



NATIONAL RESPONSE PLAN MAJOR NUCLEAR OR RADIOLOGICAL ACCIDENTS

NUMBER 200/SGDSN/PSE/PSN – FEBRUARY 2014



PREFACE

France uses nuclear technologies to produce the electricity needed to power its economy and thus strengthen its energy independence and ensure its defense capabilities. Radioactivity is used in many fields in France, including medicine and research.

France's choice of using nuclear power as a source of energy implies an absolute requirement for ensuring the safety of nuclear facilities and nuclear materials during their transport.

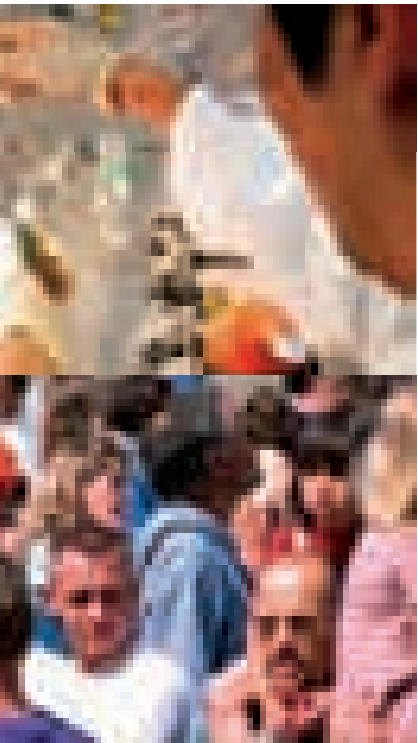
Although these new technologies are used to advance and protect society, none are devoid of risks for people and the environment. Therefore, as part of their responsibilities to protect people and the environment, the French public authorities have established a very stringent system for managing and controlling nuclear activities in order to prevent severe accidents. This system is recognized for its effectiveness. However, it is not founded solely on prevention. It includes a local and national emergency-response organization that goes hand in hand with the requirement to provide the public with timely, transparent and clear information in the event of an accident.

Despite the progress made, there is always the possibility of an accident, as evidenced by the Fukushima-Daiichi disaster. The disaster, which has seriously undermined trust in nuclear power, prompted complementary safety assessments of France's nuclear facilities. These assessments took into account beyond-design-basis conditions.

In accordance with the guidelines contained in France's White Paper on national defense and security, the French government has defined a set of measures and plans to handle various threats or emergencies that occur within or outside France's borders. Within this context of changing strategy and policy, planning actions are carried out both nationally and regionally. There are also specific plans for responding to specific situations. In the event of a nuclear or radiological accident, bringing the affected facility back to a controlled and stable state is not the only necessity. The public authorities and the operator must be able to react to a potential escalation by planning and organizing the best possible means of response that will mitigate the accident's consequences on people and the environment. This is the objective of regional plans already in place.

However, if the national emergency-response organization is to remain efficient, it must be updated regularly. This is the responsibility of the entire French government under the leadership of the French prime minister. It must rely on France's human strengths from its elected officials and local authorities, healthcare professionals, the economic sector and the scientific community, to its citizens, who play a community role in helping isolated or vulnerable people.

This plan meets this requirement. It sets out how emergency management is organized, the strategy to be implemented and the main measures to be taken by the French government.



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INTRODUCTION

Background

France has been implementing stringent radiation protection and nuclear safety and security measures for many years. However, this does not mean that the country is exempt from having to be prepared to deal with an emergency. Changes in France, Europe and other parts of the globe have made it necessary for France to reconsider how it responds to nuclear and radiological emergencies. As the potential impact of a nuclear or radiological accident can affect a wide range of activities, the plan described herein is based on a cross-sector and interministerial approach to emergency response.

The challenges and objectives of the national plan

The Chernobyl and Fukushima-Daiichi disasters are proof that the consequences of a major nuclear or radiological accident can affect all levels of society. These challenges are substantial and relate to:

- ▶▶ **Public health:** An uncontrolled nuclear accident can have immediate consequences (death, injury, irradiation) as well as long-term consequences that can lead to increased risk of developing radiation-induced diseases (such as certain types of cancer);
- ▶▶ **Environmental quality:** Radiation contamination can last for several decades and, in some cases, can result in an area being closed off permanently to the public;
- ▶▶ **Economic and social continuity:** Nuclear accidents bring human activity to a halt in contaminated areas, disrupting the economic

and social order of the entire country. It may therefore be necessary to adapt economic and social systems and carry out clean-up operations if people and businesses have been displaced;

- ▶▶ **Quality of international relations:** Related to fulfillment of obligations to alert and inform European and international partners. This international dimension also covers the protection of French nationals present in countries stricken by a nuclear accident.

This national plan provides reference information on how to prepare for a nuclear or radiological emergency and make the appropriate decisions in the event of an emergency. It covers the emergency phase (including preparation for the post-accident phase), the period in which the public must be protected and assisted and the accident must be handled so that the situation is brought back under control.

Each emergency management stage in the plan is based on constant communication with each type of public and attention to the public's demand for transparent information. Its objectives are to ensure that:

- ▶▶ the general public is protected, particularly from exposure to radioactivity;
- ▶▶ injured persons or people who are exposed to radioactivity receive assistance;
- ▶▶ economic and social continuity is not disrupted;
- ▶▶ the measures required to manage the post-accident phase and restore society and its economic and social activities to normal are proactively implemented,
- ▶▶ European and international relations are coordinated.

KEY FACT

This plan is a reference source that explains how to prepare to handle a nuclear or radiological emergency and is a decision-making guide for emergencies.



This response plan refers to reference situations rather than accident scenarios as their kinetics, progression and consequences cannot be defined in advance. It must remain adaptable to changes in the situation at hand. As a result, it covers a broad range of accident situations.

Although it includes the duties of facility operators, it does not address their internal procedures, such as their on-site emergency plans, which are aimed at running nuclear facilities under all situations and mitigating the consequences of emergencies on workers, the general public and the environment.

An adapted planning tool

Due to their magnitude and the fact that they involve different ministries, major crises require a comprehensive government response. They require strong coordination with not only national and local crisis-management participants, but external partners, such as in the EU, as well. To be able to handle these major emergencies, the White Paper on national defense and security recommends implementing an integrated emergency management system that increases the government's ability to respond to emergencies and ensures better central coordination.

KEY FACT

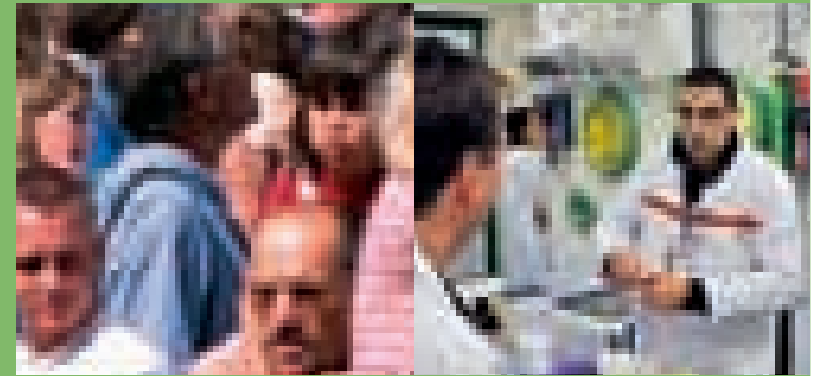
This plan has a zone-wide and a department-wide version.

It is within this framework of improving the French government's ability to respond to nuclear or radiological accidents and expanding the interministerial nature of its emergency preparedness and response approach that this plan defines the general emergency-preparedness and response framework as well as the strategic actions that may be taken as a crisis evolves, in the case of the reference situations used.


The plan refers to a series of sheets that describe how response measures are to be implemented.

This national plan has a regional and a departmental version. It is based in particular on France's public safety mechanisms and general emergency-response plan (Organisation de la réponse de la sécurité civile - ORSEC).

1.



RESPONSE STRATEGIES | AND PRINCIPLES



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1.1 BACKGROUND

1.1.1 Presentation of the scope of the plan

This plan covers all nuclear or radiological emergencies¹, regardless of their cause², that may conceivably occur in mainland France and its overseas territories or abroad and which may severely disrupt the country's functioning.

It does not address the initial causes of accidents – be they natural or technological or the result of malicious acts – just their consequences. In the case of accidents from malicious or terrorist acts, the provisions herein are supplemented, particularly in terms of safety and investigation, by those in the classified governmental plan on chemical, biological, radiological and nuclear risks (CBRN plan). It was decided that this plan should address a very broad range of facilities and transport operations for which the French government and its partners must be able to respond in the event of a nuclear or radiological event:

- ▶▶ nuclear power plants,
- ▶▶ nuclear fuel cycle facilities,
- ▶▶ research laboratories and reactors,
- ▶▶ naval nuclear propulsion systems and associated equipment,
- ▶▶ transport of nuclear or radioactive materials for the aforementioned facilities.

This plan entails the involvement of several French ministries and addresses each component of emergency response:

- ▶▶ governance at national and regional level,
- ▶▶ public information and communication,
- ▶▶ protection of the general public against exposure to radioactivity,
- ▶▶ health assistance to the wounded or persons exposed to radioactivity;
- ▶▶ ensuring economic and social continuity as well as community action on the part of citizens for their own safety and that of their families and neighbours,
- ▶▶ consideration of the European and international dimension,
- ▶▶ preparedness for the post-accident phase.

¹Excluding those situations described in circular DGSNR/DHOS/DDSC No. 2005-1390 of 23 December 2005.

²In this document, the term 'accident' is used regardless of the cause of a nuclear or radiological event.

1.1.2 Presentation of the phases covered by this plan

This plan covers the emergency phase and its exit including the preparation for the post-accident phase.

Depending on the accident, an emergency may last anywhere for a few hours to several weeks. An emergency can be described as a series of phases. This breakdown, however, is theoretical in nature. It is used solely to facilitate understanding of a situation and determine priorities for action. In reality, these phases partially overlap each other both spatially and temporally since some parties involved are required to prepare actions in anticipation of the subsequent phases.

1 EMERGENCY PHASE

The emergency phase covers:

- ▶▶ **The period of threat of release.** Such a threat, if it exists, results from failures or hazards (natural, technological or malicious) at a facility or a serious problem encountered during the transport of radioactive substances. During this period, the operator (or response teams in the case of transport operations) implements actions to bring safety back to a satisfactory level and attempt to avert releases;
- ▶▶ **The period of radioactive releases** into the environment, which occurs if a release could not be prevented or if an accident results in an immediate release;
- ▶▶ **The recovery period**, which begins when the stricken facility is returned to a controlled and stable state.

KEY FACT

This plan covers the emergency phase, its resolution and preparations for the post-accident phase.

During the emergency phase (which lasts from several hours to a few days), public-protection actions must be taken rapidly. Depending on the situation, such actions may entail sheltering in place and heeding orders, distributing stable iodine, evacuating the public and restricting activities and consumption of food and liquids. Actions for maintaining public order and safety are implemented at the same time (area monitoring, traffic restrictions, implementation of traffic plans, legal investigations, prohibitory measures, etc.). In France, a number of actions are organized as part of emergency plans, i.e. off-site emergency plans (PPI), which are supplemented by specific department- or zone-wide measures (regional version of the national plan, ORSEC-lode plan, ORSEC-Transport of radioactive materials (TMR)) general plans (ORSEC, expanded white plans, etc.):

- ▶▶ In the case of a fast-evolving accident (e.g. situation 1 or 4 of the plan), the accident may result in an immediate and short-term release of radioactivity (less than 6 hours). In such case, the immediate reaction is to instruct the public to find shelter;
- ▶▶ In the other cases (situation 3), the alert is immediately followed by a latent period that can be used to prepare and implement protective measures, such as organizing the evacuation of endangered citizens. This is the threat phase, which may precede a release phase;
- ▶▶ The release phase may occur when or after an alert is issued and may last or recur over a period of up to several days (situation 2).

▶▶▶



The recovery period (a few days) starts when releases have stopped and the stricken facility has been brought back to a controlled and stable state under the supervision of the French Nuclear Safety Authority (ASN) or the Nuclear Safety Authority for Defense-Related Facilities and Activities (ASND). This phase serves to lift protection measures previously ordered (such as to seek shelter) and prepare the post-accident phase³, which, depending on the case, may last for up to several years⁴. The principles and actions of post-accident management are set out in the CODIRPA doctrine⁵. The elements of the recovery period that may be prepared or planned are included in the PPI. The recovery period may be complicated by uncertainties about environmental contamination and the level of public exposure in the event of a release. Such uncertainties necessitate implementing ex ante public-protection measures over an area that may be larger than the ones designed in the PPI.

³Some actions aimed at facilitating post-accident management may be initiated at the start of an accident (see the situation tables).

⁴Strategy for preparing for post-accident management after the emergency-resolution period (page 47).

⁵Doctrinal elements of post-accident management issued by the post-accident management steering committee (CODIRPA).

2 POST-ACCIDENT PHASE

This relates to the implementation of a long-term programme to manage the consequences of an event and improve living conditions. The post-accident management plan is drawn up by the relevant stakeholders on the basis of guidelines proposed by the doctrine on post-accident situations. In the case of long-term releases, and if it may take a significant amount of time before the stricken facility is brought back to a controlled state, post-accident actions may be initiated in relatively distant areas not under emergency protective measures whilst the emergency phase continues in areas near the site of the accident (threat of new releases).

The post-accident phase consists of:

- ▶▶ **the transition period** (lasting from a few weeks to a few months after the radioactive releases),
- ▶▶ **the long-term period** (month or years).

1.1.3 Presentation of the 8 reference situations of the plan

The operational part of the plan is structured more around reference situations (snapshots of a given moment in time) than around scenarios, which would consider all possible assumed event sequences. This approach allows the plan to be predicated on eight reference situations that are met by a comprehensive response strategy.

The main parameters that define the situations, i.e. that distinguish between the response and the actions to be taken, are as follows:

- ▶▶ The degree of uncertainty about the type of accident and its consequences;
- ▶▶ The environmental compartment (sea or land). This has a major influence on the necessary response and measures to be taken;
- ▶▶ The location of the accident: in France or abroad;
- ▶▶ In the case of accidents that occur in other countries, the need or not to take measures to protect people in France;
- ▶▶ Whether the cause of the accident is moving or is fixed. Unlike with accidents during transport operations, fixed facilities make it possible to plan actions in a known environment;

- ▶▶ In the case of accidents at fixed facilities in France: the onset (immediate or delayed) and duration of the release. Delayed releases afford time to pre-emptively implement protective measures.

The eight situations herein were developed based on the results of nuclear risk analyses on the nuclear area. They are in line with both the assumptions of the complementary safety assessments and the threat scenarios in the national nuclear safety directive. They have been defined irrespective of any accident causes (natural disasters, technological failures, malicious acts, etc.). How events caused by these situations are handled is explained in the second part of the plan, i.e. the decision-making guide.

KEY FACT

The situations were selected without reference to the cause of the accidents (natural disasters, technological failures, malicious acts, etc.)

SITUATION NUMBER	SITUATION NAME	DESCRIPTION
SITUATION 0	Situation of uncertainty	Rumored accident, suspected release, minor release in the environment, accident that remains to be characterized, etc.
SITUATION 1	Facility accident resulting in an immediate and short-term release	Confirmed, immediate and short-term release (occurring less than 1 hour after the start of the incident and lasting for a few hours) from a nuclear facility (INB/INBS) and with moderate consequences likely to affect areas spanning a few kilometres (e.g. area covered by a PPI).
SITUATION 2	Facility accident resulting in an immediate and long-term release	Confirmed, immediate and long-term release (occurring less than 6 hours after the start of the incident and lasting for a few days or even a few weeks) from a nuclear facility (INB/INBS) and with potentially high consequences likely to affect areas that may be larger than those covered by a PPI.
SITUATION 3	Facility accident resulting in a delayed and long-term release	Threat of release followed or not by a delayed and long-term release (occurring more than 6 hours after the start of the incident and lasting for a few days or even a few weeks) from a nuclear facility (INB/INBS) and with potentially high consequences likely to affect areas that may be larger than those covered by a PPI.

<p>SITUATION 4</p>	<p>Accident during the transport of radioactive materials with potential release</p>	<p>Accident during the transport of radioactive materials (solid, liquid or gaseous) in France (on land or inland waterways). The kinetics of a release are often fast (immediate and short-term release).</p>
<p>SITUATION 5</p>	<p>Accident occurring abroad and with a potential significant impact in France (requiring public-protection measures)</p>	<p>Management of the potentially significant impact in mainland France and its overseas territories of an accident occurring at a facility or during the transport of radioactive materials in a nearby country. Issues related to French nationals present in the accident-stricken country must also be addressed.</p>
<p>SITUATION 6</p>	<p>Accident occurring abroad and having little impact in France (not requiring public-protection measures in principle)</p>	<p>Management of the potential impact in mainland France and its overseas territories of an accident occurring in a country located far from France (or located nearby but whose consequences in France are insignificant). Issues related to French nationals present in an accident-stricken country must also be addressed.</p>
<p>SITUATION 7</p>	<p>Offshore accident with a potential release</p>	<p>Accident involving a vessel carrying radioactive materials. Accident liable to result in radioactivity being released in the ocean or on land if it is near France's coastline. The kinetics are variable and the zone likely to be affected is in principle limited.</p>

1.2 GENERAL ORGANIZATION OF GOVERNMENT-LED EMERGENCY MANAGEMENT

KEY FACT

The Prime minister may appoint a minister to oversee the operational management of an emergency and head the interministerial emergency-response unit (CIC).

A nuclear emergency is one of the major crises that are managed by the French government. The organization of the French government during a nuclear or radiological emergency is based on that defined in circular 5567/SG issued by France's Prime minister on 2 January 2012 on the organization of the government regarding the management of major emergencies. Added to this basic organization are the specific attributes of nuclear technology

The Prime minister determines the political and strategic direction of emergency management with France's president. He may delegate the operational management of an emergency to any minister based on the nature of the event, the type of the emergency or the policy direction he wishes his action to follow. The delegate minister heads the interministerial crisis cell (CIC) on behalf of the Prime minister.

In accordance with the circular, the Prime minister generally assigns the operational management of an emergency to:

- ▶▶ the minister of the interior in the case of emergencies that occur within France's borders;

- ▶▶ the minister of foreign affairs in the case of emergencies that occur abroad.

The minister in charge of operational management of the emergency relies on the entire French government and particularly the ministers of energy, the environment and health.

The CIC is the instrument of emergency management used by the Prime minister. It is made up of all the relevant ministers as well as the safety regulator having jurisdiction, nuclear experts and representatives of the operator, as needed, according to the procedures described below. In no way does the appointment of the minister in charge of the operational management of the emergency relieve any minister of their responsibilities or reduce the independence of the nuclear safety regulator.

When a nuclear accident covered by the plan occurs, the CIC is assembled and measures enabling initial emergency decisions to be taken are promptly implemented.

The Prime minister may also convene an interministerial committee for nuclear or radiological emergencies (CICNR)⁶ to assist and liaise with the CIC, particularly if he considers that certain decisions should be taken at his level. The CICNR is an interministerial meeting convened specifically to address nuclear or radiological accidents.

⁶ Article D1333-68 of the French Code of Defense.

1.2.1 Presentation of the initial response organization

The fact that nuclear accidents happen quickly and receive extensive media coverage means that it is necessary to rely immediately on an initial organization based on a territorial channel (zone and departmental prefects) and a nuclear channel (safety regulators and the Institute for Radiological Protection and Nuclear Safety [IRSN]) in order to provide a first level of response until the CIC has been assembled.

1 PRINCIPLES

The Mayor, the departmental prefect, the maritime prefect, the zone prefect, the prefect of Paris police or, in the case of France's overseas territories, the government delegate for government action at sea are the competent authorities for receiving alerts from various sources of information (facility operators, police departments, gendarmerie, alert networks).

In the interim period before the CIC is set up, the response to a nuclear or radiological emergency is made via a two-pronged **alert and information channel** (flow chart 1, p. 16):

- ▶▶ the French government's general crisis-management organization, which relies primarily on regional resources,
- ▶▶ the specific nuclear-emergency organization, which requires the operator to report to the safety regulator and the IRSN, which serves as its technical adviser.

By enabling proper dissemination of information, the redundancy of these two distinct yet intersecting channels creates a fully operational and responsive emergency-management organization.

2 A CLOSE-UP LOOK AT THESE TWO CHANNELS

The French government's general organization relies on the departmental prefect, who directs the necessary local response measures using all the means available. The prefect also activates

the departmental operations centre (COD). The departmental prefects keep the zone prefect and the ministry of interior interministerial emergency-management operations centre (COGIC) informed of developments on the situation. In turn, the COGIC informs the monitoring and alert bureau (BVA) of the General Secretariat for Defense and National Security (SGDSN). The COGIC passes on the information from the regional channel to all the ministerial operations centres pending the activation of the CIC.

Once alerted, the zone prefect coordinates, via the zone operations centre (COZ), the reinforcements and assistance required by the departmental prefect. As soon as an emergency arises, he coordinates departmental-wide measures and activates the COZ. Depending on the situation, the COZ may be reinforced with representations from each relevant ministerial department and operator.

Depending on the case, the COD or the reinforced COZ(s), acting under the authority of the departmental prefect or the defense and security zone prefect(s), provide each relevant ministerial operations centre with their analyses of the situation via all the government agencies affected by the situation.

The nuclear channel relies on the safety regulator, which, immediately alerted by the operator, in turn informs the appropriate assessment bodies and institutes regional assistance measures. The ASN informs the International Atomic Energy Agency (IAEA) and the European Union of the situation.

