

1	VERIFYING THAT THE LICENSEE ASSUMES ITS RESPONSIBILITIES	105
1 1	The principles underpinning the regulatory role	
1 2	Regulating nuclear activities: a vast area	
1 2 1	Regulating safety	
1 2 2	Regulating activities entailing a risk of exposure to ionising radiation	
1 2 3	Regulating the enforcement of labour law in nuclear power plants (NPPs)	
2	REGULATION THAT IS PROPORTIONATE TO THE ISSUES INVOLVED IN THE ACTIVITIES	108
2 1	Defining the issues	
2 2	Applying the principle of licensee prime responsibility	
2 2 1	Operations subject to a licensee internal authorisations procedure	
2 2 2	Internal monitoring of radiation protection by the users of ionising radiation sources	
2 2 3	Packages not requiring approval	
2 3	Increasing ASN regulation resources by approving organisations and laboratories	
3	DEPLOYING THE MOST EFFICIENT REGULATION AND INSPECTION MEANS	111
3 1	Assessing the supporting documents submitted by the licensee	
3 1 1	Analysing the information supplied by basic nuclear installation (BNI) licensees	
3 1 2	Reviewing the procedures laid down by the Public Health Code	
3 2	Inspection of installations and activities	
3 2 1	Inspection objectives and principles	
3 2 2	Inspection resources	
3 2 3	Inspection of basic nuclear installations (BNIs) and pressure equipment in 2011	
3 2 4	Inspection of radioactive material transport (RMT) in 2011	
3 2 5	Inspection of small-scale nuclear activities in 2011	
3 2 6	Inspection of ASN approved organisations and laboratories in 2011	
3 2 7	Checks on exposure to radon and Naturally Occurring Radioactive Materials (NORM) in 2011	
3 3	Regulating the impact of nuclear activities on the environment	
3 3 1	Regulating basic nuclear installation (BNI) discharges	
3 3 2	Assessing the radiological impact of nuclear activities	
3 4	Learning the lessons from significant events	
3 4 1	Anomaly detection and analysis	
3 4 2	Implementation of the approach	
3 4 3	Conducting a technical inquiry in the event of an incident or accident concerning a nuclear activity	
3 4 4	Public information	
3 4 5	Statistical summary of events in 2011	
3 5	Raising awareness	

4	MONITORING ENVIRONMENTAL RADIOACTIVITY	125
4 1	European context	
4 1 1	The purpose of environmental monitoring	
4 1 2	Content of monitoring	
4 2	Environmental monitoring nationwide	
4 3	Guaranteeing measurement quality	
4 3 1	Laboratory approval procedure	
4 3 2	The approval commission	
4 3 3	Approval conditions	
5	IDENTIFYING AND PENALISING INFRINGEMENTS	131
5 1	Ensuring that licensee penalty decisions are proportionate, fair and consistent	
5 2	Implementing a policy of penalties	
5 2 1	For the BNI and RMT licensees	
5 2 2	For persons in charge of small-scale nuclear activities, approved organisations and laboratories	
5 2 3	For noncompliance with labour law	
5 2 4	2011 results concerning enforcement and penalties	
5 3	Information about ASN's inspections	
6	OUTLOOK	133

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 thus 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. Its purpose is to verify on the sites and the facilities of licensees and their suppliers, that the provisions relative to safety and radiation protection are applied, and to detect any deviations leading to a reduction in the safety of the installations or the protection of persons.

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 operation, 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:

- licensees of BNIs;
- those in charge of the construction and operation of pressure equipment in BNIs;
- those in charge of RMT;
- those in charge of activities entailing a risk of exposure of individuals and workers to ionising radiation;



Post-Fukushima inspection of the Cattenom NPP in the presence of experts from Luxembourg and Germany – August 2011

– 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 account of 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 all 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 must lie with the licensee organisation;
- the regulatory body must be effectively independent of the organisation in charge of promoting or using nuclear energy. 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 regulatory body meeting 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 it, 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.

Of the BNI pressure equipment regulated by ASN, the main primary and secondary systems of EDF’s pressurised water reactors (PWRs) are particularly important. Since under normal conditions they operate at high temperature and pressure, their in-service behaviour is one of the keys to nuclear power plant (NPP) safety (see chapter 12, point 1 | 1 | 3). ASN thus pays particularly close attention to the regulation of these systems.

Pressure equipment operation is regulated. This regulation in particular applies to the in-service surveillance programmes, non-destructive testing, maintenance work, handling of deviations affecting the systems and periodic post-maintenance testing of the systems. The principal PWR files currently being dealt with are presented in chapter 12.

Regulating the transport of radioactive materials

Transport comprises all operations and conditions associated with radioactive material movements, 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 radioactive material consignments and packages (see chapter 11).

The safety of RMT is guaranteed 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 is responsible for drafting the regulations pertaining to the safe transport of radioactive and fissile materials for civil use and for verifying their implementation.

In terms of regulations and practices, good coordination with the other regulatory transport authorities is sought, particularly those responsible for inspecting means of transport, conventional safety inspection in the transport sector and protection of nuclear materials.

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 regulatory body.

In France, ASN fulfils this role of regulatory body by drafting and monitoring technical regulations in the field of 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 occupational health and safety, the inspectorate for installations classified on environmental protection grounds (ICPE), the departments of the ministry responsible for health and the French Health Product Safety Agency (AFSSAPS).

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	Files produced in accordance with the procedures laid down in the Public Health Code (Articles R. 1333-1 to R. 1333-54). Review of the file and visit prior to commissioning. Leads to registration of the notification or to issue of an authorisation.	Radiation protection inspectorate (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	Application file 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. Review of the file and audit of the organisation. Leads to issue of approval. (48 organisations approved as at 31/12/2011).	Second-level inspection through: - audits, - in-depth inspections at head office and in the branches of the organisations, - unannounced field inspections.	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)

In NPPs, the regulation of safety, radiation protection and the occupational health and safety aspects very often covers common topics, such as worksite organisation or the conditions in which outside contractors are called in. The legislator therefore assigned labour inspector duties to engineers or technicians specifically designated for this purpose by the ASN Chairman from among ASN staff (article R. 8111-11 of the Labour Code). They operate under the authority of the minister responsible for labour.

There are three main conventional safety inspection duties: regulation, information and advice.

They concern working conditions and worker protection. Their legitimacy is underpinned not only by international standards, particularly convention No. 81 of the International Labour Organisation (ILO), but also by national texts regulating the inspection departments.

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

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 uniform application nationwide of the Labour Code and collective agreements;
6. highlight ASN's expanded labour inspection responsibility.

ASN implemented changes to its organisation in order to clarify:

- the organisation, among the divisions, of labour inspection duties in NPPs;
- relations with the other Government departments concerned, mainly the departments of the ministry responsible for labour;
- relations with the regional health insurance funds (CRAM) for technical appraisal, recommendations, inquiries into health and safety conditions, etc.;

- relations with the Occupational Risk Prevention Organisation for the Building and Civil Engineering Industries (OPPBTP) to promote the prevention of industrial accidents and occupational diseases, as well as to improve working conditions of building and civil engineering contractors, in particular for construction and dismantling activities;
- relations with the General Directorate for Energy and Climate (DGEC), for statutory and social issues concerning companies

and organisations involved in providing the public gas and electricity service.

Since 2009, ASN has devoted particular efforts to setting up centralised support for the labour inspectors in the divisions, by recruiting an experienced civil servant from the Ministry for Labour, given responsibility for overseeing and coordinating ASN's labour inspection duties.

2 REGULATION THAT IS PROPORTIONATE TO THE ISSUES INVOLVED IN THE ACTIVITIES

ASN organises its regulatory work in a way that is proportionate to the issues involved in 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 issues

In order to consider both the health and environmental issues and licensee safety and radiation protection performance, and the large number of activities it regulates, ASN periodically identifies those activities and topics with significant implications so that it can regulate them directly.

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.

Activities in 2011 with significant implications are presented in table 2.

Targeted inspections

Following the nuclear accident that struck the Fukushima NPP in Japan on 11th March 2011, ASN adapted its inspection programme to reinforce checks on all the French nuclear facilities considered to be high-priority.

