



## Regulation of nuclear activities and exposure to ionising radiation

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In France, nuclear activity licensees hold prime responsibility for the safety of their activity. They cannot delegate this responsibility, and must ensure permanent surveillance of their installations. In view of the risks that ionising radiation present for persons and the environment, the State exercises its own independent control over the nuclear activities through ASN, which it has empowered for this task.

Control and regulation of nuclear activities is a fundamental responsibility of ASN. The aim is to verify that all licensees fully assume their responsibility and comply with the requirements of the regulations relative to radiation protection and safety, in order to protect workers, patients, the public and the environment against the risks associated with nuclear activities.

Inspection is the key means of control available to ASN. Inspection designates a control action that requires an ASN inspector to go to the controlled site; it consists in making spot checks to verify the conformity of a given situation with respect to a regulatory or technical baseline. After the inspection, a follow-up letter is sent to the head of the inspected site and published on [www.asn.fr](http://www.asn.fr). Deviations identified during the inspection can lead to administrative or penal sanctions.

ASN has a broad vision of control and regulation, encompassing material, organisational and human aspects. Its actions take the tangible form of decisions, requirements, inspection follow-up documents and assessments of safety and radiation protection in each sector of activity.

## 1 VERIFYING THAT THE LICENSEE ASSUMES ITS RESPONSIBILITIES

### 1.1 The principles underpinning the regulatory role

ASN aims to ensure that the principle of prime responsibility of the licensee for safety and radiation protection is respected.

ASN applies the principle of proportionality when determining its actions, so that the scope, conditions and extent of its regulatory action is commensurate with the health and environmental safety implications involved.

Regulation is part of a multi-level approach and is carried out with the support of the Institute for Radiation Protection and Nuclear Safety (IRSN). It applies to all phases in the life of the installation, including shutdown and decommissioning:

- before the licensee exercises an activity subject to authorisation, by reviewing and analysing the files, documents and information provided by the licensee to justify its project with regard to safety and radiation protection. This verification aims to ensure that the information supplied is both relevant and sufficient;
- during exercise of the activity, by site visits, inspections on all or part of the installation, verification of high-risk operations performed by the licensee, review of operating reports and analysis of significant events. This verification comprises sampling and the analysis of justifications provided by the licensee with regard to the performance of its activities.

To consolidate the effectiveness and quality of its actions, ASN is adopting an approach involving continuous improvement of its regulatory practices. It uses the experience feedback from more than thirty years of nuclear activity inspections and the sharing of good practices with its foreign counterparts.

### 1.2 Regulating nuclear activities: a vast area

Article L.592-21 of the Environment Code states that ASN must regulate compliance with the general rules and particular requirements of safety and radiation protection, applicable to:



ASN inspection at the Gravelines NPP - November 2012



- licensees of BNIs;
- those in charge of the construction and operation of pressure equipment (PE) used in BNIs;
- those in charge of radioactive substance transport;
- those in charge of activities entailing a risk of exposure of individuals and workers to ionising radiation;
- those in charge of implementing ionising radiation exposure monitoring measures.

In this chapter, these entities are called the “licensees”. ASN also regulates the organisations and laboratories it approves, in order to take part in the inspections and in guaranteeing safety and radiation protection, as well as carrying out labour inspection duties in the NPPs (see chapter 12).

Although historically based on verifying the technical conformity of facilities and activities with regulations or standards, regulation today also covers a broader field incorporating social, human and organisational factors. It takes into account individual and collective behaviour and attitudes, management, organisation and procedures, relying on a variety of sources: significant events, inspections, relations with the stakeholders (personnel, licensees, outside contractors, trade unions, occupational physicians, inspection services, approved organisations, and so on).

## 1|2|1 Regulating safety

Safety covers the technical and organisational measures taken at all stages in the life cycle of nuclear installations (design, creation, commissioning, operation, final shutdown, decommissioning) to prevent or mitigate the risks for safety, public health, the environment, and so on. This notion thus includes the measures taken to optimise waste and effluent management.

The International Atomic Energy Agency (IAEA) defined the following principles in its safety fundamentals for nuclear facilities (safety collection No.110), taken up to a large extent by the European Directive on nuclear safety of 25th June 2009:

- prime responsibility for safety lies with the licensee;
- the organisation responsible for regulation and oversight is independent of the organisation responsible for promoting or using nuclear power. It must have responsibility for licensing, inspection, and formal notices, and must have the authority, expertise and resources necessary for performance of the responsibilities entrusted to it. No other responsibility shall compromise or conflict with its responsibility for safety.

In France, pursuant to the Environment Code, ASN is the body that meets these criteria.

### Regulating BNIs

In its regulatory duties, ASN is required to look at the equipment and hardware in the installations, the individuals in charge of operating them, the working methods and the organisation, from the start of the design process up to decommissioning. It reviews the steps taken concerning nuclear safety and the monitoring and limitation of the doses received by the individuals working in the facilities, and the waste management, effluents discharge monitoring and environmental protection procedures.

### Regulating pressure equipment

Numerous systems in nuclear facilities contain or carry pressurised fluids. They are therefore subject to pressure equipment regulations (see chapter 3, point 2 | 2 | 1).

Article L.592-21 of the Environment Code states that ASN “monitors compliance with the general rules and special prescriptions as regards nuclear safety and radiation protection to which are subject [...] the manufacture and use of BNI pressurised equipment”. Furthermore, so that the BNI licensees only have to deal with a single point of contact, Article 50 of Act 2009-526 of 12th May 2009 on the simplification and clarification of the law and relaxation of procedures, entrusts ASN with the verification of application of the regulations for all pressure equipment in a facility comprising a BNI.

Pressure equipment operation is subject to regulation which focuses in particular on the in-service surveillance programmes, non-destructive testing, maintenance work, handling of anomalies affecting the systems and periodic system requalification.

### Regulating the transport of radioactive substances

Transport comprises all operations and conditions associated with movements of radioactive substances, such as packaging design, manufacture, maintenance and repair, as well as the preparation, shipment, loading, carriage, including transit storage, unloading and reception at the final destination of the radioactive substance consignments and packages (see chapter 11).

The safety of transport of radioactive substances is ensured by three main factors:

- primarily, the robustness of package design and the quality of package construction;
- the reliability of transport and of certain special vehicle equipment;
- an efficient emergency response in the event of an accident.



ASN inspection of a convoy of radioactive waste in Valognes railway station – November 2011

## 1 | 2 | 2 Regulating activities entailing a risk of exposure to ionising radiation

The “International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources” issued by IAEA define the general functions of the body in charge of regulation and oversight.

In France, ASN fulfils this role by drafting and monitoring technical regulations concerning radiation protection (see chapter 3, point 1).

The scope of ASN’s regulatory role in radiation protection covers all the activities that use ionising radiation. This duty is

exercised, where applicable jointly with other State services such as the labour inspectorate, the inspectorate for Installations Classified on Environmental Protection Grounds (ICPE), the departments of the Ministry responsible for Health and the French National Agency for Medicines and Health Products Safety (ANSM).

ASN’s regulatory action takes the form of reviews of files, pre-commissioning visits, inspections, and discussions with professional organisations (trade unions, professional orders, learned societies, etc.). This action directly concerns either the users of ionising radiation sources, or organisations approved to carry out technical inspections on these users.

These actions are summarised in table 1.

Table 1: Methods of ASN regulation of the various radiation protection players

|                                                     | Review/authorisation                                                                                                                                                                                                                                      | Inspection                                                                                                                                                                                                                             | Openness and cooperation                                                                                                               |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------|
| Users of ionising radiation sources                 | <p>Review of the dossiers required by the Public Health Code (Articles R.1333-1 to R.1333-54).</p> <p>Pre-commissioning inspection.</p> <p>Registration of the notification or delivery of an authorisation.</p>                                          | Radiation protection inspection (Article L. 1333-17 of the Public Health Code).                                                                                                                                                        | Jointly with the professional organisations, drafting of a guide of good practices for users of ionising radiation.                    |
| Approved inspection bodies for radiation protection | <p>Review of application dossiers for approval to perform the inspections specified in Article R. 1333-95 of the Public Health Code and Articles R. 4451-29 to R. 4451-34 of the Labour Code.</p> <p>Organisation audit.</p> <p>Delivery of approval.</p> | <p>Second-level inspection through:</p> <ul style="list-style-type: none"> <li>– audits,</li> <li>– in-depth inspections at head office and in the branches of the organisations,</li> <li>– unannounced field inspections.</li> </ul> | Jointly with the professional organisations, drafting of guides of good practices for performance of radiation protection inspections. |

## 1 | 2 | 3 Regulating the enforcement of Labour Law in nuclear power plants (NPPs)

Labour inspection in the NPPs has been ensured from the outset by the administration tasked with technical oversight under the authority of the Minister responsible for Labour; the competence of ASN is now codified in Article R. 8111-11 of the Labour Code. The nineteen NPPs in operation, the nine reactors undergoing decommissioning and the EPR reactor under construction at Flamanville are the responsibility of the ASN labour inspectorate. The regulation of safety, radiation protection and labour inspection very often covers common topics, such as worksite organisation or the conditions of use of outside contractors (see chapter 12).

The ASN labour inspectors have four essential duties:

1. checking application of all aspects of labour legislation (health, occupational safety and work conditions,

occupational accident inquiries, quality of employment, collective labour relations);

2. advising and informing the employers, employees and personnel representatives about their rights, duties and labour legislation;
3. feeding back information to the administration on changes in the work environment and any shortcomings in the legislation;
4. facilitating conciliation between the parties.

The ASN labour inspectors also have powers of decision concerning authorisation requests (redundancy of personnel representatives, waivers to regulations in terms of work or rest times, health and safety).

Their legitimacy is underpinned not only by international standards (convention No. 81 of the International Labour Organisation - ILO), but also by national texts regulating the inspection departments. These duties are carried out in liaison

with the other Government departments concerned, mainly the departments of the Ministry of Labour.

The six main requirements identified by ASN in 2007 and related to the labour inspection responsibility in NPPs were:

1. exercise closer regulation of contractor working conditions and of EDF's surveillance of subcontracted activities;
2. deal with the growing problems of construction/dismantling;
3. take full account of social, organisational and human factors;
4. encourage EDF to include the goal of security in addition to safety and radiation protection;
5. ensure effective and consistent nationwide application of the Labour Code and collective agreements;
6. highlight ASN's extended labour inspection responsibility.

Since that date ASN has adopted an organisational structure that enables it to fulfil these requirements. To achieve the goals set in 2007, the skills in this area have been reinforced, and

the 13 ASN labour inspectors, 3 of whom are full-time inspectors (corresponding to 6.5 full-time equivalents – FTE) in the divisions are coordinated and accompanied by a labour inspection director seconded from the Ministry of Labour. Their action on the ground has increased markedly since 2009, particularly during reactor outages, with the inspection visits, advisory roles at the meetings of the Committee for Health, Safety and Working Conditions (CHSCT) and the Inter-Company Committee on Safety and Working Conditions (CIESCT), and regular discussions with the social partners. The ASN labour inspectors have no hesitation in reporting breaches of the labour regulations, whether by the licensee or by outside contractors and their subcontractors, in order more particularly to promote progress in work situations that could jeopardise the safety of the facilities or the radiological exposure of workers.

## 2 REGULATION THAT IS PROPORTIONATE TO THE IMPLICATIONS OF THE ACTIVITIES

ASN organises its regulatory work in a way that is proportionate to the implications of the activities. The licensee remains the key player in the regulation of its activities. The performance of certain inspections by organisations and laboratories offering the necessary guarantees as validated by ASN approval, contributes to this action.

### 2|1 Defining the implications

In order to take account firstly of the health and environmental implications and the licensees' safety and radiation protection performance, and secondly the large number of activities it has to oversee, ASN periodically identifies the high-consequence activities and inspects them directly:

- some activities, namely those displaying the greatest risk in terms of safety and radiation protection, are carried over from one year to the next. To give an example, the pressurised water reactors are inspected each year on the theme of “social, organisational and human factors”;
- others receive particular attention in a given year due to changes in the regulations or the findings of the previous year. Table 2 shows the major-implication activities and topics singled-out specifically for the year 2012.

In order to identify these activities and topics, ASN relies on current scientific and technical knowledge and uses the information collected by both itself and IRSN: results of inspections, frequency and nature of incidents, major modifications made to

facilities, review of files, feedback of data concerning doses received by workers, information resulting from checks by approved organisations. It can revise its priorities further to significant events that have occurred in France or elsewhere in the world.

### 2|2 Enforcing the principle of licensee prime responsibility

ASN considers that operations taking place in BNIs with the highest potential consequences in terms of safety and radiation protection must obtain prior authorisation from it (see chapter 3). Those for which the potential safety and radioprotection consequences are limited must remain under the responsibility and control of the licensee.