These two circuits are interlinked:

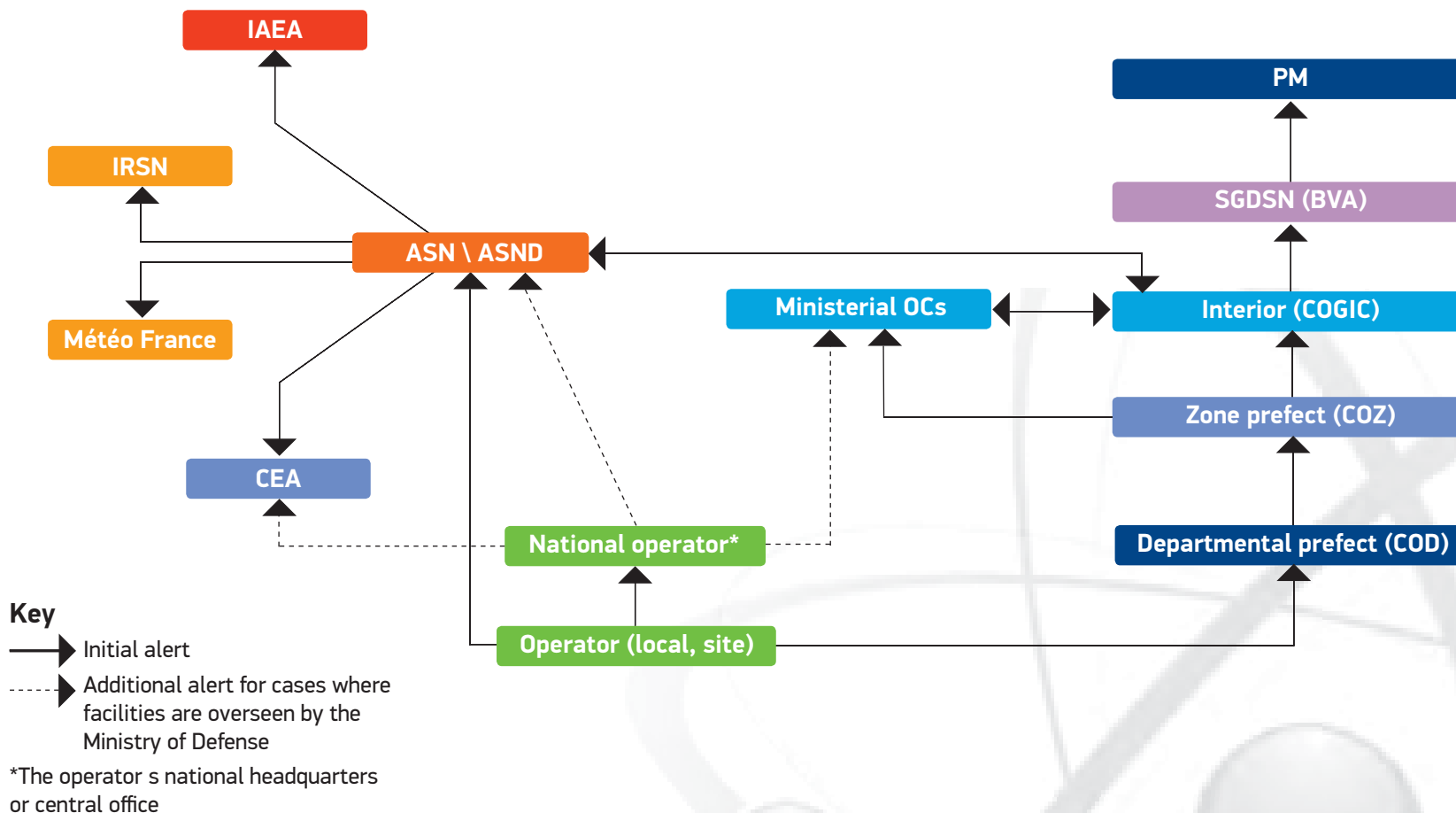
- ▶▶ at regional level by means of telephone and video conferences between the departmental prefect, the zone prefect, the safety regulator and the operator,
- ▶▶ at central level by the exchange of information between the COGIC, the safety regulator and the operator.

flow chart 1

Initial alert flow chart

This flow chart shows the two alert channels that are immediately used pending the activation of the CIC. When correctly implemented, these channels ensure that information is shared at all levels. The chart does not preclude any other links between the various bodies. This initial response organization must allow initial accident-response measures to be implemented.

This organization does not preclude any orders that may be issued by a minister for the immediate confirmation of an alert or information by its decentralised services or agencies, particularly ministerial operations centres such as the CMVOA and the CORRUSS.



As a precautionary measure, the safety regulators and the expert bodies are cc'd in the message sent by the COGIC to the ministerial OCs. Likewise, the safety regulators alert the SGDSN (BVA).

1.2.2 Presentation of the national organization (CIC)

When a major emergency occurs, the government steps up its response by activating of the CIC. The ministry in charge of dealing with the emergency draws on all the ministries represented on the CIC to:

- ▶▶ centralise all information related to the emergency,
- ▶▶ analyse this information,
- ▶▶ construct forward-looking scenarios,
- ▶▶ prepare decisions on the strategies and policies to adopt,
- ▶▶ coordinate the ministries in implementing government decisions,
- ▶▶ prepare information and communication plans.

Whatever the situation, the safety regulator ASN and the ASND (acting within its jurisdiction) serve as ex-officio members of the CIC. Moreover, contrary to the principles of the general organization, the complexity and technical nature of nuclear or radiological accidents calls for field experts to be part of the CIC by decision of the chairman of the CIC.

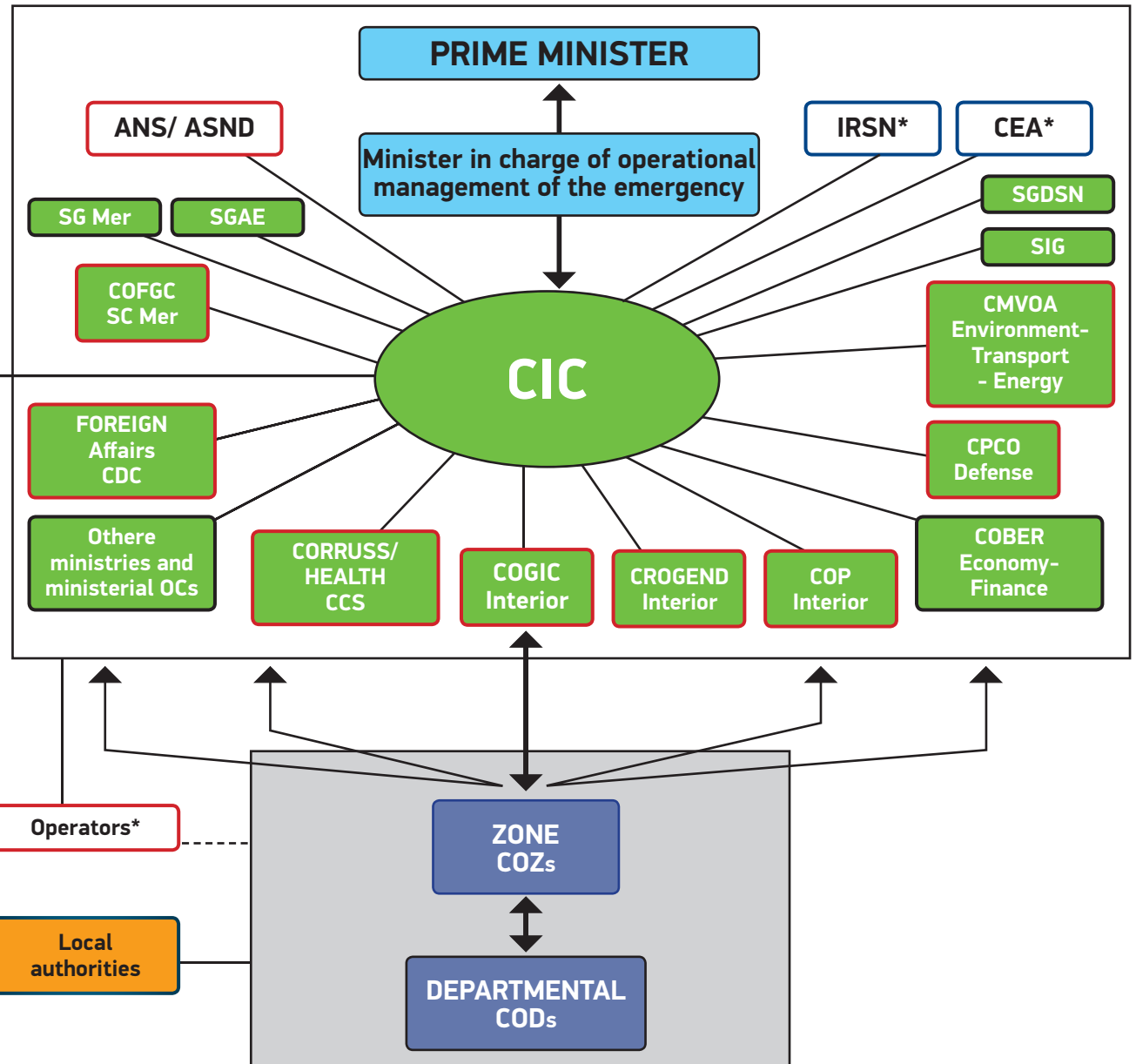
The units of the CIC:

- ▶▶ the ASN, as part of its mandate of government advisor for emergency management, and the ASND, for accidents falling within its jurisdiction, are part of the decision-making unit of the CIC. The IRSN serves as the technical adviser to the public authorities and the CEA (Atomic Energy and Alternative Energies Commission) carries out duties assigned to it. The need for their presence is decided by the chairman of the CIC;
- ▶▶ The ASN (and the ASND, if necessary), the IRSN and the CEA are part of the situation unit, particularly regarding anticipatory measures;
- ▶▶ The ASN, as part of its role to inform the public, the ASND, as part of its role to monitor nuclear safety during facility accidents within its jurisdiction, and the IRSN, as the expert in the assessment of nuclear and radiological risks, are part of the communications unit.

Where appropriate, the operator may be represented in each unit by decision of the minister in charge of supervising the emergency-response efforts.

flow chart 2

Internal organization of the CIC in the event of a nuclear or radiological emergency



- Key**
- *Represented in the CIC (chairman's decision)
 - Flow of information
 - Ad-hoc relationship
 - - - Functional relationship
 - Standing OC
 - Ad-hoc OC

1.2.3 Channel of information of the CIC

KEY FACT

"Citizens have a right to information on the major risks they are exposed to in certain areas of France and on the applicable relief measures." (Article L.125-2 of the French Environmental Code)

It is a basic right of citizens to be properly informed about accidents and their developments. This right to transparent, clear information extends to actions implemented by operators, the public authorities and safety regulators within their applicable jurisdictions. It also extends to all advisories, recommendations and orders that their public authorities may issue to the public on what to do during an emergency.

It is the political and strategic responsibility of the emergency-management officials, overseen by the Prime minister, to ensure that this objective, which is vital to the protection of people, economic continuity, humanitarian efforts and national cohesion, is met in accordance with a strategy described in Section 2 of the plan. This strategy entails setting up, within the CIC, an organization guaranteeing consistent communication by the public authorities and continuous dialogue with the safety regulator and the operator, which must meet specific information and communication obligations.

The Prime minister sets the CIC's main lines of action regarding the preparation of the government's choices of communication policies and strategies. He does so by drawing on the government's information service.

The CIC's communications unit is made up of the representative of the SIG, the representatives of the communications services of the ministries directly affected by the emergency, representatives of the ASN, as part of its role to inform the public, the ASND as part of its role to monitor nuclear safety during facility accidents within its jurisdiction, and the IRSN, as an expert in the assessment of nuclear and radiological risks. The operator may be represented in the unit by decision of the minister in charge of heading the emergency-response efforts.

Once the CIC is assembled, its **communications unit is charged with the task of:**

- ▶▶ providing the policy-decision unit with insights on the public's perception of the emergency and analysing the expectations of citizens, civil society and the public regarding the actions to be implemented by the public authorities. It participates in the situation unit, providing its expertise in analysing the situation and developing proposals for action;
- ▶▶ ensuring that the public authorities, the safety regulator and the operator share information on the communication actions implemented and planned by each;
- ▶▶ drawing up and submitting, to the policy-decision unit (strategy, wording, terms and actions), a communication plan to be issued to the ministries and prefects. This plan is seeded with information shared within the situation unit and is decided by the decision-making unit based on a proposal from the communications unit in accordance with the instructions of the emergency-management officials;
- ▶▶ coordinating, in accordance with the instructions of the emergency-management officials, media statements issued by ministries and all information and communication actions implemented by ministries in order to ensure that they are consistent;
- ▶▶ ensuring, with the help of the assessment bodies, sufficient media coverage from the very start of the emergency.

1.2.4 International channels

1 NOTIFICATION AND EXCHANGE OF INFORMATION

Under the Convention on Early Notification of a Nuclear Accident of 26 September 1986 and 87/600/Euratom Council Decision of 14 December 1987 (Article L.592-33 of the French Environmental Code), the ASN is designated as the national competent authority having jurisdiction to alert and inform the authorities of third-party states or to receive alerts and information from them (the same applies to the ASND within the scope of its jurisdiction and solely for the aforementioned convention and council decision).

If an accident occurs within France, the national competent authority promptly notifies the IAEA of the event, providing it with the necessary information about the event and informing the Ministry of Foreign Affairs (MAE) and the other agencies of the French government. If the event falls within the jurisdiction of the ASND, this notification is made after the relevant minister – the minister of defense or the minister of industry, depending on the situation – is informed. The IAEA then informs the other Member States as quickly as possible.

In the EU, if the decision is taken to implement comprehensive measures to protect the public, the national competent authority is required to quickly notify and inform the Commission and the Member

States that may be affected by the event. This information is provided via the ECURIE network;

In the case of neighbouring countries, prefects of departments where an accident occurs are bound by bilateral agreements to inform neighbouring countries that may be affected.

Regarding the other channels of notification

Under the International Health Regulations (IHR) 2005, Member States are required to notify the World Health Organization (WHO), within 24 hours of assessment of public health information, of all events that may constitute a public-health emergency of international concern. This information is transmitted by way of the national focal points (e.g. CORRUSS) to the Ministry of Health, which is the national representative.

In addition to these institutional networks there are the nuclear services of embassies and the more informal communications channels of operators (particularly that of the World Association of Nuclear Operators, WANO) and safety regulators or other relevant organizations (NEA, ENSREG, WENRA, HERCA, ETSON, etc.).



KEY FACT

As part of the international notification and exchange of information, the following entities are to be informed first:

- ➔ The International Atomic Energy Agency
- ➔ The European Union
- ➔ The World Health Organization
- ➔ Affected border countries



2 INTERNATIONAL ASSISTANCE

a. At international level

The 1986 Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency is used to issue or respond to a request for assistance through the IAEA. Coordinated internationally by the IAEA and nationally by the ASN, the Response and Assistance NETWORK (RANET) is a voluntary database of experts, equipment and materials available in each participating country in order to facilitate answering requests for assistance.

Under the Convention on Early Notification, Euratom Council Decision of 1987 and the Convention on Assistance, the MAE is the national alert point and must promptly relay the information it receives to the relevant administrative bodies.

If a request for assistance is received from abroad and it does not warrant interministerial endorsement due to its minor nature or the absence of difficulty in responding to it, the ASN, which is the national competent authority, after consultation with the MAE, informs the requesting party either directly or through the IAEA.

In all other cases, information is transmitted to the IAEA through the MAE, the national alert point, with the assistance of the permanent representation in Vienna and the French governor to the IAEA after any necessary interministerial endorsement.

b. In Europe

The Community Mechanism for Civil Protection (CMCP), established by the Council Decisions of 23 October 2001 and 8 November 2007, not specific to nuclear emergencies, may be activated in the event of a nuclear or radiological emergency (in France, it is activated at national level by the COGIC).

Drawing on the Ministry of Foreign Affairs and the operational mechanisms already in place in the ministries, the CIC's role is to:

- ▶▶ propose to the Prime minister, if required by the situation, that he invokes the European Union's solidarity clause;
- ▶▶ participate in developing common European positions to handle the emergencies;
- ▶▶ provide European institutions with all the information needed to guide their decisions;
- ▶▶ liaise with any emergency-management structures implemented within EU institutions;
- ▶▶ collect communication elements prepared at EU level.
- ▶▶ organize, where necessary, the reception of international assistance in France.

c. With border countries

France has signed bilateral agreements with Germany, Belgium, Spain, Italy, Luxembourg, the United Kingdom and Switzerland allowing it to request or receive assistance.

In addition to these institutionalised networks are the more informal assistance channels used by operators.

1.2.5 Particular case of the transport of radioactive substances

1 RESPONSIBILITIES

Consignors are responsible for ensuring that materials and packaging are safely transported from one point to another. Their responsibility starts when they hand over the materials and their shipment documents to the carrier. This ensures that the relevant regulatory requirements are met throughout each stage of transport.

Carriers are responsible for ensuring that shipments run smoothly. Prior to a shipment, they must ensure that they have a certificate proving that the cargo complies with national and international regulations. They must also ensure that the information provided by consignors is complete and available. They have obligations in terms of securing packages, placards and vehicle servicing. Carriers have instructions on the alerting of accidents and may implement accident-response plans. In some cases, vehicles carrying radioactive substances may be equipped with a real-time geolocation system.

Shipments of certain nuclear materials are tracked in real time. Vehicles may be fitted with trackers so that they may be contacted at any time. Some shipments are escorted.

2 ORGANIZATION OF RESPONSE AND ALERTING OF THE AUTHORITIES

Response actions following an accident are based on the regional version of the national plan and, regarding the organization of response teams, the ORSEC-TMR. Both are established by the prefects. They may be implemented anywhere in France where there is a radiological risk from a transport accident.

The ORSEC-TMR relates to transport operations by road, inland waterway, rail and air. Its provisions apply to civil and military transport operations. All maritime transport operations fall under the NUCMAR plan.

Article L.591-5 of the French Environmental Code states that "*in the event of a nuclear or other incident or accident having, or that may have, significant consequences on the safety ... of the transport operation ... the person in charge of the transport of the radioactive substances⁽¹⁾ is required to promptly report the incident or accident to the French Nuclear Safety Authority and the administrative authority.*"

In practice, the alert is generally given by the carrier, a witness or the emergency services. In the case of transport operations tracked in real time by the IRSN for safety purposes, any incidents or accidents involving the transport of nuclear materials are immediately reported by the carrier to the IRSN. The IRSN then promptly informs the senior official for defense and security of the competent ministry, police or the gendarmerie and the competent safety authorities.

The ASND is the competent authority for transport operations for which the Ministry of Defense, as operator, is responsible.

Special provisions are set out in the ORSEC-TMR. In the event of an accident, a national decision-making level is set up to manage the technical aspects of the accident. It draws on the CEA for the technological aspect, the SPRA for the health aspect and a communications unit.

⁽¹⁾ Within the meaning of the DGT regulation, the consignor.

1.2.6 Summary of responsibilities:

Government authorities:

- ▶ **Minister of the interior:** Prepares, coordinates and monitors the implementation of security measures in France and is responsible for ensuring public order and protecting people and property.
- ▶ **Minister of foreign affairs:** In charge of sharing information with the relevant partner countries and international organizations. With the support of the ASN and the IRSN, he also communicates, via his emergency response centre (CDC), public-protection measures to France's embassies abroad and foreign embassies in France.
- ▶ **Minister of defense:** As a nuclear operator, the minister of defense is the first person concerned by an event involving a nuclear-powered vessel, an INBS or a related transport operation for which he is the operator. He may deploy France's armed forces within France to support the action of the public authorities.
- ▶ **Minister of energy:** Establishes and implements France's policy on nuclear energy and nuclear safety. As such, he ensures that regulations on the protection and control of nuclear materials, their facilities and their transport and activities of vital importance to France's nuclear sector are enforced. Ensures that the entire country has a secure energy supply.
- ▶ **Minister of the environment:** Establishes and implements France's policy on nuclear safety, including in terms of the transport of radioactive and fissile materials for peaceful purposes, and, in conjunction with the minister of health, France's policy on radiation protection.
- ▶ **Minister of health:** Is responsible for providing health assistance to victims and for implementing health measures regarding drinking water and radiation-protection regulations. Monitors the country's state of health via the health emergency unit (CCS) and by drawing on the expertise of the InVs and the IRSN. Contributes to public-protection measures in relation with the relevant ministerial departments.
- ▶ **Minister of agriculture:** May take measures regarding agriculture, livestock and food consumption (prohibitions).
- ▶ **Minister of transport:** Ensures, under all circumstances, that land, air, waterway and maritime transport is not disrupted and contributes, for all means of transport, to the community evacuation plan.
- ▶ **Minister of housing:** Contributes, within his jurisdiction, to the community evacuation plans.

- ▶ **Minister of the economy:** Takes measures within his purview to ensure that economic activity is not disrupted and that the nation's economic interests are protected. May activate the economic continuity unit (CCE), which centralises information on the nation's economic health and provides input to the CIC.
- ▶ **Minister of labour:** Defines the policy on radiation protection of workers. Makes sure that labour measures for ensuring the continuity of economic activity are properly implemented. Ensures effective social dialogue on labour issues.
- ▶ **Minister of industry:** Determines the nuclear safety and radiation-protection policy for defense-related nuclear facilities and activities within his purview.
- ▶ **Minister of justice:** Ensures, in all circumstances, the continuity of the legal system and the enforcement of sentences. If a legal investigation is launched, the minister ensures, to the extent possible, that the decisions taken by the CIC do not impede the conduct of any necessary emergency investigations.
- ▶ **All ministers:** Each minister is required to assess the consequences of events affecting their portfolio, participate in the pooling of information with the CIC, participate in the continuity of activity in the sectors under his authority, and prepare the start of the post-accident phase.

Regional authorities:

- ▶ **Departmental prefect:** Alerted by the operator, the departmental prefect may implement the PPI or the ORSEC-TMR. He directs the emergency-response operations, particularly in terms of public safety and civil protection, in line with the operator's accident-management responsibilities. The prefect ensures the coordination of the various means implemented and informs the public and elected officials. The prefect may also implement the departmental version of the national plan with the ORSEC measures in order to ensure the protection of people and property threatened by the effects of an accident, beyond the scope of the PPI.

The departmental prefect is competent in the event of accidents that occur on land (ports included) and which may have affected sea environments. He warns the maritime prefect of the situation. The maritime prefect (and the government delegate for government action at sea in France's overseas territories) is competent to lead emergency-response operations in the event of offshore accidents. He coordinates his actions with the zone prefects and the prefects of the affected coastal departments.





- ▶ **Zone prefect:** The defense and security zone prefect is responsible for preparing and implementing national security measures within the defense and security zone. He directs the regional and departmental prefects in preparing and implementing internal security measures. He ensures that zone plans are consistent from department to department and takes the necessary coordination measures with border zones and, where applicable, border countries. Regarding the affected defense and security zones, he takes the necessary coordination measures with the maritime prefect. Where necessary, he implements the zone version of the national plan. He has the authority to coordinate the departmental prefects, the devolved administrations and operators. He also coordinates communication with the departmental prefects across the country in line with the national communication prepared by the government and the ASN.
- ▶ **The local authorities:** Contribute, in liaison with the prefects, to defining local policies and implementing the resources needed to respond to an emergency, particularly in terms of assisting those in need, both in the affected zone and in terms of receiving displaced persons.