38 targeted inspections, representing 110 days in the field, involved spot checks on the conformity of the licensee's equipment and organisation with the existing baseline safety standards. They concerned the following topics:

- protection against off-site hazards, in particular ability to withstand earthquakes and protection against flooding,
- loss of electrical power supplies,
- loss of heat sinks,
- operational management of radiological emergency situations.

ASN aimed to involve representatives of civil society in its inspections and proposed that the local information committees (CLI) of the nuclear facilities and the French High Committee for Transparency and Information on Nuclear Security (HCTISN) take part in targeted inspections as observers, subject to the licensee's approval. ASN also invited inspectors from the regulatory authorities of Germany, Switzerland, Belgium and Luxembourg to attend these inspections. In total, 51 outside observers took part in the targeted inspections carried out by ASN, mainly on NPPs.

Table 2: significant activities in 2011

Field	Topics or activities with significant implications
BNIs including: – NPPs – Research reactors – Laboratories and plants – Installations undergoing decommissioning	<ul style="list-style-type: none"> – Reactor outages – Social, organisational and human factors – Operation of the installation – Condition of barriers – Condition of systems – Prevention and management of risks, emergency situations – Radiation protection – Environment and waste
Small-scale nuclear activities	<ul style="list-style-type: none"> – Industrial radiography activities – External radiotherapy – Interventional medical radiology – Brachytherapy – Suppliers of ionising radiation sources – Nuclear medicine units performing therapeutic and/or in vivo diagnostic procedures – Holders of unsealed source licences – Industrial or research irradiation facilities or particle accelerators – Thin layer thickness measurement – Gammadensimetry – Use of neutron sources – Implementation of high-activity sealed sources
Radioactive material transport	<ul style="list-style-type: none"> – Emergency plan for approved package consignors – Packages not requiring approval – Internal transport

2|2 Applying the principle of licensee prime responsibility

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

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

For intermediate operations, with safety and radiation protection implications that are significant but that 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 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 CLI.

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

ASN verifies correct application of the internal checks arrangements by various means: inspections, review of the periodic reports forwarded 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|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 highest safety implications require approval from ASN. This includes those intended for the transport of high activity radioactive materials, or those in which the contents entail 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. The organisations approved in this way carry out:

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

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 maximum benefit is gained from the approval issued, in particular through regular exchanges with the organisations it has approved and the mandatory transmission of an annual report, in order to:

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

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 its website (*“bulletin officiel de l’ASN/agrément d’organismes”* section, available in French only).

In 2011, ASN issued:

- 12 new or renewed approvals for organisations responsible for radiation protection inspections;
- 25 new or renewed approvals for organisations responsible for radon activity concentration measurements;
- 4 approvals for worker dosimetry (3 for internal monitoring of workers and 1 for external monitoring of workers);
- 130 approvals for measurement of environmental radioactivity.

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

It sends the ministers responsible for nuclear safety and/or transport an opinion on approval of the organisations responsible for:

- training the drivers of vehicles transporting radioactive materials (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 mobile tanker units intended for transport of class 7 hazardous materials by road;
- the initial and periodic checks of tankers for transport of class 7 hazardous materials by road.

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 data should enable the technical demonstrations presented by the licensee to be analysed and the inspections to be targeted. It should also allow identification and monitoring of the milestones in the operation of a nuclear activity. The actions specific to the inspection of RMT are described in detail in chapter 11.

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 on the contrary reject the licensee's proposals, to ask for additional information or studies or to ask for work to bring the relevant items into conformity. ASN's requirements are expressed as decisions.

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.

The 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 major issues, ASN requests the opinion of the competent Advisory Committee. 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 materials.



Documentary examination by the ASN inspectors during the inspection of the nuclear medicine unit of the Oscar Lambret centre in Lille – November 2011

Once the nuclear facility has been commissioned, following ASN authorisation, all changes made by the licensee that could affect security, public health and safety, or protection of nature and the environment, are notified to ASN. In addition to these procedures, made necessary by changes to the facilities or how they operate, the licensee must, pursuant to the Environment Code, carry out periodic safety reviews in order to update the evaluation of the facility in the light of changing techniques and regulations and on the basis of operating 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 data 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 data 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 for medicine, dentistry, human biology and biomedical research, as well as for any other nuclear activity. 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 inadequacies 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 any actions demanded by ASN further to the checks have been carried out. 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 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:



ASN inspection of the nuclear medicine unit of the Oscar Lambret centre in Lille – November 2011

- inspections, according to 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 the least 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. Their purpose is to carry out detailed examinations and they are overseen by senior inspectors (see chapter 2);
- 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.

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.

a) To achieve its objectives, ASN employs inspectors chosen for their professional experience and for their legal and technical expertise. It gives them the practical tools they need to carry out their inspections.

The inspectors carry out their inspection duties under the authority of the ASN Director General. They are sworn-in and bound by professional secrecy. They are appointed and qualified once they have acquired the necessary competence through their professional experience, tutoring and appropriate training. To ensure constant progress, ASN:

- has defined a system of qualification for its inspectors, based on recognition of their technical competence, in the same way as the leading foreign safety authorities.
- has adopted a number of foreign practices identified during the course of inspector exchanges between regulatory authorities. These exchanges are organised either for a particular inspection

or for a longer period, via a secondment of up to 3 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;

- encourages an open-minded attitude to other regulatory practices on the part of its inspectors. ASN encourages its departments to take on inspectors from other regulatory bodies (ICPE inspectorate, AFSSAPS, ARS (Regional Health Agencies), etc.). It also proposes organising joint inspections with these bodies concerning the activities falling within its scope of expertise. In order to identify other methods for risk management by the licensees, the ASN inspectors may also observe inspections on specialised subjects in facilities which do not fall within their field of expertise;

- aims to ensure the uniformity of its practices. It encourages participation by its staff in inspections on different subjects, in different regions and sectors.

The ASN Chairman appoints the inspectors as defined by decree 2007-831 of 11th May 2007 which determines the procedures for the appointment and qualification of nuclear safety inspectors (formerly known as BNI inspectors) and the staff responsible for checking pressure equipment specifically designed for BNIs and by articles R. 1333-100 to R. 1333-108 of the Public Health Code (radiation protection inspectors).

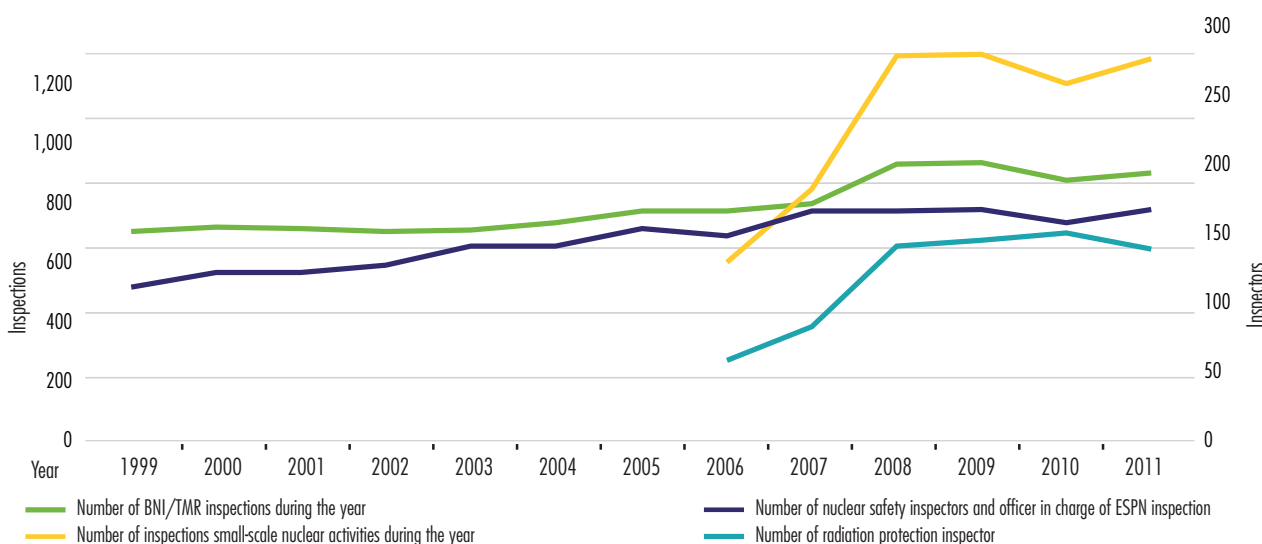
To help them with the performance of their duties, ASN provides its inspectors with inspection guides and tools to help them to decide the follow-up to the deviations observed. These guides are regularly updated to take account of changes to the regulations and to techniques.