#### 2|2|1 Operations subject to a licensee internal authorisations procedure

For operations presenting potential consequences in terms of safety and radiation protection that are significant but do not compromise the safety scenarios used in BNI operation or decommissioning, ASN allows the licensee to assume direct responsibility for them provided that it sets up a system of enhanced, systematic internal checks, offering sufficient guarantees of quality, independence and transparency. The decision on whether or not to carry out the operations must

Table 2: Activities with major implications in 2012<sup>1</sup>

| Field                                                  | Topics or activities with major implications                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Pressurised water reactors                             | <b>Safety implications:</b> <ul style="list-style-type: none"> <li>– Maintenance and operation, taking conformity deviations into account,</li> <li>– Services (in relation with the ASN labour inspectorate),</li> <li>– Obsolescence and qualification,</li> </ul> <b>Labour inspection implications:</b> <ul style="list-style-type: none"> <li>– Verification of the risk assessment,</li> <li>– Subcontracting and work duration during plant unit outages,</li> <li>– Risk of fire and explosion.</li> </ul> |
| Fuel cycle facilities                                  | <ul style="list-style-type: none"> <li>– Targeted inspections (see box),</li> <li>– Waste management procedures and conditions of approval, of on-site waste conditioning and of acceptance of waste in disposal facilities.</li> </ul>                                                                                                                                                                                                                                                                            |
| Small-scale nuclear activities in the industrial field | <ul style="list-style-type: none"> <li>– Industrial radiography activities,</li> <li>– Equine veterinary activities,</li> <li>– Removal of lightning arresters,</li> <li>– Regularising noncompliant activity situations,</li> <li>– Cyclotron,</li> <li>– X-ray generator suppliers.</li> </ul>                                                                                                                                                                                                                   |
| Small-scale nuclear activities in the medical field    | <ul style="list-style-type: none"> <li>– Computed tomography (CT),</li> <li>– Priorities of preceding years continued in radiotherapy, brachytherapy, nuclear medicine, interventional radiology.</li> </ul>                                                                                                                                                                                                                                                                                                       |
| Transport of radioactive substances                    | <ul style="list-style-type: none"> <li>– Management of transport safety,</li> <li>– Packages not requiring approval,</li> <li>– Safety parameters and requirements in the certificates,</li> <li>– Maintenance,</li> <li>– On-site transport operations,</li> <li>– Manufacture of packages.</li> </ul>                                                                                                                                                                                                            |

1. These activities and themes with major implications are additional to the important ones always inspected each year by ASN.

be the subject of a formal authorisation issued by the licensee's duly qualified staff. This organisation is called the "internal authorisations system". It is presented to the competent Local Information Committees (CLI).

This internal authorisations system is regulated by the decree of 2nd November 2007 and by ASN resolution 2008-DC-106 of 11th July 2008, which specifies ASN's requirements.

ASN verifies correct application of the internal check arrangements by various means: inspections, review of the periodic reports communicated by the licensees, cross-checking of the dossiers, etc. It can at all times either terminate or temporarily suspend an "internal authorisations system" if it considers it to be unsatisfactorily implemented, in which case the corresponding operations must be referred to ASN for prior authorisation.

## 2.2 Internal monitoring of radiation protection by the users of ionising radiation sources

The aim of internal monitoring of radiation protection is to ensure regular assessment of the radiological safety of the facilities using sources of ionising radiation. This monitoring is performed under the responsibility of the licensees. It may be carried out by the Person Competent in Radiation protection (PCR), appointed and mandated by the employer, or be entrusted to IRSN or to organisations approved by ASN. It does not replace either the periodic checks required by the regulations, or the inspections conducted by ASN. It for example concerns the performance of the protection systems, monitoring of the ambient atmosphere in regulated areas, checks on medical appliances before they enter service or after modification.

## 2|2|3 Packages not requiring approval

The package models with the greatest safety implications require approval from ASN. This includes those intended for the transport of high activity radioactive substances, or those in which the contents could present a criticality risk (see chapter 11). However, for the other types of packages, in particular those for which destruction can lead to exposure of up to 50 mSv in 30 minutes at a distance of 1 metre, the consignor is responsible for demonstrating that the package model used does indeed meet the safety requirements set by the regulations and that it is appropriate for the contents to be transported. ASN regularly conducts inspections to check the measures adopted by the consignors of these packages, referred to as “packages not requiring approval”.

## 2|3 Increasing ASN regulation resources by approving organisations and laboratories

Article L.592-21 of the Environment Code states that ASN must issue the necessary approvals to the organisations taking part in the inspections and in ensuring nuclear safety and radiation protection. Depending on the health or safety implications of a nuclear activity or a facility category, ASN may rely on the results of checks carried out by independent organisations and laboratories it has approved and which it monitors via second level checks.

ASN thus approves organisations to perform the technical inspections required by the regulations in the fields within its scope of competence.

- radiation protection checks;
- measurement of radon activity concentration in premises open to the public;
- assessment of nuclear pressure equipment conformity and inspection of equipment in service.

The checks carried out by these organisations contribute to ASN's overview of all nuclear activities.

In order to approve the applicant organisations, ASN ensures that they perform the inspections in accordance with their technical, organisational and ethical obligations and in compliance with the rules of professional good practice. Compliance with these provisions should enable the required level of quality to be obtained and maintained.

ASN ensures that benefit is gained from the approval, in particular through regular exchanges with the organisations it has approved and the mandatory submission of an annual report, in order to:

- turn operating experience feedback to good account;
- improve the approval process;
- improve the conditions of intervention of the organisations.

ASN also approves laboratories to conduct analyses requiring a high level of measurement quality if the results are to be usable.

It thus approves laboratories:

- for monitoring environmental radioactivity (see point 4);
- for worker dosimetry (see chapter 1).

The list of approvals issued by ASN is kept up to date on [www.asn.fr](http://www.asn.fr) (“Bulletin officiel de l'ASN/agréments d'organismes” section).

As at 31st December 2012, the following are approved by ASN:

- 39 organisations tasked with radiation protection checks, of which 14 are approvals or approval renewals delivered during 2012;
- 39 organisations tasked with measuring radon activity concentration, of which 23 are approvals or approval renewals delivered during 2012;
- 18 organisations tasked with worker dosimetry (9 for the internal monitoring of workers, 7 for the external monitoring of workers and 2 for internal and external exposure of workers associated with natural radioactivity), of which 6 are approvals or approval renewals delivered during 2012;
- 63 laboratories for environmental radioactivity measurements covering 810 approvals, of which 105 are approvals or approval renewals delivered during 2012.

ASN gives the General Directorate for Health (DGS) an opinion on the approval of the laboratories analysing radioactivity in water intended for human consumption.

It gives the Ministers responsible for nuclear safety and transport an opinion on the approval of the organisations responsible for:

- training the drivers of vehicles transporting radioactive substances (class-7 hazardous materials);
- organising safety adviser examinations for transport of dangerous goods by road, rail or navigable waterway;
- certifying the conformity of packagings designed to contain 0.1 kg or more of uranium hexafluoride (initial and periodic checks);
- issuing type approval for tank-containers and swap tanks intended for transport of class-7 hazardous materials by land;
- the initial and periodic checks of tankers for transport of class-7 hazardous materials by land.



### 3 DEPLOYING THE MOST EFFICIENT REGULATION AND INSPECTION MEANS

The licensee is required to provide ASN with the information it needs to meet its regulatory responsibilities. The volume and quality of this information should enable ASN to analyse the technical demonstrations presented by the licensee and target the inspections. It should also allow identification and monitoring of the milestones in the operation of a nuclear activity.

#### 3|1 Assessing the supporting documents submitted by the licensee

The purpose of the documents supplied by the licensee is to demonstrate compliance with the objectives set by the general regulations, as well as those that it has set for itself. ASN is required to check the completeness of the data and the quality of the demonstration.

Review of this data may lead ASN to accept or to reject the licensee's proposals, to ask for additional information or studies or to ask for work to bring the relevant items into conformity.

#### 3|1|1 Analysing the information supplied by basic nuclear installation (BNI) licensees

Reviewing the supporting documents produced by the licensees and the technical meetings organised with them are one of the forms of control carried out by ASN.

Whenever it deems necessary, ASN seeks the advice of technical support organisations, primarily IRSN. The safety review implies cooperation by numerous specialists, as well as efficient coordination, in order to identify the essential points relating to safety and radiation protection.

IRSN assessment relies on research and development programmes and studies focused on risk prevention and improving our knowledge of accidents. It is also based on in-depth technical discussions with the licensee teams responsible for designing and operating the plants.

For the more important issues, ASN requests the opinion of the competent Advisory Committee of experts. For other matters, IRSN examines the safety analyses and gives its opinion directly to ASN. ASN procedures for requesting the opinion of a technical support organisation and, where required, of an Advisory Committee, are described in chapter 2.

At the design and construction stage, ASN – aided by its technical support organisation – examines the safety analysis reports describing and justifying basic design data, equipment design calculations, utilisation rules and test procedures, and quality organisation provisions made by the prime contractor and its suppliers. ASN also checks the construction and manufacture of structures and equipment, in particular PWR Main Primary Systems (MPS) and Main Secondary Systems (MSS). In accordance with the same principles, it checks the packages intended for the transport of radioactive substances.

Once the nuclear facility has been commissioned, following ASN authorisation, all changes to the facility or its operation

made by the licensee that could affect security, public health and safety, or protection of nature and the environment, are notified to ASN. Moreover, the licensee must perform periodic safety reviews to update the assessment of the facility, taking into account any changes in techniques and regulations, and experience feedback. The conclusions of these reviews are submitted to ASN, which can issue new provisions in order to tighten the safety requirements (see chapter 12 point 2|2|3).

#### *Other information submitted by BNI licensees*

The licensee submits routine activity reports and summary reports on water intake, liquid and gaseous discharges and the waste produced.

Similarly, there is a considerable volume of information on specific topics such as fire protection, PWR fuel management strategies, relations with subcontractors, and so on.

#### 3|1|2 Reviewing the procedures laid down by the Public Health Code

ASN is responsible for reviewing applications to possess and use ionising radiation sources in the medical and industrial sectors. ASN also deals with the specified procedures for the acquisition, distribution, import, export, transfer, recovery and disposal of radioactive sources. It in particular relies on the inspection reports from the approved organisations and the reports on the steps taken to remedy nonconformities detected during these inspections.

In addition to the internal inspections carried out under the responsibility of the establishments and the periodic checks required by the regulations, ASN carries out its own verifications. In this respect it directly carries out checks during the procedures for issue (pre-commissioning inspections) or renewal (periodic inspections) of the authorisations to possess and use radiation sources granted on the basis of Article R. 1333-23 of the Public Health Code. The authorisation notifications can only be issued if the requests submitted by ASN following the checks have been taken into account. These checks are in particular designed to compare the data contained in the files with the actual physical reality (sources inventory, check on the conditions of production, distribution and utilisation of the sources and the devices containing them). They also enable ASN to ask the establishments to improve their in-house provisions for source management and radiation protection.

### 3|2 Inspection of installations and activities

#### 3|2|1 Inspection objectives and principles

The inspection carried out by ASN is based on the following principles:

1. the inspection aims to detect any deviations indicative of a possible deterioration in facility safety or the protection of



Examination of documents during the commissioning inspection of a radiotherapy facility at the Franco-British Hospital Institute in Levallois-Perret – September 2012

individuals and any non-compliance with the legislative and regulatory requirements the licensee is bound to apply;

2. the inspection is proportionate to the level of risk presented by the facility or activity;
3. the inspection is neither systematic nor exhaustive, is based on sampling and focuses on subjects with the greatest implications.

### 3|2|2 Inspection resources

To ensure greater efficiency, ASN's action is organised on the following basis:

- inspections, at a predetermined frequency, of the nuclear activities and topics of particular health and environmental significance;
- inspections on a sample of installations representative of the other nuclear activities;
- systematic technical inspections of all facilities by approved organisations.

As mentioned earlier, the activities with lesser implications are checked by the approved organisations, but can also be the subject of targeted inspections by ASN.

The inspections may be unannounced or notified to the licensee a few weeks before the visit. They take place mainly on the site or during the course of the relevant activities (work, transport operation). They may also concern the head office departments or design and engineering departments at the major licensees, the workshops or engineering offices of the subcontractors, the construction sites, plants or workshops manufacturing the various safety-related components.

ASN uses various types of inspections:

- standard inspections;
- in-depth inspections, which take place over several days and mobilise about ten inspectors (example on page 144). Their purpose is to carry out detailed examinations and they are overseen by senior inspectors;
- inspections with sampling and measurements. These are designed to check discharges by means of samples that are independent of those taken by the licensee;

- inspections carried out further to a particularly significant event;
- worksite inspections, ensuring a significant ASN presence on the sites on the occasion of reactor outages or particular work, especially in the decommissioning phase;
- inspection campaigns, which involve conducting inspections in a large number of facilities applying the same method each time; these are short inspections focusing on a specific inspection theme or part of a theme, to verify application of the regulations or to explore a new theme.

The labour inspectors carry out various types of inspection, focusing in particular on:

- checking application of the Labour Code by EDF and outside contractors in the NPPs (checking operations that include inspections);
- participation in the meetings of various committees for health, safety and working conditions (CHSCT, CIESCT and CISSCT - EPR work site);
- conducting inquiries further to requests, complaints or information, which may for example lead to resolutions or opinions.

These inspections give rise to records, made available to the licensee. They concern:

- anomalies in the facility or aspects warranting additional justifications;
- deviations between the situation observed during the inspection and the regulations or documents produced by the licensee pursuant to the regulations.

Some inspections are carried out with the support of an IRSN representative specialised in the facility visited or the topic of the inspection.

#### ASN inspectors

To fulfil its tasks ASN has inspectors designated and accredited by the ASN Chairman, in accordance with the conditions defined by decree 2007-831 of 11th May 2007, subject to having acquired the requisite legal and technical skills through professional experience, mentoring or training courses.

The inspectors take an oath and are bound to professional secrecy. They exercise their inspection activity under the authority of the Director-General of ASN and have regularly updated practical aids (inspection guides, decision aids) to assist them in their inspections.

As part of its continuous improvement policy, ASN encourages the exchange and integration of good practices used by other inspection organisations:

- by organising exchanges of inspectors between safety authorities, either for the duration of one inspection or for longer periods that could extend to a secondment of up to three years. Thus, after having observed its advantages, ASN has adopted the concept of in-depth inspections described earlier. However, it has not opted for the system involving a resident inspector on a nuclear site: ASN considers that its inspectors must work within a structure large enough to allow the sharing of experience and that they must take part in inspections on different licensees and facilities in order to acquire a broader view of this field of activity. This also avoids confusion of responsibilities;
- by taking on inspectors training in other inspection practices. ASN encourages the integration in its services of inspectors

from other inspection authorities (inspectorates of Installations Classified on Environmental Protection Grounds (ICPE), National Agency for Medicines and Health Product Safety (ANSM), Regional Health Agencies (ARS), etc.). It also proposes organising joint inspections with these bodies concerning the activities falling within its scope of expertise;

- by encouraging its staff to take part in inspections on subjects in different regions and domains, to ensure the uniformity of its practices, among other things.