Special bodies:

- ▶ **ASN:** The government-appointed independent administrative authority in charge of nuclear safety and radiation protection for civilian nuclear power in France. It participates in managing nuclear and radiological emergencies with the technical support of the IRSN. It verifies the suitability of measures taken by operators to mitigate the consequences of accidents and audits the implementation of these measures. The ASN may issue recommendations to operators, conduct inspections in operators' facilities and, if necessary, impose penalties. It advises the government or its representative on the measures to take to protect people, contributes to informing the public and fulfills its international obligations.
- ▶ **ASND:** The authority in charge of monitoring safety and radiation protection in defense-related nuclear facilities and activities. It advises the minister of defense or the minister of industry, depending on the situation, and participates in informing the public. It fulfills its obligations to alert international partners.
- ▶ **Operator:** Responsible for launching its facility's on-site emergency plan (PUI). The operator must immediately notify the competent safety regulator (ASN or ASND) as well as the local government representative to be alerted (usually the departmental prefect). Measures to alert the public may be taken in part by the operator under conditions defined by the departmental prefect. The operator is responsible for the safety of the affected facility and implements the necessary procedures for preventing radioactive releases and for returning the facility to a controlled state.
- ▶ **Transport operators:** Consignors and carriers share the responsibility of ensuring that transport operations are conducted in accordance with rules on safe and secure transport of nuclear or radiological materials. In the event of an event affecting a transport operation, both are required to alert the public authorities, provide them with all the information needed to cope with the event and implement their emergency management systems.

- ▶ **ARS:** The regional health agencies and the regional health agencies in the defense and security zones implement health measures under the authority of the prefects.
- ▶ **IRSN:** Source of technical expertise on radiological and nuclear risks. As such, it participates in managing emergencies. It proposes to the ASN and ASND technical, health and medical measures to protect people and the environment and return facilities to safe conditions. It assists the safety regulators and the ministries. These tasks are set out in special agreements and protocols. The IRSN centralises the results of environmental measurements and cooperates with Météo-France. The IRSN's mobile unit enables it to go directly in the field to organize measurements and provide local authorities with information.
- ▶ **CEA:** Operates basic nuclear facilities and basic nuclear facilities classified as secret. Its chairman has a seat on the nuclear policy council headed by France's president. This council sets the broad guidelines relating to safety, security and protection of the environment. As a nuclear R+D organization, the CEA provides its expertise to the public authorities. As part of its assistance duties, it deploys special means throughout level-1 emergency response zones (ZIPes) and uses special emergency-response equipment (ESI). The CEA also provides the ministry of defense with support, assistance and expertise in the event of accidents at any of the facilities operated by the ministry. The CEA also plays an international role. Its director of international relations represents France on the board of governors of the International Atomic Energy Agency (IAEA) and supervises CEA's network of nuclear advisers based in embassies around the world.
- ▶ **Météo-France:** In the event of the risk of atmospheric releases, Météo-France is in charge of assisting the public authorities by providing meteorological data to the IRSN. It cooperates with the IRSN in modelling the transport and dispersion of atmospheric releases and in assessing these releases. Météo-France is in constant contact with the CIC, the safety regulators and the operator. Furthermore, Météo-France has been designated by the IAEA and the World Meteorological Organization as a Regional Specialized Meteorological Centre (RSMC).
- ▶ **Institut de Veille Sanitaire (national health-watch institute):** The InVS contributes to analysing the health impact of accidents and to implementing epidemiological monitoring.

1.3 RESPONSE STRATEGIES

1.3.1 Cross-sector strategy

The strategy of responding to a major nuclear or radiological accident is predicated on a synergy of actions among the various ministries and their partners. No objective may be met without the combined action of all. The main objectives and principles of this strategy are described below.

1 PROMPTLY DEPLOY THE EMERGENCY MANAGEMENT SYSTEM

► see page 14

The French government's interministerial emergency-response organization is defined by a circular issued by the Prime minister on 2 January 2012. It brings together the safety regulators (ASN or ASND), experts and operators and is therefore suited to the specificities of nuclear and radiological accidents. It must be implemented without delay by assembling the CIC.

Until the CIC is assembled, the response strategy is implemented by the immediate organization combining the government's regional channel and the nuclear-sector stakeholders. The Prime minister and his cabinet use this plan as a basis for taking all the national emergency measures needed to mitigate the consequences of accidents.

2 RETURN THE FACILITY OR TRANSPORT OPERATION TO A CONTROLLED AND STABLE STATE

► see page 31

In the event of an accident, **operators are responsible for implementing response measures on their sites and returning them to a controlled state.** They establish the necessary procedures and resources for responding to all plausible events as part of their on-site emergency plans.

Assistance among operators must be promoted. If necessary, operators may ask the French government to implement, in addition to their resources, essential exceptional means that are not part of their safety duties.

In the event of an accident involving the transport of nuclear or radiological materials, consignors and carriers are responsible for implementing, in correlation with response by the public authorities, measures to control the event.

3 PROTECT PEOPLE

► see page 32

In an emergency, operators issue public advisories under the conditions set by the prefect (situations 1 and 2). **In the event of a threat of release by a facility** (situation 3), the prefect implements the measures in the PPI. He issues a public advisory, recommends protective measures and endeavours to protect the public from

►►►



radiological risks by ordering a preventive evacuation. The area covered by the PPI, specific to each facility, is designed to cover the first 24 hours of an emergency with the utmost effectiveness. It is where preparations are made to deal with the radiological emergency (orders to be immediately followed by the public and pre-positioned means of response).

Some accidents may result in releases that affect areas beyond the scope of the PPI. Releases may also be blown in from abroad (situation 5) or following a transport accident on land or sea (situations 4 and 7). In such case the prefects implement the regional versions of the national plan and the specific plans (e.g. the ORSEC-TMR version). It falls to the regional level to plan the interdepartmental coordination measures and to decide on the measures that will make it possible to rapidly move in and implement the resources.

Shelter in-place, stable-iodine prophylaxis and evacuation are the main orders given. They are decided based on the foreseeable exposure to the radioactive risk and may change as the situation progresses. In cross-border areas, cooperation with neighbouring countries is essential and must aim to achieve harmonised orders so as to provide the highest level of protection.

If necessary, radiological control measures and prohibitions on the harvesting, consumption and distribution of foodstuffs are taken so that the ingestion of contaminated foods or the handling of manufactured goods does not expose people to an additional source of radiation. Pets and livestock are protected where possible.

This mechanism is based on public order and safety measures to apply to the control of areas designated for sheltering or evacuation purposes or any additional measure (protection of property, no-go areas, etc.).

4 PROVIDE HEALTH AND PSYCHOLOGICAL ASSISTANCE TO PEOPLE

► see page 36

This strategy is structured around four main objectives:

- treat injured persons and medical emergencies resulting from the event,
- provide assistance to potentially contaminated people,
- provide psychological counselling,
- identify and take a census of, for epidemiological monitoring purposes, people in the zone affected by the accident and, more specifically, people suffering from internal or external exposure.

Depending on the circumstances and the magnitude of the accident, these objectives are met over a more or less extended period of time. Priority is placed on the most urgent actions and on people who were exposed the most or are particularly susceptible (children, pregnant women, vulnerable or excluded people).

5 COMMUNICATE WITH THE PUBLIC THROUGHOUT THE EMERGENCY

► see page 38

Throughout an emergency, the public authorities must be sensitive to the public's concerns and quickly provide it with a continuous flow of transparent and proactive information. The public authorities provide all media outlets with information. Clear explanations are provided regularly by experts during the emergency phase.

If their on-site emergency plan (even non-radiological) is implemented in the event of an emergency, operators immediately broadcast the first pieces of information. They indicate whether the accident may result in releases and, if so, in how much time. The prefect ensures





that operators have informed the media and immediately indicates the type of risk and issues protection orders. In the case of a transport accident, the public authorities first inform communities located near the site of the accident. The information they provide must be aimed at the general public, not just local populations. Nuclear accidents, even limited in scope, immediately take on a national dimension. The information provided on such accidents indicates which areas are threatened so that people know whether they are inside a protected area. International communication is essential. In the case of cross-border accidents, the countries involved must harmonise their communication.

6 PROMOTE ECONOMIC AND SOCIAL CONTINUITY AND ENCOURAGE COMMUNITY ACTION

► see page 41

The public authorities keep a cross-sector view of the economic and social impact of accidents on the nation in order to take specific resilience measures to mitigate the effects, ensure continuity and return the situation to as near as normal as possible. Priority is placed on ensuring the living conditions of sheltered or displaced persons.

The continuity plans for government administrations, the local authorities and the appropriate business operations are activated. Priority is placed on ensuring the roles of activities of vital importance. The objective is to keep economic activity going as best as possible in strict compliance with workplace safety rules. Industry professionals, businesses and workers play a major role in the nation's resilience, which must be considered in advance with the relevant government agencies. The public is encouraged to take an active role in maintaining social bonds and economic continuity by helping isolated or disabled persons, receiving displaced persons and continuing their professional activities to the maximum extent possible. This mobilisation may be conducted as part of community-preparedness plans, citizen-response teams or associative action and even occur in the workplace.

7 TAKE THE INTERNATIONAL DIMENSION OF EMERGENCIES INTO ACCOUNT

► see page 44

France immediately reports any accidents that occur on its soil and promptly exchanges the information set out in international conventions and European instruments. It affords foreign residents the same treatment as French nationals.

In the event of a nuclear accident in another country, government measures apply to French nationals in that country. These nationals must follow the recommendations issued by that country's authorities. Diplomatic missions may receive orders to supplement these recommendations and provide assistance to the French community (distribution of iodine tablets, repatriation, etc.).

Where required by the situation, France may provide stricken countries with its expertise and means of assistance.

8 PREPARE FOR POST-ACCIDENT MANAGEMENT

► see page 46

Long-term environmental contamination by radioactivity substances following a nuclear accident is a complex situation that affect all aspects of people's lives, including their local economy. It can affect a broad area as well as human activities in outlying areas.

The potentially lasting effects of this radioactive fallout can prompt the authorities to implement a post-accident management strategy that can last between several years or several decades.

The aim is to facilitate, right from emergency phase, post-accident actions implemented to protect people from the dangers of exposure to ionising radiation, provide assistance to people affected by the consequences of the accident, and reclaim areas whose economic and social fabric were affected.

1.3.2 Strategies by area

Strategy for returning facilities or transport operations to a controlled and stable state

1 RESPONSIBILITY OF THE OPERATOR

Operators of basic nuclear facilities are responsible for ensuring safety, security and radiation protection within their facilities.

They must therefore establish a system for responding to accidents.

In the event of a nuclear or radiological accident, whether looming or actual, the operator's objective is to restore the facility to a controlled state and ensure the safety of people present on the site. The measures to be taken are outlined in an on-site emergency plan (PUI), that is implemented by the operator.

The emergency management system is based on the operator's local responsibility within a framework whose consistency is ensured nationally by the operator with respect to France's main nuclear operators (Électricité de France [EDF], CEA, AREVA, Ministry of Defense).

2 OBJECTIVES

The objectives of an operator's emergency response system are as follows:

- ▶▶ return the facility to a controlled and stable state;
- ▶▶ in the event of threats of release, implement the most appropriate to reduce them;
- ▶▶ mitigate the spread of the accident and its consequences;
- ▶▶ alert the public authorities and the general public affected by the threat or occurrence of an accident and keep them informed as the situation develops;
- ▶▶ assist and protect workers and, if necessary, evacuate them from the site of the accident;
- ▶▶ collect, and forward to the appropriate emergency response centres, information that may be used to assess the accident, predict its consequences and monitor its progress, and assign a technically qualified person to explain the situation to the local authority;

KEY FACT

Operators of basic nuclear facilities are responsible, within their facilities, for ensuring:

- ➔ security
- ➔ safety
- ➔ radiation protection

▶▶▶

- ▶▶ implement material and human emergency-response resources and facilitate their efforts in accordance with regulations.

Priority functions to be carried out in the event of a nuclear accident are identified through safety objectives:

- ▶▶ fuel cooling;
- ▶▶ controlling the reactivity of the reactor and the criticality hazard;
- ▶▶ ensuring confinement of the radioactive materials and chemical substances;
- ▶▶ protecting the environment from radioactive releases.

At the same time, the operator must continue to:

- ▶▶ control the movement of people on the site,
- ▶▶ transmit data,
- ▶▶ protect workers from radiation exposure,
- ▶▶ monitor the environment, etc.

3 ORGANIZATION AND IMPLEMENTATION OF THE PLANS BY THE OPERATOR

Managing emergencies requires **clear definitions of the respective responsibilities** of each participant, channels of information and chains of command and implementation.

Nuclear site directors rely on technical emergency teams (local or national) to assess emergencies and predict their outcomes. They dialogue with the central level of the operator's emergency management system.

The operator's system relies on:

- ▶▶ special procedures and teams trained in accident management,
- ▶▶ dedicated resources,
- ▶▶ means of information and communication.

This system makes it possible to coordinate all the means deployed by the operator and provide **experts in strategy, analysis and outcome prediction**. In particular, it is used to carry out the following actions:

- ▶▶ management of the emergency by the site's management,
- ▶▶ strategic coordination of the emergency, with the definition of guidelines on managing the event with assistance from the teams of analysis and outcome prediction experts;
- ▶▶ remaining in contact with off-site representatives: the operator's management, local and national authorities and institutional experts;
- ▶▶ bringing together experts in the field to return the facility to a satisfactorily safe state;
- ▶▶ work by maintenance, logistics and measurement teams on the equipment or the performance of environmental measurements;
- ▶▶ In addition, and where appropriate, the operator's management decides whether to send in additional means to the affected site and organizes mutual assistance by other nuclear sites or operators.

The safety regulator (civil or defense, depending on the affected facilities or activities) ensures that the measures taken by the operator are well founded.

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4 SPECIAL MEANS AND COOPERATION BETWEEN OPERATORS

Operators use dedicated means to return their facilities to a controlled state. In the event a large-scale event overwhelms or renders inoperative or inaccessible the means on an affected site, reinforcements from other sites may be brought in to control the accident and best mitigate discharges into the environment.

In such a case, **operators may make use of their internal means of support**, in the form of units or otherwise (e.g. EDF's Nuclear Rapid Response Force [FARN] or CEA's), that are shared by all their facilities. Mobilised quickly, these means are sent to an affected site in the first few hours after it has issued an alert. The implementation of these means is the sole responsibility of the operator (EDF, CEA, AREVA).

Cooperation between French operators is set up for the purposes of pooling together, within an established framework, available human and material resources within desired timeframes and in accordance with regulations. This pooling of resources is currently embodied by the INTRA economic interest grouping (GIE-INTRA). In principle, most equipment is specific to each site or facility. However, this equipment may be loaned between sites and facilities. That said, any mutual assistance (either between operators or between an operator's sites), including at international level, must take into account the response capabilities required by the loaner in the event of a concomitant emergency at one of its facilities.

Under the terms of existing agreements or depending on the situation, **operators may also implement additional local means of emergency management off their sites**. The CEA's sites have multi-service fire protection, rescue and physical protection teams that are equipped with technical resources. The same is true of AREVA's La Hague and Tricastin sites. Some of these means may be used to provide assistance to other operators provided this does not endanger the safety and security of the loaner site. Human and material resources provided to a site are placed under the responsibility of the receiving site's director.

If necessary, **operators may request special assistance or reinforcements from the French government** for various purposes, such as transporting human and material resources and facilitating access to the scene of an accident. The government deploys these means based on scheduling, availability and signed agreements.

KEY FACT

Cooperation between French operators may be set up to pool together, within an established framework, available human and material resources within desired timeframes and in accordance with regulations.

Particularities of the response strategy for emergencies during the transport of radioactive substances

Before government agencies certify that radioactive substances were being transported, the operations are carried out according to the standard method of managing hazardous material transport operations (HMT).

After providing assistance to any victims, securing the area and moving the population to safety, the objective is to check and restore the integrity of the containment as quickly as possible and, if necessary, decontaminate the affected area.

National assistance is required to endorse the protective measures, set up the first post-accident measures and ensure that press releases are consistent. Response measures may involve the deployment of technical resources (mobile radiological response units [CMIRs], the IRSN, ZIPEs, means provided by AREVA or any other means commandeered by the prefect).

The purposes of the first actions carried out are to:

- ▶▶ protect the response teams;
- ▶▶ rescue victims;
- ▶▶ immediately set up a no-go zone and evacuate the local population.
In addition to this zone, the plans may call for instructing the public

to take shelter in-place (confinement). If this appears hard to achieve (lack of means, little public awareness), the evacuation zone must be extended;

- ▶▶ upon the arrival of the specialist teams, confirm the no-go zone based on dose-rate or surface-contamination measurements;
- ▶▶ protect public safety, maintain law and order, restrict access to the area, close roads, investigate.

Given that radioactive iodine is not released in the event of transport accidents, stable-iodine prophylaxis is not used as a measure.

Public-protection strategy

KEY FACT

The public-protection strategy is based on three key measures:

- ➔ evacuation
- ➔ shelter-in-place
- ➔ stable-iodine prophylaxis

1 OVERALL STRATEGY

The aim of the strategy for protecting the public in the event of a threat or actual radioactive release is to limit the public's exposure level as low as reasonably achievable.

During the emergency phase, this strategy is based on three key measures – evacuation, sheltering-in-place and stable-iodine prophylaxis. The choice of measure to implement, the geographic scope and the sequence depend on the situation. The objective of evacuation is to protect the public as quickly as possible from risks related to significant long-term releases. Where possible, evacuation must be carried out before a release occurs or at least while it is still minor.

The consequences of exposure to a release are mitigated by:

- ▶▶ shelter-in-place actions, whenever the release occurs quickly and is of short duration,
- ▶▶ seeking shelter along the edges of evacuation zones or at intervals based on changes in the extent of the release and the weather conditions,
- ▶▶ stable-iodine prophylaxis in the event of the release of radioiodine.

Afterwards, public exposure to fallout deposited on the ground by a release is mitigated by:

- ▶▶ moving the public away from the most-contaminated areas;
- ▶▶ banning the consumption and distribution of foodstuffs produced in contaminated areas as quickly as possible.

This public-protection strategy is also based on the ability to carry out the following actions:

- ▶▶ alerting the public and any people located in the affected areas,
- ▶▶ effectively providing the public with information and safety orders,

- ▶▶ the upholding of law and order, patrolling of areas and traffic control by the forces of law and order,
- ▶▶ providing health assistance,
- ▶▶ providing a continuous flow of information.

2 DECISION TO IMPLEMENT MEASURES

The order to seek shelter may be given immediately in an emergency.

Furthermore, the areas in which protective measures are to be implemented are defined using the response levels set out in ASN decision 2009-DC-0153, approved by the minister of health, for radiological emergencies. This decision calls for the prefect to be ready to order:

- ▶▶ **an evacuation** if public-exposure predictions exceed a whole-body effective dose of 50 mSv,
- ▶▶ **shelter-in-place** if public-exposure predictions exceed a whole-body effective dose of 10 mSv,
- ▶▶ **stable-iodine prophylaxis** if thyroid-exposure predictions exceed an equivalent dose to the thyroid of 50 mSv.

The decision to implement protective measures is taken based on an analysis of the risks and benefits for the population. This analysis is based on the natural hazards, local data (e.g. lay of the land, population density) and knowledge of the release, the weather conditions and the estimated doses for each factor. It may be conducted to compare the radiological risks of evacuating the public against those of having the public shelter in place.



These countermeasures are implemented in affected areas that are either:

- ▶▶ identified beforehand, particularly in the case of first-response actions, during the planning process (off-site emergency plans);
- ▶▶ or proposed based on estimates of the dosimetric consequences for the population.

Some situations may lead to releases or to risk of releases that affect areas outside the scope of the PPI. In such cases, two types of plans may be implemented:

- ▶▶ detailed plans in the areas covered by the PPI, and which are provided to the public so that it is prepared, so that certain measures may be implemented rapidly or as a first response depending on the alert;
- ▶▶ a local version of the national plan (internal security⁷, transport, health response, etc.), which must make it possible to implement measures identified outside the area covered by the PPI and relying on the general emergency-response plan (ORSEC).

3 MECHANISMS OF ACTION

a. Shelter-in-place

Shelter-in-place is immediately applicable, particularly in the case of fast-evolving accidents. Its objective is twofold – make use of the physical structures of buildings to mitigate the effects of radiation from releases and keep people inside sealed, airtight buildings to reduce the risk of internal and external contamination from particles and gases. The public is constantly kept informed during the shelter-in-place phase.

The order to take shelter may be issued by an operator on behalf of and under the direction of the chief of police based on criteria defined in the emergency plans. The public in a first-response area defined in the PPI is alerted by sirens and, in some cases, by automated telephone messages sent by operators.

This measure may also be decided by the local prefect for outlying areas, areas near the scene of a transport accident (on land or at sea), or border

areas at risk of being exposed to a release from a neighbouring country. Shelter-in-place must be a short-term strategy. This is because its effectiveness diminishes over time as indoor radiation levels rise and residents begin to venture outdoors in order to obtain supplies and find loved ones. An effective duration of one half-day may be implemented.

If a release is long and threatens to get worse, shelter-in-place may be followed by evacuation during the release. When an order to shelter in place is lifted, information is given to the public on how to proceed.

b. Evacuation

Evacuation is twofold – that of people able to evacuate by their own means, as defined by the public authorities, and the assisted evacuation of people with disabilities (mass-evacuation doctrine).

It is crucial to define evacuation zones. People must be moved to areas that are sufficiently far from the area affected by a release and do not require the implementation of any other protective measures. Special information must be given to non-evacuees located on the outskirts of an evacuated area to prevent spontaneous (i.e. unorganized) evacuations.

Evacuation orders must be complete (which items to take, the evacuation route to follow, how to find loved ones and information on contamination-control actions and decontamination actions).

Certain activities, if shut down, may result in damage to property or people or be difficult to bring back online. This is particularly the case of certain industrial activities. It may therefore be necessary to implement measures to keep these activities online or ensure the safety of people or facilities whilst reducing worker exposure.

If people are evacuated to a border country, they must be provided assistance in accordance with regulations and human rights. As a matter of principle, it is preferable that these populations be evacuated to another part of their home country so that they receive adequate psychological and humanitarian assistance.



⁷Internal security: as defined in the French Code of Internal Security, internal security encompasses the notions of public security and civil protection.



c. Stable-iodine prophylaxis

The aim of this measure is to mitigate the risks of the onset of thyroid cancer caused by the buildup of radioactive iodine in this organ via inhalation of contaminated air. Infants, children, adolescents and pregnant and nursing women are highly susceptible to this.

This measure is most effective when stable iodine is administered at the required dosage two hours prior to exposure. Its effectiveness decreases within approximately 24 hours.

Stable iodine may be administered a second time if the situation warrants.

The decision to administer stable iodine is made by the public authorities and broadcast by the government-approved media. The public is informed about when to take the iodine and who would most benefit from both administrations.

The measure is based on two distribution mechanisms:

- ▶▶ preventive distribution of potassium iodide tablets to areas around facilities with a risk of exposure to releases containing radioactive iodine (nuclear power reactors, research reactors and navy bases), within the scope of the PPI,
- ▶▶ distribution anywhere in France from emergency departmental and local stockpiles (ORSEC-iodine).

d. Checkpoints

Fixed checkpoints within and along the edges of the area defined by the administrative authority are immediately set up. These checkpoints serve to:

- ▶▶ keep the area under control,
- ▶▶ conduct searches within the area,
- ▶▶ perform monitoring operations.

