

The control of radiation protection in France

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Abstract

Since February 2002, in addition to licensed nuclear sites the French Nuclear Safety Authority (ASN) has gained the new remit to regulate and inspect radiation protection on unlicensed sites such as, small industries, research facilities and any other ionising radiation users.

For licensed nuclear sites, licensing procedures request utilities to demonstrate compliance with nuclear safety and radiation protection principles. These procedures include quality assurance that apply to nuclear safety and radiation protection. The ASN performs inspections to ensure compliance with French regulations deriving from European directives and Licensees' own procedures. The French context, with its fleet of 58 reactors and all its fuel cycle, in the hands of very few owners (EDF, AREVA, CEA) allows these utilities to gain benefit from a large expertise force. Therefore, the ASN can regulate nuclear activities with a non prescriptive regime ; for licensed sites where the experts are the licensees. Among the tools the French ASN implemented there is a set of criteria for reporting radiation protection incidents to the regulator.

For unlicensed sites the expert is often the inspector rather than the ionising radiation users. The expertise capacity is, indeed, spread apart among thousands of such small users. In 2002-2003 an exploratory mission has been launched by the ASN in two benchmark regions. One finding of this mission is that a special effort is needed to co-ordinate the various French administrations which share responsibilities in radiation protection : the regional government representative, the environment regional regulators, the conventional safety inspectorate, several health inspectorates as well as the national health insurance agency. Another finding is that the ASN should closely co-operate with accredited private companies performing periodic tests of radiation sources. Such external periodic tests are required by the French regulation. These companies are paid by licensees and are requested to report to the regulator.

Introduction

There are about 250 000 persons in France working with ionising radiation.

The French nuclear safety Authority (ASN) is in charge of writing down ionising radiation regulations for the protection of the public, the patients and the environment

Occupational exposure only, still remains within the scope of the ministry in charge of labour issues. It should be added that the ASN is also an inspectorate in charge of inspecting pressurised Water Reactors (PWRs) and radioactive material transport for nuclear safety and occupational exposure. For other facilities using ionising radiation, the ASN has also a role of co-ordination between the different regulators concerned by ionising radiation. Thanks to its experience and in such a context, occupational exposure has become one of its main priority.

First of all, ionising radiation protection has started to be reinforced on licensed sites, i.e.: large nuclear facilities, and has produced significant results. For unlicensed sites, i.e.: small nuclear facilities such as hospitals, research or small industrial source users, the ASN enforces the implementation of regulations and accompanies this taking into account the particular conditions of resources small users can mobilise for updating radiation protection practices.

1 - Inspection of radiation protection on licensed sites.

Before the French 31/03/2003 decree dealing with the protection of workers against ionising radiation deriving from the 1996 European directive the ASN issued, in 1999, a specific radiation protection requirement to be included in any PWR's primary coolant system maintenance schedule. This requirement imposes upon all PWR licensees to notify the planning of doses to the regulatory authority, prior to any intervention on the Reactor Cooling System. Such a requirement strengthens the ALARA monitoring from the ASN, pushing licensees to analyse and justify any discrepancy between the planned doses and the dose objectives. Moreover, the ASN issued a mandatory provision for incident reporting. Such reporting criteria and the reporting figures to the nuclear safety Authority are given in table 1.

Table 1 Number of radiation protection events and reporting criteria at French licensed sites in 2003.

Criteria	A	B	C	D	E	F	G	H	I	J	Total
NPP	0	8	1	16	2	78	70	0	6	91	262
Fuel cycle plants _	0	0	7	0	1	0	0	0	0	10	18
Decommissioning	0	0	3	0	1	0	2	0	0	3	9

_ From 30 June 2003

Reporting criteria for licensed sites :

- A) individual exposure exceeding an annual dose limit or occurrence of an unplanned situation that could have led to such an excess;
- B) unplanned situation having led to exceeding one fourth of an annual limit;
- C) abnormal spread of contamination;
- D) lack of optimisation before undertaking a work involving radiation;
- E) mismanagement of a radioactive source (lost, stolen, misplaced ...);

- F) mislabelling of a working area;
- G) violation of a radiation controlled area access condition;
- H) uncompensated failure of a radiation protection system ;
- I) exceeding a radiation protection device test period;
- J) any significant deviation to radiation protection requirements.

Table 1 shows that no annual limit violation was reported. It should be noted that the annual French limit of effective dose is 35 mSv for a rolling year. This limit will be set down to 20 mSv in 2005. The number of persons having exceeded 20 mSv in 2003 on licensed sites in France is of 5.

