333-11 of the Public Health Code. This regulatory framework improves the examination of approval applications submitted by the laboratories, the number of which is rising significantly.

The coming years will enable the ASN, together with the IRSN, to define the national radiological monitoring strategy and develop the network as an information tool.

The sustained efforts devoted to supervision and reduction of the impact of nuclear installation discharges will be continued. This approach will lead to the issue of several discharge licenses in 2006. The ASN will initiate a programme of work designed to improve the conditions for retrieval of the results of discharges monitored by the operators, particularly so that they are more easily accessible to the public.

The modification to the interministerial order of 31 December 1999 establishing the general technical regulations for preventing and limiting detrimental effects and external hazards resulting from the operation of basic nuclear installations, will also give the ASN a better opportunity to ensure that the steps taken by the operators conform to the new regulatory requirements, in particular with regard to preventing the development of legionella.

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