This mechanism is coordinated with shelter-in-place or evacuation decisions. It includes the protection of the personnel manning the checkpoints and the sharing of information between response teams and with the population and the economic sector.

e. Restriction on outdoor work and advisories

These public-protection measures are supplemented by specific advisories designed to protect people exposed to low-level or very-low-level releases or fallout. Implemented in particular along the edges of areas where the public-protection measures are in effect, they relate to restrictions on outdoor work, more frequent bathing and washing of clothing, housework and cleaning of communal areas.

Depending on the case, they may be supplemented by restrictions on the consumption of potentially contaminated foodstuffs. The consumption of water from the public network remains authorised during the entire shelter-in-place phase. Other measures to be taken during the emergency phase are considered on a case-by-case basis.

f. Legal investigation

The forces of law and order carry out their criminal-investigation duties, which are required in order to assign responsibility. The investigation is initiated without delay to ensure that compensation, and civil and criminal proceedings are carried out quickly and efficiently.

4 VARIANTS OF THE MEASURES IN THE PLAN BY SITUATION

This strategy has a variant for each of the eight reference situations. When an event occurs, the proposed variant should be used as a starting point and a decision-making aid.





Proposed variants for the eight reference situations

Situation 0:

No ex-ante public-protection measures, precautionary measures possible depending on the case.

Situation 1:

Immediate shelter-in-place in the immediate protection zone following the alert and possible administration of iodine.

Situation 2:

Immediate shelter-in-place in the immediate protection zone following the alert then evacuation during the release with administration of iodine.

Situation 3:

Preventive evacuation.
Potential ad-hoc shelter-in-place actions at the outskirts and iodine administration in the event of radioiodine releases.

Situation 4:

Immediate evacuation within a restricted area around the scene of the accident (creation of an exclusion zone) and potential shelter-in-place actions at the outskirts.

Situation 5:

Potential shelter-in-place and iodine administration.
Consider receiving evacuees from borders areas and repatriated nationals.

Situation 6:

No public-protection measures implemented in France.
Consider receiving repatriated nationals.
Possible distribution of iodine tablets by diplomatic missions in the affected country.

Situation 7:

Evacuation highly unlikely
Potential comprehensive shelter-in-place
Potential iodine administration.

Health-assistance strategy

The protection of people is based on shelter-in-place, evacuation and stable-iodine prophylaxis associated with health assistance when needed.

1 HEALTH EFFECTS OF A NUCLEAR ACCIDENT

a. Immediate effects

The immediate effects of a nuclear accident include collapsing buildings, fires and explosions. Response teams are the ones most at risk of these effects. Given the types of accident that are possible, there should be a limited number of injured people, irradiated people and deaths.

These effects also include injuries sustained during evacuations as well as cardiovascular, respiratory or other conditions induced by psychological or physical stress and requiring immediate attention.

b. Delayed effects

In the longer term, and depending on the dose received during a nuclear accident, there is a recognised risk of radiation-induced diseases (primarily certain forms of cancer) developing several years after exposure.

A nuclear accident can be a source of great stress. Its psychological effects must be treated without delay and may require prolonged follow-up.

2 HEALTH-ASSISTANCE STRATEGY

The challenge is to limit the impacts on the health of workers at the affected site and of the public at large. The actions are designed to deal with the immediate effects and mitigate any delayed effects that may develop.

Health assistance is structured around **four objectives**:

- ▶▶ **treat** the wounded and other medical emergencies;
- ▶▶ **conduct a census of the people** affected by the accident and treated by means of:
 - checks for external contamination,
 - external decontamination of people,
 - detection of possible internal contamination, to be conducted as early on as possible,
 - implementation of individual therapeutic measures,
- ▶▶ **short- and long-term psychological counselling**;
- ▶▶ **long-term epidemiological monitoring** of affected people, particularly those who suffer from internal or external exposure.

Meeting all these four objectives is the best course of treatment.

Depending on the type of accident, the magnitude of the releases, the extent of the zone and the density of the affected population, local health services may be supplemented by national teams. Depending on whether equipment is mobile or fixed, it will take time to arrive at a place of need or people will be required to travel.

Assistance is adapted to the circumstances and available means. The four objectives may be adapted in terms of time and quantity, and priorities may be set depending on the circumstances.

The provision of health assistance depends on whether victims are injured or may have been exposed.



a. Injured persons

Injured persons are victims who suffer conventional traumatic lesions (thermal or chemical burns, various types of injury, etc.) associated or otherwise with exposure to radionuclides. Emergency treatment of life-threatening injuries overrides any considerations regarding radiological contamination.

Such victims are likely to be few in number and generally receive standard emergency treatment that is provided with the use of the means on hand and based on their potential contamination or irradiation status.

However, if there is a large number of injured people, the standard principles of disaster medicine are applied:

- ▶▶ emergency-relief teams equipped with radiation-protection equipment are deployed to the site of the accident to treat and evacuate victims from the contaminated area and implement basic external decontamination measures,
- ▶▶ field hospitals are set up outside the exclusion zone to perform triage and provide immediate medical attention,
- ▶▶ after medical regulating and based on their injuries, victims are evacuated to the appropriate medical facilities for further medical treatment and decontamination.

Injuries and medical conditions that may be sustained by initially able-bodied victims during evacuation and assembly are treated in accordance with the principles of emergency medical assistance after medical regulating is performed.

b. Persons who may have been exposed

People who were present at the scene of the accident, or in or near the zone exposed to a release, or whose condition is of serious concern. Depending on the case, their number may be high or low.

- ▶▶ **In the event of a release affecting a limited number of people** across a small area, local and national teams have the sufficient means to conduct a thorough census of the victims, carry out external decontamination and monitoring measures, and measure the potential victims' internal contamination.

Such measures are to be implemented following transport accidents (situations 4 and 7), accidents involving short-time releases with shelter-in-place (situation 1), accidents occurring abroad but having no significant impact in France (situation 6).

- ▶▶ **In the event of a release affecting a large number of people,** it may be necessary to adapt medical treatment, particularly in terms of the following:

- ex-ante monitoring of external contamination is to be avoided. Instead, external decontamination is to be systematically performed as quickly as possible;
- the public is to be advised to undergo external decontamination using ordinary facilities (soap-and-water showers at home, in gymnasiums, in swimming pools, at campgrounds, etc.);
- internal contamination levels are to be measured, especially in the most vulnerable people (those most exposed, children and pregnant women);
- people are to be registered for epidemiological monitoring at the evacuation centres, using a system guaranteeing data completeness, access to electronic registration forms over the Internet, etc.

Such measures are to be implemented following accidents resulting in long-term releases, evacuations during a release (situation 2) and accidents that occur in highly populated areas.

KEY FACT

- ➔ Emergency treatment of life-threatening injuries overrides any considerations regarding contamination.
- ➔ Access to treatment facilities by disabled persons must be ensured and organized in all cases.

Communication strategy

Communication with the public is a dual process of listening and conveying information. It is an essential component of emergency management and must continue throughout the duration of an emergency. More than for any other situation, the ability to immediately inform the public during a nuclear emergency is also essential to ensuring efficient public-protection measures.

Informing the public is an essential component of emergency management. As soon as an emergency occurs, the public authorities must be able to provide quality information based on the communication elements listed below.

1 OBJECTIVES

The objectives of effective communication are listed in the table below:

Quick, continuous and credible information	Maintain a relationship of trust	Empower citizens
Provide information on the reality of the situation and respond quickly to requests for information. The public is guaranteed the right to reliable and continuously available information by France's Environmental Code (Nuclear Security and Transparency Act – TSN).	Clearly explain the measures taken to each population group. Quickly clear up false information and rumors. Explain the methods used to assess the consequences of nuclear accidents.	Inform the public on what to do (communication on the conduct to adopt). Encourage local community initiatives (assistance to vulnerable people).

2 REQUIREMENTS FOR SUCCESSFUL COMMUNICATION

Communication must be based on a clear definition of the roles and responsibilities of each source of information:

- **The operator communicates on how the accident is being managed.** It informs the government agencies about the technical aspects of the site or transport operation, the risks of release, the

possible directions the situation may take and the measures taken to control it. It informs the public of the actions it is taking to manage the accident;

- **The government communicates on how the emergency is being managed.** It compares its assessment of the risk with the protective measures to be followed by the public. It may rely on the local authorities to inform the public; ►►



▶▶ **The safety regulator informs the public** about its position on the safety of the situation and any releases into the environment as well as the risks of such releases for health and the environment. It informs the public about these decisions and recommendations on management of the risk by the operator. It advises the government on informing the public.

▶▶ **As a public-service expert on nuclear and radiological risks, the IRSN provides clear information** on the situation, puts the risks into perspective and reports on the results of environmental radioactivity measurements as part of its role to monitor, collect and interpret measurement results.

As communication must take place immediately after an accident is reported, information on the affected activities and main identified risks must be prepared. This also entails alerting the public.

▶▶ When an accident occurs at a fixed facility, it is the facility operator's duty to immediately alert the prefect and issue an initial statement to the public and the media. In the event of a transport accident, this initial statement will be issued by the public authorities.

▶▶ In either case, the government's representative ensures that the operator has informed the media. If the operator fails to do so, the prefect immediately issues a statement on the nature of the risk, the response measures being taken, and the orders to be followed.

▶▶ The safety regulator informs the media about its assessment of the situation.

▶▶ Pending further information, the public authorities and the operator provide the public with the elements needed to better understand the information it will receive throughout the emergency.

The public authorities and the operator are bound by an **obligation of transparency** with the public. As such, they must continuously pass on the (reliable and clear-cut) information they obtain to all media outlets in a simple and effective manner.

The technical specificities of nuclear emergencies require clear information that is supplemented by experts in charge of assisting the public authorities and the safety regulators. Throughout the entire emergency phase, these experts **provide the media and the public with clear insights** into the situation, the measures to take and what to do. These insights are given in addition to the information provided by the public authorities and the operator. This information must be updated throughout the emergency phase and be clear and consistent. Information must be communicated quickly and must anticipate the demands of the media and public, particularly regarding contaminated areas, so that citizens and their families may understand how the accident affects them. The entities in charge of managing nuclear emergencies must be sensitive to the concerns of the general public.

The information they provide must be aimed at the general public, not just local populations. Specific information must be provided to businesses and their employees to ensure business continuity. A nuclear or radiological accident, even limited in scope, that immediately takes on a national dimension, is rated on the INES scale to enable a common understanding of the situation at hand (Appendix 3).

Communication must also be targeted to an international audience (press releases and websites in English). In the case of accidents occurring in cross-border areas, concerted communication must be implemented with the relevant country or countries.





The communication strategy must also:

- ▶▶ Take into account uncertainty, which is inherent to any emergency and will fuel the public's doubts and perception of a lack of safety. Questions asked must be taken into account. Unknowns, failures and difficulties must be acknowledged. Efforts must be made to provide answers;
- ▶▶ Anticipate societal changes brought on by the emergency. The solution to these changes is related to society's capacity for resilience.

3 ACTIONS TO BE IMPLEMENTED

a. During the emergency phase

- ▶▶ The operator and the public authorities immediately inform the public once an accident at a site is reported and the PUI (even non-radiological) is activated on the site or when an accident involving the transport of nuclear materials or substances occurs even if there are no releases (for reasons of prompt communication, the matter of whether or not there is a risk of releases must be stated orally and immediately);
- ▶▶ The alert is received and passed on via two distinct and redundant channels (see Section 2.1.2.). The information is shared by the various echelons in these channels both before and after the activation of the CIC. They do so in accordance with their respective operating protocols and ensure consistency of information;
- ▶▶ Once assembled, the CIC oversees coordination of national communication;
- ▶▶ The public authorities and experts in all fields are continuously present to provide the media with information (conventional means of communication, monitoring of the media and social networks, TV and radio as well as the infocrise.gouv.fr website for the public). Information is provided around the clock;

- ▶▶ Topics of communication are determined and ranked. A specific type of communication is established for each topic;
- ▶▶ Explanations, including on nuclear technicalities, are provided on all decisions taken. Messages should be easy to read, explain technical aspects (units of measure) and contain comments that address matters of public concern;
- ▶▶ The needs of the media must be understood (salient facts, developments in the situation). Indicate specific information timeframes, provide documents and technical data and assist the media;
- ▶▶ Internal communication actions, particularly regarding safety and protection measures, are conducted within government services and businesses that will be required to be present in the risk areas.

b. During the recovery period/start of the transition phase

- ▶▶ Information on launching the post-accident phase is provided (management of contaminated areas, instructions on how to proceed and the consumption of food and water, displaced persons, possibility of return, health monitoring, economic and social life in the affected areas, etc.);
- ▶▶ Communication on feedback, human and economic toll, and lessons learnt.

KEY FACT

Nuclear or radiological accidents are rated according to the INES severity scale to enable a common understanding of the situation at hand (see Appendix 3).

Strategy for economic and social continuity

1 OBJECTIVES

The aim of the interministerial strategy for economic and social continuity is to ensure **the country's resilience in the face of nuclear or radiological emergency**, i.e.:

- ▶▶ mitigate the emergency's effects on society,
- ▶▶ ensure that activities are not disrupted,
- ▶▶ return life to as near-normal as possible.

These priority objectives may be met by:

- ▶▶ maintaining the living conditions of sheltered or displaced persons,
- ▶▶ protecting consumers and workers from potentially contaminated foodstuffs and manufactured goods,
- ▶▶ maintaining essential activities through business continuity plans and using all trained and equipped human resources on hand,
- ▶▶ keeping economic activity going as best as possible in strict compliance with workplace safety rules,
- ▶▶ safely shutting down, after evacuating their workers, industrial and other facilities that may become hazardous.

KEY FACT

The strategy for economic and social continuity makes the distinction between what falls under:

- ➔ a nationwide, multisectoral view,
- ➔ regional economies,
- ➔ continuity of social activities, a major factor of public resilience.

The strategy discussed below distinguishes between what falls under:

- ▶▶ a nationwide, multisectoral view,
- ▶▶ regional economies,
- ▶▶ continuity of social activities, a major factor of public resilience.

2 STRATEGY FOR ENSURING THE ECONOMIC CONTINUITY OF THE ENTIRE NATION

This strategy consists in **taking governmental decisions to ensure the resiliency of vital businesses and government services**. The minister of the economy may activate an economic continuity unit (CCE). This unit receives information on the emergency's impact on economic sectors from local sources and compiles into a single national focal point.

It also prepares ministerial decisions for ensuring economic continuity, keeps the CIC informed of measures taken or submits to it decisions taken jointly by ministers or the Prime minister.

These decisions relate to:

- ▶▶ analyses of this information and anticipation of short-, medium- and long-term consequences,
- ▶▶ assessing the budgetary consequences of the emergency and immediately releasing emergency aid,

▶▶▶

▶▶▶

- ▶▶ general measures concerning farms, particularly measures to be implemented for farm animals and crops,
- ▶▶ protective measures against foodstuffs or manufactured goods that may be unsuitable for consumption, and their implementation in Europe,
- ▶▶ actions to inform French consumers and importing countries in the event of an accident in France to prevent sudden and unwarranted drops in sales of safe products,
- ▶▶ measures for ensuring the continuity of transport and energy supplies,
- ▶▶ preventing psychosocial reactions in businesses or government agencies which might impact economic continuity.

3 STRATEGY FOR ENSURING ECONOMIC CONTINUITY IN FRANCE'S REGIONS

Government agencies prepare and implement measures in businesses and facilities run by operators. These measures include:

- ▶▶ distribution of emergency aid to businesses,
- ▶▶ protection of workers from internal and external risks,
- ▶▶ protection of animals from foodstuffs or manufactured goods that may be unsuitable for consumption.

Once the recovery period starts, the aim is to also get indemnification and insurance claims by businesses and individuals under way.

The resilience of businesses that may be affected by total or partial disruptions in activity, the evacuation or temporary relocation of people, a slackening of some activities, or distribution restrictions must be monitored:

- ▶▶ businesses, services or local authorities that are vital to emergency management or to the nation's functioning must continue operating to the fullest possible extent, particularly if they provide services to displaced persons and are located in relocation or hosting areas. These vital public services include local authorities, public health, food supplies and networks (transport, telecommunications, energy, water and waste management, banking services);
- ▶▶ all other affected businesses must protect their potential and viability:
 - businesses or farms in stricken areas and businesses outside these areas and which are affected by the inability of their suppliers in stricken areas to honour their commitments,
 - businesses or farms located outside affected areas yet whose products, also unaffected, lose credibility.

Whatever the case, **extra attention will be paid to workers** protection and health and to informing them on the necessary and adequate measures taken in this respect.

Where risks exist, it falls to all administrative bodies, local authorities and authorities to draw up, in advance, a business continuity plan (BCP) in order to deal with major emergencies. This document, which is regularly updated, has two objectives:

- ▶▶ mitigate the impact of an emergency on business operations,
- ▶▶ restore business operations to as near-normal as possible.

The BCP of businesses located near nuclear facilities must address this risk and factor in the possibility of fast and long-term evacuation.

▶▶▶



4 STRATEGY FOR SOCIAL CONTINUITY AND COMMUNITY INVOLVEMENT

a. Continuity of social activities

The aim is to:

- ▶▶ maintain the living conditions of sheltered or displaced persons and reinforce public services;
- ▶▶ register affected populations to facilitate evacuation and reception, health monitoring (where applicable) and investigative and indemnification measures;
- ▶▶ distribute emergency aid.

b. Community actions

The actions of the government and public and private bodies do not suffice alone. The public must also take action. This involves helping families and neighbours, such as by:

- ▶▶ encouraging them to follow instructions,
- ▶▶ refusing to spread baseless rumors,
- ▶▶ assisting isolated or disabled persons during an alert or helping to evacuate them from affected areas,
- ▶▶ if the order to take shelter is issued, taking in people seeking shelter and reporting isolated or disabled persons,
- ▶▶ in the event of evacuation, helping to receive displaced persons,
- ▶▶ continuing to participate in social and economic activities within the framework of business continuity plans (BCP).

KEY FACT

Community actions can be initiated by one person or be part of community-preparedness plans, citizen-response teams and associative action.

Such mobilisation can be an individual initiative. It can also be part of community-preparedness plans, citizen-response teams and initiatives by associations. The government's technical support to these actions and information are provided via dedicated local offices.

c. Definition of responsibilities

The damage suffered by the public and the socioeconomic fabric must be taken into consideration. It entails taking into account the psychological consequences of the emergency and efforts to keep society moving.

European and international strategy for policy coordination and technical cooperation

1 OBJECTIVES

International mechanisms currently in place make it possible to meet **four distinct objectives:**

- ▶▶ take the international dimensions of nuclear accidents into account;
- ▶▶ facilitate notification and the exchange of information on developments in accidents;
- ▶▶ implement international assistance in order to manage the consequences of accidents on people and the environment,
- ▶▶ in the case of cross-border accidents, coordinate the measures taken by the various affected countries.

2 PRINCIPLES

State Parties have an obligation of notification and information-sharing in the cases defined by the applicable international conventions (IAEA, border countries) and European instruments.

Under the principle of state sovereignty, requesting or granting international assistance is optional.

The mechanisms existing within the European Union are used to voice needs for policy coordination and operational cooperation.

The solidarity clause, introduced by Article 222 of the Treaty on the Functioning of the European Union (TFEU), provides the option for the Union and its Member States to provide assistance to another Member State which is the victim of a terrorist attack or a natural or man-made disaster.

In the event of a nuclear accident, France provides foreign nationals on its soil with the same treatment given to French nationals. Actions taken by the government also benefit French nationals abroad.

French workers who are deployed abroad for the purposes of providing assistance continue to be subject to the rules and standards in effect in France (labour law) unless the rules and standards in the country of deployment afford a higher level of protection.

3 NOTIFICATION AND REQUEST FOR ASSISTANCE

To achieve its objectives, the strategy is different depending on whether an accident occurs in France or a foreign country.

a. Accidents occurring in France

- ▶▶ neighbouring countries are immediately notified if an accident occurs near a border,
- ▶▶ the ASN notifies the IAEA and the European Union of the accident (ECURIE),
- ▶▶ the World Health Organization (WHO) is notified via the International Health Regulations networks,
- ▶▶ assistance may be requested.

KEY FACT

In the event of a nuclear accident, France provides foreign nationals on its soil with the same treatment given to French nationals. Actions taken by the government also benefit French nationals abroad.



b. Accidents occurring abroad

- ▶▶ human assessment resources and technical assessment resources that are ready for deployment in the affected country and those which can be pooled together with a foreign partner are identified,
- ▶▶ the IAEA is notified of these resources via RANET,
- ▶▶ measures for protecting French nationals present in the affected countries and, where necessary, other countries liable to be directly affected are planned, as are measures for inspecting imported manufactured goods and foodstuffs. French nationals are requested to follow the recommendations issued by the authorities of the country where the accident occurs.

4 EUROPEAN COORDINATION

Regardless of the location of an accident, **policy coordination within the European Union is necessary** to:

- ▶▶ be able to assess the situation at EU level;
- ▶▶ harmonise, where necessary, public-protection measures implemented by Member States, particularly regarding the movement of people and goods, inspections of foodstuffs and products, and even public communication;
- ▶▶ review the conditions for invoking the solidarity clause, if need be.

The EU Crisis Coordination Arrangements (CCA) have a twofold objective:

- ▶▶ identify and implement, as early on as possible, the strategies that will facilitate understanding of the cross-sector and policy aspects of an emergency;
- ▶▶ allow EU institutions, in the context of a major emergency, to express their policy views as cohesively as possible.

This policy coordination is supplemented by operational coordination, the principles of which are set by the Community Mechanism for Civil Protection (CMCP).

5 OTHER EXCHANGES WITH INTERNATIONAL ORGANIZATIONS

Policy communications fall under the jurisdiction of the Ministry of Foreign Affairs (MAE/ASD), which passes them on to the permanent representation in Vienna and the French governor to the IAEA (CEA/DRI).

Exchanges with international organizations in the field of transport are made with the Ministry of Transport. The Ministry of Health liaises with the WHO on matters regarding implementation of the International Health Regulations.

As a Regional Specialized Meteorological Centre (RSMC) for environmental emergencies, Météo-France models the atmospheric dispersion of radioactive elements and draws up weather assessments at the request of the IAEA. When an event occurs elsewhere in Europe or in Africa, Météo-France provides the competent national authorities and the IRSN with a copy of the elements drawn up for the IAEA.