Table 3 presents the inspector staffing levels as at 31st December 2012. Some inspectors operate in several inspection areas, and all the operational entity heads and their deputies fulfil both managerial and inspection functions.

Graph 1 shows how the numbers of inspectors and inspections in the areas of nuclear safety and radiation protection have evolved.

In 2012, ASN carried out 2093 inspections on BNIs, radioactive substance transport, activities using ionising radiation, organisations and laboratories it has approved and activities involving pressure equipment, and 281 days of labour inspections.

### ASN inspections programme

To guarantee an adequate distribution of the inspection resources, proportionate to the safety and radiation protection implications of the various facilities and activities, ASN each year drafts an inspections forecast schedule, taking into account the inspection implications (see 2 | 1). This schedule is not known to those in charge of nuclear activities.

ASN performs qualitative and quantitative supervision of the inspection programme and the actions taken subsequent to the inspections. Reports are issued as the inspection programme is carried out. They enable the inspected activities to be assessed and contribute to the process of continuous improvement of the inspection process.

### Information relative to the inspections

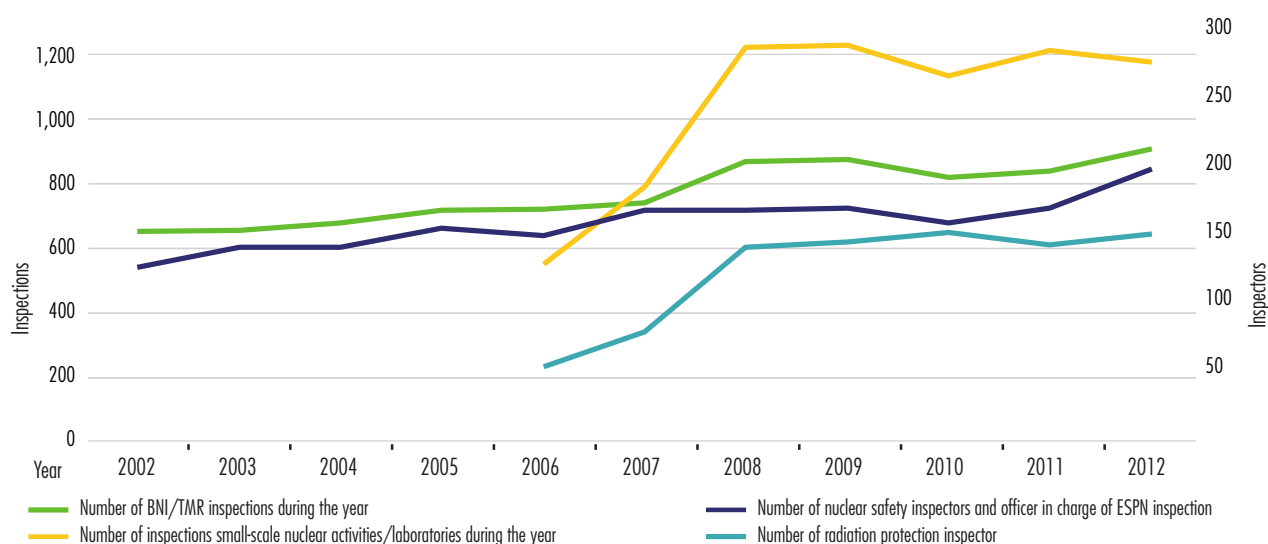
ASN informs the public of the follow-up to the inspections by posting the inspection follow-up letters on-line at [www.asn.fr](http://www.asn.fr). This subject is developed in greater detail in chapter 6.

Table 3: Number of inspectors per inspection domain (as at 31.12.2012)

| Type of inspector                          | Departments | Divisions | Total |
|--------------------------------------------|-------------|-----------|-------|
| Nuclear safety inspector (BNI)             | 81          | 98        | 179   |
| Pressure equipment inspector               | 18          | 33        | 51    |
| Nuclear safety inspector (transport)       | 9           | 36        | 45    |
| Radiation protection inspector             | 39          | 108       | 147   |
| Labour inspector                           | 1           | 12        | 13    |
| Number of inspectors (all fields included) | 113*        | 163*      | 276*  |

\* Some inspectors are qualified in several inspection domains.

Graph 1: Evolution of the number of ASN inspectors and inspections over the last ten years



### ASN's reflections on the inspections programme

*In 2012, ASN initiated a reflection with the aim firstly of improving the preparation and tracking of the annual inspection programme and secondly of raising the profile of the inspection activity*

*It organised a discussion day with inspection representatives from the areas of the environment, health, and nutrition. Many common points between inspection practices were highlighted, notably the defining of inspection priorities proportionate to the implications of the activities and the regulatory developments, and finding a balance between the inspection activities and the inspectors' other duties.*

*ASN will use the feedback from that day to:*

- facilitate the understanding of the inspection programme and its preparation process;*
- better evaluate the time devoted to the inspection activity and take into account the particularities of certain types of inspection to increase their effectiveness;*
- define communication and programme tracking indicators to give a better picture of the inspection activity.*

*Some proposals may be implemented when the next inspection programme is produced.*

### 3|2|3 Inspection of basic nuclear installations (BNIs) and pressure equipment in 2012

In 2012, 802 BNI inspections were carried out, of which more than 26% were unannounced.

The inspection breakdown by theme is shown in graph 2.

The themes related to nuclear safety and social, organisational and human factors represent more than 50% of the BNI inspections. Several targeted inspections on the themes relating to the Fukushima accident were carried out (see box).

With regard to pressure equipment, in 2012, ASN and the approved organisations carried out:

– more than 830 inspections as part of the manufacturing inspection of the nuclear pressure equipment (NPE) for the EPR FA3 reactor, which represented more than 1,600 man/days in the plants of the manufacturers and their suppliers and subcontractors;

– more than 1,600 inspections as part of the manufacturing inspection of the replacement steam generators intended for the in-service nuclear power reactors, which represented more than 3,400 man/days in the plants of the manufacturers and their suppliers and subcontractors.

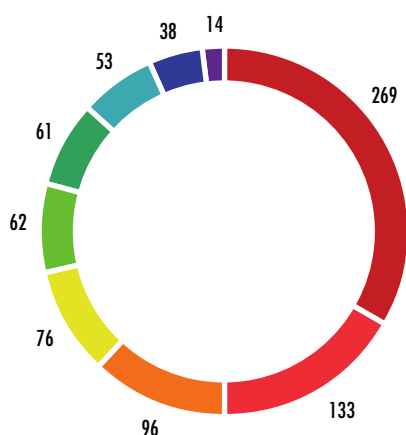
Lastly, the ASN labour inspectors carried out 281 days of labour inspection.



ASN inspection at the Nogent-sur-Seine NPP on the theme of operational management for incidents and accidents—September 2012

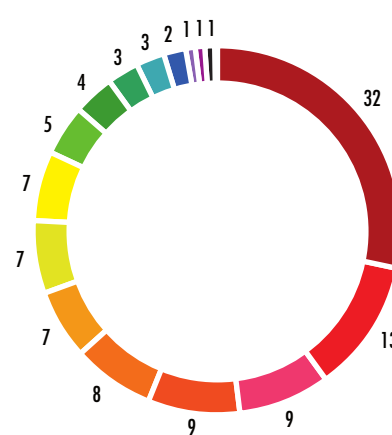


Graph 2: Breakdown of BNI inspections in 2012 by theme



- Nuclear safety
- Staff and organisation
- Effluent, waste and environmental monitoring
- Pressure equipment
- General inspection and others
- Prevention of risks including fire
- Radiation protection
- Post-Fukushima targeted inspection
- Emergency management

Graph 3: Breakdown of RMT inspections in 2012 by theme



- Shipment - organisation of transport operations
- Road transport
- Transport of F18
- General inspection
- Non-approved packages
- Others
- Maintenance
- Air transport
- Gamma radiography
- Gammasensimetry
- Tests
- Manufacture
- Transit storage
- Rail transport
- Sea transport
- Internal transport

### Targeted inspections and follow-up inspections

The ASN inspection programme for 2012 continued to take into consideration the nuclear accident at the Fukushima power plant in Japan.

The 19 facilities of the fuel cycle considered lower priority underwent targeted inspections that provided an on-the-ground sampling check of the conformity of the licensee's equipment and organisation with the existing baseline safety standards. They concerned the following topics:

- protection against external hazards, in particular seismic resistance and protection against flooding,
- loss of electrical power supplies,
- loss of heat sinks,
- operational management of radiological emergency situations.

ASN also carried out 40 “follow-up” inspections to verify the correction of deviations detected in 2011 during inspections in the 38 French nuclear facilities considered as priority cases.

As it does regularly, ASN suggested that the CLI and the HCTISN (French High Committee for Transparency and Information on Nuclear Security) send observers to attend these post-Fukushima inspections; fifteen inspections have thus been attended by observers. In addition to this, one inspection was attended by a member of the Belgian safety authority.

TO BE NOTED IN 2012

### 3 | 2 | 4 Inspection of radioactive substance transport in 2012

The 112 inspections on transport activities in 2012 can be broken-down according to theme as shown in graph 3.

More than 30% of the inspections were carried out on the theme of “shipment and organisation of transport operations”.

### ASN carries out its first in-depth inspection in small-scale nuclear activities



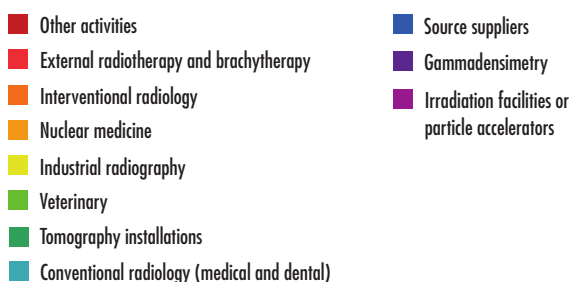
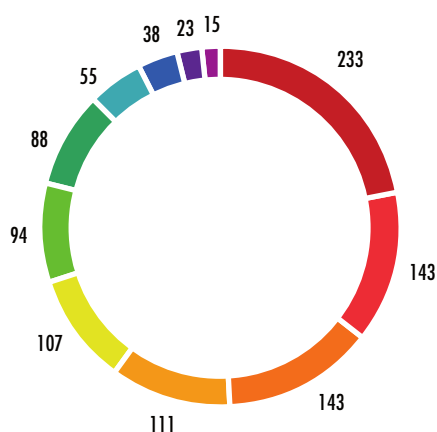
The ASN in-depth inspection team, accompanied by two IRSN experts, at the ONERA centre in Toulouse – October 2012

Five ASN inspectors and two IRSN experts performed a three-day in-depth inspection in the Toulouse branch of the ONERA (the French National Aerospace Research Centre). The ONERA operates several irradiation facilities that are subject to ASN oversight. These facilities, the purpose of which is to study the reliability of the electronic components used in satellites, comprise two industrial gammagraphy facilities, sealed sources used in an irradiator, three electron and proton accelerators, and electron guns.

The ASN inspectors conducted an in-depth inspection of the conformity of the facilities, of the robustness and durability of the radiation protection organisation in place, and - more broadly - compliance with the licensee's commitments to ASN as part of the examination of its facility commissioning applications.

By covering all the oversight themes, this inspection gave the inspectors a cross-spectrum view of the ONERA's activities. It revealed the value of developing the in-depth inspection process in small-scale nuclear activities.

Graph 4: Breakdown of small-scale nuclear activity inspections in 2012 according to nature of activity



### 3|2|5 Inspection of small-scale nuclear activities in 2012

ASN organises its inspection activity so that it is proportionate to the radiological issues involved in the use of ionising radiation, and consistent with the actions of the other inspection services.

In 2012 ASN carried out 1,050 inspections - over 15% of which were unannounced - in some of the 50,000 or so nuclear facilities and activities in the sector. These inspections are divided among the medical (53%), industrial or research (35%) and veterinary (9%) sectors. Furthermore, 38 inspections were carried out in landfills, mines and spoil heaps, polluted sites, and companies without a nuclear activities but whose employees are exposed to ionising radiation. The breakdown according to the various activity categories is shown in graph 4.

### 3|2|6 Inspection of ASN approved organisations and laboratories in 2012

ASN carries out a second level of inspection on approved organisations and laboratories. In addition to reviewing the application file and issuing the approval, this comprises surveillance such as the following:

- approval follow-up or renewal audits;
- checks to ensure that the organisation and operation of the entity concerned comply with the applicable requirements;
- checks, which are usually unannounced, to ensure that the organisation's staff work in satisfactory conditions.

In 2012, ASN carried out 129 inspections of approved organisations and laboratories, broken down as follows:

- organisations carrying out radiation protection technical checks: 84 inspections;
- organisations evaluating nuclear pressure equipment conformity and inspecting operational equipment: 23 inspections;
- organisations measuring radon activity concentration: 9 inspections;
- laboratories approved for environmental radioactivity measurements: 13 inspections.

### 3|2|7 Checks on exposure to radon and Naturally Occurring Radioactive Materials (NORM) in 2012

ASN also monitors radiation protection in premises where exposure of individuals to natural ionising radiation can be enhanced owing to the underlying geological context (radon in premises open to the public) or the characteristics of the materials used in industrial processes (non-nuclear industries).