Table 3 presents the inspector staffing levels on 31st December 2011. Some inspectors are qualified in several inspection domains.

Table 3: number of inspectors per inspection domain (as at 31.12.2011)

Type of inspector	Departments	Divisions	Total
Nuclear safety inspector (BNI)	65	92	157
Pressure equipment inspector	10	34	44
Nuclear safety inspector (transport)	14	29	43
Radiation protection inspector	38	103	141
Labour inspector	2	10	12
Number of inspectors (all fields included)	95	155	250

Graph 1 : evolution of number of ASN inspectors and inspections



In 2011, ASN carried out 256 days of labour inspections and 2,061 inspections on BNIs, RMT operations, activities using ionising radiation, organisations and laboratories it has approved and activities involving pressure equipment.

b) 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.

This schedule identifies the facilities, activities and subjects targeted. This is not known beforehand 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 on compliance with the forecast schedule of inspections and enable the activities checked to be evaluated in terms of both the licensee and the sector or particular topic concerned. These reports contribute to the process of continuous improvement of the inspection system.

c) With regard to these inspections, ASN informs the public by posting the inspection follow-up letters on-line on its website. This subject is developed in greater detail in chapter 6.

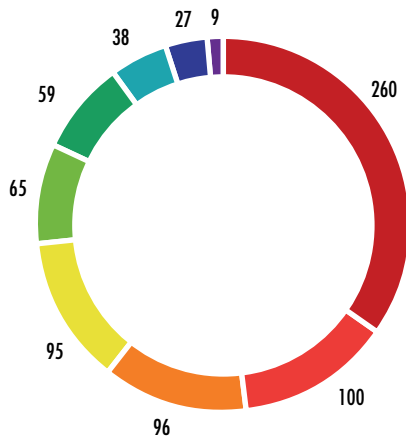
3|2|3 Inspection of basic nuclear installations (BNIs) and pressure equipment in 2011

In 2011, 749 BNI inspections were carried out, of which 157 (21%) were unannounced. The breakdown according to the various installation categories is described in the graphs 2 to 4. All the NPP reactors and 18 laboratories and plants of the fuel cycle underwent 38 specific post-Fukushima inspections concerning five topics: earthquake, flooding, electrical power supplies, cooling and management of accident situations. These inspections each mobilised several inspectors for several days of inspections and required specific preparation. To take account of the extra work generated by these inspections, on top of the routine inspections, they were weighted and counted in the following way:

- a targeted inspection in the PWRs counts for three routine inspections,
- a targeted inspection in the LUDD (Laboratories, Plants, Waste and Decommissioning) sites counts for two routine inspections.

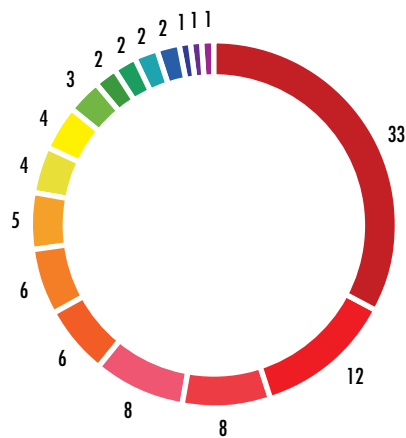
ASN and the organisations it has approved also performed more than 400 inspections to assess the conformity of the nuclear pressure equipment.

Graph 2: breakdown per topic of BNI inspections in 2011



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

Graph 3: breakdown by topic of RMT inspections in 2011



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

3|2|4 Inspection of radioactive material transport (RMT) in 2011

The 100 inspections on transport activities in 2011 can be broken down according to topic as shown in graph 3.

3|2|5 Inspection of small-scale nuclear activities in 2011

ASN organises its regulation 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. ASN carried out 1,088 inspections in 2011 on the 50,000 or so nuclear facilities and activities in the sector, including 617 in the medical sector, 452 in industry or research and 19 on landfills, mines and spoil heaps, polluted sites or companies not exercising a nuclear activity but exposing their staff to ionising radiation. The breakdown according to the various activity categories is described in graph 4.

3|2|6 Inspection of ASN approved organisations and laboratories in 2011

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 2011, ASN carried out 124 inspections of approved organisations and laboratories, broken down as follows:

- organisations carrying out radiation protection technical checks: 87 inspections;
- organisations evaluating nuclear pressure equipment conformity and inspecting operational equipment: 15 inspections;
- organisations measuring radon activity concentration: 11 inspections;
- laboratories approved for environmental radioactivity measurements: 11 inspections.

3|2|7 Checks on exposure to radon and Naturally Occurring Radioactive Materials (NORM) in 2011

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 and 30th April of the following year.

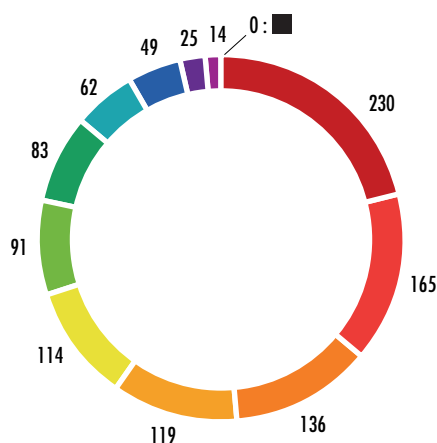
For the 2011-2012 measurement campaign, the number of approved organisations is indicated in table 4.

Monitoring exposure to natural ionising radiation in non-nuclear industries

The order of 25th May 2005 provides the list of professional activities (industries, spas and drinking water treatment plants) 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.

Verification of application of these provisions over the 2007-2011 period confirmed that certain industries using enhanced natural ionising radiation came within the scope of application of the regulatory radiation protection provisions. These include facilities for zircon production and for processing of titanium ore and rare earths, to which the worker radiation protection regulations apply in accordance with articles R.4451-143 and R.4451-144 of the Labour Code.

Graph 4: breakdown of small-scale nuclear activity inspections in 2011 according to nature of activity



- Other activities
- External radiotherapy and brachytherapy
- Interventional radiology
- Tomography installations
- Industrial radiography
- Nuclear medicine
- Conventional radiology (medical and dental)
- Veterinary
- Source suppliers
- Irradiation facilities or particle accelerators
- Gammadensimetry
- Teaching and research

Table 4: number of organisations approved for measuring radon levels

	Approval until 15th september 2012	Approval until 15th september 2013	Approval until 15th september 2014	Approval until 15th september 2015	Approval until 15th september 2016
Level 1 or Level 1 option A*	19	0	0	8	18
Level 1 option B**	8				
Level 2***	1			1	5

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

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

*** Corresponds to complementary investigations

The inspection and evaluation actions taken in collaboration with the conventional safety inspectorate and the ICPE inspectorate were carried out over the period 2008-2011. These actions completed the results obtained and improved understanding of the issues in these industrial sectors, as well as in spas and groundwater extraction facilities.

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 Regional Health Agencies (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 for health. A summary of these results is presented in chapter 1.

3|3 Regulating the impact of nuclear activities on the environment

3|3|1 Regulating basic nuclear installation (BNI) discharges

Monitoring of discharges

The monitoring of discharges from an installation is essentially the responsibility of the licensee. The provisions regulating discharges stipulate the minimum checks that the licensee is required to carry out. These checks for example concern 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.). Lastly, the measurement of environmental - particularly meteorological - parameters is imposed when necessary.

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. During the course of these inspections, inspectors – assisted when necessary by technicians from a specialised, independent laboratory – check compliance with the regulation requirements, take samples from the effluents or the environment, and have them analysed by this laboratory. Since 2000, ASN has carried out 10 to 30 inspections - with sampling - every year (23 in 2011).

Accounting rules for BNI discharges

The lowering of the activity level of the radioactive effluents discharged by BNIs, the changes made to the categories of radionuclides regulated in the discharge licence orders and the need to be able to calculate the dosimetric impact of the discharges on the population, led ASN to change the radioactive discharge accounting rules in 2002, based on 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.

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 $LD \approx 2 \times SD$.