In Europe:

- ▶▶ the Ministry of Agriculture is the point of contact for the Standing Committee on the Food Chain and Animal Health (SCFCAH),
- ▶▶ the Ministry of Health is the point of contact for the Health Security Committee and various other groups and committees that monitor public-health issues,
- ▶▶ the Ministry of the Interior is the correspondent of the Community Mechanism for Civil Protection and implements certain agreements with border countries,
- ▶▶ the Ministry of Transport participates in coordinating the community plan of actions taken.

Work on an EU draft decision on serious cross-border threats to health was begun in 2012. It may include an obligation of notification in the event of a radionuclear threat.

6 ASSISTANCE TO FRENCH NATIONALS ABROAD

As part of efforts to protect French nationals abroad, the MAE updates travel advisories for countries and regions and distributes analyses, questionnaires and recommendations published by the ASN or the Ministry of Health and established with the IRSN and the InVS. It ensures that information on nuclear risks and travel advisories are updated.

In addition, the MAE:

- ▶▶ ensures that French diplomatic missions maintain safety plans and that safety equipment is supplied,
- ▶▶ asks French diplomatic missions and consular posts to properly disseminate information or instructions to French nationals with technical assistance and expertise from the embassies nuclear departments and, if necessary, the IRSN,
- ▶▶ if necessary, provides French missions and posts with lists of measures recommended by the French authorities, particularly those concerning French nationals or other nationals travelling to France,
- ▶▶ if decided by the government, instructs posts to distribute iodine tablets to the French community,
- ▶▶ draws up, with the relevant missions and posts, regular updates on the French community and answers the public's questions about French nationals in the affected areas. A first response sheet may be provided to France's ambassadors.

Lastly, the MAE schedules and ensures, where necessary, the repatriation and reception of French nationals affected by the emergency.

Strategy for preparing for post-accident management after the recovery period

Once a facility is returned to a controlled state, the public authorities can begin managing the post-accident phase. The first elements of this are set out in the CODIRPA's post-accident doctrine.

1 GENERAL OBJECTIVES AND PRINCIPLES

Long-term environmental contamination by radioactive substances following a nuclear accident is a complex situation that affects all aspects of people's lives, including their local economy. It can affect a broad area as well as human activities in outlying areas.

The potentially lasting effects of this radioactive fallout can prompt the authorities to implement a post-accident management strategy that can last between several years or several decades.

The three main objectives of post-accident management are as follows:

- ▶▶ **protect people** from the dangers of ionising radiation;
- ▶▶ **provide assistance to people affected** by the consequences of the accident;
- ▶▶ **reclaim areas whose economic and social fabric were affected.**

In order to be effective or achievable, many post-accident management actions require taking a pre-emptive approach from the emergency phase on.

The public, elected officials, and economic and social stakeholders are involved in this management. Transparent information is the corollary. As the information issued during the recovery period still contains many instructions, the measures and restrictions taken by the public authorities must be explained and an appeal must be made to the responsibility of all and to daily action by the public (living tips, practical tips on administrative procedures). This information is relayed by the reception centres.

2 MANAGEMENT OF THE LIFTING OF EMERGENCY PROTECTIVE MEASURES – DEFINITION OF POST-ACCIDENT ZONING

Once a facility is returned to a controlled state, the public authorities must begin managing the post-accident phase, particularly by using the information in the document titled 'doctrinal elements of post-accident management of a nuclear accident'.

Post-accident zones must be defined based on predictive models of the level of the public's exposure to radioactive fallout in inhabited areas and contamination of the food chain.

These zones are established using guideline values for maximum exposure to humans and maximum permitted levels for the contamination of foodstuffs from the latest international references and EU regulations. There are three types of zone:

▶▶▶

KEY FACT

The three main objectives of post-accident management are as follows:

- ➔ protect people from the dangers of ionising radiation;
- ➔ provide assistance to people affected by the consequences of the accident;
- ➔ reclaim areas whose economic and social fabric were affected.

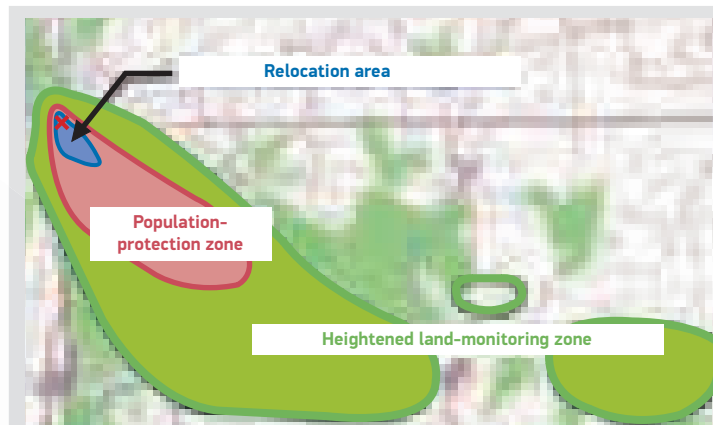
In order to be effective or achievable, many post-accident management actions require taking a pre-emptive approach from the emergency phase on.

►►►

- a **public-protection zone** (ZPP) in which actions are necessary to mitigate human exposure;
- a **heightened territorial-surveillance zone** (ZST), which is larger and focused more on economic management. Inside this zone, foodstuffs and agricultural products or manufactured goods are specially monitored;
- and, if warranted by the contamination levels, a **relocation area** (PE) inside the ZPP. Residents living in the PE must be relocated for periods of as long as several months or years.

3 PUBLIC-PROTECTION MEASURES TAKEN AFTER AN ACCIDENT

Various actions are decided or adjusted after the post-accident zones are set up:



The size of the areas depends on the severity of the accident and may extend beyond the scope covered by the PPIs.

- relocation of people residing in the PE (animals left behind must be cared for);
- ban on the consumption and distribution of foodstuffs likely to be contaminated (total ban in the ZPP for at least one month; lifted progressively in the ZST based on the results of clearance tests);
- maintenance of consumption of tap water, except in the case of vulnerable water resources and facilities and for which alternatives or consumption restrictions may be considered, particularly in the case of infants, young children and pregnant women;
- ban on the distribution of materials and manufactured goods that may be contaminated;
- seizure of farms located in the ZPP and the ZST in order to prevent deliveries of animal and plant products that may be contaminated;
- bans on accessing areas where radioactive substances tend to build up (forests, green spaces, etc.).

4 ASSISTANCE TO AFFECTED PEOPLE

The **public reception and information centres (CAI)**, which supplement the ORSEC's reception and regroupment centres (CARE) and are set up by the prefectures. They must be operational as soon as emergency protective measures are lifted in order to meet priority needs: reception, census, medical and psychological treatment, information, accommodation, supplying, extreme-emergency assistance and aid, and preparing indemnification procedures.

Taking a census, and registering the exposure levels of, response teams and people in affected areas where emergency protective measures are in effect, then in the ZPP, will facilitate health and epidemiological monitoring as well as reaccommodation and indemnification. Epidemiological monitoring activities must be implemented as soon as possible.

►►►



5 BEGIN LAND RECLAMATION MEASURES

a. The first actions to mitigate the exposure of residents

For the best effectiveness, the first actions for improving the radiological situation (cleaning) must be taken in the ZPP as quickly as possible after the releases have ended. The waste created by this work must be managed. This management must be defined beforehand.

b. The first radioactivity measurement programme

After releases have ended, knowledge of actual contamination in the environment is piecemeal. Radioactivity measurement programmes must be carried out in the field as soon as possible in order to:

- ▶▶ confirm and, if necessary, redefine the zones;
- ▶▶ fine-tune actions taken in these zones;
- ▶▶ guide contamination-mitigation actions and other steps taken in the contaminated area.

c. Actions for the management of economic and agricultural activities

The first things that must be done regarding products and economic activities are as follows::

- ▶▶ PE: Monitor the shutdown of activities (particularly sensitive sites or sites with industrial risks, facilities that cannot be shut down at all or easily, etc.) and the continuation of networks. Guide the relocation of economic activities that can be relocated outside the zone. Where necessary, allow vital activities to continue operating according to regulations;
- ▶▶ ZPP and ZST: Begin clearance testing of agricultural activities in the ZST (ranked by importance and very quickly for some) If necessary, begin dispelling doubts about foodstuffs assumed to be protected in the ZPP and ZST Stockpile basic emergency necessities (e.g.: bottled water, food, dosimeters). Define the conditions of re-use of infrastructure;

- ▶▶ Outside these zones: If necessary, set up inspections of exports (food products and manufactured goods). Specially monitor tourist areas if necessary.

Regarding agriculture, it is important to:

- ▶▶ ZPP: ensure that bans on agricultural products are effective;
- ▶▶ ZST: implement clearance tests to release farms in the ZST from seizure.

Agricultural and manufactured products that may not be distributed are considered waste and must be treated appropriately.

Funding is provided through the swift granting of aid to businesses so that activity may resume.

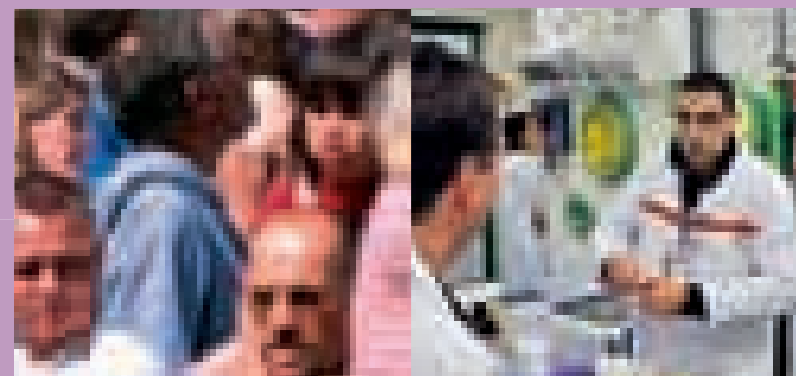
At the same time, a first estimate of the economic cost for the nation, together with the various components, must be swiftly made.

6 LONG-TERM MANAGEMENT

Post-accident management begins where the emergency phase ends. It is divided into two periods:

- ▶▶ The transitional period (a few weeks to a few months), which is characterized by rapid changes in the radiological situation, which is increasingly better understood, and the economic, social and health situations. The management system must adapt to these changes, particularly through the use of flexible decision criteria and the definition of an adapted method of governance;
- ▶▶ The long-term period, which begins when the long-term consequences of the accident have been adequately identified and consolidated.

2.



DECISION-MAKING GUIDE





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2.2 QUICK-RESPONSE SHEETS

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little impact in France p. 90

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2.1. USING THIS GUIDE

The eight situations

The plan's decision-making guide is structured around **eight reference situations**, each of which is characterized by a comprehensive response strategy:

- ▶▶ **One situation relates to situations of uncertainty;**
- ▶▶ **Three situations relate to accidents** that may occur in permanent facilities in France (situations 1, 2 and 3);

- ▶▶ **Two situations relate to transport accidents** (situation 4 on land ; situation 7 offshore);
- ▶▶ **Two situations relate to nuclear and radiological accidents** that may occur abroad (situations 5 and 6).

Situations of uncertainty	Facility situations	Transport situations	Situations abroad
Cases of doubt, rumor, detected increase in environmental radioactivity without any identified cause, etc. The aim here is to attempt to best handle situations of uncertainty.	The situations relate to civil or defense-related facilities in France. They are differentiated by the kinetics (immediate, delayed, short-term, long-term) and consequences of releases.	They relate to accidents that may occur during the transport of radioactive materials. They are differentiated by the location of the accident (land, inland waterway in France or offshore).	They related to accidents that occur during transport operations or at facilities in nearby or far-off countries. They are differentiated by their consequences on France.
SITUATION 0	SITUATIONS 1-2-3	SITUATIONS 4-7	SITUATIONS 5-6

Choosing the appropriate situation

Situation 0:

► Situation of uncertainty

Rumor of an accident, suspected release, accident that remains to be characterized, etc.

Situation 1:

► Facility accident resulting in an immediate & short-term release

Confirmed, immediate and short-term release (less than 1 hour) from a nuclear facility (INB/INBS) with moderate consequences.

Situation 2:

► Facility accident resulting in an immediate & long-term release

Confirmed, immediate and long-term release (lasting from a few days to a few weeks) from a nuclear facility (INB/INBS) with potentially high consequences.

Situation 3:

► Facility accident resulting in a delayed & long-term release

Threat of a release followed or not by a delayed and long-term release (lasting from a few days to a few weeks) from a nuclear facility (INB/INBS) with potentially high consequences.

Situation 4:

► Accident during the transport of radioactive materials with potential release

Accident during the transport of radioactive materials (solid, liquid or gaseous) in France (on land or inland waterways). The kinetics of a release are often fast (immediate short-term release) and the consequences are generally limited.

Situation 5:

► Accident occurring abroad and which may have a significant impact in France

Management of the potentially significant impact in mainland France and its overseas territories of an accident occurring at a facility or during the transport of radioactive materials in a nearby country. Issues related to French nationals present in the accident-stricken country must also be addressed.

Situation 6:

► Accident occurring abroad and having little impact in France (not requiring public-protection measures in principle)

Management of the potential impact in mainland France and its overseas territories of an accident occurring in a far-off country (or located nearby but whose consequences in France are insignificant).

Issues related to French nationals present in the accident-stricken country or countries must also be addressed.

Situation 7:

► Offshore accident

Damage to a vessel carrying or using (power plants) nuclear materials may result in the release of radioactivity. Depending on the cargo being carried, damage may also result in grounding that may lead to radiological risks on land.

➡ The decision whether or not to assemble the CIC must be taken without delay.

Presentation of the situations and the associated measures

KEY FACT

To avoid cluttering the tables, measures already proposed in the tables are not repeated even if they are implemented throughout the plan (e.g. information and communication).

Each situation is presented in **two parts**:

1 Part one

It gives the characteristics (kinetics, consequences, facility types) and comprehensive response strategy to be implemented.

It highlights:

- ▶▶ the main points to bear in mind,
- ▶▶ the questions that should be asked.

2 Part two

The second part is a **list of the measures that are taken** from the start of the emergency and a **list of measures to be considered** and which are to be taken based on the conditions encountered in the field.

These measures are organized by main target objective and split among the two or three time periods of the emergency phase (threat, release, recovery). For practical reasons, the transitions shown are distinctly separate. However, in real-world situations, some phases may actually overlap. As a result, the measures are not necessarily in chronological order. Note that measures that continue to be implemented, unchanged, throughout the phases are not repeated in the tables.

a. Objectives

They are listed on the left side of the document and correspond to the response strategies explained in part one of the plan:

- ▶▶ ascertain, assess and anticipate the situation;
- ▶▶ protect the public;
- ▶▶ provide health assistance;
- ▶▶ inform the public;
- ▶▶ work with international and European partners;
- ▶▶ allow economic and social continuity;
- ▶▶ begin land reclamation measures (run-up to post-accident management).

b. Measures

The measures proposed for each situation are described in more detail in the corresponding **measurement sheets** attached to the plan. Their numbers are given in the right-hand column (11) and clarify the related procedure. These numbers are not chronological.

c. Ministries or entities in charge of implementing the measures

This being a government-wide plan, and in order to ensure the efficiency of the CIC, each proposed measure is overseen by one or, where necessary, two ministries. There are exceptions in the case of special missions. This does not obviate the support that may be provided by other ministries, operators, the ASN, the ASND, the IRSN, the IAEA and the CEA, particularly within the CIC's units. These entities play an advisory and/or oversight role during the emergency response or post-accident management phases.

The consequences of an accidental release of radioactive material may differ across space and time. As a result, whatever the situation considered, if radioactivity is released into the atmosphere, the environmental contamination resulting from atmospheric dispersion may affect areas significantly larger than those requiring emergency measures to protect people from short-term exposure to radiation (emergency phase). It is therefore important to take this into account right from the start of an emergency, particularly in terms of informing the public. Indeed, the areas that will be affected by this radioactive fallout may be outside the scope of the PPI, which relates only to providing emergency protection to people most directly exposed to radioactive fallout.



2.2 QUICK-RESPONSE SHEETS

Situation of uncertainty

WHAT YOU SHOULD KNOW: response characteristics and strategy

- 1 The situation may be a rumor, a suspected release, a report of an unexplained release, an accident that has not yet been characterized, etc.
- 2 The first minutes or hours following a report of a nuclear or radiological risk can be a period of high uncertainty as to the nature and reality of the risk.
- 3 The authorities must focus on obtaining additional information from all available sources and having it analyzed by the panel of experts. The analysis must make it possible to assess the relevance of the information, anticipate evolutions in the situation and identify the necessary measures.
- 4 The public (both local and national) must systematically be informed. This information must clearly state what has been confirmed and what remains uncertain and explain the reasons why. It must also indicate the actions taken by the public authorities to deal with the situation and prepare any necessary protective measures. Such information must be provided each time there are new, confirmed developments.

QUESTIONS FOR CONSIDERATION

Questions the government should first ask the local authorities or, where necessary, the ASN, the ASND, the IRSN or the Ministry of Foreign Affairs:

- 1 How reliable is the initial source? Who can confirm or refute the information (the operator, the T el eray alert network in France, the assessment networks, the French of foreign safety regulator, the IAEA, the network of embassies, etc.)?
- 2 Have radiation measurements been taken?
- 3 If an accident has occurred, is it really radiological in nature? Is there a potential impact on people?
- 4 What communication actions have already been taken or are planned? Is there media pressure or demand for information by the public?
- 5 Is there an international dimension?

Once an event has been confirmed and its nature identified, refer to the most appropriate solution in this guide.

Situation of uncertainty

Flow chart of possible measures

<p>Confirm the actions that could have already been taken</p>	<p>Where necessary, obtain confirmation from the source of information or the relevant government representative</p>	
<p>EMERGENCY PHASE</p> <p>Ascertain, assess and anticipate the situation: 1st review of the situation and verifications</p>	<p>OBJECTIVE</p> <p>MEASURE</p> <p>Activation of the national emergency management organization</p> <p>Review of the available information (existence of a rumor, confirmation of abnormal measurements, search for information around the country, search abroad, etc.) Assessment/anticipation of the situation</p> <p>Adapted monitoring of environmental radioactivity</p>	<p>MAIN MINISTRIES OR ENTITIES ACCOUNTABLE FOR THE MEASURE IN CIC</p> <p>PM</p> <p>ASN (D) + IRSN + Interior + Foreign Aff. + Ecology</p> <p>ASN + IRSN</p> <p>SHEET</p> <p>1</p> <p>2</p> <p>36</p>

**EMERGENCY
PHASE**
(CONTINUED)

<p>Protect people, the environment and property</p>	<p>▶ Public-protection actions (if necessary)</p>	Interior + Health	6
	<p>▶ Alerting of emergency response capabilities</p>	Interior	
<p>Inform and communicate with the various publics</p>	<p>▶ Nationwide communication</p>	Communication CIC	9
	<p>▶ Opinion tracking and rumor detection</p>	Communication CIC	10

If the elements make it possible to identify one of the seven other situations in the plan, the ASN will indicate which one. This situation will then become the reference situation.

Facility accident resulting in an immediate & short-term release

WHAT YOU SHOULD KNOW: response characteristics and strategy

- 1 Immediate short-term release (occurring less than 1 hour after the start of the incident and lasting for a few hours) likely to leave short-term impacts on people in areas of as much as several kilometres in radius (PPI zone for facilities with a PPI).
- 2 Due to the fast-changing nature of the situation, the responsiveness of the local organization plays a key role. The national organization will have more to do with the recovery period.
- 3 The alert must be given immediately and the population must immediately take shelter. International partners must be alerted quickly.
- 4 All vehicle traffic in the area must be halted as quickly as possible.
- 5 The information given must emphasise how to take shelter and the risks of taking one's vehicle, particularly in terms of radiation exposure. It must identify the affected areas.

EXAMPLE FACILITIES	EXAMPLE INITIATING EVENTS
LABORATORIES & PLANTS	Fire, explosion
Nuclear power plants (NPP)	Pipe Rupture Steam generator SGTR

QUESTIONS FOR CONSIDERATION

Questions the government should first ask the ASN, the ASND, the IRSN or, where necessary, the operator

- 1 Has the operator alerted the decision-makers, response teams and the public (signal + orders by the media or other outlets)?
- 2 What area is affected? What population is affected? Are radiation measurements available? What is the impact of the weather?
- 3 Is the scene of the accident near a border with another country? Are relations maintained with the neighbouring country? Is there a risk of radioactive releases reaching the border in short time?
- 4 Has the release ended? Are there new threats of releases?
- 5 Have protective measures been recommended? Are orders being followed? Are there risks of spontaneous evacuation? Are means of transport disrupted? How are populations far from the site of the event reacting?
- 6 What type of communication has been issued? By whom? What is the media coverage?
- 7 Are there special means in the area to cope with the accident?