#### *Monitoring exposure to radon*

Article R.1333-15 of the Public Health Code and Article R.4451-136 of the Labour Code provide for the radon activity concentration to be measured either by IRSN or by ASN-approved organisations. These measurements are to be taken between 15th September of a given year and 30th April of the following year.

For the 2012-2013 measurement campaign, the number of approved organisations is indicated in table 4.

#### *Monitoring exposure to natural ionising radiation in non-nuclear industries*

The order of 25th May 2005 provides the list of professional activities (ore or rare earth processing industries, spas and facilities treating groundwater for human consumption) requiring monitoring of human exposure to natural ionising radiation, owing to the fact that the materials used contain natural radionuclides and are likely to generate doses that are significant from the radiation protection standpoint.

#### *Monitoring natural radioactivity in water intended for human consumption*

Since 1st January 2005 (order of 12th May 2004), monitoring of natural radioactivity in water intended for human consumption is an integral part of the health monitoring carried out by the ARS. The procedures for these checks take account of the recommendations issued by ASN and taken up in the DGS circular of 13th June 2008. The results of the checks are jointly analysed and utilised by ASN and the services of the Ministry of Health.

### 3|3 Controlling the environmental and health impacts of NPPs

ASN considers that protection of the public and the environment is an essential part of the regulation of nuclear activities, whether these activities are carried out in BNIs or in the industrial and medical sectors.

Regulation of the environmental and health impact of BNIs was put in place at the time the first installations were commissioned, and is the subject of particular provisions figuring in the order of 7th February 2012. The impact is primarily assessed from the measurement or evaluation of discharges from the installations. The monitoring of discharges on this account is particularly important, and is implemented as soon as a site is commissioned.

In the small-scale industrial nuclear sector, few plants discharge effluents apart from the cyclotrons (see chapter 10). The discharge permits stipulate requirements for the discharges and their monitoring, which are subject to particular scrutiny during inspections.

Lastly, with regard to the activities in the medical sector, the impact was initially evaluated on the basis of studies and estimates. More accurate monitoring based on discharge measurements is gradually being established under the impetus of ASN.

#### 3|3|1 Monitoring discharges

##### *Monitoring discharges from BNIs*

The monitoring of discharges from an installation is essentially the responsibility of the licensee. The provisions regulating

Table 4: Number of organisations approved for measuring radon levels

|                    | Approval until<br>15th September 2013 | Approval until<br>15th September 2014 | Approval until<br>15th September 2015 | Approval until<br>15th September 2016 | Approval until<br>15th September 2017 |
|--------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|---------------------------------------|
| Level 1 option A*  | 4                                     | 0                                     | 7                                     | 18                                    | 10                                    |
| Level 1 option B** | 0                                     | 0                                     | 0                                     | 0                                     | 5                                     |
| Level 2***         | 1                                     | 0                                     | 1                                     | 5                                     | 1                                     |

\* Workplace and premises open to the public for all types of buildings

\*\* Workplace, cavities and underground structures (except buildings)

\*\*\* Corresponds to complementary investigations

discharges stipulate the minimum checks that the licensee is required to carry out. The monitoring focuses on the effluents (monitoring of the activity of discharges, characterisation of certain effluents prior to discharge, etc.) and environmental monitoring (checks during discharge, samples of air, milk, grass, etc.). It can include measurements of environmental parameters, such as meteorological parameters. 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. This programme of cross-checks defined by ASN is a way of ensuring that the accuracy of the laboratory measurements is maintained over time.

Finally, ASN uses a system of unannounced inspections to ensure that the licensees abide by the regulations. Inspectors - assisted when necessary by technicians from a specialised, independent laboratory, check compliance with the regulation requirements, have samples taken 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 (20 in 2012).

### Accounting rules for BNI discharges

The accounting rules for radioactive discharges, which enable their dosimetric impact on the population to be calculated, obey the following 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;
- applicable decision thresholds are defined 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. These evolving reference spectra are based on operating experience feedback



ASN inspection on the “Environment” theme at the Bugey NPP - May 2012

### 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  $LD \approx 2 \times SD$ .

UNDERSTAND

### Reference spectra used for NPPs

The reference spectra selected for NPP radioactive discharges are as follows:

#### • Liquid:

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

#### • Gaseous:

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

UNDERSTAND



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.

The rules applicable to chemical discharges shall be formalised in the general regulations applicable to BNIs, currently being overhauled.

### Monitoring discharges in the medical sector

Pursuant to ASN Resolution 2008-DC-0095 of 29th January 2008, radioactivity measurements are taken on the effluents coming from the places that produce them. In hospitals that have a nuclear medicine department, these measurements chiefly concern iodine-131 and technetium-99m. In view of the difficulties in putting in place the permits to discharge radionuclides into the public sewage networks, as provided for by the Public Health Code, ASN has taken the initiative to prepare new recommendations which should in particular address the conditions of monitoring these discharges.

## 3.3.2 Evaluating the radiological impact of the facilities

In application of the optimisation principle, the licensee must reduce the radiological impact of its facility to values that are as low as possible under economically acceptable conditions.

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. The result must be compared with the annual dose limit for the public (1 mSv per year) defined in Article R.1333-8 of the Public Health Code. This regulation limit corresponds to the sum of the effective doses received by the public as a result of nuclear activities.

It must be pointed out that in practice, only traces of artificial radioactivity are detectable in the vicinity of the nuclear facilities and that most measurements taken during routine surveillance are below the decision threshold or reflect the

natural radioactivity. Consequently, these measurements cannot be used for estimating doses. It is therefore necessary to use models of radioactivity transfer to man based on the facility discharge measurements. These models are specific to each licensee. ASN, who wants the methods used to be as uniform as possible, received an opinion from IRSN in 2012 on the methodologies used for the dosimetric impact calculations. In 2013, ASN will reflect upon the actions that should be implemented.

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 carrying out these measurements must be approved by ASN (see 4 | 3).

An estimation of the doses from BNIs is presented in table 5. For each site and per year, this table gives the effective doses received by the most exposed reference population groups.

The doses from BNIs for a given year are determined on the basis of the actual discharges from each installation for the year in question. 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 radiation present in the facilities. These elements are the “source term”.

The estimate is made in relation to one or more identified reference groups. These are uniform groups of people (adults, infants, children) receiving the highest average dose out of the entire population exposed to a given installation, following realistic scenarios (taking into account the distance to the site, meteorological data, etc.). All of these parameters, specific to each site, explain most of the differences observed between sites and from one year to another.

For each of the nuclear sites presented, the radiological impact remains far below 1% of the limit for the public 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 radiological impact.

Table 5: Radiological impact of BNIs since 2006 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 licensees)

| Licensee/Site  | Most exposed reference group<br>(population/distance from site in km) <sup>a</sup> | Estimation of received doses, in mSv     |                                          |                                          |                                          |                                          |                                          |
|----------------|------------------------------------------------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|------------------------------------------|
|                |                                                                                    | 2006                                     | 2007                                     | 2008                                     | 2009                                     | 2010                                     | 2011                                     |
| AREVA/La Hague | Digulleville / 2.8 [Child]<br>Fisherman Gourey / 6 [Adult, Child (2008, 2009)]     | 1,10 <sup>-2</sup><br>6,10 <sup>-3</sup> | 1,10 <sup>-2</sup><br>6,10 <sup>-3</sup> | 8,10 <sup>-3</sup><br>5,10 <sup>-3</sup> | 8,10 <sup>-3</sup><br>4,10 <sup>-3</sup> | 1,10 <sup>-2</sup><br>5,10 <sup>-3</sup> | 9,10 <sup>-3</sup><br>5,10 <sup>-3</sup> |
| GANIL/Caen     | IUT / 0.6 [Adult]                                                                  | 3,10 <sup>-3</sup>                       | < 6,10 <sup>-3</sup>                     | < 9,10 <sup>-3</sup> b                   | 3,10 <sup>-3</sup>                       | < 3,10 <sup>-3</sup>                     | < 3,10 <sup>-3</sup>                     |
| EDF/Cattenom   | Garce nord, Warpich (2009, 2010, 2011) / 1.5<br>(Adult, Infant (2009, 2010, 2011)) | 3,10 <sup>-3</sup>                       | 3,10 <sup>-3</sup>                       | 3,10 <sup>-3</sup>                       | 3,10 <sup>-3</sup>                       | 3,10 <sup>-3</sup>                       | 3,10 <sup>-3</sup>                       |
| CEA/Cadarache  | Saint-Paul-Lez-Durance / 4.5 [Adult]                                               | 3,10 <sup>-4</sup>                       | 2,10 <sup>-3</sup>                       | 2,10 <sup>-3</sup>                       | 2,10 <sup>-3</sup>                       | 2,10 <sup>-3</sup>                       | 3,10 <sup>-3</sup>                       |
| EDF/Civaux     | Ervaux Sud / 0.7 [Adult]                                                           | *                                        | *                                        | 8,10 <sup>-4</sup>                       | 7,10 <sup>-4</sup>                       | 1,10 <sup>-3</sup>                       | 7,10 <sup>-4</sup>                       |
| AREVA/FBFC     | Ferme Riffard / 0.2 [Adult]                                                        | *                                        | *                                        | 6,10 <sup>-4</sup>                       | 8,10 <sup>-4</sup>                       | 1,10 <sup>-3</sup>                       | 6,10 <sup>-4</sup>                       |

