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## **In the event of a nuclear accident in France: the IRSN makes its expertise available for the management of the post-accidental consequences**

*Bruno CESSAC, Karine HERVIOU*

Institut de Radioprotection et de Sûreté Nucléaire (IRSN) – BP 17  
92262 Fontenay-aux-roses Cedex

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### **Abstract:**

The lack of organisation, methodologies and strategies to respond to the post-accidental consequences of a nuclear accident in France has been pointed out in 2004. In 2005, a Post-accident Management Steering Committee (CODIR-PA) has been established by the French Nuclear Safety Authority (ASN) to define the first elements of an updated French doctrine on the management of situations following a nuclear accident or a radiological emergency. The process involves several partners among them IRSN which provides a technical and scientific support. Developments made by the IRSN for more than twenty years in the field of sciences of the environment, of the man health and of metrology have indeed brought a strong basis to support current reflexions. In this context, IRSN contributes to make some proposals in order to elaborate a zoning for the implementation of protective action in post-accidental situations. This zoning is focused on actions regarding locally produced foodstuffs which may be contaminated as well as on the issue of relocation of population when the ambient level of radioactivity doesn't allow anymore people to stay in the area.

Moreover, in case of emergency situation resulting in contaminated areas, the IRSN makes as well its expertise available to public authorities by suggesting optimized strategies to manage the effects in the environment and on the population. In the prolongation of its action during the emergency phase, the IRSN must continue to mobilise its human capacities and its technical means to answer the specific needs which are posed at the time of the post-accidental phase. The first elements of doctrines of management of post-accidental situations emitted by the CODIR-PA bring a new visibility to the IRSN in its future developments, in particular on the practical and operational aspects of the expertise during an emergency.

The incident that occurred in France in July 2008 has shown the central position of the IRSN as a support to the public authorities in the management of incident consequences and provide a technical and scientific information source that make credible their action.

## **1 IRSN AS AN ACTOR OF POST-ACCIDENTAL SITUATION PREPAREDNESS AND RESPONSE**

### **1.1 Context**

For many years, the IRSN has developed some R&D activities regarding the transfer of radioactivity in the different compartments of the environment and health effects on man following a chronic or an accidental exposure to radioactive materials. In particular, the feedback experience gained after the Chernobyl accident has been used to develop predictive models of radioactivity transfer to the biosphere and to improve the knowledge on health effects following a radioactive exposure.

In the mean time, a lot of efforts have been engaged in the field of emergency preparedness and response concerning the early phase of an accident in a nuclear installation or involving a transportation of radioactive materials.

In 2004, a French commission working on priorities in radiation protection has pointed out the lack of organisation, methodologies and strategies to respond to the post-accidental consequences of a nuclear accident. Since June 2005, the French nuclear safety authority (ASN) set up a Post-accidental Management Steering Committee (CODIR-PA), having for general objective to work out the doctrine as a basis for the organisation and the action of the public authorities to face such a situation. This committee includes representatives of the various ministries concerned with this subject, of the agencies of public health and public institutes of which the IRSN.

To reach its objectives, the CODIR-PA set up since 2005 six working groups, supplemented by three others created more recently.

IRSN is also strongly involved in the response system to support public authorities in the management of a post-accidental situation.

## 1.2 IRSN involvement in the work of the CODIR-PA

IRSN plays a major and recognised role as a support to the ASN in this project, while bringing its expertise in nuclear accidents, on consequences assessment in the environment and for the population, and on the strategies of consequences management. IRSN contribution to the CODIR PA takes multiple forms:

- participation to the Steering Committee,
- development of nuclear accident scenarios in support of the reflexions of the various working groups: the IRSN provided two accidental scenarios involving a radioactive moderated release and affecting a nuclear power plant and one scenario involving a release of Plutonium into the environment. The IRSN is currently developing a NPP severe accident scenario;
- lead of two thematic working groups: one, set up in 2005, deals with the assessment of radiological and dosimetric consequences in the environment and to the population ; the other, created in 2007, works on the choice of assumptions used for predictive evaluations which should be realised at the beginning of the post-accidental phase;
- permanent participation to 6 to 7 working groups, in particular while bringing technical talks there on the topics tackled by these groups: lifting of early countermeasures and management of the urban compartment, life conditions in rural territories and agriculture management, medical follow up of the populations, management of wastes, contaminated products and grounds, organisation of public authorities and stakeholders involvement, water resource management...;
- development of specific studies as the consequences of a nuclear accident on water resources, impact of inadvertent ingestion...