Facility accident resulting in an immediate & short-term release

Flow chart of possible measures

Confirm the actions that could have already been taken

- ▶ Activation of the PUI. Public authorities alerted. Public informed for first time. Control of the event on the site.
- ▶ Activation of the PPI if necessary.
- ▶ Public-protection actions (alert, immediate advisory to take shelter)
- ▶ Implementation of cross-border agreements for the alert and harmonisation of countermeasures.
- ▶ Dissemination of the alert to the relevant services. Mobilisation of emergency-response capabilities.
- ▶ Upholding of law and order; protection of places and traffic control
- ▶ Government assistance in deploying EDF s FARN (see the Appendix to Sheet 2)

EMERGENCY PHASE

OBJECTIVE	MEASURE	MAIN MINISTRIES OR ENTITIES ACCOUNTABLE FOR THE MEASURE IN CIC	SHEET
<p>Ascertain, assess and anticipate the situation 1st review of the situation and verifications</p>	▶ Activation of the national emergency management organization (including information/communication)	PM	1
	▶ Review of information about the facility and the environment; diagnosis & prognosis (developments in the safety of the facility and radiological consequences)	ASN (D) + IRSN + operator	2
	▶ Review of the situation of the public and response teams (including their health status) and business operations, networks, and relevant infrastructure and services	Interior + Health + Transport + Energy	
	▶ Communication of useful information to response teams for better local management of the emergency	Interior	
	▶ Implementation of the legal investigative process	Justice	21

**EMERGENCY
PHASE**
(CONTINUED)

Protect people, the environment and property	▶ Route instructions for ground, inland waterway, maritime and air-transport operations	Transport	5
	▶ Changes to the public-protection actions or additional actions: extension of the alert and shelter-in-place period, iodine, activity restrictions	Interior + Health	6
	▶ Upholding of law and order; protection of routes and places	Interior	24
	▶ Management of response teams (radiation protection)	Labour (+ Defense where appropriate)	8
Inform and communicate with the various publics	▶ Nationwide communication	Communication CIC	9
	▶ Opinion tracking and rumor detection	Communication CIC	10
Work with international and European partners	▶ Mandatory notification and information of international partners via the IAEA and the WHO and European partners via EU and border partners	ASN + Foreign Aff. + Health + ASND + Interior	11
	▶ Needs assessment and request to international (via the IAEA) or border partners for international assistance (if necessary)	Foreign Aff. + ASN + Interior + Health	12
Allow economic and social continuity	▶ Encourage the implementation of measures allowing key activities to continue and secure businesses that may pose a risk	Economy + Industry + Labour	13
	▶ Management of energy supplies	Energy	14

EXIT PERIOD FROM THE EMERGENCY PHASE

Protect people, the environment and property	▶ Implementation of post-accident zoning	Interior + Health	22
	▶ Restrictions and bans on the consumption of possibly contaminated foodstuffs and enforcement of distribution bans and management of imports and exports	Agriculture + Economy	16
	▶ Restrictions and bans on the use of possibly contaminated manufactured goods and materials and enforcement of distribution bans and management of imports and exports	Industry + Economy	17
	▶ Decision whether to relocate people, keep them in the area or allow them to return	Interior + Health + Housing	23
	▶ Management of drinking-water consumption	Health + Ecology	15
	▶ Upholding of law and order; protection of places and traffic control	Interior	24
	▶ Setting-up of reception centres	Interior	25
Provide health assistance	▶ Health assistance to people	Health + Interior	18
	▶ Registration of affected people	Interior + Health	19
	▶ Implementation of epidemiological monitoring	Health	39

**EXIT PERIOD
FROM THE
EMERGENCY
PHASE
(CONTINUED)**

Work with international and European partners	▶ Notification of border partners of the lifting of measures	Interior + Foreign Aff.	11
	▶ Monitoring of, and information on, the consumption and exportation of unaffected products	Agriculture + Economy	20
	▶ Implementation of extreme-emergency relief funding and preparation of indemnification procedures	Economy	28
Allow economic and social continuity	▶ Implementation of radiological inspections of materials, manufactured goods and foodstuffs	Agriculture + Economy + Industry	29
	▶ Implementation of a programme for measuring environmental contamination in the affected areas	Interior	30
Begin land reclamation measures	▶ Adapted monitoring of environmental radioactivity in areas not significantly impacted by the accident	ASN + IRSN	36
	▶ First contamination-mitigation actions	Ecology + Interior	31
	▶ Preparation for waste management	Ecology	32
	▶ First agricultural-management actions	Agriculture	33
	▶ Management of workers (long-term exposure)	Labour	34
	▶ Support of civil society in post-accident management as part of efforts to get stakeholders involved	Interior	35

Facility accident resulting in an immediate & long-term release

WHAT YOU SHOULD KNOW: response characteristics and strategy

- 1 Immediate long-term release (occurring less than 6 hours after the start of the incident and lasting from a few days to a few weeks) likely to cause significant impacts in terms of public exposure and land contamination in areas that may be beyond the scope of PPIs.
- 2 The alert must be given immediately and the population must take shelter. The area in which this measure is applied may be extended, particularly beyond the PPI areas, based on developments in the situation and the technical data received. Depending on the type of release, stable-iodine prophylaxis may be necessary.
- 3 International partners must be alerted quickly.
- 4 Evacuation will occur during the release. Where possible, it must take place before the release worsens.
- 5 In order to maintain law and order, vehicle traffic in the area must be shut down as quickly as possible.

EXAMPLE FACILITIES	EXAMPLE INITIATING EVENTS
Nuclear power plants (NPP)	Core meltdown – emanations from the containment
Nuclear power plants (NPP)	Core meltdown – filtered containment venting



- 6 The information provided must emphasise how to take shelter and the fact that evacuation measures are likely but must be prepared for in order to ensure people's safety. It must identify the affected areas.
- 7 The recovery period must include the provision of assistance to people and the reclamation of contaminated areas, which may be extensive.

QUESTIONS FOR CONSIDERATION

Questions the government should first ask the ASN, the ASND, the IRSN or, where necessary, the operator

- 1 Has the operator alerted the decision-makers, response teams and the public (signal + orders by the media or other outlets)?
- 2 Given the type of the accident, how long are the releases likely to last? What area is affected? What population is affected? What impact will the weather have? Are radiation measurements available?
- 3 Is the scene of the accident near a border with another country? Are relations maintained with the neighbouring country? Is there a risk of the radioactive releases reaching the border in short time?
- 4 Have protective measures been recommended? Are orders being followed? Are there risks of spontaneous evacuation? Are means of transport disrupted? How are populations far from the site of the event reacting? What compounding phenomena might make the situation more complicated?
- 5 What type of communication has been issued? By whom? What is the media coverage?
- 6 Are there special means in the area to cope with the accident?

Facility accident resulting in an immediate & long-term release

Flow chart of possible measures

Confirm the actions that could have already been taken

- ▶ Activation of the PUI. Public authorities alerted. Public informed for first time. Control of the event on the site.
- ▶ Public-protection actions (alert, advisory to take shelter)
- ▶ PPI activated. If necessary, the adapted national plan is activated in areas beyond that covered by the PPI.
- ▶ Upholding of law and order; protection of places and traffic control
- ▶ Dissemination of the alert to the relevant services. Mobilisation of emergency-response capabilities.
- ▶ Implementation of cross-border agreements for the alert and harmonisation of countermeasures (if necessary)
- ▶ Government assistance in deploying EDF s FARN

EMERGENCY PHASE

Alert and release

OBJECTIVE	MEASURE	MAIN MINISTRIES OR ENTITIES ACCOUNTABLE FOR THE MEASURE IN CIC	SHEET
<p>Ascertain, assess and anticipate the situation 1st review of the situation and verifications</p>	<p>▶ Activation of the national emergency management organization (including information/communication)</p>	PM	1
	<p>▶ Review of information about the facility and the environment; diagnosis & prognosis (developments in the safety of the facility and radiological consequences)</p>	ASN (D) + IRSN + operator	2
	<p>▶ Review of the situation of the public and response teams (including their health status) and business operations, networks, and relevant infrastructure and services</p>	Interior + Health + Transport + Energy	
	<p>▶ Communication of useful information to response teams for better local management of the emergency</p>	Interior	
	<p>▶ Implementation of the legal investigative process</p>	Justice	21

EMERGENCY PHASE

Alert and release (CONTINUED)

Protect people, the environment and property	▶ Route instructions for ground, inland waterway, maritime and air-transport operations	Transport	5
	▶ Changes to the public-protection actions (extension of the alert, evacuation, iodine, activity restrictions, etc.)	Interior + Health	6
	▶ Restrictions and bans on the consumption of possibly contaminated foodstuffs and enforcement of distribution bans and management of imports and exports	Agriculture + Economy	16
	▶ Restrictions and bans on the use of possibly contaminated manufactured goods and materials and enforcement of distribution bans and management of imports and exports	Industry + Economy	17
	▶ Management of drinking-water consumption	Health + Ecology	15
	▶ Management of response teams (radiation protection)	Labour (+ Defense where appropriate)	8
	Provide health assistance	▶ Health assistance to people	Health + Interior
Inform and communicate with the various publics	▶ Nationwide communication	Communication CIC	9
	▶ Opinion tracking and rumor detection	Communication CIC	10
Work with international and European partners	▶ Mandatory notification and information of international partners via the IAEA and the WHO and European partners via EU and border partners	ASN + Foreign Aff. + Health + ASND + Interior	11
	▶ Needs assessment and request to international (via the IAEA) or border partners for international assistance (if necessary)	Foreign Aff. + ASN + Interior + Health	12
Allow economic and social continuity	▶ Encourage the implementation of measures allowing key activities to continue and secure businesses that may pose a risk	Economy + Industry + Labour	13
	▶ Management of energy supplies	Energy	14
	▶ Monitoring of, and information on, the consumption, use and exportation of unaffected products	Agriculture + Economy	20

EMERGENCY PHASE

Long-term release

RESOLUTION OF THE EMERGENCY	Protect the public and property	▶ Implementation of additional countermeasures or changes to the previous actions (iodine, evacuation, expansion of the evacuation, activity restrictions)	Interior + Health	6
	Protect people, the environment and property	▶ Implementation of initial post-accident zoning	Interior + Health	22
		▶ Decision whether to relocate people, keep them in the area or allow them to return	Interior + Health + Housing	23
		▶ Upholding of law and order; protection of places and traffic control	Interior	24
		▶ Setting-up of reception centres	Interior	25
	Provide health assistance	▶ Health assistance to people	Health + Interior	18
		▶ Registration of affected people	Interior + Health	19
		▶ Implementation of epidemiological monitoring	Health	39
	Work with international and European partners	▶ Notification of border partners of the lifting of protective measures	Interior + Foreign Aff.	11

**RESOLUTION
OF THE
EMERGENCY**
(CONTINUED)

Allow economic and social continuity	▶ Implementation of extreme-emergency relief funding and preparation of indemnification procedures	Economy	28
	▶ Implementation of radiological inspections of materials, manufactured goods and foodstuffs	Agriculture + Economy + Industry	29
Begin land reclamation measures	▶ Implementation of a programme for measuring environmental contamination in the affected areas	Interior	30
	▶ Adapted monitoring of environmental radioactivity in areas not significantly impacted by the accident	ASN + IRSN	36
	▶ First contamination-mitigation actions	Ecology + Interior	31
	▶ Preparation for waste management	Ecology	32
	▶ First agricultural-management actions	Agriculture	33
	▶ Management of workers (long-term exposure)	Labour	34
	▶ Support of civil society in post-accident management as part of efforts to get stakeholders involved	Interior	35

Accident that may result in a delayed & long-term release

WHAT YOU SHOULD KNOW: response characteristics and strategy

EXAMPLE FACILITIES	EXAMPLE INITIATING EVENTS
Nuclear power plants (NPP)	Delayed core meltdown – emanations from the containment
Nuclear power plants (NPP)	Core meltdown – filtered containment venting (U5 procedure)
Fuel reprocessing plant	Loss of cooling and containment in the fission-product processing units
Nuclear propulsion power plants/RES reactor	Core meltdown – containment venting
Fuel storage pool	Loss of cooling

- 1 Threat of a release followed or not by a delayed and long-term release (occurring more than 6 hours after the start of the incident and lasting for a few days or even a few weeks). The authorities must take advantage of the available time to take the appropriate protective measures.
- 2 The authorities must base their actions on an anticipation of the forthcoming consequences, which may be significant, the worst-case assumption and the impact of the release, which may extend beyond the areas covered by the PPIs.
- 3 Preventive evacuation is recommended. Moreover, ad-hoc shelter-in-place actions at the outskirts of the affected area (see Section 1 of the plan) and even restrictions on activities are possible depending on the case.
- 4 Given the time required to organize these measures, the alert must be given immediately and instructions on what to do must be issued at all times.
- 5 The halting of all vehicle traffic in the area must be anticipated.



- 6 The information must emphasise the importance of listening to the media and following orders. It must list the areas that may be affected in the near future.
- 7 The recovery period must include the reclamation of contaminated areas, which may be extensive.

QUESTIONS FOR CONSIDERATION

Questions the government should first ask the ASN, the ASND, the IRSN or, where necessary, the operator

- 1 Has the operator alerted the decision-makers, response teams and the public (signal + orders by the media or other outlets)?
- 2 Has the absence of release been confirmed at this stage? Are any radiation measurements available? What is the foreseeable duration of the releases? What impact will the weather have? What area will be affected by the future releases? What populations may be affected? Are preparations being made to evacuate these populations?
- 3 Is the scene of the accident near a border with another country? Are relations maintained with the neighbouring country or countries? Will the release quickly reach the border?
- 4 Have orders been issued? Are they being followed? Are means of transport disrupted? How are populations far from the site of the event reacting?
- 5 What type of communication has been issued? By whom? What is the media coverage?
- 6 Are there special means in the area to cope with the accident?

Accident that may result in a delayed & long-term release

Flow chart of possible measures

Confirm the actions that could have already been taken

- ▶ Activation of the PUI. Public authorities alerted. Public informed for first time. Control of the event on the site.
- ▶ PPI activated. If necessary, the adapted national plan is activated in areas beyond that covered by the PPI.
- ▶ Public-protection actions (alert, advisory to take shelter)
- ▶ Upholding of law and order; protection of places and traffic control
- ▶ Implementation of cross-border agreements for the alert and harmonisation of countermeasures (if necessary)
- ▶ Government assistance in deploying EDF s FARN (see the Appendix to Sheet 2)

THREAT PHASE

OBJECTIVE	MEASURE	MAIN MINISTRIES OR ENTITIES ACCOUNTABLE FOR THE MEASURE IN CIC	SHEET
Ascertain, assess and anticipate the situation 1 st review of the situation and verifications	▶ Activation of the national emergency management organization (including information/communication)	PM	1
	▶ Review of information about the facility and the environment; diagnosis & prognosis (developments in the safety of the facility and radiological consequences)	ASN (D) + IRSN + operator	2
	▶ Review of the situation of the public and response teams (including their health status) and business operations, networks, and relevant infrastructure and services	Interior + Health + Transport + Energy	
	▶ Communication of information to response teams for better local management of the emergency	Interior	
	▶ Implementation of the legal investigative process	Justice	21

**THREAT
PHASE**
(CONTINUED)

Protect people, the environment and property	▶ Route instructions for ground, inland waterway, maritime and air-transport operations	Transport	5
	▶ Preparation of public-protection actions (evacuation, iodine: pre-positioning, activity restrictions) and deployment where appropriate	Interior + Health	6
	▶ Livestock-protection actions (if necessary)	Agriculture	7
	▶ Management of response teams (radiation protection)	Labour (+ Defense where appropriate)	8
	▶ Setting-up of reception centres	Interior	25
Provide health assistance	▶ Health assistance to people (preparation)	Health + Interior	18
Inform and communicate with the various publics	▶ Nationwide communication	Communication CIC	9
	▶ Opinion tracking and rumor detection	Communication CIC	10
Work with international and European partners	▶ Mandatory notification and information of international partners via the IAEA and the WHO and European partners via EU and border partners	ASN + Foreign Aff. + Health + ASND + Interior	11
	▶ Needs assessment and request to international (via the IAEA) or border partners for international assistance (if necessary)	Foreign Aff. + ASN + Interior + Health	12
Allow economic and social continuity	▶ Encourage the implementation of measures allowing key activities to continue and secure businesses that may pose a risk	Economy + Industry + Labour	13
	▶ Management of energy supplies	Energy	14

EMERGENCY PHASE
Long-term release (>24h)

Protect people, the environment and property	▶ Implementation of additional countermeasures or changes to the previous actions (iodine, evacuation, expansion of the evacuation, activity restrictions)	Interior	6
	▶ Management of drinking-water consumption	Health + Ecology	15
	▶ Restrictions and bans on the consumption of possibly contaminated foodstuffs and enforcement of distribution bans and management of imports and exports	Agriculture + Economy	16
	▶ Restrictions and bans on the use of possibly contaminated manufactured goods and materials and enforcement of distribution bans and management of imports and exports	Industry + Economy	17
	Provide health assistance		
	▶ Health assistance to people	Health + Interior	18
	▶ Registration of affected people	Interior + Health	19
Allow economic and social continuity	▶ Monitoring of, and information on, the consumption, use and exportation of unaffected products	Agriculture + Economy	20

RESOLUTION OF THE EMERGENCY

RESOLUTION OF THE EMERGENCY	Protect people, the environment and property	▶ Implementation of initial post-accident zoning	Interior + Health	22
		▶ Decision whether to relocate people, keep them in the area or allow them to return	Interior + Health + Housing	23
		▶ Management of drinking-water consumption	Health + Ecology	15
		▶ Upholding of law and order; protection of places and traffic control	Interior	24
		▶ Setting-up of reception centres	Interior	25
	Provide health assistance	▶ Health assistance to people	Health + Interior	18
		▶ Implementation of epidemiological monitoring	Health	39
	Work with international and European partners	▶ Notification of border partners of the lifting of protective measures	Interior + Foreign Aff.	11
	Allow economic and social continuity	▶ Implementation of extreme-emergency relief funding and preparation of indemnification procedures	Economy	28
		▶ Implementation of radiological inspections of materials, manufactured goods and foodstuffs	Agriculture + Economy + Industry	29
Begin land reclamation measures	▶ Implementation of a programme for measuring environmental contamination in the affected areas	Interior	30	
	▶ Adapted monitoring of environmental radioactivity in areas not significantly impacted by the accident	ASN + IRSN	36	
	▶ First contamination-mitigation actions	Ecology + Interior	31	
	▶ Preparation for waste management	Ecology	32	
	▶ First agricultural-management actions	Agriculture	33	
	▶ Management of workers (long-term exposure)	Labour	34	
	▶ Support of civil society in post-accident management as part of efforts to get stakeholders involved	Interior	35	

Accident during the transport of radioactive substances with potential release

WHAT YOU SHOULD KNOW:

response characteristics and strategy

- 1 This situation can involve the transport of radioactive materials (solid, liquid or gaseous) by land or inland waterway.
- 2 Most transport accidents can be viewed as being fast-evolving with short-term releases (less than 1 hour) across a highly localised area.
- 3 The local authorities may be alerted by the forces of law and order, emergency services, the carrier, the consignor, the IRSN or any witness of the accident.
- 4 The public authorities are the first to respond to an accident involving the transport of packages of radioactive materials. They call on special local resources (CMIRs in some departments) or national resources (IRSN) as well as the resources of nearby operators (CEA, AREVA, EDF). The objective is to quickly regain control of the situation.
- 5 In general, few people are likely to be exposed to the release. Exposed people are quickly provided with information and treated.

QUESTIONS FOR CONSIDERATION

Questions the government should first ask the ASN, the ASND, the IRSN or, where necessary, the operator

- 1 What is the type of cargo? Has the package been breached?
- 2 Has the alert been given? To whom? The response teams? The public? Are there releases? Is it easy to respond at the scene of the accident? What area is affected? Have measures been taken to establish an exclusion zone? Is there a nearby watercourse that could be affected by a release? How might the situation develop? What impact will the weather have?
- 3 Have protective measures been recommended? Are orders being followed?
- 4 Is the scene of the accident near a border with another country? Are relations maintained with the neighbouring country?
- 5 Are the local resources used adequate and sufficient to manage the event? Are ad-hoc resources being sent?
- 6 What type of communication has been issued? By whom? What is the media coverage?

Accident during the transport of radioactive materials with potential release

Flow chart of possible measure

Confirm the actions that could have already been taken

- ▶ Issue of local alert, information to transport management centres and/or forces of law and order and emergency services, implementation of ORSEC-TMR if necessary
- ▶ Establishment of an exclusion zone, safeguarding of routes and places, public-protection actions
- ▶ Dissemination of the alert to the relevant services. Mobilisation of emergency-response capabilities.
- ▶ Dose rate and surface-contamination measurements at the scene of the accident in order to determine the exact safety perimeter
- ▶ Implementation of cross-border agreements for the alert and harmonisation of countermeasures (if necessary)

THREAT PHASE

OBJECTIVE	MEASURE	MAIN MINISTRIES OR ENTITIES ACCOUNTABLE FOR THE MEASURE IN CIC	SHEET
<p>Ascertain, assess and anticipate the situation 1st review of the situation and verifications</p>	▶ Activation of the national emergency management organization (including information/communication)	PM	1
	▶ Review of information about the facility and the environment; diagnosis & prognosis (developments in the safety of the facility and radiological consequences)	ASN(D) + IRSN + Transports	2
	▶ Review of the situation of the public and response teams (including their health status) and business operations, networks, and relevant infrastructure and services	Interior + Health + Transport + Energy	
	▶ Communication of information to response teams for better local management of the emergency	Interior	
	▶ Implementation of the legal investigative process	Justice	21

**EMERGENCY
PHASE
(CONTINUED)**

EMERGENCY PHASE (CONTINUED)	Protect people, the environment and property	▶ Implementation of additional countermeasures or changes to the previous actions (evacuation, expansion of the evacuation, activity restrictions)	Interior	6
		▶ Route instructions for ground, inland waterway, maritime and air-transport operations	Transport	5
		▶ Salvaging and securing of the cargo, establishment of the process for placing the accident-stricken cargo in a safe location	Transport + Defense	37
		▶ Management of response teams (radiation protection)	Labour (+ Defense where appropriate)	8
		▶ Management of drinking-water consumption	Health + Ecology	15
	Provide health assistance	▶ Health assistance to people	Health + Interior	18
	Inform and communicate with the various publics	▶ Nationwide communication	Communication CIC	9
		▶ Opinion tracking and rumor detection	Communication CIC	10
	Work with international and European partners	▶ Mandatory notification and information of international partners via the IAEA and the WHO and European partners via EU and border partners	ASN + Foreign Aff. + Health + ASND + Interior	11
		▶ Needs assessment and request to international (via the IAEA) or border partners for international assistance (if necessary)	Foreign Aff. + ASN + Interior + Health	12
	Allow economic and social continuity	▶ Encourage the implementation of measures allowing key activities to continue and secure businesses that may pose a risk	Economy + Industry + Labour	13

RESOLUTION OF THE EMERGENCY

Protect people, the environment and property	▶ Implementation of initial post-accident zoning	Interior + Health	22
	▶ Restrictions and bans on the use of possibly contaminated manufactured goods and materials and enforcement of distribution bans and management of imports and exports	Industry + Economy	16
	▶ Restrictions and bans on the consumption of possibly contaminated foodstuffs and enforcement of distribution bans and management of imports and exports	Industry + Economy	17
	▶ Decision whether to relocate people, keep them in the area or allow them to return	Interior + Health + Housing	23
	▶ Management of drinking-water consumption	Health + Ecology	15
	▶ Upholding of law and order; protection of places and traffic control	Interior	24
Provide health assistance	▶ Setting-up of reception centres (if necessary)	Interior + Health	19
	▶ Registration of affected people	Interior + Health	25
	▶ Implementation of epidemiological monitoring	Health	39

**RESOLUTION
OF THE
EMERGENCY**
(CONTINUED)


Work with international and European partners	▶ Notification of border partners of the lifting of measures	Interior + Foreign Aff.	11
	▶ Monitoring of, and information on, the use and exportation of unaffected products (where applicable)	Agriculture + Economy	20
Allow economic and social continuity	▶ Implementation of extreme-emergency relief funding and preparation of indemnification procedures	Economy	28
	▶ Implementation of radiological inspections of materials, manufactured goods and foodstuffs	Agriculture + Economy + Industry	29
	▶ Implementation of a programme for measuring environmental contamination in the affected areas	Interior	30
Begin land reclamation measures	▶ Adapted monitoring of environmental radioactivity in areas not significantly impacted by the accident	ASN + IRSN	36
	▶ First contamination-mitigation actions	Ecology + Interior	31
	▶ Preparation for waste management	Ecology	32
	▶ First agricultural-management actions	Agriculture	33
	▶ Management of workers (long-term exposure)	Labour	34
	▶ Support of civil society in post-accident management as part of efforts to get stakeholders involved	Interior	35

Accident occurring abroad and that may have a significant impact in France

WHAT YOU SHOULD KNOW: response characteristics and strategy

- 1 The aim is to manage the significant impact in mainland France and its overseas territories of an accident occurring in another country. Issues related to French nationals present in the accident-stricken country must also be addressed.
- 2 The impact can vary depending on the type of accident, its magnitude, the distance from the location of the accident and the weather. Depending on the assessed radiological impact, public-protection measures may be necessary. Depending on the available time, the release will be managed as an immediate or delayed release.
- 3 Given the potential impact and the international implications, the national emergency-response organization is activated without delay.
- 4 Existing cross-border agreements must be implemented without delay.