Continuation of table 5

| Licensee/Site                                               | Most exposed reference group<br>(population/distance<br>from site in km) <sup>a</sup>                                   | Estimation of received doses, in mSv |                    |                    |                    |                    |                    |
|-------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------|--------------------|--------------------|--------------------|--------------------|
|                                                             |                                                                                                                         | 2006                                 | 2007               | 2008               | 2009               | 2010               | 2011               |
| EDF/Dampierre-en-Burly                                      | La Maison Neuve (2008), Les Serres (2009, 2010, 2011) / 0.7 [Adult]                                                     | *                                    | *                  | 8,10 <sup>-4</sup> | 1,10 <sup>-3</sup> | 1,10 <sup>-3</sup> | 2,10 <sup>-3</sup> |
| EDF/Gravelines                                              | Petit-Fort-Philippe / 1.5, Espace Culturel Decaestecker (2009, 2010, 2011) / 1.1 [Adult, Fischerman (2009, 2010, 2011)] | 3,10 <sup>-4</sup>                   | 3,10 <sup>-4</sup> | 3,10 <sup>-4</sup> | 1,10 <sup>-3</sup> | 1,10 <sup>-3</sup> | 2,10 <sup>-3</sup> |
| EDF/Flamanville                                             | La Berquerie / 0.8, Hameau es Louis (2009, 2010, 2011) [Adult, Fischerman (2009, 2010, 2011)]                           | 5,10 <sup>-3</sup>                   | 1,10 <sup>-3</sup> | 7,10 <sup>-4</sup> | 9,10 <sup>-4</sup> | 9,10 <sup>-4</sup> | 2,10 <sup>-3</sup> |
| EDF/Chooz                                                   | Les Pirettes (gymnase) / 0.8 [Adult, Infant (2009)]                                                                     | *                                    | *                  | 2,10 <sup>-3</sup> | 1,10 <sup>-3</sup> | 1,10 <sup>-3</sup> | 1,10 <sup>-3</sup> |
| EDF/Penly                                                   | Saint-Martin Plage / 1.1 Vassonville (2009, 2010, 2011)/7 [Adult, Fischerman (2009, 2010, 2011)]                        | 5,10 <sup>-4</sup>                   | 6,10 <sup>-4</sup> | 3,10 <sup>-3</sup> | 9,10 <sup>-4</sup> | 1,10 <sup>-3</sup> | 1,10 <sup>-3</sup> |
| EDF/Golfech                                                 | Pascalet / 0.9 Labaqui re (2009, 2010, 2011) / 1 [Adult]                                                                | 2,10 <sup>-4</sup>                   | 5,10 <sup>-4</sup> | 8,10 <sup>-4</sup> | 8,10 <sup>-4</sup> | 9,10 <sup>-4</sup> | 8,10 <sup>-4</sup> |
| EDF/Nogent-sur-Seine                                        | Port Saint-Nicolas 2.25, Maison de l' cluser (2009, 2010, 2011) / 1 [Adult]                                             | 8,10 <sup>-4</sup>                   | 9,10 <sup>-4</sup> | 7,10 <sup>-4</sup> | 6,10 <sup>-4</sup> | 9,10 <sup>-4</sup> | 8,10 <sup>-4</sup> |
| EDF/Paluel                                                  | Le T t / 1.5 [Adult, Fischerman (2009, 2010, 2011)]                                                                     | 2,10 <sup>-3</sup>                   | 2,10 <sup>-3</sup> | 2,10 <sup>-3</sup> | 6,10 <sup>-4</sup> | 7,10 <sup>-4</sup> | 8,10 <sup>-4</sup> |
| EDF/Belleville-sur-Loire                                    | Neuvy-sur-Loire / 1.3 [Adult]                                                                                           | 2,10 <sup>-4</sup>                   | 2,10 <sup>-4</sup> | 6,10 <sup>-4</sup> | 7,10 <sup>-4</sup> | 6,10 <sup>-4</sup> | 8,10 <sup>-4</sup> |
| EDF/Tricastin                                               | Clos du Bonneau / 1.25, Le Trop Long (2009, 2010, 2011) 1.35 [Adult, Infant (2009, 2010, 2011)]                         | 6,10 <sup>-5</sup>                   | 7,10 <sup>-5</sup> | 4,10 <sup>-4</sup> | 7,10 <sup>-4</sup> | 9,10 <sup>-4</sup> | 7,10 <sup>-4</sup> |
| CEA/Saclay                                                  | Christ de Saclay [Fischerman / 1]                                                                                       | 5,10 <sup>-3</sup>                   | 9,10 <sup>-4</sup> | 7,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 7,10 <sup>-4</sup> | 6,10 <sup>-4</sup> |
| EDF/Blayais                                                 | Le Bastion / 1.1 [Adult, Fischerman (2009, 2010, 2011)]                                                                 | 4,10 <sup>-4</sup>                   | 4,10 <sup>-4</sup> | 5,10 <sup>-4</sup> | 5,10 <sup>-4</sup> | 6,10 <sup>-4</sup> | 6,10 <sup>-4</sup> |
| AREVA/Tricastin (AREVA NC, COMURHEX, EURODIF, SOCATRI, SET) | Les Pr s Gu rin s / 1.5 [Adult, Child (2005)]                                                                           | 1,10 <sup>-3</sup>                   | 1,10 <sup>-3</sup> | 5,10 <sup>-4</sup> | 5,10 <sup>-4</sup> | *                  | *                  |
|                                                             | Clos de Bonnot / 0.1 [Adult]                                                                                            | *                                    | *                  | 7,10 <sup>-4</sup> | 8,10 <sup>-4</sup> | 7,10 <sup>-4</sup> | 5,10 <sup>-4</sup> |
| EDF/Cruas-Meyssse                                           | Ferme de Grimaud, 1.25, Serres (2009, 2010, 2011) / 1.5 [Adult (2008, 2011), Infant (2009, 2010)]                       | 2,10 <sup>-4</sup>                   | 8,10 <sup>-5</sup> | 4,10 <sup>-4</sup> | 5,10 <sup>-4</sup> | 5,10 <sup>-4</sup> | 5,10 <sup>-4</sup> |
| EDF/Chinon                                                  | Le Neman / 1.25 [Adult]                                                                                                 | 3,10 <sup>-4</sup>                   | 2,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 5,10 <sup>-4</sup> |
| EDF/Bugey                                                   | St- tienne d'Hi res sud / 0.6 [Adult (2011)]                                                                            | *                                    | *                  | 5,10 <sup>-4</sup> | 5,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 5,10 <sup>-4</sup> |
| ANDRA/Manche                                                | Hameau de La Fosse / 2.5 [Adult]                                                                                        | 8,10 <sup>-4</sup>                   | 7,10 <sup>-4</sup> | 7,10 <sup>-4</sup> | 6,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 4,10 <sup>-4</sup> |
|                                                             | Fischerman Goury / 8 [Adult]                                                                                            | 8,10 <sup>-8</sup>                   | 9,10 <sup>-8</sup> | 5,10 <sup>-8</sup> | 8,10 <sup>-8</sup> | 8,10 <sup>-8</sup> | 7,10 <sup>-8</sup> |
| EDF/St-Alban                                                | Les Cr s [Adult / 1.45]                                                                                                 | 2,10 <sup>-4</sup>                   | 7,10 <sup>-5</sup> | 3,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 4,10 <sup>-4</sup> |
| CEA/Marcoule (ATALANTE, CENTRACO, PH NIX, M LOX, CIS-Bio)   | Codolet [Adult / 2]                                                                                                     | 4,10 <sup>-4</sup>                   | 5,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 3,10 <sup>-4</sup> | 3,10 <sup>-4</sup> |
| EDF/St-Laurent-des-Eaux                                     | Port au Vin [Adult / 0.75]                                                                                              | 9,10 <sup>-5</sup>                   | 2,10 <sup>-4</sup> | 4,10 <sup>-4</sup> | 3,10 <sup>-4</sup> | 3,10 <sup>-4</sup> | 3,10 <sup>-4</sup> |
| EDF/Fessenheim                                              | Cit  EDF (Koechlin) [Adult (2010, 2001 : infant) / 1.2]                                                                 | *                                    | *                  | 8,10 <sup>-5</sup> | 8,10 <sup>-5</sup> | 1,10 <sup>-4</sup> | 8,10 <sup>-5</sup> |
| EDF/Creys-Malville                                          | Ferme de Chancillon [Adult (2010, 2011 : infant) / 0.85]                                                                | *                                    | 1,10 <sup>-5</sup> | 2,10 <sup>-5</sup> | 8,10 <sup>-6</sup> | 6,10 <sup>-5</sup> | 7,10 <sup>-4</sup> |
| ILL/Grenoble                                                | Fontaine / 1 (gaseous discharges) and Saint-Egr ve (liquid discharges) / 1.4 [Infant]                                   | *                                    | *                  | *                  | 1,10 <sup>-4</sup> | 1,10 <sup>-4</sup> | 5,10 <sup>-5</sup> |
| CEA/Fontenay-aux-Roses                                      | Fontenay-aux-Roses / 1.5 [Child]                                                                                        | 2,10 <sup>-5</sup>                   | 9,10 <sup>-6</sup> | 1,10 <sup>-5</sup> | 5,10 <sup>-6</sup> | 4,10 <sup>-6</sup> | 1,10 <sup>-5</sup> |
| ANDRA/CSA                                                   | Pont du CD24 / 2.1 [Child]                                                                                              | 5,10 <sup>-6</sup>                   | 3,10 <sup>-6</sup> | 2,10 <sup>-6</sup> | 5,10 <sup>-6</sup> | 2,10 <sup>-6</sup> | 3,10 <sup>-6</sup> |
| CEA/Grenoble <sup>c</sup>                                   | Fontaine / 1 (gaseous discharges) and Saint-Egr ve (liquid discharges) / 1.4 [Infant, adult (2004, 2008, 2011)]         | 2,10 <sup>-6</sup>                   | 7,10 <sup>-7</sup> | 1,10 <sup>-6</sup> | 3,10 <sup>-7</sup> | 3,10 <sup>-7</sup> | 7,10 <sup>-9</sup> |

a: For installations operated by EDF, only "adult" figures are calculated. Since 2009, the dose of the most exposed reference group of each site for the two age classes (adult or infant) is mentioned.

b: Value measured at site perimeter by means of passive dosimeters. Several dosimeters showed contamination readings, even when the facility was shut down. The value is thus highly over-estimated, according to the licensee.

c: Because the outfall for the liquid discharges is geographically distant from the stack, two impact calculations are performed. One reflects the aggregate of maximum impact of gaseous discharges plus maximum impact of liquid discharges. The other corresponds to an actual reference group.

\*Information not supplied by the licensees.

### 3|4 Learning the lessons from significant events



Action conducted by ASN, IRSN, SDIS 13 and the CEA further to the act of banditry on a truck containing a very low activity source of americium in the industrial zone of Vitrolles – October 2012

### 3|4|1 Anomaly detection and analysis

#### History

The international conventions ratified by France (Article 9v of the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management of 5th September 1997; Article 19vi of the Convention on

Nuclear Safety of 20th September 1994) require that BNI licensees, on account of the defence in depth principle, implement a reliable system for early detection of any anomalies that may occur, such as equipment failures or errors in the application of operating rules.

Based on twenty years of experience, ASN felt that it would be useful to transpose this approach, which was initially limited to nuclear safety, to radiation protection and protection of the environment. ASN thus drafted two guides defining the principles and reiterating the obligations binding on the licensees with regard to notification of incidents and accidents:

- the 21st October 2005 guide contains the requirements applicable to BNI licensees and to carriers. It concerns significant events affecting nuclear safety of BNIs and RMTs, radiation protection and protection of the environment;
- guide No. 11 of 15th June 2007 (modified on 7th October 2009) is intended for those in charge of nuclear activities as defined in L. 1333-1 of the Public Health Code and the heads of the facilities in which ionising radiation is used (medical, industrial and research activities).

These guides can be consulted on [www.asn.fr](http://www.asn.fr).

#### What is a significant event?

Detection of events (deviations, anomalies, incidents, etc.) by those in charge of the activities using ionising radiation, and implementation of corrective measures decided after analysis, play a fundamental role in accident prevention. To give an idea of what this entails, the licensees detect and analyse 100 to 300 anomalies a year for each EDF reactor and about 50 a year for a research facility.

Prioritising the anomalies should enable the most important ones to be addressed first. ASN has defined a category of anomalies called “significant events”. These are events that are

#### The ASN tritium action plan

Further to questions as to what becomes of tritium in the environment and its impact on man, ASN created two pluralistic think-tanks in 2008, one examining the sources of tritium, the other examining its impact on health and the environment. The work confirmed the low impact of tritium discharges in France, but also evidenced the need for further studies and research to consolidate current data and knowledge on the behaviour of tritium in the environment.

On the basis of the conclusions and recommendations of the think-tanks, ASN proposed a plan of action for standardising tritium measurement, for controlling tritiated discharges, and improving the environmental monitoring and estimation of the impact of tritium. The entire Tritium White Paper, including the ASN action plan, is available on the <http://livre-blanc-tritium.asn.fr> website.

ASN has set up a pluralistic committee to monitor the action plan. Its last meeting was held on 4th July 2012. Some actions started in 2011 were continued in 2012:

- ASN has initiated a review of tritium emissions from all French nuclear sites, which is published on the White Paper website. This review also includes the dosimetric impact of each site and the tritium contribution to the total dose;
- the work to standardise the measurement of organically bound tritium conducted by the BNEN (Nuclear Equipment Standards Office);
- the licensees have initiated work to improve characterisation of their discharges;
- with regard to radiological impact, ASN has asked the licensees to supplement their impact assessments with a critical study taking account of a doubling of the tritium impact.

sufficiently important in terms of safety or radiation protection to justify rapid notification of ASN, followed by a subsequent and more complete analysis. Significant events must be notified to it, as specified in the Environment Code (Article L.591-5), the Public Health Code (Articles L. 1333-3 and R. 1333-109 to R. 1333-111) and the Labour Code (Article R. 4451-99). The criteria for notifying the public authorities of events considered to be “significant” take account of the following:

- the actual or potential consequences for workers, the public, patients or the environment, of events that could occur and affect nuclear safety or radiation protection;
- the main technical, human or organisational causes that led to the occurrence of such an event.

This notification process is part of the continuous safety improvement approach. It requires the active participation of all licensees (users of ionising radiation, carriers, etc.) in the detection and analysis of deviations. It enables the authorities:

- to ensure that the licensee has suitably analysed the event and taken appropriate measures to remedy the situation and prevent it happening again;
- to analyse the event in the light of the experience available to other parties in charge of similar activities.

The purpose of this system is not to identify or penalise any individual person or party. Moreover, the number of events that occur in a nuclear facility is not in itself an indicator of the level of safety of that facility.

### 3|4|2 Implementation of the approach

#### *Event notification*

In the event of an incident or accident, whether or not nuclear, which has or risks having significant consequences for the safety of the facility or the transport operation, or risks harming people, property or the environment through significant exposure to ionising radiation, the licensee is obliged to notify ASN and the State representative in the *département* without delay.

According to the provisions of the Labour Code, employers are obliged to declare significant events affecting their workers. When the head of a facility carrying out a nuclear activity calls in an external contractor or non-salaried worker, the significant events affecting salaried or non-salaried workers are notified in accordance with the prevention plans and the agreements concluded pursuant to Article R. 4451-8 of the Labour Code.

The declaring party determines the urgency of the notification in the light of the actual or potential severity of the event and the speed of response necessary to prevent the situation from getting worse or to mitigate the consequences of the event. The notification time of two working days tolerated in the ASN notification guides is not applicable if the consequences of the event necessitate intervention by the public authorities.

#### *Utilisation of the notification by ASN*

ASN analyses the initial notification to check the implementation of immediate corrective measures, decide whether to conduct an on-site inspection to analyse the event in depth, and to prepare for informing of the public if necessary.

Within two months of the notification, it is followed by a report indicating the conclusions the licensee has drawn from analysis of the events and the steps it intends to take to improve safety or radiation protection. This information is taken into account by ASN and its technical support organisation, IRSN, in the preparation of the inspection programme and when performing the BNI periodic safety reviews.

ASN ensures that the licensee has analysed the event pertinently, has taken appropriate steps to remedy the situation and prevent it from recurring, and has circulated the operating experience feedback.

ASN's review focuses on compliance with the applicable rules for detecting and notifying significant events, the immediate technical measures taken by the licensee to maintain or bring the installation into a safe condition, and the pertinence of the submitted analysis.

ASN and IRSN subsequently examine the operating feedback from the events. The assessment by ASN, the significant event reports and the periodic results sent by the licensees constitute the organisational basis of operating experience feedback. This experience feedback can lead to requests for improvement of the condition of the facilities and the organisation adopted by the licensee, as well as for changes to the regulations.

Operating experience feedback encompasses events occurring both in France and abroad, whenever relevant to enhancing nuclear safety or radiation protection.

### 3|4|3 Conducting a technical inquiry in the event of an incident or accident concerning a nuclear activity

ASN has the authority to carry out an immediate technical inquiry in the event of an incident or accident in a nuclear activity. This inquiry consists in collecting and analysing all useful information, without prejudice to the judicial inquiry, in order to determine the circumstances and the identified or possible causes of the event, and draw up the appropriate recommendations if necessary. Articles L. 592-35 and following of the Environment Code give ASN powers to set up a commission of inquiry, determine its composition (ASN staff and people from outside ASN), define the subject and scope of the investigations and gain access to all necessary elements in the event of a judicial inquiry.

Decree 2007-1572 of 6th November 2007 on technical inquiries into accidents or incidents concerning a nuclear activity specifies the procedure to be followed. It is based on the practices established for the other investigation bureaus and takes account of the specific characteristics of ASN, particularly its independence, its ability to impose requirements or penalties if necessary and the concurrence of its investigative and other duties.



### 3|4|4 Public information

Independently of this process, the public must be informed of those events whose importance so warrants (see chapter 6).