ASN "environmental" inspection at the Nogent-sur-Seine NPP – December 2011

These evolving reference spectra are based on operating experience feedback from the analyses carried out. When the activity is lower than the decision threshold, then the latter value is used;

- other radionuclides, which are occasionally present, are considered if their activity concentration is higher than the decision threshold.

These rules are applied in all BNIs. The rules for chemical discharges are identical to those in force for ICPEs. These rules will be put down in writing in the general regulations applicable to BNIs, which are currently being revised.

As other countries use different accounting methods, it is hard to compare the results published by the various national nuclear regulators.

Quality of measurement is a precondition if the results obtained and published are to be conclusive. In the area of effluent measurement, in view of the shortcomings in the available body of standards, ASN supported the creation of a working group by the French nuclear equipment standardisation office (BNEN). This programme will eventually produce a set of high-quality methods that are standardised and therefore comparable.

3 | 3 | 2 Assessing the radiological impact of nuclear activities

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

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 then becomes necessary to use models of radioactivity transfer to man, for which the input is the facility discharge measurement data.

Reference spectra used for NPPs

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

- *Liquid:*

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

- *Gaseous:*

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

These models are specific to each licensee. ASN aims for optimum harmonisation of the methods used and in 2009 initiated an examination of this subject with IRSN.

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.

Table 5: radiological impact of BNIs since 2005 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 [population/distance from site in km] ^a	Estimation of received doses, in mSv					
		2005	2006	2007	2008	2009	2010
AREVA/La Hague	Digulleville (Child/2.6) Fisherman Goury [Adult (2008. 2009: child)/7.5]	1.10 ⁻²	1.10 ⁻²	1.10 ⁻²	8.10 ⁻³	8.10 ⁻³	1.10 ⁻²
		6.10 ⁻³	6.10 ⁻³	6.10 ⁻³	5.10 ⁻³	4.10 ⁻³	5.10 ⁻³
GANIL/Caen	IUT (Adult/0.6)	2.10 ⁻³	3.10 ⁻³	< 6.10 ⁻³	< 9.10 ⁻³ ^b	3.10 ⁻³	< 3.10 ⁻³
EDF/Cattenom	Garche nord, Warpich (2009. 2010) [Adult/2.15] [2009. 2010: baby/1.5]	2.10 ⁻³	3.10 ⁻³	3.10 ⁻³	3.10 ⁻³	3.10 ⁻³	3.10 ⁻³
CEA/Cadarache	Saint-Paul-Lez-Durance [Adult/2]	8.10 ⁻³	3.10 ⁻⁴	2.10 ⁻³	2.10 ⁻³	2.10 ⁻³	2.10 ⁻³
AREVA/FBFC	Ferme Riffard [Adult/0.2]	*	*	*	6.10 ⁻⁴	8.10 ⁻⁴	1.10 ⁻³
EDF/Chooz	Les Pirettes (gymnasium) [Adult (2009: infant)/0.75]	*	*	*	2.10 ⁻³	1.10 ⁻³	1.10 ⁻³
EDF/Civaux	Ervaux sud [Adult/0.7]	*	*	*	8.10 ⁻⁴	7.10 ⁻⁴	1.10 ⁻³
EDF/Dampierre-en-Burly	La Maison Neuve, Les Serres (2009. 2010) [Adult/0.9 (2009. 2010: adult/0,7)]	*	*	*	8.10 ⁻⁴	1.10 ⁻³	1.10 ⁻³
EDF/Gravelines	Petit-Fort-Philippe, Esp. Cult. Decaestecker (2009. 2010) [Adult/1.45] [2009. 2010: fisherman/1.1]	2.10 ⁻⁴	3.10 ⁻⁴	3.10 ⁻⁴	3.10 ⁻⁴	1.10 ⁻³	1.10 ⁻³
EDF/Penly	Saint-Martin Plage, Vassonville (2009. 2010) [Adult/1.05] [2009. 2010: fisherman/0.7]	9.10 ⁻⁴	5.10 ⁻⁴	6.10 ⁻⁴	3.10 ⁻³	9.10 ⁻⁴	1.10 ⁻³
EDF/Flamanville	La Berquerie, Hameau es Louis (2009. 2010) [Adult/0.8] [2009. 2010: fisherman/0.8]	5.10 ⁻³	5.10 ⁻³	1.10 ⁻³	7.10 ⁻⁴	9.10 ⁻⁴	9.10 ⁻⁴
EDF/Golfech	Pascalet, Labaquièrre (2009. 2010) [Adult/0.85] [2009. 2010: adult/1]	2.10 ⁻⁴	2.10 ⁻⁴	5.10 ⁻⁴	8.10 ⁻⁴	8.10 ⁻⁴	9.10 ⁻⁴
EDF/Nogent-sur-Seine	Port Saint-Nicolas, lock-keeper's house (2009. 2010) [Adult/2.25] [2009. 2010: adult: 1]	7.10 ⁻⁴	8.10 ⁻⁴	9.10 ⁻⁴	7.10 ⁻⁴	6.10 ⁻⁴	9.10 ⁻⁴
EDF/Tricastin	Clos du Bonneau, Le Trop Long (2009. 2010) [Adult/1.25] [2009. 2010: infant/1.25]	7.10 ⁻⁵	6.10 ⁻⁵	7.10 ⁻⁵	4.10 ⁻⁴	7.10 ⁻⁴	9.10 ⁻⁴
AREVA/Tricastin (AREVA NC, COMURHEX, EURODIF, SOCATRI, SET)	Les Prés Guérinés [Adult (2005: child)/3; 3.1; 2.16; 1.3; 1.5] Clos de Bonnot [Adult/2.2; 2.3; 1.3; 0.6; 0.8)]	2.10 ⁻³	1.10 ⁻³	1.10 ⁻³	5.10 ⁻⁴	5.10 ⁻⁴	*
		*	*	*	7.10 ⁻⁴	8.10 ⁻⁴	7.10 ⁻⁴
CEA/Saclay	Fisherman, Christ de Saclay [Adult/1] Farmer, Christ de Saclay [Adult/1]	4.10 ⁻³	5.10 ⁻³	9.10 ⁻⁴	7.10 ⁻⁴	4.10 ⁻⁴	7.10 ⁻⁴
		5.10 ⁻⁴	5.10 ⁻⁴	4.10 ⁻⁴	4.10 ⁻⁴	*	*
EDF/Paluel	Le Tôl [Adult (2009. 2010: fisherman)/1.45]	2.10 ⁻³	2.10 ⁻³	2.10 ⁻³	2.10 ⁻³	6.10 ⁻⁴	7.10 ⁻⁴
EDF/Belleville-sur-Loire	Neuvy-sur-Loire [Adult/1.3]	2.10 ⁻⁴	2.10 ⁻⁴	2.10 ⁻⁴	6.10 ⁻⁴	7.10 ⁻⁴	6.10 ⁻⁴
EDF/Blayais	Le Bastion [Adult (2009. 2010: fisherman)/1.1]	4.10 ⁻⁴	4.10 ⁻⁴	4.10 ⁻⁴	5.10 ⁻⁴	5.10 ⁻⁴	6.10 ⁻⁴
EDF/Cruas-Meyssse	Ferme de Grimaud, Serres (2009. 2010) [Adult/1.25] [2009. 2010: infant/1.1]	2.10 ⁻⁴	2.10 ⁻⁴	8.10 ⁻⁵	4.10 ⁻⁴	5.10 ⁻⁴	5.10 ⁻⁴