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- 5 Protecting French nationals from contaminated air masses while in a foreign country and/or while travelling may require immediate action.
 - 6 It may be necessary to prohibit the use of individual and collective means of transport in the affected area, in France and abroad.
 - 7 Efforts must be coordinated with the affected country to ensure that protective measures on both sides of the border and information provided to people are consistent.
 - 8 Rapidly assisting the affected country can both help to protect its citizens and mitigate the consequences of the accident.

QUESTIONS FOR CONSIDERATION

Questions the government should first ask the ASN and the minister of foreign affairs

- 1 Have releases occurred in the affected country? Will others occur? When?
- 2 Has the local population been alerted? Have protective measures been recommended? Have French nationals been informed?
- 3 Is there a risk of the releases reaching France? In how much time? What area is affected? What population is affected? What impact will the weather have?
- 4 What are the bilateral or international agreements that may be implemented?
- 5 Has a mutual channel of information been established with the country in question?
- 6 What type of communication has been issued? By whom? What is the media coverage?
- 7 Do the experts find the information obtained to be consistent?
- 8 Has international assistance been requested?

Accident occurring abroad and that may have a significant impact in France

Flow chart of possible measures

Confirm the actions that could have already been taken

- ▶ Receipt of the alert and information sent by the foreign partner (IAEA network) or the European partner (EU network)
- ▶ Implementation of the adapted national plan (public safety, ORSEC, etc.) in the affected area **in France**
- ▶ Public-protection actions (alert, orders) in the affected **area in France**
- ▶ Upholding of law and order; protection of places and traffic control in the affected area **in France**
- ▶ Dissemination of the alert to the relevant services, mobilisation of emergency-response capabilities
- ▶ Route instructions for ground, inland waterway, maritime and air-transport operations
- ▶ Implementation of cross-border agreements and harmonisation of countermeasures.

EMERGENCY PHASE

OBJECTIVE	MEASURE	MAIN MINISTRIES OR ENTITIES ACCOUNTABLE FOR THE MEASURE IN CIC	SHEET
Ascertain, assess and anticipate the situation 1 st review of the situation and verifications	▶ Activation of the national emergency management organization (including information/communication)	PM	1
	▶ Activation of the diplomatic and consular network in the affected country or countries	Foreign Aff.	
	▶ Review of information about the facility and the environment; diagnosis & prognosis (developments in the safety of the facility and radiological consequences) (at the scene and in France)	ASN + Foreign Aff. + IRSN + CEA	2
	▶ Review of the situation of French nationals in the foreign country	Foreign Aff.	3
	▶ Communication of information to response teams (affected area in France) for better local management of the emergency	Interior	
Protect people, the environment and property	▶ Implementation of additional countermeasures or changes to the previous actions (shelter-in-place, evacuation, iodine, activity restrictions in affected areas in France). Ensure actions are harmonised.	Interior + Health	6
	▶ Organization of measures to protect French nationals in the foreign country and harmonisation of actions with other countries nationals are present	Foreign Aff. + Health	38

EMERGENCY PHASE (CONTINUED)

Protect people, the environment and property(continued)

- ▶ Restrictions and bans on the consumption of possibly contaminated foodstuffs in the affected areas **in France** or **the affected country** and enforcement of distribution bans and management of imports and exports
- ▶ Restrictions and bans on the use of possibly contaminated materials and manufactured goods in the affected areas **in France** or **the affected country** and management of imports and exports
- ▶ Management of drinking-water consumption
- ▶ Management of response teams (radiation protection)

Agriculture + Economy

16

Industry + Economy

17

Health + Ecology

15

Labour

8

Provide health assistance

- ▶ Preparation or implementation of registration of and health assistance to affected French nationals **in the foreign country** or who have been repatriated, setting-up of reception centres
- ▶ Preparation or implementation of registration of and health assistance to affected people and the setting-up of reception centres (affected area **in France**)

Foreign Aff. + Health

18 19 25

Interior + Health

18 19 25

Inform and communicate with the various publics

- ▶ Nationwide communication
- ▶ Information of French nationals **present** in the affected countries and of their families **in France**
- ▶ Information of businesses **in France** and of French companies **in the affected countries**
- ▶ Opinion tracking and rumor detection

Communication CIC

9

Foreign Aff. + Communication CIC

40

Economy + Foreign Aff.

26

Communication CIC

10

Work with international and European partners

- ▶ Assessment of the country s needs and offer of international assistance through the IAEA or bilaterally

Foreign Aff. + ASN

12

Allow economic and social continuity

- ▶ Encourage the implementation of measures allowing key activities to continue and secure businesses that may pose a risk in the affected area **in France**
- ▶ Monitoring of, and information on, the consumption and exportation of unaffected products (if impact **in France**) and imports from **affected countries**
- ▶ Assessment of the potential consequences on businesses and imports

Economy + Industry + Labour

13

Agriculture + Economy

20

Economy

RESOLUTION OF THE EMERGENCY

Protect people, the environment and property	▶ Relocate people, keep them in the area or allow them to return to the area in France	Interior + Health + Housing	23	
	▶ Upholding of law and order; protection of routes and places (affected area in France)	Interior	24	
	▶ Setting-up of reception centres: affected area in France, French nationals in the foreign country and repatriated nationals	Interior + Foreign Aff.	25	
	Provide health assistance	▶ Health assistance to affected people: affected area in France, French nationals in the foreign country and repatriated nationals	Health + Interior + Foreign Aff.	18
		▶ Registration of affected people: affected area in France, French nationals in the foreign country and repatriated nationals	Interior + Health + Foreign Aff.	19
		▶ Implementation of epidemiological monitoring: affected area in France, French nationals in the foreign country and repatriated nationals	Health + Foreign Aff.	39
Work with international and European partners	▶ Assessment of the country's post-accident needs and offer of assistance through the IAEA or bilaterally	Foreign Aff. + ASN	12	
Allow economic and social continuity	▶ Implementation of extreme-emergency relief funding and preparation of indemnification procedures (affected area in France)	Economy	28	
	▶ Implementation of radiological inspections of materials, manufactured goods, foodstuffs (affected area in France) and imports	Agriculture + Economy + Industry	29	
Begin land reclamation measures	▶ Implementation of a programme for measuring environmental contamination in the affected areas (affected area in France)	Interior	30	
	▶ Adapted monitoring of environmental radioactivity in areas not significantly impacted by the accident	ASN + IRSN	36	
	▶ First contamination-mitigation actions (affected area in France)	Ecology + Interior	31	
	▶ Preparation for waste management (affected area in France)	Ecology	32	
	▶ First agricultural-management actions (affected area in France)	Agriculture	33	
	▶ Management of workers (long-term exposure) (affected area in France)	Labour	34	
	▶ Support of civil society in post-accident management as part of efforts to get stakeholders involved (affected area in France)	Interior	35	

Accident occurring abroad and having little impact in France

WHAT YOU SHOULD KNOW: response characteristics and strategy

- 1 The aim is to manage the potential impact on mainland France and its overseas territories of a nuclear accident that occurs abroad but whose consequences in France are insignificant. The main aim is to address issues related to French nationals present in an accident-stricken country.
- 2 The releases may be of any type but do not appear to require measures to protect the public in France. However, consumption restrictions may be enacted in France.
- 3 Given the international implications, the national emergency-response organization may be activated if warranted by local conditions. The Prime minister may delegate the chairmanship of the CIC to the minister of foreign affairs.
- 4 Existing international agreements must be implemented without delay.
- 5 Rapidly assisting the affected country can both help to protect its citizens and mitigate the consequences of the accident.
- 6 The matter of whether foods from the affected country are fit for consumption in France may be raised during the emergency phase. A special inspection must be conducted to protect people and maintain the credibility of safe products.

QUESTIONS FOR CONSIDERATION

Questions the government should first ask the ASN, the minister of foreign affairs, the relevant embassy or the IRSN

- 1 Have releases occurred in the affected country? Will others occur? When?
- 2 What orders have been issued by the local authorities? Have French nationals been informed? What measures have the relevant diplomatic missions already taken?
- 3 Is there a risk of the radioactive releases reaching France in short time? Which part of France? What is the potential impact?
- 4 Are restrictions on food consumption to be recommended?
- 5 What international agreements have been implemented?
- 6 Has a mutual channel of information been established with the country in question?
- 7 What type of communication has been issued? By whom? What is the media coverage?
- 8 Do the experts find the information obtained to be consistent?
- 9 Has international assistance been requested?

Accident occurring abroad and having little impact in France

Flow chart of possible measures

Confirm the actions that could have already been taken

- ▶ Receipt of the alert and information sent by the foreign partner (IAEA network) or the European partner (EU network)
- ▶ Implementation of international agreements and harmonisation of countermeasures.
- ▶ Dissemination of the alert to the relevant services
- ▶ Route instructions for ground, inland waterway, maritime and air-transport operations

THREAT PHASE

OBJECTIVE	MEASURE	MAIN MINISTRIES OR ENTITIES ACCOUNTABLE FOR THE MEASURE IN CIC	SHEET
<p>Ascertain, assess and anticipate the situation 1st review of the situation and verifications</p>	▶ Activation of the national emergency management organization (including information/communication)	PM	1
	▶ Review of information about the facility and the environment; diagnosis & prognosis (developments in the safety of the facility and radiological consequences), at the scene and in France	Foreign Aff. + ASN + IRSN + CEA	2
	▶ Review of the situation of French nationals in the foreign country	Foreign Aff.	3
	▶ Activation of the diplomatic and consular network in the affected country or countries	Foreign Aff.	

**EMERGENCY
PHASE**
(CONTINUED)

Protect people, the environment and property	<ul style="list-style-type: none"> ▶ Organization of measures to protect French nationals in the foreign country and harmonisation of actions with other countries whose nationals are also present 	Foreign Aff. + Health	38
	<ul style="list-style-type: none"> ▶ Route instructions for ground, inland waterway, maritime and air-transport operations 	Transport	5
	<ul style="list-style-type: none"> ▶ Restrictions and bans on the consumption of possibly contaminated foodstuffs and enforcement of distribution bans (imports) and management of imports and exports 	Agriculture + Economy	16
	<ul style="list-style-type: none"> ▶ Restrictions and bans on the use of possibly contaminated manufactured goods and materials and enforcement of distribution bans (imports) and management of imports and exports 	Industry + Economy	17
Provide health assistance	<ul style="list-style-type: none"> ▶ Preparation or implementation of registration of and health assistance to affected French nationals in the foreign country or who have been repatriated, setting-up of reception centres 	Foreign Aff. + Health	18 19 25
Inform and communicate with the various publics	<ul style="list-style-type: none"> ▶ Nationwide communication 	Communication CIC	9
	<ul style="list-style-type: none"> ▶ Information of French nationals present in the affected countries and of their families in France 	Foreign Aff. + Communication CIC	40
	<ul style="list-style-type: none"> ▶ Information of businesses in France and of French companies in the affected countries 	Economy + Foreign Aff.	26
	<ul style="list-style-type: none"> ▶ Opinion tracking and rumor detection 	Communication CIC	10

EMERGENCY PHASE (CONTINUED)

Work with international and European partners	▶ Assessment of the country's needs and offer of international assistance through the IAEA or bilaterally	Foreign Aff. + ASN	12
	▶ Monitoring of, and information on, the consumption and exportation of unaffected products and imports from affected countries	Agriculture + Economy	20
Allow economic and social continuity	▶ Assessment of the potential consequences on businesses and imports	Economy	

RESOLUTION OF THE EMERGENCY

Protect people, the environment and property	▶ Implementation of additional countermeasures or changes to the previous actions (including the lifting of measures) or even repatriation of French nationals present in the country	Foreign Aff. + Health	6
	▶ Setting-up of reception centres for French nationals in the foreign country or repatriated nationals	Interior + Health	25
Provide health assistance	▶ Health assistance to French nationals in the foreign country or of repatriated nationals	Health + Interior + Foreign Aff.	18
	▶ Registration of French nationals in the foreign country or of repatriated nationals	Interior + Health + Foreign Aff.	19
	▶ Implementation of epidemiological monitoring and monitoring of French nationals in the foreign country or of repatriated nationals	Health + Foreign Aff.	39

**RESOLUTION
OF THE
EMERGENCY**
(CONTINUED)


<p>Work with international and European partners</p>	<p>▶ Assessment of the country's post-accident needs and offer of assistance through the IAEA or bilaterally</p>	<p>Foreign Aff. + ASN + Interior</p>	<p>12</p>
<p>Allow economic and social continuity</p>	<p>▶ Implementation of radiological inspections of materials, manufactured goods, foodstuffs and imports</p>	<p>Agriculture + Economy + Industry</p>	<p>29</p>
<p>Begin land reclamation measures</p>	<p>▶ Adapted monitoring of environmental radioactivity</p>	<p>ASN + IRSN</p>	<p>36</p>

Offshore accident

WHAT YOU SHOULD KNOW: response characteristics and strategy

- 1 Vessels propelled by nuclear power or carrying nuclear materials or radioactive substances may be involved in an accident while at sea (damage, collision, grounding). These accidents may result in releases into the sea and/or the air.
- 2 The emergency-response conditions depend on the status of the marine waters where the event occurs. In the event of a release, existing international agreements must be implemented without delay.
- 3 Marine currents and the weather have a strong impact (wind, sea conditions). Releases near coastlines may have consequences on land. Releases that occur far out at sea may be greatly diluted and the consequences on land very likely to be limited.
- 4 Given the international implications, the national emergency-response organization may be activated rapidly. The General Secretariat for the Sea is associated. The national emergency-response organization involves the maritime prefect(s) of the area affected by an accident (PreMar for mainland France or the government delegate for government action at sea). International partners must be alerted quickly.
- 5 Management of such accidents may involve rescuing people, assisting vessels in distress and accommodating disabled vessels in ports.



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- 6 Radiological inspections may focus on seafood.
 - 7 If the release reaches land, the maritime prefect coordinates with the prefects of the affected departments.

QUESTIONS FOR CONSIDERATION

Questions the government should first ask the local authorities

- 1 What is the status of the marine waters where the event is occurring?
- 2 What is the nationality of the vessel? Who is the shipowner or charterer? What type of cargo or fuel is being carried?
- 3 If a foreign country is affected, has a mutual channel of information been established with it?
- 4 Is the release immediate or delayed? If it is delayed, what is the time window for action? Could the release reach the shoreline? If yes, have protective measures been taken or need to be taken on land?
- 5 Are there other vessels that may be affected by a potential impact of the accident? Have they been informed?
- 6 Have measures restricting or prohibiting navigation been taken?
- 7 Does the vessel involved in the accident require assistance? Does the crew need to be rescued?
- 8 Should access to ports or the sea be restricted?

Offshore accident

Flow chart of possible measures

Confirm the first-response actions that may have been completed

- ▶ Procedure for alerting the public authorities. Activation of the link between the maritime prefect and the departmental prefect.
- ▶ Public-protection actions (no-go zone, alert, shelter-in-place) (ORSEC, public safety, etc.) in the **on-land area**
- ▶ Implementation of emergency procedures **at sea**. Implementation of the maritime ORSEC and NUCMAR plans – ISM Code
- ▶ Upholding of law and order, protection of shipping lanes, routes and places in the affected area **on land**
- ▶ Route instructions for ground, inland waterway, maritime and air transport operations (affected areas)
- ▶ Implementation of cross-border agreements and harmonisation of countermeasures.

EMERGENCY PHASE

OBJECTIVE	MEASURE	MAIN MINISTRIES OR ENTITIES ACCOUNTABLE FOR THE MEASURE IN CIC	SHEET
<p>Ascertain, assess and anticipate the situation 1st review of the situation and verifications</p>	▶ Activation of the national emergency management organization (including information/communication)	PM	1
	▶ Activation of the diplomatic and consular network in the affected country or countries	Foreign Aff.	
	▶ Review of information about the facility and the environment; diagnosis & prognosis (transported materials, developments in the safety of the ship and radiological consequences) (offshore, on land)	ASN (D) + IRSN + Sea	2
	▶ Assessment of the condition of the crew of the affected vessel and of other nearby crews or passengers who may be affected at the scene	Sea	4
	▶ Communication of information to response teams for better local management of the emergency on land	Interior	
	▶ Implementation of the legal investigative process	Justice	21

**EMERGENCY
PHASE
(CONTINUED)**

Protect people, the environment and property	<ul style="list-style-type: none"> ▶ Protective actions: crew and other vessels at the scene and affected areas on land (protection of people: public alert/shelter-in-place/evacuation/iodine/activity restrictions, etc.) 	Interior + Sea + Health	6
	<ul style="list-style-type: none"> ▶ Restrictions and bans on the consumption of possibly contaminated foodstuffs and enforcement of distribution bans (imports) and management of imports and exports 	Agriculture + Economy	16
	<ul style="list-style-type: none"> ▶ Restrictions and bans on the use of possibly contaminated manufactured goods and materials and enforcement of distribution bans and management of imports and exports 	Industry + Economy	17
Provide health assistance	<ul style="list-style-type: none"> ▶ Registration of affected people (affected area on land), other nearby crews or passengers 	Interior + Health + Foreign Aff.	19
	<ul style="list-style-type: none"> ▶ Health assistance to crews or other nearby passengers 	Sea + Health	18
	<ul style="list-style-type: none"> ▶ Health assistance to people in the affected area on land 	Health + Interior	18
Inform and communicate with the various publics	<ul style="list-style-type: none"> ▶ Information of the public in France/abroad, depending on the case 	Communication CIC + Foreign Aff.	9
	<ul style="list-style-type: none"> ▶ Opinion tracking and rumor detection 	Communication CIC	10
Work with international and European partners	<ul style="list-style-type: none"> ▶ Mandatory notification and information of international partners via the IAEA and the WHO and European partners via EU and border partners 	ASN + Foreign Aff. + Health + ASND + Interior	11
	<ul style="list-style-type: none"> ▶ Offer of international assistance through the IAEA, or under bilateral agreements or via maritime networks (depending on the case) 	Foreign Aff. + ASN + Health	12
	<ul style="list-style-type: none"> ▶ Needs assessment and request by France for international assistance from international (via the IAEA) or border partners for consequences on land or sea rescue 	Foreign Aff. + ASN + Interior + Health	12

EMERGENCY PHASE (CONTINUED)

Allow economic and social continuity

- ▶ Assess the potential consequences on shipping companies, ports or on land
- ▶ Encourage the implementation of measures allowing key activities to continue and secure businesses that may pose a risk in the affected area on land and/or the shipping companies concerned or affected
- ▶ Monitoring of, and information on, the consumption and exportation of unaffected products (if impact on land) and imports from affected or otherwise impacted areas

Economy + Sea

Economy + Industry + Labour

13

Agriculture + Economy

20

RESOLUTION OF THE EMERGENCY

Protect people, the environment and property

- ▶ Implementation of initial post-accident zoning (affected area on land)
- ▶ Decision whether to relocate people, keep them in the area or allow them to return (affected area on land)
- ▶ Upholding of law and order; protection of places and traffic control (affected area)
- ▶ Assistance to the affected vessel
- ▶ Setting-up of reception centres (affected area on land)

Interior + Health

22

Interior + Health + Housing

23

Interior + Sea

24

Interior + Sea

27

Interior

25

Provide health assistance

- ▶ Implementation of epidemiological monitoring (affected on-land areas) and monitoring of crews and passengers

Health

39

**RESOLUTION
OF THE
EMERGENCY**
(CONTINUED)

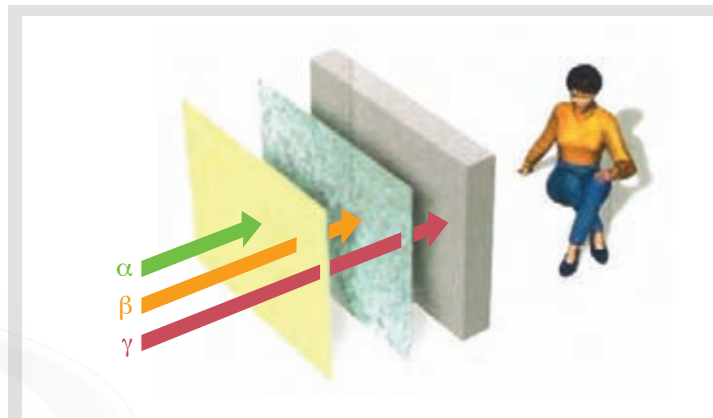
<p>Work with international and European partners</p>	<p>▶ Notification of the lifting of measures through the IAEA or bilaterally</p>	<p>Foreign Aff. + ASN + Health</p>	<p>11</p>
	<p>▶ Implementation of extreme-emergency relief funding and preparation of indemnification procedures (affected area on land)</p>	<p>Economy</p>	<p>28</p>
<p>Allow economic and social continuity</p>	<p>▶ Implementation of radiological inspections of materials, manufactured goods, foodstuffs (affected area on land or at sea) and imports and exports</p>	<p>Agriculture + Economy + Industry</p>	<p>29</p>
	<p>▶ Implementation of a programme for measuring environmental contamination in the affected areas (affected area on land at sea)</p>	<p>Interior</p>	<p>30</p>
<p>Begin land reclamation measures</p>	<p>▶ Adapted monitoring of environmental radioactivity in areas not significantly impacted by the accident</p>	<p>ASN + IRSN</p>	<p>36</p>
	<p>▶ First contamination-mitigation actions (affected area on land)</p>	<p>Ecology + Interior</p>	<p>31</p>
	<p>▶ Preparation for waste management (affected area on land)</p>	<p>Ecology</p>	<p>32</p>
	<p>▶ First agricultural-management actions (affected area on land)</p>	<p>Agriculture</p>	<p>33</p>
	<p>▶ Management of workers (long-term exposure) (affected area on land)</p>	<p>Labour</p>	<p>34</p>
	<p>▶ Support of civil society in post-accident management as part of efforts to get stakeholders involved (affected area on land)</p>	<p>Interior</p>	<p>35</p>

Radioactivity – units and dose limits

1 RADIOACTIVITY

The nuclei of some atoms that make up the molecules of matter are unstable, i.e. they spontaneously transform into different nuclei. During this transformation they lose neutrons and protons (or they 'disintegrate' or 'decay') and emit various types of alpha, beta or gamma radiation. This is radioactivity.