### 3|4|5 Statistical summary of events in 2012

In 2012, ASN was notified of:

- 1,170 significant events concerning nuclear safety, radiation protection and the environment for the BNIs; 1,032 of these events are rated on the INES<sup>2</sup> scale (920 events rated level 0, 110 events rated level 1 and 2 events rated level 2 on the INES scale). 32 of the notified events were classified as “generic events”, of which 5 were rated level 1 on the INES scale.
- 59 significant events concerning the transport of radioactive substances (52 events rated level 0, 6 events rated level 1, and 1 event rated level 2).
- 593 significant events concerning radiation protection in small-scale nuclear activities, 152 of which were classified on the INES scale, with 118 level 0 events, 33 level 1 events and 1 level 2 event.

Compared with 2011, there has been an increase in the number of significant events notified for the BNIs (+7%) and in small-scale nuclear activities (+ 11%); in the transport of radioactive substances, the number of events doubled in 2012 compared with 2011, after having fallen by 50% in 2011 compared with 2010.

As indicated earlier, these data must nevertheless be used with caution: they do not in themselves constitute a safety indicator. ASN encourages the licensees to notify incidents, which contributes to transparency and the sharing of experience.

The distribution of significant events rated on the INES scale is specified in table 6. The INES scale is not applicable to patients, who are rated on the ASN-SFRO scale of significant events affecting one or more radiotherapy patients, and is described in chapter 9.

Likewise, the significant events concerning the environment but involving non-radiological substances are not covered by the INES scale. Such events are classified as “out of INES scale” events.

Graphs 5 to 11 describe in detail the significant events notified to ASN in 2012, differentiating between the various notification criteria for each domain.

### 3|5 Heightening professionals' awareness and cooperating with the other administrations

Regulation is supplemented by awareness programmes designed to ensure familiarity with the regulations and their application in practical terms appropriate to the various professions. ASN aims to encourage and support initiatives by the professional organisations who implement this approach by issuing good practice and professional information guides.

Raising awareness also involves joint action with other administrations and organisations that carry out regulatory duties on the same facilities, but with different prerogatives, such as the

Graph 5: Breakdown per type of events for BNIs in 2012

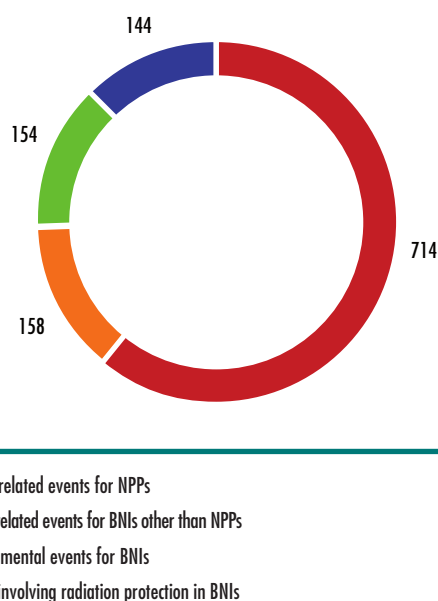
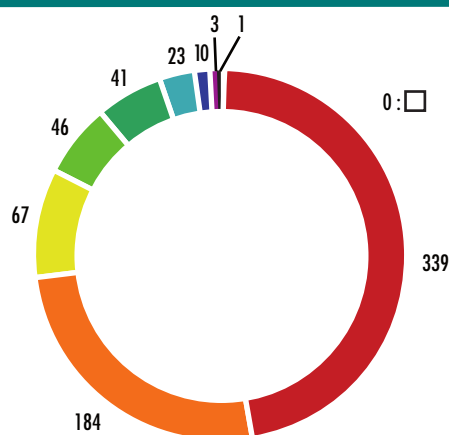


Table 6: Rating of significant events on the INES scale in 2012

| Level              | PWRs       | Other BNIs installations | Transport | Small-scale nuclear | Total        |
|--------------------|------------|--------------------------|-----------|---------------------|--------------|
| 3 and more         | 0          | 0                        | 0         | 0                   | 0            |
| 2                  | 1          | 1                        | 1         | 1                   | 4            |
| 1                  | 95         | 15                       | 6         | 33                  | 149          |
| 0                  | 734        | 186                      | 52        | 118                 | 1,090        |
| <b>Rated total</b> | <b>830</b> | <b>202</b>               | <b>59</b> | <b>152</b>          | <b>1,243</b> |

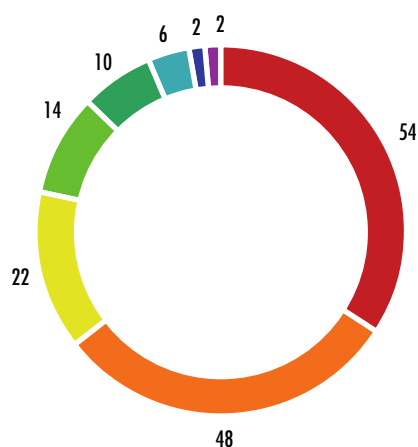
2. The INES (International Nuclear Event Scale) is a scale for rating significant events according to their importance; the scale comprises 8 levels (from 0 to 7).

Graph 6: Events involving safety in NPPs in 2012



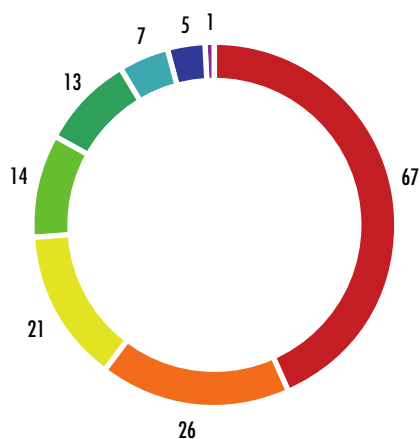
- Deviation from Operational Technical Specifications (STE) or event which could lead to a deviation
- Other significant events which could affect safety
- Design, manufacturing or assembly anomaly
- Automatic reactor trip
- Transition to shutdown state according to the STE or accident procedures
- Inadvertent start-up of a protection or safeguard system
- Event or anomaly specific to the primary or secondary system
- On-site or off-site hazard affecting the availability of important equipment
- Event which caused or could cause multiple failures
- Actual or attempted malicious act

Graph 7: Events involving safety for BNIs other than NPPs in 2012



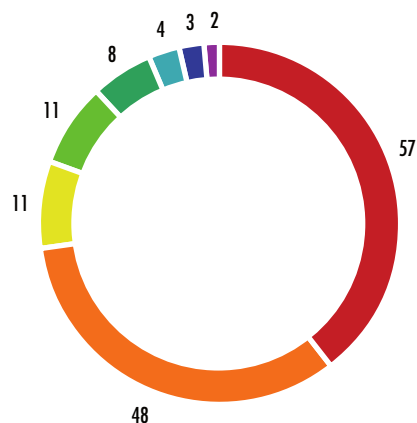
- Event which led to safety limit(s) being exceeded
- Event actually or potentially affecting the containment of hazardous materials
- Other significant events which could affect safety
- Inadvertent start-up of a protection or safeguard system
- Fault, deterioration or failure which affected a safety function
- On-site or off-site hazard affecting the availability of important equipment
- Event which caused or could cause multiple failures
- Events affecting a safety function which could subsequently lead to an accident

Graph 8: Significant environment-related events for BNIs in 2012



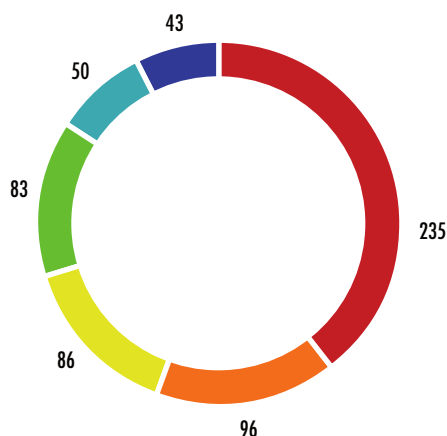
- Non-compliance with the order of 31st December 1999
- Other significant events which could affect the environment
- Bypassing of normal discharge channels, with a significant chemical impact
- Non-compliance with an operational requirement which could lead to a significant impact
- Confirmed overshoot of a discharge or concentration limit
- Bypassing of normal discharge channels, with a significant radioactive impact
- Non-compliance with the site or facility waste study
- Discovery of a site polluted by chemical or radioactive contamination

Graph 9: Events involving radiation protection for BNIs in 2012



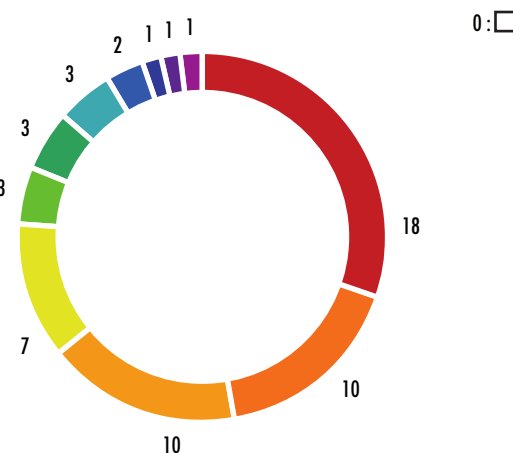
- Other significant events which could affect radiation protection
- Signage anomaly or failure to comply with zone access conditions
- Any significant deviation concerning radiological cleanliness
- Radiological monitoring device inspection interval exceeded
- Abnormal situation affecting a source with activity higher than the exemption threshold
- Operation with a radiological risk performed without analysis or ignoring the findings of the analysis
- One quarter of the annual dose limit exceeded or event capable of leading to such a situation
- Uncompensated failure of radiological monitoring systems

Graph 10: Events involving radiation protection (other than BNIs and RMT) in 2012



- Concerning one or more patients (therapeutic purposes)
- Concerning the general public
- Concerning one or more patients (diagnostic purposes)
- Loss, theft or discovery of radioactive sources or substances
- Other event concerning radiation protection
- Concerning one or more workers

Graph 11: Events involving the transport of radioactive substances in 2012



- Non-compliance with regulations applicable to RMT operations
- Non-compliance with a radiation intensity or contamination limit
- Other significant events which could affect the transport operation
- Loss or theft of a radioactive material package during transport
- Actual or potential hazard affecting the safety of a transport operation
- Fault, deterioration or failure which affected a safety function
- Repetitive event of unknown cause affecting a safety function
- Event having affected at least one barrier, with actual or potential consequences
- Shipment of a package even though the consignee is not in a position to receive the shipment
- Actual or attempted malicious act
- Gap certificate of approval without degradation of safety functions
- Accidental discovery of a transport package not declared as having been stolen or lost
- Event open to misinterpretation in the media or by the general public
- Nuclear or other event leading to injury or death

state labour inspectorate, inspection of medical appliances by the ANSM or medical activity inspection as entrusted to the technical divisions of the Ministry of Health.

More specifically, ASN and the Armed Forces General Inspectorate (CGA) signed an agreement in April 2012 aiming to coordinate their inspections that exclusively concern small-scale nuclear activities in the medical, industrial and veterinary sectors, and research within the Ministry of Defence and Military Veterans. This agreement also provides for the mutual informing of the two parties concerning the occurrence of significant events.



Signing of the memorandum of collaboration between ASN and the CGA (Armed Forces General Inspectorate) by Jean-Christophe Niel, Director-General of ASN, and Christian Piotre, Inspector General of the Armed Forces – April 2012

## 4 MONITORING ENVIRONMENTAL RADIOACTIVITY

In France, many actors are involved in environmental monitoring:

- the nuclear facility licensees, who monitor their nuclear sites and their surroundings;
- IRSN, ASN, the Ministries (DGS – General Directorate for Health, DGAL – General Directorate for Food, DGCCRF – General Directorate for Competition Policy, Consumer Affairs and Fraud Control, etc.), the State services and other public players tasked with ensuring national monitoring of the territory and/or carrying out inspection or monitoring assignments in specific sectors (foodstuffs, for example, in the case of the Ministry of Agriculture);
- the approved air quality monitoring associations (local authorities), associations that conduct monitoring campaigns independently of the public authorities (CLIs, environmental protection associations).

The French National Network for Environmental Radioactivity Monitoring (RNM) federates all these players. Its primary aim is to bring together and make available to the public all the environmental measurements made in a regulatory framework on the French territory. The quality of these measurements is guaranteed by subjecting the measuring laboratories to an approval procedure.

### 4|1 European context

Article 35 of the Euratom Treaty requires the Member States to establish the facilities necessary to carry out continuous monitoring of the level of radioactivity in the air, water and soil and to ensure compliance with the basic standards of health protection for the general public and workers against the hazards of ionising radiation. All Member States, whether or not they have nuclear facilities, are therefore required to implement environmental monitoring arrangements throughout their territory.

By virtue of the provisions of this same Article 35, the European Commission also has the right of access to these monitoring facilities, in order to check their operation and effectiveness. During its verifications, the European Commission gives an opinion on the means implemented by the member States to monitor radioactive discharges into the environment and levels of radioactivity in the environment around nuclear sites and over the national territory.

It gives its assessment of the monitoring equipment and methodologies used, and of the organisational setup.

Since 1994, the Commission has carried out the following inspections:

- the La Hague reprocessing plant and ANDRA's Manche repository in 1996;
- Chooz NPP in 1999;
- Belleville-sur-Loire NPP in 1994 and 2003;
- the La Hague reprocessing plant in 2005;
- the Pierrelatte nuclear site in 2008;
- the old uranium mines in the Limousin *département* in 2010;
- the CEA site at Cadarache in 2011.

During the course of this latest verification, in June 2011, the Commission's experts concluded that France was in conformity with the requirements of Article 35 of the Euratom Treaty (see chapter 7).

### 4|1|1 The purpose of environmental monitoring

Licensee prime responsibility includes monitoring the environment around nuclear sites in accordance with individual requirements (creation authorisation decree, discharge license or ASN decision) defining the steps to be taken and their frequency, regardless of any additional arrangements made by the licensees for their own monitoring.