At nuclear power plants, most of radiation protection events are connected to the lack of optimisation and the lack of compliance with working area regulatory requirements. The ASN has requested EDF to improve its procedures for entering red areas, i.e. areas where dose rates are higher than 0,1 Sv/h. This requirement was prescribed after the 1999 Tricastin incident feedback experience where a worker entered the nuclear vessel shaft without permission and received a dose of 0,35 Sv.

As far as fuel cycle and decommissioning activities are concerned, the spread of contamination is the main category of incidents.

The ASN has always taken into account radiation protection in its inspection practices. For instance, out of the 650 total number of inspections on licensed sites, the 2004 inspection programme includes 150 inspections dealing only with radiation protection and especially occupational exposure. The inspection themes and number of inspections are displayed in table 2

Table 2 : Inspection themes and number of inspections in the field of radiation protection on French licensed sites in 2004.

Inspection theme	Number of inspections
outage worker exposure	9
Radiological cleanness and Foreign Material Exclusion	12
radiation protection organisation	9
Total occupational exposure	30
Management of sources	7
Discharges to the environment	20
Environmental monitoring	3
Total radiation protection	60
Outage visits which include radiation protection items	88 (x3 days)

The figure of 30 inspections dealing with occupational exposure in 2004 is in line with the 30 inspections on the application of the ALARA principle during outages that were performed in 2003.

Nuclear installation inspectors of the regional inspectorate, part of the ASN and also the regional directorate for research, industry and the environment (DRIRE) can also be appointed as labour inspectors on PWRs. This official appointment strengthens their occupational exposure monitoring on NPPs.

Inspections are also performed at EDF headquarters. One was performed in 2003 on radiological cleanliness and demonstrated that earlier comments from the ASN were well integrated in EDF procedures. This led to decrease the number of hot spots above 1MBq outside controlled areas from 14 in 1999 to 1 in 2003. However it was found that the contamination of worker clothing above 800 Bq remains constant around 500 cases in 2003 as well as contamination above 10 000 Bq which remains around 15 cases.

Nuclear installation inspectors in France are allowed to ask non nominative dose records. Nominative dose records are restricted to the use of the appointed doctor and the radiation protection supervisor. Non nominative dose records are found to be a sufficient information for controlling the application of the ALARA principle, nominative operational dose records being available to inspectors.

An example of what the ASN is looking at during inspection to enhance ALARA is given in table 3.

Table 3 : Examples of items being inspected as part of ALARA by inspectors in PWR in France.

PWR housekeeping during outages	Adequate attitude and work organisation, training of personal including "common sense" attitude towards ALARA ... To get rid of hot spot & to reduce source term.
Outage management and surveillance on the ground	Quality assurance, organisation, training & good practices, appropriate work planning and projected dose estimate, provisions towards ALARA...
Radiation protection management	Performance indicators, benchmark internal audit between reactors and sites, appropriate staffing and training, appropriate ALARA committee and management of contractors...

2 - Radiation protection inspection on unlicensed sites

There are about 56 000 unlicensed sites in France.

Unlicensed site inspections has been a new remit of the ASN since 2002. In order to define appropriate regulatory practices based on the existing situation, an exploratory mission was launched in two benchmark regions of France. Moreover, a group of experts in radiation protection has been established to identify priority actions to be started to monitor radiation protection on unlicensed sites. Finally, a law is expected to enter into force by fall 2004 creating a status and a clear framework for radiation protection inspectors in France. The number of inspectors awaiting a formal status is currently of 50 and is expected to increase up to 100 in a few years.

Such inspectors will be inspecting electrical ionising radiation generators and radioactive sources in medical, research and industrial applications. The number of X-ray machines in France for medical and dental radio-diagnoses is about 50 000. There are about 1400 so called "medical heavy pieces of equipment" which include accelerators, tomography imaging, brachi-therapy, gamma-knives, blood irradiators and nuclear medicine. For research and industrial applications, there are about 1350 sites using sealed sources among which about 900 sources are used for device calibrations. Most of unsealed sources are used for research with a number of about 1000 uses in 2003. Several types of sources can be held by a same licensee. However, it is obvious that the number of installations where sources are being used is very important. In many cases, the use of radiation is a minor part of the whole technology applied by its users and therefore radiation protection is not the main know-how investment. The competence in radiation protection is very scarce on unlicensed sites compared to the means that can be displayed by a company owning 58 PWRs such as *Electricité de France*, the French nuclear power operator. On licensed sites, the operator is competent ; on unlicensed sites the inspector is often the only competent person. Therefore there is a risk on unlicensed sites for inspectors to become more advisers than inspectors.