Table continued

Licensee/Site	Most exposed reference group (population/distance from site in km) ^a	Estimation of received doses, in mSv					
		2005	2006	2007	2008	2009	2010
ANDRA/Manche	Hameau de La Fosse [Adult/2.5] Fisherman Goury [Adult/8]	8.10 ⁻⁴	8.10 ⁻⁴	7.10 ⁻⁴	7.10 ⁻⁴	6.10 ⁻⁴	4.10 ⁻⁴
		7.10 ⁻⁷	8.10 ⁻⁸	9.10 ⁻⁸	5.10 ⁻⁸	8.10 ⁻⁸	8.10 ⁻⁸
EDF/Bugey	St Etienne d'Hières sud [Adult/0.45]	*	*	*	5.10 ⁻⁴	5.10 ⁻⁴	4.10 ⁻⁴
EDF/Chinon	Le Neman [Adult/1.25]	3.10 ⁻⁴	3.10 ⁻⁴	2.10 ⁻⁴	4.10 ⁻⁴	4.10 ⁻⁴	4.10 ⁻⁴
EDF/St-Alban	Les Crès [Adulte / 1.45]	2.10 ⁻⁴	2.10 ⁻⁴	7.10 ⁻⁵	3.10 ⁻⁴	4.10 ⁻⁴	4.10 ⁻⁴
CEA/Marcoule (ATALANTE, CENTRACO, PHENIX, MÉLOX, CIS-Bio)	Codolet [Adult/2]	4.10 ⁻⁴	4.10 ⁻⁴	5.10 ⁻⁴	4.10 ⁻⁴	4.10 ⁻⁴	3.10 ⁻⁴
EDF/St-Laurent-des-Eaux	Port au Vin [Adult/0.75]	7.10 ⁻⁵	9.10 ⁻⁵	2.10 ⁻⁴	4.10 ⁻⁴	3.10 ⁻⁴	3.10 ⁻⁴
EDF/Fessenheim	Cité EDF (Koechlin) [Adult (2010: infant)/1.2]	*	*	*	8.10 ⁻⁵	8.10 ⁻⁵	1.10 ⁻⁴
ILL/Grenoble	Fontaine (gaseous discharges); Saint-Egrève (liquid discharges) [infant/1 (Fontaine); 1.4 (Saint-Egrève)]	*	*	*	*	1.10 ⁻⁴	1.10 ⁻⁴
EDF/Creys-Malville	Ferme de Chancillon [Adult (2010: infant)/0.85]	*	*	1.10 ⁻⁵	2.10 ⁻⁵	8.10 ⁻⁶	6.10 ⁻⁵
CEA/Fontenay-aux-Roses	Fontenay-aux-Roses [Child/1.5]	2.10 ⁻⁵	2.10 ⁻⁵	9.10 ⁻⁶	1.10 ⁻⁵	5.10 ⁻⁶	4.10 ⁻⁶
ANDRA/CSA	CD24 road bridge [Child/2.1]	6.10 ⁻⁶	5.10 ⁻⁶	3.10 ⁻⁶	2.10 ⁻⁶	5.10 ⁻⁶	2.10 ⁻⁶
CEA/Grenoble ^c	Fontaine (gaseous discharges); Saint-Egrève (liquid discharges) [infant (2004, 2008: adult)/1 (Fontaine); 1.4 (Saint-Egrève)] Saint-Egrève [infant (2004, 2007: adult)/ 1.4 (liquids); 3.9 (gaseous)]	7.10 ⁻⁷	2.10 ⁻⁶	7.10 ⁻⁷	1.10 ⁻⁶	3.10 ⁻⁷	3.10 ⁻⁷
		4.10 ⁻⁷	8.10 ⁻⁷	3.10 ⁻⁷	6.10 ⁻⁷	*	*

^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.

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 homogeneous groups of individuals receiving the highest average dose from among the population exposed to a given installation according to realistic scenarios. This population category (adults, infants, children) differs from one site to another and from one year to another, as does the group's distance from the site.

Finally, the estimate is made according to modelling parameters, such as meteorological data (locally observed wind rose). 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 1mSv per year. ASN is therefore of the opinion that in

France, the discharges produced by the nuclear industry have an extremely small radiological impact.

3|4 Learning the lessons from significant events

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 implement a reliable system for detecting any anomalies that may occur, such as equipment failures or errors in the application of operating rules. This system should allow early detection of any abnormal operation and is a factor in defence in depth. These anomalies must be notified to ASN.

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

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 chairmen of the groups, Dr Patrick Smeesters of the Belgian Federal Agency for Nuclear Control (FANC) and Mr Roland Masse of the Academy of Technologies, submitted their conclusions and the recommendations of the two think-tanks to ASN in April 2010.

The work confirmed the low impact of tritium discharges in France, but also evidenced the need for further studies and research to consolidate existing 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 the management of tritiated discharges, and for improvements to environmental monitoring and estimation of the impact of tritium. It has asked the research organisations to further research into the evaluation of the impact of tritium, its effects on the foetus and embryo, and the potential induction of hereditary effects.

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 plans, which met for the first time on 6th July 2011. Certain aspects of the action plans are already under way:

- ASN has initiated a review of tritium emissions from all French nuclear sites, which are published on the White Paper website. This review also includes the dosimetric impact of each site and the tritium contribution to the total dose;
- ASN asked the BNEN to begin work to standardise the measurement of organically bound tritium: a special working group was created in 2011 and is tasked with drafting a standard;
- ASN asked the licensees to initiate work to improve characterisation of their discharges;
- with regard to radiological impact, ASN referred the question of impact assessment to the International Commission on Radiological Protection (ICRP) and also asked the licensees to supplement their impact assessments with a critical study using $w_R = 2$ (weighting factor for tritium).

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). It has been used since 1st June 2007, in order to familiarise the professionals with this approach and take account of any problems they could encounter, while enabling them to meet their legal obligations straight away.

These guides can be consulted on the ASN website, www.asn.fr. They are currently being revised by ASN.

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 highlighted 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.

Rating the anomalies should enable priority to be given to addressing the most important ones. ASN has defined a category of anomalies called “significant events”. These are events that are 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 individual in charge of the activity has carried out a relevant analysis of 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 (see point 4).

3|4|2 Implementation of the approach

Event notification

In the event of an incident or accident, whether or not nuclear, with a real or potential risk of significant consequences for the safety of the facility or transport, or liable to constitute a risk for people, property or the environment through significant exposure to ionising radiation, the person in charge of a nuclear activity is obliged to notify ASN and the State representative in the *département*¹ 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.

ASN analysis of the notification

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 extremely valuable for ASN and its technical support organisation, IRSN, in particular for the periodic safety reviews conducted on BNIs.

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 licensee's 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, carried out for events that justify it, 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 drawing up recommendations if necessary. The inquiry is conducted by an inquiry team which, in addition to ASN staff, can comprise specifically designated outside individuals.

This arrangement covers incidents and accidents associated with both BNIs and RMT as well as those which can occur during activities entailing a risk of human exposure to ionising radiation, in particular activities carried out for medical purposes.

Articles L. 592-35 and following of the Environment Code give ASN powers to set up a commission of inquiry, determine its composition, define the subject and scope of the investigations and gain access to all necessary elements in the event of a judicial inquiry.

However, unlike the investigation bureaus set up in other fields², whose sole purpose is to conduct inquiries, disseminate information gleaned from operating experience feedback and conduct research into accidents and their causes, ASN's main responsibility is the inspection of nuclear activities and the drafting of the regulations. This entails certain particularities in how the investigators and ASN work together.

This primarily concerns three aspects:

- for inquiries concerning a nuclear activity, it is necessary to differentiate between the inquiry duty, the aim of which is to determine the circumstances and causes of the event, and the ASN's regulation duty, the aim of which is to protect workers, patients, the public and the environment from risks related to nuclear activities.

1. Administrative region headed by a *préfet*

2. The maritime accidents investigation bureau (BEAmer), the land transports accident investigation bureau (BEA TT), the civil aircraft accident investigation bureau (BEA), and their counterparts for events affecting defence-related transport.

- the accident investigation bureau (BEA) officers whose duty is to take part in the inquiries, receive permanent commissions as technical investigators. As the responsibility of the ASN officers is primarily one of inspection, they are temporarily commissioned on a case-by-case basis;
- the investigators must offer guarantees of independence and impartiality. This requirement applies to ASN officers, who must not have taken part in the inspection of the activity which is the subject of the inquiry for which they are commissioned.

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 2011

In 2011, ASN was notified of:

- 1,092 significant events for the BNIs, concerning nuclear safety, radiation protection and the environment, 938 of which were classified on the INES scale;
- 29 significant events concerning the transport of radioactive materials; 27 of which were classified on the INES scale;
- 534 significant events concerning radiation protection in small-scale nuclear activities, 97 of which were rated on the INES scale.

By comparison with 2010, the number of significant events is up by about 6% for BNIs and 8% for small-scale nuclear activities, but significantly down for RMT operations. The overall rise in the number of significant events stems from the rise in notifications, in particular from those in charge of small-scale nuclear activities.

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

3|5 Raising awareness

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. Initiatives such as these, initiated in the medical field, are mentioned in chapter 9.