Some preliminary elements are given in the chapter 2, as an illustration of the work performed within the CODIR-PA.

## 1.3 IRSN as an actor of the response system

In the event of nuclear accident mobilising the emergency response national organisation, the IRSN brings its expertise in support of the public authorities having to act to protect the goods and the people exposed to the consequences from the accident. This organisation aims:

- to evaluate the risks related to the accidental situation and, if necessary, its radiological and dosimetric consequences;
- to give advices and technical assistance to the public authorities and the medical structures;
- to provide a technical and scientific information source that make credible the action of the authorities.

In the prolongation of its action during the emergency phase, the IRSN must continue to mobilise its human capacities and its technical means to answer the specific needs which are posed at the time of the post-accidental phase. The developments made by the IRSN for more than twenty years have brought a strong foundation to meet these needs, while being based on its know-how mainly in the

field of sciences of the environment (evaluation of the transfers of radionuclides and the exposures of the people), of the man health (evaluation of the risks on health and advices on the medical follow-up) and of metrology (measurement of the radioactivity in the environment and the people, dosimetry). The first elements of doctrines of management of post-accidental situations emitted by the CODIR-PA bring a new visibility to the IRSN in its future developments, in particular on the practical and operational aspects of the expertise during an emergency.

Generally, two dependent and complementary approaches of expertise would be implemented by the IRSN in post-accidental situation:

- a predictive, dominating approach during the accident and at the beginning of the post-accidental phase, consisting in carrying out assessments of the consequences of the accident in the environment, at the same time in terms of contamination of the territories and doses received by the people exposed to radiations. Such evaluations determine an essential part of the actions of protection of the populations, in particular with respect to the food risk and of the risks related to the stay in the contaminated territories; they are necessarily carried out using numerical models implemented in real-times or used to obtain precalculated elements before any emergency situation; these predictive evaluations give unprecise results at the beginning, because of the lack of data on the real situation on the ground, and they have vocation periodically to be updated according to the new data available;
- a retrospective approach, aiming at reconstituting the consequences of the accident, in the environment and on the people, mainly starting from radioactivity and dosimetric monitoring, recorded environmental data (for example, localisation and importance of the rains at the time of the accident) and of the tools for interpretation. The reconstitution of the radiological and dosimetric consequences of the accident according to this approach makes it possible to bring an objective and credible knowledge on the impact on the territories, the goods and to the people resulting from the accident, to evaluate the real effectiveness of the actions of protection or improvement implemented and to provide a base for the organisation of the medical follow-up of the exposed populations. The results obtained by this reconstitution are also used for the update of the predictive evaluations.

## **2 FIRST ELEMENTS OF AN UPDATED DOCTRINE ON RADIOLOGICAL PROTECTION OF POPULATION IN POST ACCIDENTAL SITUATIONS**

### **2.1 Action regarding permanent or temporary relocation of the population**

In the context of events leading to radiologically contaminated areas, the CODIR-PA prepares a doctrine to determine the conditions for the termination, continuation or extension of the first urgent actions taken for the protection of the populations during the early phase.

Temporary relocation may be decided after an evacuation. It may also be a need to relocate populations not evacuated during the early phase. Such protective action relies on many criteria such as magnitude of exposures, size of population, availability of means, climatic conditions, etc.

As far as a dosimetric criterion is concerned, the CODIR-PA looked forward to determine an indicator related to the radiological consequences that would result from living in contaminated areas. The proposed indicator is the projected effective dose received the 1st month for the most sensitive group of population, without taking into consideration the actions for reducing the contamination. It is completed by the projected effective dose received during the 1st week, in order to have a view of the kinetic of the dose engagement. All exposure pathways are considered except ingestion (because the consumption of locally produced food is presumed to be banned and other food is presumed to be safe).