The Public Health and Environment Regulations include rules for protection of the public and the environment against ionising radiation, which contribute somehow to ensure the protection of workers. Radiation safety at work is one of the major criteria for delivering authorisations for using radiation sources, including electric generators, in medicine, industry and research activities. An important part of inspections performed by the ASN on unlicensed sites is dedicated to the protection of workers against ionising radiation in liaison with regional labour regulators. These controls include external exposure risk management such as measurement of radiation leak from devices, the working order of safety systems and compliance of source characteristics to existing rules. Internal exposure risk management is monitored by the ASN through design checking inspections and inspections focused on the management of radioactive waste and radiation protection organisation.

In 2003, the ASN performed 155 inspections on medical installations and 23 inspections on installations dealing with industrial and research activities. Such inspections are performed in co-operation with the regional labour regulators especially where high risk situations are identified. For low risk facilities labour inspectors receive inspection follow up letters and can decide whether or not to sue the ionising radiation users.

Some of these inspections were performed as part of the above mentioned exploratory mission. The major areas of discrepancies found during such mission were :

- absence of mandatory technical inspection of the installations ;
- absence or lack of individual dosimeters ;
- absence of medical supervision ;
- absence of operational dosimeters in almost all cases ;
- seldom dose planning ;
- personnel arbitrarily classified into the A category (35mSv a year);
- lack of information or lack of training of the personnel ;
- no emergency procedure.

The number of persons having exceeded 20 mSv in 2003 on unlicensed sites in France is of 69, mainly due to industrial radiography. The ASN has issued in April 2004 a circular letter to remind the existing regulations to industrial radiography employers. This letter includes a digest recalling of existing regulations in France. The content is summarised in table 4. It should be said that, so far, these regulations are spread apart in various regulatory documents to which the regulation digest refers.

Table 4 : Content of regulations for industrial radiography in France

Title	Content
General provisions	ALARA, responsibility of the radiation employer, dose limits, worker categories, outside workers, declaration of incidents, site radiography.
Radiation protection supervisor	Training, planning of doses, dose objectives, exceeding of dose limits, use of personal protective equipment.
Designated areas	Labelling, access procedures.
Training of operators	Training package, information notice, two men rule.
Health record	
Maintenance of devices and installations	Annual maintenance, maintenance passport, tube protection, self control and external control.
Transport and storage	Training of drivers, safety locking, theft and fire.

In addition to the inspection performed by the ASN, mandatory technical inspections and testing are performed by accredited private companies. Such external periodic inspections are required by the French regulation. These companies, paid by ionising radiation users are requested to report to the ASN.

Finally, the ASN has started to co-operate with the various French administrations which share responsibilities in radiation protection : the regional government representative, the environment regional regulators, the conventional safety inspectorate, several health inspectorates as well as the national health insurance agency.

It is expected that with the help of the private accredited companies inspecting source users and the co-operation with other French administrations, the ASN will overcome the weaknesses that are currently observed in radiation protection practices on unlicensed sites.

Inspection of radiation protection in radioactive material transport.

The implementation of a radiation protection programme by the operators for radioactive material transport has been mandatory in France :

- since the first of July 2001 for transport by air,
- since the first of January 2002 for other ways.

In 2003, the ASN has made a priority of transport inspections. One third of transport inspections in 2003 dealt with radiation protection. It was found that the

implementation of radiation protection programmes by operators was not well formalised. This topic has remained a priority for 2004.

A transport incident reporting system is also in place in France. This procedure has led to record only 5 events on spent fuel cask exceeding the regulatory limits of 4 Bq/cm₂ for gamma and beta emitters and 0,4 Bq/cm₂ for alpha emitters. Height incidents strictly dealing with radiation protection in 2003 due to the spread of contamination were reported..

Conclusion

A part of the inspections carried out by the ASN at licensed sites is focused on the optimisation principle application. This principle constitutes the bases of the French regulatory enforcement system. Even if the implementation of such a principle has been engaged for several years on licensed sites, the ASN intends to remain vigilant as incidents at the beginning of 2004 on EDF sites suggested it.

On unlicensed sites, it is still needed to generalise the implementation of good practices. The ability of radiation employers to improve radiation safety depends on the resources that can be made available. From the ASN point of view, it is well understood and acknowledged that the publication of guides could be a useful way to help and better protect workers on unlicensed sites. The ASN also intends to take all necessary steps to give a sense of responsibility to radiation employers through the issuing of circular letters when needed before using enforcement actions.