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 state labour inspectorate, inspection of medical appliances by AFSSAPS or health inspection as entrusted to the technical divisions of the Ministry for Health.

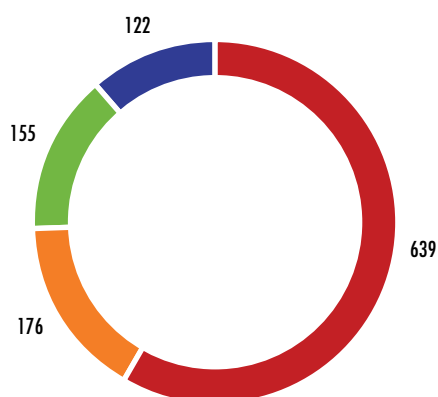
ASN and the General Directorate for Labour (DGT) for example signed an agreement in 2011 to coordinate the labour inspection and radiation protection inspection duties. This includes information exchanges, both local and national, joint inspections and cross-training courses.

Graphs 5 to 11 describe in detail the significant events notified to ASN in 2011, differentiating between the various notification criteria for each domain.

Table 6: rating of significant events on the INES scale in 2011

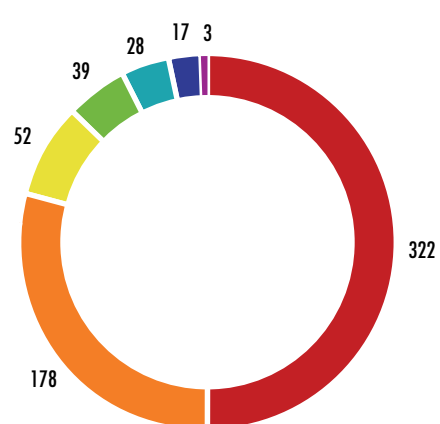
Level	Water reactors	Other pressurised facilities	Basic nuclear transport operations	Small-scale nuclear activities	Total
3 and +	0	0	0	0	0
2	1	0	0	1	2
1	66	23	2	15	106
0	680	168	25	81	954
Total	747	191	27	97	1,062

Graph 5 : breakdown per type of event for BNIs in 2011



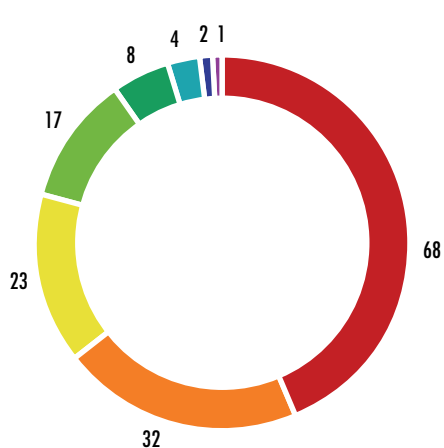
- Safety related events for NPPs
- Environmental events for BNIs
- Safety related events for BNIs other than NPPs
- Events involving radiation protection in BNIs

Graph 6 : events involving safety in NPPs in 2011



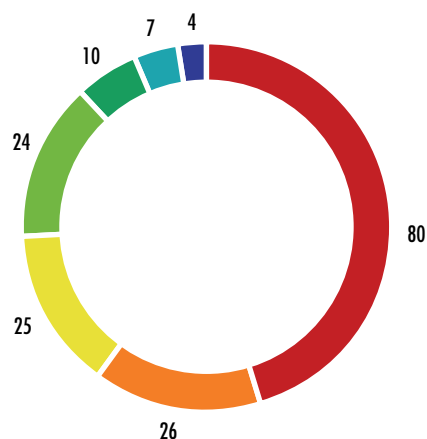
- Deviation from Operational Technical Specifications (STE) or event which could lead to a deviation
- Other significant events which could affect safety
- Automatic reactor trip
- Design, manufacturing or assembly anomaly
- Transition to shutdown state according to the STE or accident procedures
- Inadvertent 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
- Actual or attempted malicious act
- Event which caused or could cause multiple failures

Graph 7 : events involving safety for BNIs other than NPPs in 2011



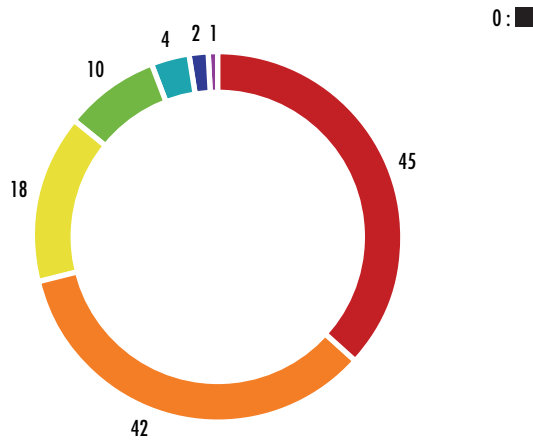
- Event which led to safety limit(s) being exceeded
- Event actually or potentially affecting the containment of hazardous materials
- Other significant events which could affect safety
- Fault, deterioration or failure which affected a safety function
- Inadvertent start-up of a protection or safeguard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

Graph 8 : significant environmental events for BNIs in 2011



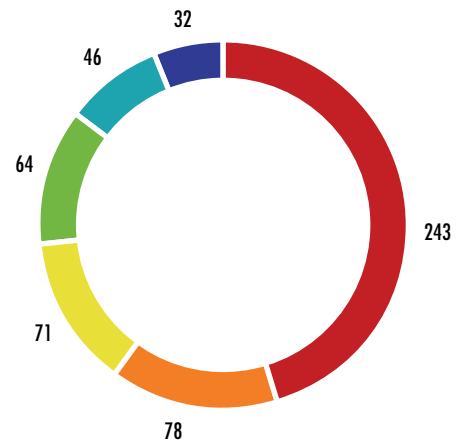
- Non-compliance with the order of 31st December 1999
- By-passing of normal discharge channels, with a significant chemical impact
- Other significant events which could affect the environment
- Confirmed overshoot of a discharge or concentration limit
- By-passing of normal discharge channels, with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

Graph 9 : events involving radiation protection for BNIs in 2011



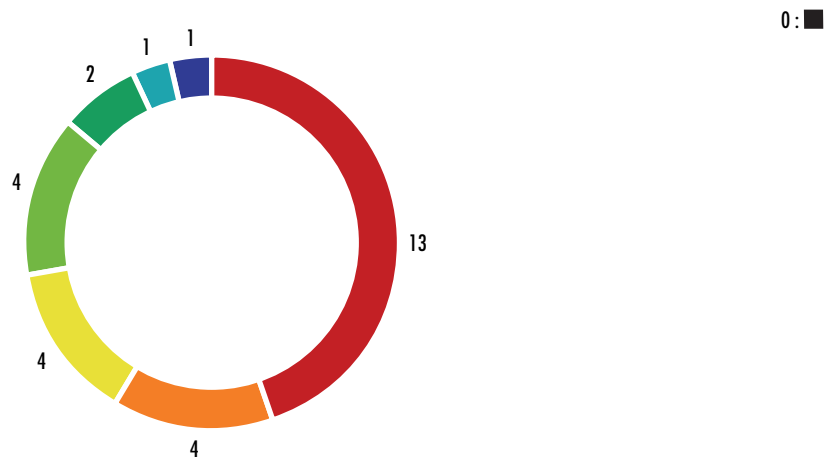
- Other significant events which could affect radiation protection
- Signage anomaly or failure to comply with zone access conditions
- Any significant deviation concerning radiological cleanliness
- Abnormal situation affecting a source with activity higher than the exemption threshold
- Radiological monitoring device inspection interval exceeded
- 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
- Annual dose limit exceeded or event capable of leading to such a situation
- Actual or attempted malicious act liable to affect the protection of the workers or general public
- Uncompensated failure of radiological monitoring systems

Graph 10 : events involving radiation protection (other than BNIs and RMT) in 2011



- 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 materials (RMT) in 2011



- Non-compliance with regulations applicable to RMT operations
- Non-compliance with a radiation intensity or contamination limit
- Fault, deterioration or failure which affected a safety function
- Other significant events which could affect the transport operation
- Actual or potential hazard affecting the safety of a transport operation
- Repetitive event of unknown cause affecting a safety function
- Event open to misinterpretation in the media or by the general public
- Loss or theft of a radioactive material package during transport
- Shipment of a package even though the consignee is not in a position to receive the shipment
- Accidental discovery of a transport package not declared as having been stolen or lost
- Actual or attempted malicious act
- Nuclear or other event leading to injury or death
- Event having affected at least one barrier, with actual or potential consequences

4 MONITORING ENVIRONMENTAL RADIOACTIVITY

Within a European regulatory context, the monitoring of the environment is in particular based on:

- monitoring around the nuclear facilities by the licensees in accordance with the terms of their discharge licences;
- monitoring of environmental radioactivity by IRSN;
- the French National Network for the Measurement of Environmental Radioactivity (RNM), the aim of which is to collate and make available to the public all the environmental measurements taken nationwide as required by the regulations. 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. Following these checks, the European Commission issues an opinion on the resources put in place by the Member States to monitor:

- radioactive liquid and gaseous discharges into the environment;
- the levels of radioactivity in the land and aquatic environment around nuclear sites and nationwide.