This environmental monitoring:

- helps give a picture of the condition of the radiological and radio-ecological state of the facility's 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 facility and environmental monitoring enables any changes to be tracked;
- helps verify that the impact of the facility on health and the environment is in conformity with the impact assessment provided for in 6° of I of Article 8 of the decree of 2nd November 2007;
- detects any abnormal increase in radioactivity as early as possible;
- ensures there are no facility malfunctions, including by analysing the ground water and checking licensees' compliance with the regulations;
- contributes to transparency and informing the public by transmitting monitoring data to the RNM.



Inspection around the CEA site at Cadarache on the theme of environmental monitoring – September 2012



Table 7: Example of radiological monitoring of the environment around BNIs

| Environment monitored or type of inspection | Nuclear power plant                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Research laboratory or plant                                                                                                                                                                                                                                                                                                                                             |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Air at ground level                         | <ul style="list-style-type: none"> <li>• 4 stations continuously sampling atmospheric dust on a fixed filter, with daily measurements of the total <math>\beta</math> activity (<math>\beta_G</math>).</li> <li>• <math>\gamma</math> Spectrometry if <math>\beta_G &gt; 2 \text{ mBq/m}^3</math></li> <li>• 1 continuous sampling under the prevailing winds with weekly tritium measurement (<math>^3\text{H}</math>)</li> </ul>                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                          |
| Ambiant $\gamma$ radiation                  | <ul style="list-style-type: none"> <li>• 4 detectors at 1 km with continuous measurement</li> <li>• 10 detectors with continuous measurement at the site limits (monthly recording)</li> <li>• 4 detectors at 5 km with continuous measurement</li> </ul>                                                                                                                                                                                                                                                                                                       | <ul style="list-style-type: none"> <li>• 4 detectors with continuous measurement and recording</li> <li>• 10 integrating dosimeters at the site limits (monthly recording)</li> </ul>                                                                                                                                                                                    |
| Rain                                        | <ul style="list-style-type: none"> <li>• 1 station under the prevailing wind (monthly collector) with measurement of <math>\beta_G</math> and <math>^3\text{H}</math> on a monthly mixture</li> </ul>                                                                                                                                                                                                                                                                                                                                                           | <ul style="list-style-type: none"> <li>• 2 continuous sampling stations including one under the prevailing wind with weekly measurement of <math>\beta_G</math> and <math>^3\text{H}</math></li> </ul>                                                                                                                                                                   |
| Liquid discharge receiving environment      | <ul style="list-style-type: none"> <li>• Sampling in the river upstream and at mid-discharge, for each discharge (riverside plant)</li> <li>or</li> <li>• Sampling after dilution in the cooling water and bi-monthly sampling at sea (coastal plant)</li> <li>• Measurement of <math>\beta_G</math>, of potassium (K)</li> <li>• Continuous sampling of <math>^3\text{H}</math> (daily average mixture)</li> <li>• Annual sampling in sediments, aquatic fauna and flora with measurement of <math>\beta_G</math>, of K and <math>^3\text{H}</math></li> </ul> | <ul style="list-style-type: none"> <li>• At least weekly sampling of water in the receiving environment with measurement of the total <math>\alpha</math> activity, <math>\beta_G</math>, of K and <math>^3\text{H}</math></li> <li>• Annual sampling in sediments, aquatic fauna and flora for <math>\gamma</math> spectrometry</li> </ul>                              |
| Groundwater                                 | <ul style="list-style-type: none"> <li>• 5 sampling points (monthly check) with measurement of <math>\beta_G</math>, K and <math>^3\text{H}</math></li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                   | <ul style="list-style-type: none"> <li>• 5 sampling points (monthly check) with measurement of <math>\beta_G</math>, K and <math>^3\text{H}</math></li> <li>• Measurement of total <math>\alpha</math> activity</li> </ul>                                                                                                                                               |
| Soil                                        | <ul style="list-style-type: none"> <li>• 1 annual sample of topsoil with <math>\gamma</math> spectrometry</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                          |
| Vegetation                                  | <ul style="list-style-type: none"> <li>• 2 grass sampling points (monthly check) with measurement of <math>\beta_G</math>, K and <math>\gamma</math> spectrometry</li> <li>• Measurement of carbon-14 (<math>^{14}\text{C}</math>) and total carbon (quarterly)</li> <li>• Annual campaign on the main agricultural produce, with measurement of <math>\beta_G</math>, K, <math>^{14}\text{C}</math> and total carbon, and <math>\gamma</math> spectrometry</li> </ul>                                                                                          | <ul style="list-style-type: none"> <li>• 4 grass sampling points (monthly check) with measurement of <math>\beta_G</math>, K and <math>\gamma</math> spectrometry</li> <li>• Annual campaign on the main agricultural produce, with measurement of <math>\beta_G</math>, K, <math>^{14}\text{C}</math> and total carbon, and <math>\gamma</math> spectrometry</li> </ul> |
| Milk                                        | <ul style="list-style-type: none"> <li>• 2 sampling points (monthly check) with measurement of <math>\beta</math> activity (except <math>^{40}\text{K}</math>), <math>\beta</math> (<math>^{40}\text{K}</math> exclu), K and annually <math>^{14}\text{C}</math></li> </ul>                                                                                                                                                                                                                                                                                     | <ul style="list-style-type: none"> <li>• 1 sampling point (monthly check) with measurement of <math>\beta</math> activity and <math>\gamma</math> spectrometry (+ <math>^3\text{H}</math> and <math>^{14}\text{C}</math> periodically)</li> </ul>                                                                                                                        |

$\beta_G$  = total  $\beta$

## 4.1.2 Content of monitoring

All the nuclear sites in France that produce discharges are subject to systematic environmental monitoring. The nature of this monitoring is proportionate to the potential environmental risks or drawbacks of the facility, as presented in the authorisation file, particularly the impact assessment.

The regulatory monitoring of the BNIs environment is tailored to each type of installation, depending on whether it is a power reactor, a plant or a research facility. What this monitoring actually involves, prescribed in the authorisation order, is

defined by the ministerial order of 26th November 1999. This ministerial order will be repealed and replaced as of 1st July 2013 by the provisions of part IV of the ministerial order of 7th February setting the general rules for BNIs. ASN is also working on a draft resolution relative to water intakes, discharges and environmental monitoring which will supplement the order of 7th February 2012.

Depending on specific local features, monitoring may vary from one site to another. Table 7 gives examples of the monitoring performed by a NPP and by a research centre or plant.

## 4|2 Environmental monitoring nationwide by IRSN

IRSN's environmental monitoring of the French territory is ensured through measurement and sampling networks dedicated to:

- air monitoring (aerosols, rainwater, ambient gamma activity);
- monitoring of surface water (watercourses) and groundwater (aquifers);
- monitoring of the human food chain (milk, cereals, food intake);
- terrestrial continental monitoring (reference stations located far from all industrial facilities).

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 163 measurement detectors; the density of detectors in the network is going to be increased around the nuclear sites in the zone of 10 to 30 km around the BNIs;
  - the atmospheric aerosols radioactivity measurement network;
  - the *Hydrotéléray* network (monitoring of the main water courses downstream of all nuclear facilities and before they cross national boundaries);
  - processing and measurement in a laboratory of samples taken from the various compartments of the environment,

whether or not close to facilities liable to discharge radionuclides.

Every year, IRSN takes more than 25,000 samples in all compartments of the environment (excluding the remote-measurement networks).

The radioactivity levels measured in France are stable and situated at very low levels, generally at the detection sensitivity threshold of the measuring instruments. The artificial radioactivity detected in the environment results essentially from fallout from the atmospheric tests of nuclear weapons carried out in the 1960's, and from the Chernobyl accident. Traces of artificial radioactivity associated with discharges can sometimes be detected near installations. To this can be added very local contaminations resulting from past industrial incidents or activities, and which do not represent a health risk.

## 4|3 Guaranteeing measurement quality

Articles R.1333-11 and R.1333-11-1 of the Public Health Code make provision for the creation of a National Network for Environmental Radioactivity Monitoring (RNM) and a procedure for having the radioactivity measurement laboratories approved by ASN. The RNM procedures were defined by an ASN resolution (approved resolution 2008-DC-0099 of 29th April 2008).

Table 8: Approval chart and forecast five-year inter-laboratory test (ILT) programme

| Code  | Radioactive measurements category    | Type 1    |       | Type 2           | Type 3              | Type 4             | Type 5           | Type 6                           |
|-------|--------------------------------------|-----------|-------|------------------|---------------------|--------------------|------------------|----------------------------------|
|       |                                      | Sea water | Water | Soil matrices    | Biological matrices | Aerosols on filter | Gas air          | Ambient environment (soil / air) |
| ..-01 | Gamma emitters $\gamma > 100$ keV    |           | 1_01  | 2_01             | 3_01                | 4_01               | 5_01             | -                                |
| ..-02 | Gamma emitters $\gamma < 100$ keV    |           | 1_02  | 2_02             | 3_02                | 4_02               | 5_02             | -                                |
| ..-03 | Total alpha                          |           | 1_03  | -                | -                   | 4_03               | -                | -                                |
| ..-04 | Total beta                           |           | 1_04  | -                | -                   | 4_04               | -                | -                                |
| ..-05 | H-3                                  |           | 1_05  | 2_05             | 3_05                | -                  | Cf. < water      | -                                |
| ..-06 | C-14                                 |           | 1_06  | 2_06             | 3_06                | -                  | Cf. water/Na OH  | -                                |
| ..-07 | Sr-90/Y-90                           |           | 1_07  | 2_07             | 3_07                | 4_07               | -                | -                                |
| ..-08 | Other pure beta emitters (Ni-63,...) |           | 1_08  | <sup>99</sup> Tc | 3_08                | -                  | -                | -                                |
| ..-09 | U isotopes                           |           | 1_09  | 2_09             | 3_09                | 4_09               | -                | -                                |
| ..-10 | Th isotopes                          |           | 1_10  | 2_10             | 3_10                | 4_10               | -                | -                                |
| ..-11 | Ra-226 + daughters                   |           | 1_11  | 2_11             | 3_11                | -                  | Rn 222: 5_11     | -                                |
| ..-12 | Ra-228 + daughters                   |           | 1_12  | 2_12             | 2_12                | -                  | Rn 220: 5_12     | -                                |
| ..-13 | Isotopes Pu, Am, (Cm, Np)            |           | 1_13  | 2_13             | 3_13                | 4_13               | -                | -                                |
| ..-14 | Halogenated gases                    |           | -     | -                | -                   | -                  | 5_14             | -                                |
| ..-15 | Rare gases                           |           | -     | -                | -                   | -                  | <sup>85</sup> Kr | 5_15                             |
| ..-16 | Gamma dosimetry                      |           | -     | -                | -                   | -                  | -                | 6_16                             |
| ..-17 | Total uranium                        |           | 1_17  | 2_17             | 3_17                | 4_17               | -                | -                                |

1st semester 2012

1st semester 2013

1st semester 2014

1st semester 2015

1st semester 2016

2nd semester 2012

2nd semester 2013

2nd semester 2014

2nd semester 2015

2nd semester 2016

This network is being deployed for two main reasons:

- to ensure the transparency of information on environmental radioactivity by making the results of this environmental monitoring and information about the radiological impact of nuclear activities in France available to the public;
- to continue a quality assurance policy for environmental radioactivity measurements by setting up a system of laboratory approvals granted by ASN resolution, pursuant to Article L.592-21 of the Environment Code.

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 table 8).

In total, about fifty types of measurements are covered by approvals. There are just as many corresponding inter-laboratory comparison tests. These tests are organised by IRSN in a 5-year cycle, which corresponds to the maximum approval validity period.

#### 4|3|1 Laboratory approval procedure

The abovementioned ASN resolution 2008-DC-0099 of 29th April 2008 specifies the organisation of the national network and sets the approval arrangements for the environmental radioactivity measurement laboratories.

The approval procedure includes:

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

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

This resolution obliges BNI licensees to have approved laboratories take the environmental radioactivity monitoring measurements required by regulations.

#### 4|3|2 The approval commission

The approval commission is the body which, for the RNM, is tasked with ensuring that the measurement laboratories have the organisational and technical competence to provide the network with quality measurement results. The commission is responsible for giving ASN its proposed approval, refusal, revocation or suspension of approval. It decides on the basis of an application file submitted by the candidate laboratory and its results in the ILTs organised by IRSN.