Reference values were also proposed as triggers helping authorities to decide on temporary relocation. The CODIR-PA did not set a unique reference value but rather proposed a range of effective doses: 1 – 10 mSv in the month. This choice is due to the difficulties to estimate doses in

such a situation. It also allows authority to make use of a broader margin to take into account the prevailing circumstances of the situation (including the kinetic of the dose engagement).

These criteria allows to characterize an area – the so-called relocation area.

Permanent relocation may be decided when the residual contamination cannot allow population to stay and live in the area. For such a decision, the CODIR-PA proposes to use as an indicator of the radiation dose consequences of long-term staying in the affected area: the dose received in the 12 months following the possible return in the contaminated area, taking into account the actions for reduction of contamination. As previously, all exposure pathways will be considered except ingestion.

## **2.2 Protection of population regarding the consumption of locally produced contaminated food**

During past conducted exercises concerning the post-accident phase of a nuclear accident, risk prevention actions related to contaminated foods generally involve the definition of areas where the consumption and sale of these foods are prohibited. To determine such areas, activity concentrations in foodstuffs were assessed and compared to the European Food Intervention Levels (CFILs) defined by the Council following the Chernobyl accident (Council Regulation (Euratom) No. 3954/87 laying down the maximum permitted levels of radioactive contamination of foodstuffs and feeding stuffs following a nuclear accident or any other case of radiological emergency. Off. J. Eur. Commun., L371/11 (1987), amended by Council Regulation 2218/89. Off. J. Eur. Commun., L211/1).

In theory, however, Maximum Permissible Levels (MPLs) only consider populations living far from the site of the accident and who are only likely to be contaminated by eating contaminated foods, which may arrive in limited quantities from the contaminated area by way of international trade. This means that MPLs do not offer systematic protection for those living in the immediate vicinity of an accident, who are liable to consume more food from the contaminated area as well as risk contamination through other exposure pathways.

The CODIR-PA has therefore put forward some proposed guidelines for a new zoning system aiming to:

- protect local populations liable to consume large quantities of contaminated food, and
- authorise trade of products below the European maximum permissible level.

Two separate areas have been marked out:

- Firstly, a "food prohibition area": in this area, a comprehensive and systematic ban will be temporarily placed on the consumption and marketing of locally produced foods. This area would be located close to the accident site and its perimeter based on radiation dose criteria.

The CODIR-PA looked forward to determine an indicator on radiological consequences that would result from living in this contaminated area. Again the proposed indicator is the projected effective dose received the 1st month, without taking into consideration the actions for reducing the contamination. Unlike the relocation area, all exposure pathways are considered including the dose due to ingestion of locally produced contaminated food.

The CODIR-PA proposed the range from 1 mSv to 10 mSv expressed in effective dose as reference values. In complement the same values will help authorities to decide on the evolution of the food prohibition area on a period concerning the 12 following months.

- Secondly, a larger "monitoring area": in this area, foodstuffs may be marketed as far as they are in compliance with European or international standards. Products will be subject to monitoring. Following a probable temporary ban, local consumption of locally produced foods would be authorised there, subject to "good food hygiene" recommendations.

The criteria for the determination of the monitoring area are the European Food Intervention Levels (CFILs) of radioactive contamination in foodstuffs defined by the Council following the Chernobyl accident.

The food prohibition area is deliberately more restricted than the monitoring one. In addition, the extent of both areas will gradually be reduced as radioactivity decays and any steps taken to reduce contamination become effective. This new approach addresses a number of issues. The aim is to protect human health while allowing the agricultural sector to continue producing marketable foods,

under the umbrella of radiological monitoring measures. These proposals are still at an early stage and must be confirmed by the CODIR-PA.

### **3 CONCLUSION**

The developments made by the IRSN for more than twenty years in the field of sciences of the environment, of man health and of metrology have brought a strong basis to support current national reflexions concerning the management of post-accidental consequences of a nuclear accident. IRSN plays a major and recognised role as a support to the ASN in the Post-accidental Management Steering Committee and appears as an essential actor of the response system. This was confirmed during the incident that occurred in the site of Tricastin in July 2008. The IRSN was in a central position to support the public authorities in the management of the consequences of this incident and provide a technical and scientific information source that make credible their action.