It gives its opinion more particularly on:

- the operation of the measuring instruments;
- the representativeness of the samples and the sampling methods;
- the relevance of the analytical methods;
- management and archiving of results;
- reports and procedures;
- quality control of measurements.

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.

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;



ASN inspection on the topic "sampling and measurement of effluents" discharged from the Flamanville NPP – November 2011

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

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

β_G = total β

- detects any abnormal increase in radioactivity as early as possible;
- ensures there are no facility malfunctions, including by analysing the ground water and checking compliance with the regulations by the licensees;
- contributes to transparency and informing the public by transmitting monitoring data to the RNM.

4 | 1 | 2 Content of monitoring

Virtually all nuclear sites in France carry out 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 regulation 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. The nature of the environmental monitoring associated with liquid discharges, which must be stipulated in the authorisation order, is defined in articles 14, 22 and 23 of the ministerial order of 26th November 1999. To bring it into line with the progress achieved with the Environment Code, ASN has initiated an update of the general technical regulations applicable to BNIs.

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.

When several facilities (whether or not BNIs) are present on the same site, joint monitoring of all these installations is possible,

Special monitoring plan during the Fukushima accident

To estimate radioactivity levels across French territory following releases from the Fukushima Daiichi nuclear power plant, ASN asked operators to demonstrate particular vigilance regarding the results of measurements made and to step up monitoring. Additional analyses were requested by ASN on 22nd March 2011 relative to monitoring the air, entailing measurement of the radioactivity levels of aerosols and gaseous iodines.

The first phase of this additional monitoring (22nd March – 18th April 2011) consisted in grouped daily gamma spectrometry measurement of aerosol filters, as well as gamma spectrometry measurement of iodine gases on a cartridge, at intervals of 24h to 72h. Depending on the specificities of each site, the licensees were able to adapt this mechanism. To take account of changing contamination levels, a second phase was initiated as of 18th April, with a weekly gamma spectrometry measurement of the 7 daily aerosol filters and a weekly gamma spectrometry measurement of the iodine gases on a cartridge.

Faced with the very low concentrations of artificial radionuclides in early May and, as of the second week of April 2011, the consistent decline as of the second week of April 2011 of traces detected in air masses that reached France at the end of March 2011, ASN has therefore asked operators to lift the special monitoring implemented.

During this period, the nuclear licensees continued to monitor the environment in accordance with the regulations applicable to them. The results of these measurements are transmitted monthly to the RNM and are published on this network's website www.mesure-radioactive.fr.

A total of 30 sites took part in this complementary monitoring. More than 600 gamma spectrometry measurements of filter groups (4 to 28 filters) and more than 250 gamma spectrometry measurements of cartridges to measure gaseous iodine, were taken.

The summary report on these measurement results has been integrated into the information notes published on the IRSN website since 24th March 2011 [1].

Everyone involved in monitoring the environment, especially university laboratories and associations, has also played a crucial role in assessing the very long-range impact of the releases from Fukushima thanks to their specific and independent measurements.

Everyone involved in monitoring the environment, especially university laboratories and associations, has also played a crucial role in assessing the very long-range impact of the releases from Fukushima thanks to their specific and independent measurements.



Post-Fukushima inspection of the Flamanville NPP – July 2011

1. www.irsn.fr/FR/Actualites_presse/Actualites/Documents/IRSN_Bulletin14_Bilan-surveillance-environnement-France_22042011.pdf

as has been the case on the Cadarache and Pierrelatte sites since 2006, for example.

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

Each year, in addition to forwarding the monitoring results to ASN, as required by the regulations, the operators send some 120,000 measurements to the RNM.

4.2 Environmental monitoring nationwide

IRSN ensures the environmental monitoring of the French territory through a measurement and sampling network 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 164 measurement detectors;
 - 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);
 - the Téléhydro network (monitoring of waste water in the sewerage treatment plants in the main French cities);
- 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 the Measurement of Environmental Radioactivity (RNM) and a procedure for having the radioactivity measurement laboratories approved by ASN. The RNM procedures were defined by an ASN decision (approved decision 2008-DC-0099 of 29th April 2008).

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 decision, pursuant to article L.592-21 of the Environment Code.

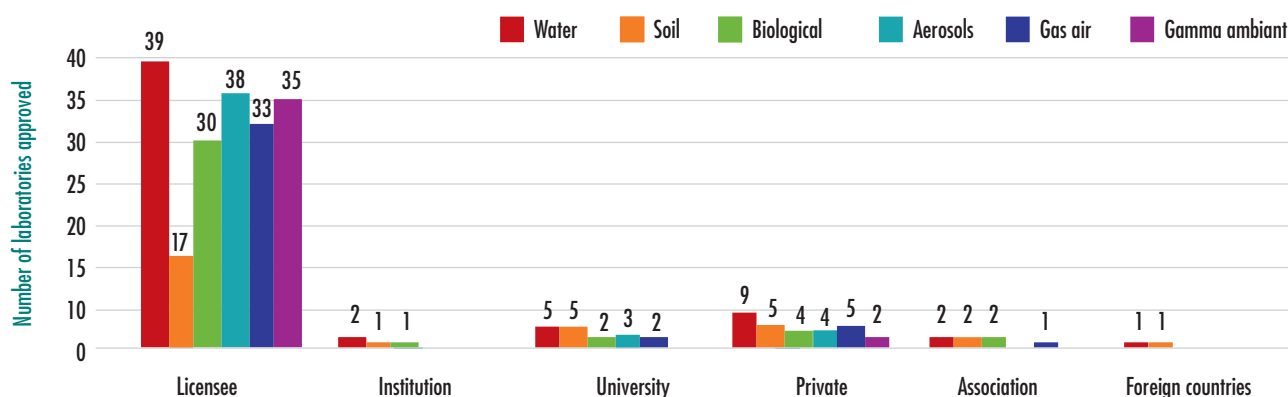
Table 8: approval chart and forecast five-year programme of inter-laboratory tests

Code	Radioactive measurements category	Type 1		Type 2		Type 3		Type 4		Type 5		Type 6	
		Water		Soil matrices		Biological matrices		Aerosols on filter		Gas air		Ambient environment (soil / air)	
..-01	Gamma emitters $\gamma > 100$ keV	2	1_01	1	2_01	2	3_01	2	4_01	1	5_01		-
..-02	Gamma emitters $\gamma < 100$ keV	2	1_02	1	2_02	2	3_02		4_02	1	5_02		-
..-03	Total alpha	1	1_03		-		-	2	4_03		-		-
..-04	Total beta	1	1_04		-		-	2	4_04		-		-
..-05	H-3	1	1_05		2_05	2	3_05		-		See water		-
..-06	C-14	1	1_06		2_06	2	3_06		-	1	5_06		-
..-07	Sr-90/Y-90	1	1_07	1	2_07	2	3_07	2	4_07		-		-
..-08	Other pure beta emitters (Tc99,...)		1_08	2	2_08	1	3_08		-		-		-
..-09	U isotopes	2	1_09	1	2_09	2	3_09	2	4_09		-		-
..-10	Th isotopes		1_10	1	2_10	2	3_10		4_10		-		-
..-11	Ra-226 + daughters	2	1_11	1	2_11	2	3_11		-		Rn 222: 5_11		-
..-12	Ra-228 + daughters	2	1_12	1	2_12	2	3_12		-		Rn 220: 5_12		-
..-13	Isotopes Pu, Am, (Cm, Np)	*	1_13*	2	2_13*	1	3_13	2	4_13		-		-
..-14	Halogenated gases		-		-		-		-	1	5_14		-
..-15	Rare gases		-		-		-		-	1	5_15		-
..-16	Gamma dosimetry		-		-		-		-		-	1	6_16
..-17	Total uranium	2	1_17	1	2_17	1	3_17	2	4_17		-		-

2011 2012 2013 2014 2015

The number of stars corresponds to the half year period during which the inter-comparison test is organised :
 * 1_13* and 2_13* in the second half of 2010 and scheduled for the second half of 2016.
 ** 1***: 1_04 and 1_05 in seawater in the first half of 2014

Graph 12: breakdown of number of approved laboratories as at 1st January 2012



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 p. 130 approval chart below in 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 according to a 5-year cycle, which corresponds to the maximum approval validity period.