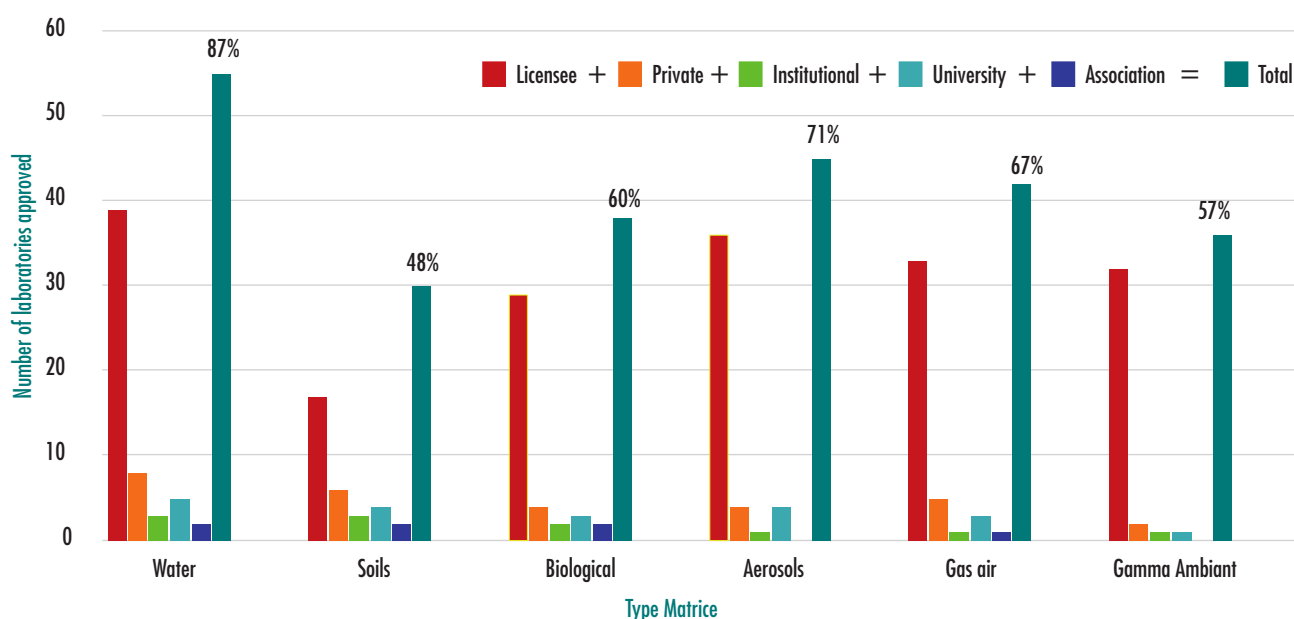
The commission presided over by ASN comprises qualified persons and representatives of the State services, laboratories, standardising authorities and IRSN. ASN resolution 2008-DC-0117 of 4th November 2008, for appointing candidates to the environmental radioactivity measurement laboratory approval commission, renewed the mandates of the commission's members for a further five years.

#### 4|3|3 Approval conditions

Laboratories seeking approval must set up an organisation meeting the requirements of standard NF EN ISO/IEC 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 ILTs organised by IRSN. The ILT programme,

Graph 12: Breakdown of the number of approved laboratories for a given environmental matrix as at 1st January 2013



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](http://www.mesure-radioactivite.fr)).

The ILTs 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.

In 2012, IRSN organised 5 intercomparison tests, which means 42 ILTs since 2003 covering 47 types of approvals. Most of the approved laboratories specialise in water monitoring, with 58 laboratories holding up to 13 different approvals for monitoring of this medium. About forty laboratories are approved for measurement of biological matrices (food chain), atmospheric dust, air, or ambient gamma dosimetry. About 30 laboratories

deal with soils. Although most of the laboratories are competent to measure gamma emitters in all environmental matrices, only about ten of them are approved to measure carbon-14, transuranium elements or radionuclides of the natural chains of uranium and thorium in water, soil and biological matrices.

In 2012, ASN issued 105 approvals and extended about sixty. On 1st January 2013, the total number of approved laboratories stood at 63, which represents 810 approvals of all types currently valid.

The detailed list of approved laboratories and their scope of technical competence is available on [www.asn.fr](http://www.asn.fr).

ASN is considering modifying ASN resolution 2008-DC-0099 of 29th April 2008 in order to create a specific approval for the health inspection of foodstuffs. Presentations to this effect were made to the RNM steering committee and the approval commission in 2012.

### The French National Network for Environmental Radioactivity Monitoring (RNM) website



Measurements map of environmental radioactivity on [www.mesure-radioactivite.fr](http://www.mesure-radioactivite.fr)

*In order to meet this transparency goal, the RNM launched a website on 2nd February 2010 to present the environmental radioactivity monitoring results and information on the health impact of nuclear activities in France. In order to guarantee the quality of the measurements, only those taken by an approved laboratory or by IRSN may be communicated to the RNMRE.*

*The website is organised around three topics (radioactivity, the national network and the measurements map) and can be used to obtain information about radioactivity (what is radioactivity? how is it measured? what are its biological effects?), about the RNM (operation, network participants, laboratory approval procedure), plus access to a database containing all the radioactivity measurements taken nationwide (almost 600,000 measurements). The RNM management report is also available on it. At the end of 2012 IRSN published a report on the radiological state of the French environment for 2010 and the first half of 2011. This*

*report is drawn for the first time using data from the RNM.*

*ASN considers that the launch of the RNM website is a decisive step forward in terms of transparency. It also considers this to be just a first step in providing the public with environmental radioactivity monitoring information, and will ensure that the general public and web users are consulted about how they would like this website to develop.*

*A panel of users was set up in 2012 to test the website. The feedback from this panel will enable work to be started in 2013 so that functions and information can be added to the site, enabling the public to understand and interpret the results of the environmental radioactivity measurement transmitted to the RNM.*



## 5 IDENTIFYING AND PENALISING DEVIATIONS



Meeting between the magistrature and ASN at Marcoule – October 2012

### 5|1 Ensuring that licensee penalty decisions are proportionate, fair and consistent

In certain situations in which the licensee fails to conform to the regulations or legislation, or when it is important that appropriate action be taken by it to remedy the most serious risks without delay, ASN may impose the penalties provided for by law. The principles of ASN's actions in this respect are:

1. penalties that are impartial, justified and appropriate to the level of risk presented by the situation concerned. Their scale is proportionate to the health and environmental consequences associated with the deviation detected and also takes account of intrinsic factors relating to the behaviour of the party at fault and external factors relating to the context of the deviation;
2. administrative action initiated on proposals from the inspectors and decided on by ASN in order to remedy risk situations and non-compliance with the legislative and regulatory requirements as observed during its inspections.

ASN has a range of tools at its disposal, in particular:

- remarks made by the inspector to the licensee;
- the official letter from the ASN departments to the licensee (follow-up letters);
- formal notice from ASN to the licensee to regularise its administrative situation or meet certain specified conditions, within a given time-frame;
- administrative penalties applied after formal notice.

In parallel with ASN's administrative action, reports can be drafted by the inspector and sent to the Public Prosecutor's Office.

To provide the inspectors with the tools they need to assess the seriousness of the deviations observed and impose appropriate penalties, ASN has drawn up procedures and decision-making tools. These documents provide a structured framework

enabling an impartial decision to be reached that is proportionate to the deviation detected, and consistent between all the inspectors.

The decision to issue demands is based on the observed risk for people or the environment and takes account of factors specific to the licensee (history, behaviour, repeated nature of the problem), contextual factors and the nature of the infringements observed (regulations, standards, "rules of good practice", etc.).

### 5|2 Implementing a policy of coercion and penalties

#### 5|2|1 For the BNI licensees and entities responsible for the transport of radioactive substances

When ASN's regulatory actions reveal failures to comply with safety requirements, penalties can be imposed on the licensees concerned, after serving formal notice if necessary. Penalties in such cases may consist in prohibiting restart of a plant or suspending operation until the requisite corrective measures have been taken.

If an infringement is observed, the Environment Code comprises graduated administrative penalties that become applicable after formal notice, as defined in its Articles L. 596-14 to L. 596-22:

- deposit in the hands of a public accountant of a sum covering the total cost of the work to be performed;
- have the work or prescribed measures carried out without consulting the licensee and at its expense (any sums deposited beforehand can be used to pay for this work);
- suspension of operation of the installation or of performance of an operation until the licensee has brought it into conformity.

If the licensee has any observations concerning the penalties it shall present them to the ASN Commission before they are applied.

The Act also makes provision for interim measures to safeguard public health and safety or protect the environment. ASN can therefore:

- provisionally suspend operation of a BNI, immediately notifying the Ministers responsible for nuclear safety, in the event of any serious and imminent risk;
- at all times require assessments and implementation of the necessary measures in the event of a threat to the above-mentioned interests.

Infringements are written up in reports by the nuclear safety inspectors and transmitted to the Public Prosecutor's Office, which decides on what subsequent action, if any, is to be taken. The Environment Code makes provision for criminal penalties, detailed in Articles L. 596-27 to L. 596-30; these penalties comprise fines of from €7,500 to €150,000 plus a possible prison term of from 1 to 3 years, depending on the nature of the infringement. For legal persons found to be criminally liable, the amount of the fine can reach €1,500,000.

Decree 2007-1557 of 2nd November 2007 concerning BNIs and the regulation of the transport of radioactive substances with respect to nuclear safety, also imposes class 5 fines for infringements as detailed in its Article 56.

## 5|2|2 For persons in charge of small-scale nuclear activities, approved organisations and laboratories

The Public Health Code makes provision for administrative and criminal sanctions in the event of a breach of the radiation protection requirements.

Administrative decision-making powers lie with ASN and can entail:

- temporary or definitive license withdrawals after receiving formal notice;
- interim suspension of an activity (whether licensed or notified) if urgent measures are required to safeguard human health;
- revocation or suspension of any approvals it has issued.

The formal notice prior to revocation of a licence (based on Article L.1333-5 of the Public Health Code) concerns application of all the requirements of the “ionising radiation” chapter of the legislative part of the Public Health Code (Articles L.1333-1 to L.1333-20), regulatory requirements and the stipulations of the licence. Temporary or final revocation of the licence by ASN must be fully explained in a decision within one month following serving of formal notice.

The formal notices prior to criminal sanctions (based on Article L.1337-6 of the Public Health Code) are served by ASN. They concern the requirements of Articles L.1333-2, L.1333-8 (human exposure monitoring, protection and information measures), L.1333-10 (monitoring of exposure to enhanced natural radioactivity and in premises open to the public) and L.1333-20 (certain implementations of the chapter of the Public Health Code relating to ionising radiation, as determined by decrees).

Infringements are written up in reports by the radiation protection inspectors and transmitted to the Public Prosecutor's Office, which decides on what subsequent action, if any, is to be taken. The Public Health Code makes provision for criminal sanctions as detailed in Articles L.1337-5 to L.1337-9 and range from a fine of €3,750 to one year of imprisonment and a fine of €15,000.

## 5|2|3 For noncompliance with Labour Law

In the performance of their duties in NPPs, the ASN's labour inspectors have at their disposal all the inspection, decision-making and enforcement resources of ordinary law inspectors. Observation, formal notice, report, injunction (to obtain immediate cessation of the risks) or even shutdown of the worksite, offer a range of incentive and constraining measures for the ASN labour inspectors that is broader than that available to the nuclear safety or radiation protection inspectors.

The labour inspector have special decision-making powers enabling them to check the employer's disciplinary capability, to protect the general interests from an economic standpoint and to act as arbitrator, if necessary by delegation from the Regional Directorate for Enterprises, Competition, Consumption, Labour and Employment (DIRECCTE).

### The actions undertaken by ASN in liaison with the magistrates

*ASN's penal action is implemented by sworn inspectors. Having observed that the violation reports drawn up by the ASN inspectors concern complex areas, often unfamiliar to magistrates, ASN has initiated steps to close the gap between itself and the magistrates. ASN's regional divisions are thus organising meetings with the magistrates to present ASN's activities to them. These meetings help to improve the transmission of information between ASN and the Judicial institutions.*

*In 2012, the Marseille division organised a meeting at the Marcoule site to present the role and functioning of ASN to the magistrates of several tribunals and appeal courts, and to go back over dossiers of joint interest. The magistrates visited several BNIs on this occasion.*

*In a similar vein, the Caen division also had exchanges with the public prosecutors' offices of the Basse-Normandie region.*

*Lastly, ASN ensured a teaching module on the penalties applicable in the field of safety and radiation protection at the National School of the Judiciary in Bordeaux.*

On the penal side, the labour inspectorate issued eleven official reports in NPPs in 2012.

### 5|2|4 2012 results concerning enforcement and penalties

ASN took administrative action (formal notice, suspension, etc.) against nine licensees and managers of nuclear activities. Further to the observed infringements, it sent 23 infringement reports to the Public Prosecutors, eleven of which were on account of labour inspections in NPPs.

### 5|3 Information about ASN's regulatory activity

ASN attaches importance to coordinating Government departments and informs the other departments concerned of its inspection programme, the follow-up to its inspections, the penalties imposed on the licensees and any significant events. To ensure the transparency of its regulatory activity, ASN informs the public by posting the following documents on line at [www.asn.fr](http://www.asn.fr):

- inspection follow-up letters for all the activities it inspects;
- approval authorisations or rejections;
- incident notifications;
- the results of reactor outages;
- its publications on specific subjects (*Contrôle* magazine, etc.).

## 6 OUTLOOK

In 2013, ASN scheduled 1,875 inspections on BNIs, radioactive substance transport, activities using ionising radiation, organisations and laboratories it has approved, and activities involving pressure equipment. Continuing the approach used in 2012, ASN will inspect the activities with potential high consequence in priority, taking account of the experience feedback from 2012.

During 2013, ASN will aim at further increasing the effectiveness of its oversight, supported more particularly by the inspection programme optimisation work it carried out in 2012. It will also continue the in-depth inspection approach in small-scale nuclear activities. Lastly it will organise a day of exchanges for its inspectors, to make them aware of inspection practices in other countries which have been identified as “good practices” during the cross-inspections or personnel exchanges between nuclear regulators.

ASN will continue revising the conditions for notification of significant events, taking into account the experimentation of the events notification guide in small-scale nuclear activities and the changes in regulations in the BNI sector.

It will draw the lessons from the implementation of an approach proportionate to the risk in small-scale nuclear activities, notably by proposing changes in the policy of penalties applicable in the industrial and medical sectors.

In the area of the environment, ASN will finalise the overhaul of the BNI system regulations with the publication of a regulatory resolution relative to water intakes, discharges and environmental monitoring. This resolution will supplement part IV of the ministerial order of 7th February 2012 setting the general rules for BNIs. ASN will continue to implement its tritium action plan, assisted by the pluralistic committee responsible for monitoring the action plan. With regard to monitoring of environmental radioactivity, ASN will communicate the results of the work on the strategy for monitoring the national territory and the surroundings of the nuclear sites. The RNM website will be recast in order to improve its clarity and facilitate the public's understanding of the measurement results.