4|3|1 Laboratory approval procedure

ASN decision 2008-DC-0099 of 29th April 2008 specifies the organisation of the national network and sets new approval arrangements for the environmental radioactivity measurement laboratories. This ASN decision, which replaced the ministerial order of 27th June 2005, takes account of the changes to the Public Health Code, the ASN prerogatives defined by the Environment Code and the operating experience feedback acquired since 2003.



ASN inspection on the topic "sampling and measurement of effluents" discharged from the Flamanville NPP – November 2011

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 decision, published in its Official Bulletin.

This decision 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 adequate 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 the IRSN. ASN decision 2008-DC-0117 of 4th November 2008 renewed the mandates of the commission's members for a further 5 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, 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).

The French National Network for the Measurement of Environmental Radioactivity Monitoring (RNM) website



In order to meet this transparency goal, the Network 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 Network.

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 national monitoring network (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 the website. The next summary of the radiological situation in France, including notable findings will also be available on-line.

At the time of the Fukushima events, the site experienced a traffic peak, with 150,000 visits in March.

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 will thus be set up in 2012 so that functions and information can be gradually added to the site, enabling the public to understand and interpret the environmental radioactivity measurement results transmitted to the national monitoring network.

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 2011, IRSN organised 5 intercomparison tests, which means 39 ILT since 2003 covering 44 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, trans-uranium elements or radionuclides of the natural chains of uranium and thorium in water, soil and biological matrices.

In 2011, ASN issued 130 approvals and extended a further hundred. On 1st January 2012, the total number of approved laboratories stood at 63, which represents 788 approvals of all types currently valid.

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

5 IDENTIFYING AND PENALISING INFRINGEMENTS

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 immediately, 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 anomaly 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 infringement;
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 anomalies observed and impose appropriate penalties, ASN has drawn up procedures and decision-making tools regarding the position to be adopted. These documents provide a structured framework enabling an impartial decision to be reached that is proportionate to the anomaly detected, coherent between all the inspectors and in conformity with ASN policy. They also constitute a learning aid for the less experienced 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 penalties

5|2|1 For the BNI and RMT licensees

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 materials 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 authorisation 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 implementation 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 enforcement 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 has special decision-making powers enabling him 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). He is also tasked with examining approval applications by the occupational health departments, jointly with the occupational physicians.

The labour inspector is in contact with many parties from different EDF entities. Management of these internal interfaces is an integral part of his duties. The labour inspector is first of all in contact with the unit senior management, the risk prevention departments and the occupational health departments. He is also in direct contact with the members of the Health, Safety and Working Conditions Committees (CHSCT) and the trade union representatives. The members of the CHSCT are a vital means of transmitting information for the labour inspector, in the light of their knowledge of the facility, the operating procedures, working conditions and accidents that occur in the facility. The members of the CHSCT are informed of the inspector's visits and of his observations during the inspections.

The inspector is notified of the ordinary meetings of the CHSCT (one every quarter) and the Inter-Company Working Conditions and Safety Committee (CIESCT) meetings held on the power plant sites, and can attend them. He takes part in extraordinary meetings held following an industrial accident, and in issuing an alert in the event of serious and imminent danger.

The mandatory posting of the contact details of the inspector with competence for each NPP leads to him being frequently contacted both by EDF personnel and by the personnel of the contractors working in the NPPs. The main subjects concern performance of their employment contract (working times, rest periods, travel, leave, etc.), but also notification of degraded working conditions.

The labour inspector is in contact with the occupational health departments. He may be required to validate (or invalidate) a decision by the occupational physician. Close relations with the occupational physician may enable him to gain a relatively clear picture of the “health” of the facility, in particular with regard to the organisational and human factors to be monitored.

Relations on the site can also concern EDF entities from outside the plant, which have their own staff consultation and medical supervision structures. The entities most concerned are the National Electricity Generating Equipment Centre (CNEPE) which is in charge of carrying out and supervising major non-nuclear works, the Nuclear Equipment Engineering Department (CIPN) for major operations on the nuclear island (in particular steam generator replacement), the Nuclear Environmental and Decommissioning Engineering Centre (CIDEN) for all work relating to the decommissioning of retired NPPs, and which on some sites has a separate structure, the workforce of which will rise as the decommissioning phases progress.

In 2011, the ASN labour inspectorate carried out 256 days of inspection and 580 interventions. It ordered two temporary shutdowns of building sites and issued four formal notices. In terms of criminal sanctions, the labour inspectorate issued six official reports on three NPPs.

5|2|4 2011 results concerning enforcement and penalties

ASN took administrative action (formal notice, suspension, etc.) against 12 licensees and managers of nuclear activities. Further to the observed infringements, it sent 33 reports to the Public Prosecutors, four of which were on account of labour inspections in NPPs.

The report drawn up by the ASN inspectors in 2008 concerning the SOCATRI company, led to the Court of first instance of Carpentras sentencing the company in July 2010, in respect of the event which took place on the SOCATRI facility in the night of 7th to 8th July 2008, finding it guilty of having failed to notify the incident without delay. The Public Prosecutor's office appealed this sentence.

On 30th September 2011, the Nimes court of appeal ruled on the appeal brought by the Public Prosecutor's Office. Concerning liability, the court partially reversed the appealed sentence regarding the acquittal in respect of the release of

substances into groundwater, surface water or the sea leading to effects harmful to health or to flora or fauna. The Court requalified the offence and declared the SOCATRI company guilty. Finally, with respect to enforcement and the civil suit, the court also reversed the appealed sentences.

5|3 Information about ASN's inspections

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 that its inspection work is transparent, ASN informs the public (both general and specialised) by placing the following on its website:

- 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.).

Message ordered by the Court to be published in the regional and national daily newspapers, at the expense of the SOCATRI company

By order of 30th September 2011, the court of appeal of Nimes found the SOCATRI company guilty of the offence of releasing substances into the groundwater, surface water or the sea leading, even temporarily, to significant modifications to the normal water supply and to restrictions on the use of bathing waters, and of a failure to notify without delay the incident that occurred in its premises on the night of 7th to 8th July 2008, pursuant to articles 48 and 54 of the 13th June 2006 Act on transparency and security in the nuclear field (TSN Act), and ruled on damages for the civil plaintiffs.

6 OUTLOOK

In 2012, ASN scheduled 1,846 inspections on BNIs, radioactive material transport, activities using ionising radiation, organisations and laboratories it has approved and activities involving pressure equipment. As in 2011, ASN will give priority to the inspection of activities with significant implications, as defined in point 2 | 1.

Other activities, such as services in BNIs, the supply of electrical generators of ionising radiation and computer tomography will also receive particular attention.

ASN is currently revising the conditions for notification of significant events, which will take into account the experimentation of the events notification guide in small-scale nuclear activities and the changes in regulations in the BNIs sector. The notification criteria and conditions shall be detailed and harmonised between the different sectors.

In the environmental field, ASN will continue to implement its tritium action plan, for example with the assistance of the pluralistic committee responsible for monitoring the action plan. With regard to monitoring of environmental radioactivity, ASN will finalise the work initiated on the monitoring strategy, both nationwide and around the nuclear sites. Together with the ministry responsible for the environment, ASN will also be reinforcing monitoring and inspection of the arrangements made for environmental protection around the BNIs.

Lastly, ASN is preparing to inspect a new field, namely the security of radioactive sources (see chapter 10). While broadening its area of competence, ASN will call on the experience feedback from previous years in order to improve the organisation and accounting of its inspection activities.