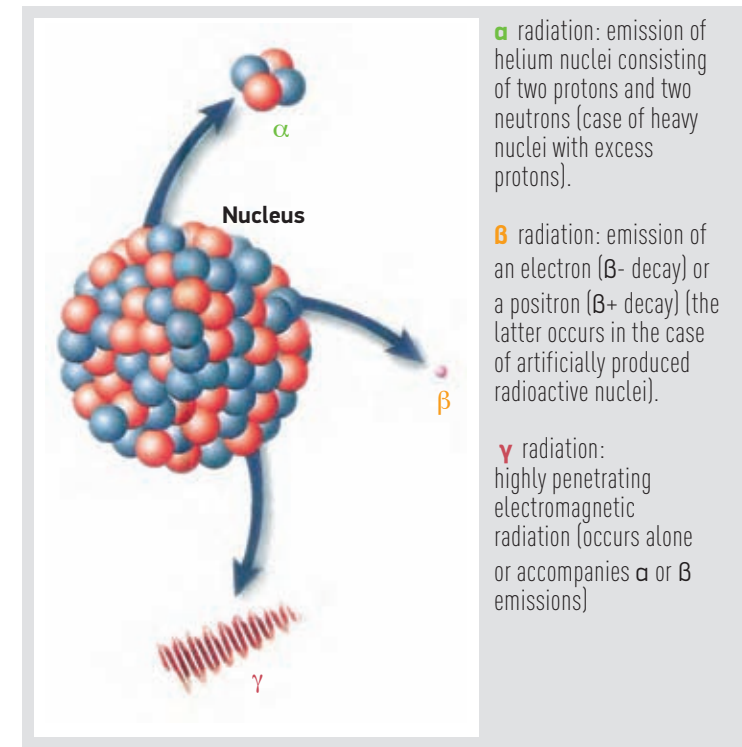
Radioactive nuclei (such as iodine-131) are radionuclides. Radioisotopes are elements that are composed entirely of radioactive isotopes. An example is uranium, which has three isotopes (uranium-235, uranium-238, and uranium-234), all of which are radioactive.



Alpha radiation travels only a few centimetres in air and can be stopped by a sheet of paper.

Beta radiation travels a few metres in air and can be stopped by a sheet of aluminium.

Gamma radiation can travel up to several dozens of metres in air and can be stopped only by a very thick layer of lead or concrete.



α radiation: emission of helium nuclei consisting of two protons and two neutrons (case of heavy nuclei with excess protons).

β radiation: emission of an electron (β⁻ decay) or a positron (β⁺ decay) (the latter occurs in the case of artificially produced radioactive nuclei).

γ radiation: highly penetrating electromagnetic radiation (occurs alone or accompanies α or β emissions)

A radioactive substance is therefore made up of atoms whose nuclei spontaneously disintegrate and release specific radiation with a specific energy. The time taken by half a substance's nuclei to disintegrate is called **radioactive half-life (T)**.



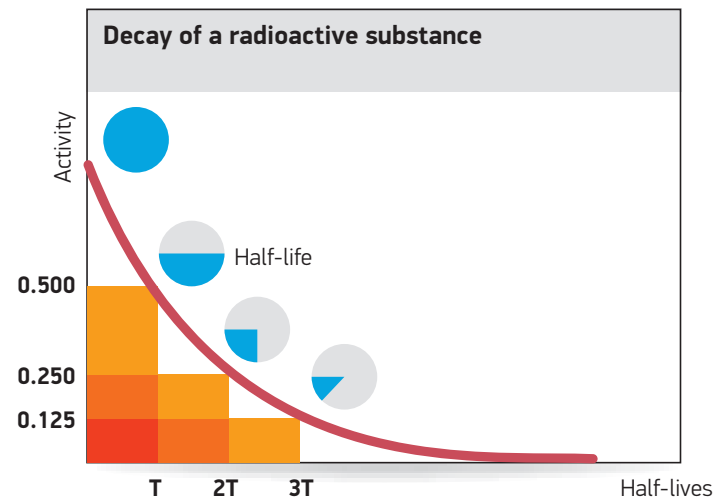


The radioactive half-life (T) varies greatly by type of radionuclide, as shown below:

- ▶▶ 8 days for iodine-131 (β γ emitter)
- ▶▶ 5 years for cobalt-60 (β γ emitter),
- ▶▶ 12 years for tritium (β emitter)
- ▶▶ 30 years for caesium-137 (β γ emitter)
- ▶▶ 24,000 years for plutonium-239 (α emitters)
- ▶▶ 704 million years for uranium-235 and 4.5 billion years for uranium-238 (α emitters)
- ▶▶ more than 1 billion years for potassium-40 (β emitter), which is naturally present in the human body.

After one half-life, radioactivity (which corresponds to the number of disintegrations per unit of time and at a given moment) is **divided in half**. After two half-lives, **it is divided by 4**, and so on. Thus, after ten half-lives have elapsed, radioactivity **is divided by more than one thousand**.

Thus, radioactivity disappears either quickly, in the case of short-lived radionuclides, or very slowly, in the case of very long-lived radionuclides.



2 UNITS OF MEASURE

There are **three units of measure** that correspond to three different aspects of radioactivity.

a. The becquerel, which is used to measure radioactivity

The becquerel (Bq) is the unit used to measure the activity of a radionuclide. A radioactive substance (or a radioactive source) is said to have a radioactivity (or activity) of one becquerel (1 Bq) when it emits one burst of radiation per second.

- ▶▶ 1 Bq equals one atom disintegration per second

b. The gray, which is used to measure the absorbed dose

When radiation passes through matter, it strikes the atoms in the material concerned. In doing so, it transfers its energy to these atoms, which become ionised, or excited by this supply of energy. These disruptions are what cause the effects of radiation on both living and non-living matter.

The energy deposited by this ionising radiation triggers a series of interactions with the atoms found along their path. The quantity of energy deposited in one kilogram of matter is called the absorbed dose (D) and is measured in gray.

- ▶▶ 1 gray equals 1 joule per (1 Gy = 1 J/kg)

c. The sievert is used to measure the effects of radiation on health

The energy deposited by radiation in living tissues induces lesions in some of the cells of these tissues.

These biological lesions depend on:

- ▶▶ the quantity of energy transferred, i.e. the absorbed dose;
- ▶▶ the type of radiation (e.g. neutrons are more damaging than gamma rays);

▶▶▶

- ▶▶ the type of exposed tissue; the body's organs are more or less sensitive to radiation (e.g. bone marrow is around 10 times more sensitive than skin).

Depending on the dose received, these lesions can lead to early biological effects (redness, burns, etc.) as well as late effects (risk of radiation-induced cancers, etc.).

The absorbed dose, which is measured physically using a detector (or dosimeter), cannot be used alone to assess the late biological effects of radiation exposure. As a result, in order to assess these effects, a weighting factor specific to the type of radiation being measured must be applied to the absorbed dose. Basically, the absorbed dose (measured in grays) is multiplied by this weighting factor to obtain a measurement of the equivalent dose in sieverts (Sv). This dose is weighted by a second weighting factor that indicates the relative extent of the effects that may occur in the tissues that absorbed the dose. It is an output of the risk modelling, which is expressed in sieverts (Sv) and is known as the effective dose. The effective dose is the overall damage or risk associated with exposure to low doses of ionising radiation.

3 THE VARIOUS TYPES OF EXPOSURE TO IONISING RADIATION

a. External exposure

Exposure to radiation from a source or ionising radiation located outside the body. Depending on its type and energy, the radiation emitted by the source irradiates all or part of the body. External exposure is influenced by the following factors:

- ▶▶ the type of radiation emitted (α , β , γ , etc.),
- ▶▶ distance in relation to the source,
- ▶▶ duration of exposure.

b. Internal exposure (or radioactive contamination from radionuclides) and external skin exposure

The radiation source is in direct contact with the skin or the inside of the body:

- ▶▶ In skin contamination (external exposure), skin is irradiated by direct contact with radioactive particles that settle on its surface. Depending on the energy of the radiation emitted by these radionuclides, underlying tissues may also be irradiated;
- ▶▶ Internal contamination is caused by the entry of radioactive elements into the body via ingestion (contaminated water or food), inhalation (contaminated air) or contaminated wounds. Inhaled or swallowed radioactive elements circulate through the body and are taken up more or less permanently by some organs. Internal radioactivity persists in the body until the absorbed radionuclides are excreted and/or physically by radioactive decay. There are treatments that accelerate the elimination of absorbed radionuclides. (For example, Prussian blue is used to promote elimination of caesium).

The key factors to be kept in mind in the case of internal contamination include:

- ▶▶ the radionuclide,
- ▶▶ the effective half-life, or the time taken for the activity of a radionuclide to halve as a result of radioactive decay and the time taken by the affected organ to biologically eliminate the radionuclide.

4 REGULATORY DOSE LIMITS AND RESPONSE LEVELS IN THE EVENT OF A RADIOLOGICAL EMERGENCY

Annual dose limits (effective dose, all exposure pathways) for workers and the general public are set by French regulations (French labour code and code of public health). These limits must be observed in

▶▶▶



the course of normal nuclear facility operations (i.e. non-accident situations):

- ▶▶▶ the annual effective dose limit for the general public is 1 mSv, excluding doses from background radioactivity and doses received for medical purposes;
- ▶▶▶ the annual effective dose limit for workers exposed to ionising radiation in the course of their duties is 20 mSv for category-A workers and 6 mSv for category-B workers.

These regulations also mandate that the doses received by the general public and radiation workers be kept at a level as low as reasonably achievable below these limits (optimisation principle).

These regulatory limits – which are not hazard thresholds – do not apply to radiological emergencies. In such situations, French regulations stipulates that public-protection measures be implemented according to response level. In France, these response levels are set by regulations:

- ▶▶▶ shelter-in-place: an effective dose of 10 mSv;
- ▶▶▶ evacuation: an effective dose of 50 mSv;
- ▶▶▶ stable-iodine prophylaxis: an equivalent dose of 50 mSv to the thyroid.

In the event of a radiological emergency, the authorities will use these response levels, compared to the estimated projected doses likely to be received rapidly by populations exposed to the radioactive releases, to identify the appropriate emergency countermeasures and map out the affected areas. **These response levels must not be regarded as limits. Furthermore, the optimisation principle still applies in such situations.** Depending on the implementation possibilities or the specific conditions at the time (adverse weather, logistical constraints, safety of people), the authorities should decide which actions to take to maintain the received doses at a level as low as reasonably achievable.

In regard to emergency-response personnel, the French code of public health splits them into two groups for the purposes of determining the conditions of their selection, training and medical and radiological supervision:

- ▶▶ Personnel in charge of training existing special technical, medical or health management teams in responding to radiological emergencies. The effective dose likely to be received by this personnel in the course of their duties must not exceed 100 mSv. This limit is increased to 300 mSv when response measures are aimed at protecting people;
- ▶▶ Persons who are not members of a special team but who respond to emergencies in the course of their normal duties. The effective dose likely to be received by these persons is limited to 10 mSv.

5 THE EFFECTS OF IONISING RADIATION ON PEOPLE

a. Consequences of exposure

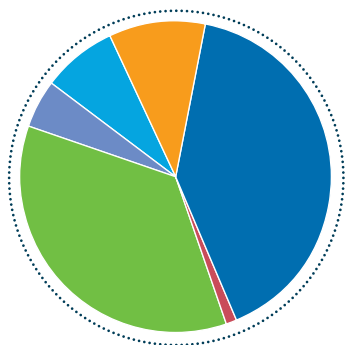
The consequences of exposure to ionising radiation vary based on:

- ▶▶ the dose rate and the received dose,
- ▶▶ the type of radiation (alpha, beta, gamma, neutrons),
- ▶▶ the anatomical site and the affected body area,
- ▶▶ the type(s) of affected tissue,
- ▶▶ external or internal exposure (such as contamination via inhalation or ingestion).

Exposure to ionising radiation has **two effects** on people:



Breakdown of the average individual annual doses in France:



- 40% Medical exposure
- 1% Nuclear testing and industry
- 35% Radon (natural radioactive gas)
- 5% Mineral water and food
- 7.5% Cosmic radiation
- 10% Terrestrial radiation

▶▶▶

b. Deterministic effects

These effects appear only after a certain level of exposure (dose threshold level that varies depending on the effect). They occur soon after exposure (from several hours to a few weeks afterward).

The following are observed as the level of exposure increases:

- ▶▶ Changes in complete blood count (especially a drop in the white blood cell count, leading to increased susceptibility to infection),
- ▶▶ Onset of various symptoms of sickness: nausea, vomiting, fever, agitation, prostration and potentially fatal coma. In the event of localised irradiation, exposed individuals may develop erythema (skin redness) that may progress to necrosis of the affected tissues,
- ▶▶ Inevitable death after a certain level of exposure.

c. Stochastic, or random, effects

These effects do not systematically occur in all exposed individuals and are not specific to exposure.

The higher the received dose, the likelier these effects are to occur in an individual exposed to ionising radiation. A threshold for the onset of these effects has yet to be demonstrated.

These effects appear long after exposure (several years) and are primarily radiation-induced cancers and, to a lesser degree, genetic abnormalities.



Definition and enforcement of maximum permitted levels (MPLs) in foodstuffs following a nuclear accident

1 GENERAL BACKGROUND

In the event of a nuclear accident, consumption of foodstuffs contaminated by atmospheric radioactive fallout may be a major exposure pathway that must be taken into account in order to protect local populations. The onus is on each country to establish its own public-protection doctrine that incorporates the management of contaminated foodstuffs.

Trade relations between countries mean that populations living far away from an accident-stricken site may also be affected if they consume contaminated foodstuffs. International recommendations have been issued on the distribution of foodstuffs from accident-stricken countries. These recommendations are based primarily on levels expressed in activity concentration (Bq kg⁻¹ or Bq L⁻¹) beyond which a foodstuff may not be distributed for consumption. In the European Union, these levels are referred to as Maximum Permitted Levels (MPLs).

2 DEFINITION OF MPLS IN THE EUROPEAN REGULATION

In the aforementioned general context, MPLs have been defined to regulate trade between EU Member States (intra-Community trade) or with third countries (importation) following a nuclear accident resulting in varying degrees of contamination of food products intended for distribution. As a result, contaminated foodstuffs may neither be imported into nor distributed within the Community market

unless these MPLs are met. This policy helps to prevent unnecessary doses in European consumers living far from the site of a nuclear accident.

Established after the Chernobyl accident, these MPLs are based on an acceptable dosimetry reference level applied to a scenario of contaminated-foodstuff consumption in the daily life of the average European consumer living far from the Chernobyl site. The assumption is that the proportion of contaminated foodstuffs from the stricken country contained in the person's food intake remains limited due to the geographic distance. Furthermore, contrary to the populations of the countries affected by the accident (EU or third countries), Europe's citizens are not believed to be exposed to the other exposure pathways to which the people living in the contaminated areas are subjected.

3 THE VARIOUS APPLICABLE EU INSTRUMENTS

Applicable standards on contaminated food within the European Union are based on either the Euratom Treaty or the EU treaty (which replaced the EC Treaty). **They are transposed into regulations and thus must be enforced by the Member States of the European Union.**



▶▶▶

A first set of regulations covers the current consequences of past accidents **in terms of trade flows from a third country to EU Member States.**

- ▶▶ Post-Chernobyl regulation EEC No. 737/90 and post-Fukushima regulations EU No. 250/2012 and EU No. 284/2012 were published based on the EC Treaty then the EU Treaty. **They frame the conditions for the importation to the EU** of agricultural products from third countries affected by the Chernobyl accident and the Fukushima-Daiichi accident, respectively, by defining maximum contamination tolerances or limits for imported foodstuffs.
- ▶▶ Pending a new accident within the EU, there are no Community instruments on the radiological quality of foodstuffs used in trade relations between Member States. At the time of publication,

regulation EC No. 737/90 governing imports from third countries affected by the Chernobyl accident is, by default, still being enforced 23 years after being published.

A second set of regulations was defined to address a **future accident in terms of trade between EU Member States or with third countries.**

- ▶▶ Regulation (Euratom) No. 3954/87 is based on the Euratom Treaty. It sets maximum permitted levels (MPLs) in foodstuffs and feedingstuffs (see Table 1) to reduce the exposure of populations throughout the European Union following a nuclear accident or any other case of radiological emergency that may occur in the future in a European Union country or a third country.

▶▶▶

Table 1:
MPLs defined by Council Regulation (Euratom) No. 3954/87

RADIONUCLIDES	BABY FOODS ^(*)	DAIRY PRODUCE ^(**)	LIQUIDS INTENDED FOR HUMAN CONSUMPTION ^(***)	OTHER FOODSTUFFS ^(****)
Alpha-emitting isotopes of plutonium and transplutonium elements, (notably ²³⁹Pu and ²⁴¹Am)	1	20	20	80
Isotopes of strontium (notably ⁹⁰Sr)	75	125	125	750
Isotopes of iodine (notably ¹³¹I)	150	500	500	2000
All other nuclides of half-life greater than 10 days (notably ¹³⁴Cs and ¹³⁷Cs)	400	1000	1000	1250

^(*) Staple foods meeting the entire dietary needs during the first 4 to 6 months of life and marked as food preparation for infants.

^(**) Milk and cream (concentrated or not, with or without added sugar or other sweetener).

^(***) Water, fruit or vegetable juices, alcoholic beverages, vinegar.

^(****) Meats, cereals, fruits and vegetables.

^(*****) Foods making up only a very small part of the population's diet.



- ▶▶ Based on the EC Treaty, Council Regulation (EEC) No. 2219/89 regulates the exportation of foodstuffs to third countries, by means of MPLs set by the Euratom Treaty, following a nuclear accident or any other case of radiological emergency that in the future may occur in an EU country or affect its territory.

In the event of a new accident, the MPLs in Council Regulation (Euratom) No. 3954/87 must systematically be applied within 24 hours of the occurrence of the accident by means of publication of an implementing regulation valid for 3 months. During this three-month validity period the European Commission must review the suitability of the MPLs as defined by this regulation and, where necessary, reassess them based on the specific nature of the accident.

4 CHANGES IN MPLS OVER TIME: EXAMPLE OF MANAGEMENT OF THE CONSEQUENCES OF THE FUKUSHIMA-DAIICHI ACCIDENT

After the Fukushima-Daiichi accident, the EU's Member States quickly implemented the MPLs set out in Council Regulation (Euratom) No. 3954/87 as part of efforts to monitor imports of foodstuffs from Japan into Europe. When Japan revised its standards downward, the EU defined new maximum levels pursuant to regulations EU No. 250/2012 then EU No. 284/2012 by aligning them with the Japanese values each time they were revised.

In Europe, this lowering of the maximum levels is not warranted in pure terms of radiation protection considering that, for a consumption level that at most is equivalent to that before the accident, the contamination of foodstuffs from Japan has continued to drop primarily through radioactive decay and inspections conducted by the Japanese authorities. It should be noted that the lowering of food standards in Belarus after the Chernobyl accident did not lead to any revisions in the maximum tolerance levels applied in the EU.

A nationwide revision of food standards, such as that which took place in Japan after the Fukushima-Daiichi accident, may be implemented as part of efforts to better protect people living in areas directly contaminated by an accident. However, this is more of a matter of the MPLs insofar that, by design, they are set for areas located far from the location of the accident.

After the Chernobyl accident, the Norwegian authorities (not a member of the EU) raised their food standards on reindeer meat, considering that the corresponding risk was negligible (low dosimetry) and that it was a staple of the Sami diet.

5 THE PLACE OF MPLS IN THE OVERALL MANAGEMENT OF FOOD RISKS FOLLOWING A NUCLEAR ACCIDENT OR A RADIOLOGICAL EMERGENCY IN FRANCE

In their scope of application, i.e. for populations living far from the site of an accident and consuming only a small portion of contaminated foodstuffs imported from a country affected by the accident, the Maximum Permitted Levels in the Euratom Regulation are not, strictly speaking, health standards. They are indicators of the radiological quality, at a given moment, of foodstuffs circulating throughout the Community market or imported from third countries or exported from an EU country. Because of the assumptions used to create them and the small likelihood that individuals living far from the scene of an accident would regularly consume contaminated foodstuffs, particularly at MPL levels, it is clear that this system is conservative in nature. EU compliance with the MPLs ensures to all EU citizens that their exposure from the consumption of foodstuffs from contaminated areas is well below the dose limits. By extension, an individual who may occasionally eat foodstuffs having contamination levels above the MPLs would therefore not be exposed to a significant risk.





As these MPLs are instituted by EU regulations, they must be enforced in all EU Member States. However, if a nuclear accident or a radiological emergency were to occur in a European country, food-risk management based solely on comparison with the MPLs would be suitable only for national populations living far from the accident-stricken site. Indeed, the nearer populations requiring protection are to an accident-stricken site, the higher the likelihood that contaminated foodstuffs might be distributed locally. The proportion of the other exposure pathways, particularly external irradiation, would also increase.

These considerations prompted the CODIRPA (interministerial steering committee for the management of the post-accident phase of a nuclear accident or a radiological emergency) to propose a more comprehensive approach to the management of food risks in the country following an accident. This approach is based on a three-pillar system designed to strike a balance between protection of the public, protection of the quality of crops and the economic potential of areas.

► The radiological risks from foods must be managed in a specific way in areas located near accident-stricken sites and thus where food contamination is highest. In these areas, inspecting foodstuffs with reference to the MPLs would not make it possible to sufficiently protect public health. Doing so would require setting up a population-protection zone (ZPP) based on guideline values expressed in projected doses. The distribution and consumption of all foodstuffs, irrespective of their contamination levels, would be banned in this zone;

► In areas where contamination is high but does not require implementing radiation-protection measures such as ZPPs, the challenge is no longer to manage the health effects of the situation. Rather, it is more to maintain the radiological quality of foodstuffs that might be distributed around the country and the EU and the preservation of the economic potential of areas. These areas would be grouped together in the ZST, or the heightened land-monitoring zone. Distribution of foodstuffs produced in this zone would be conditional on passing clearance tests based on EU MPLs. In addition to protecting local economies, defining such a zone would also help to protect French and European consumers from unnecessary doses.

► In the areas in France beyond the ZST, monitoring would have to be carried out to detect potential contamination concentrations that could result in sporadic exceedances of the MPLs.

The ZPP and the ZST would be established based on predictive modelling in order to pre-emptively manage the foreseeable consequences of radioactive fallout in the environment. These zones would then be reassessed over time and by taking into account increased knowledge in actual contamination levels in areas.

INES scale

In 1987 France created a severity scale for nuclear events much like the scales used to rate natural phenomena such as earthquakes, wind and avalanches. This scale provided much of the inspiration for the IAEA's INES scale.

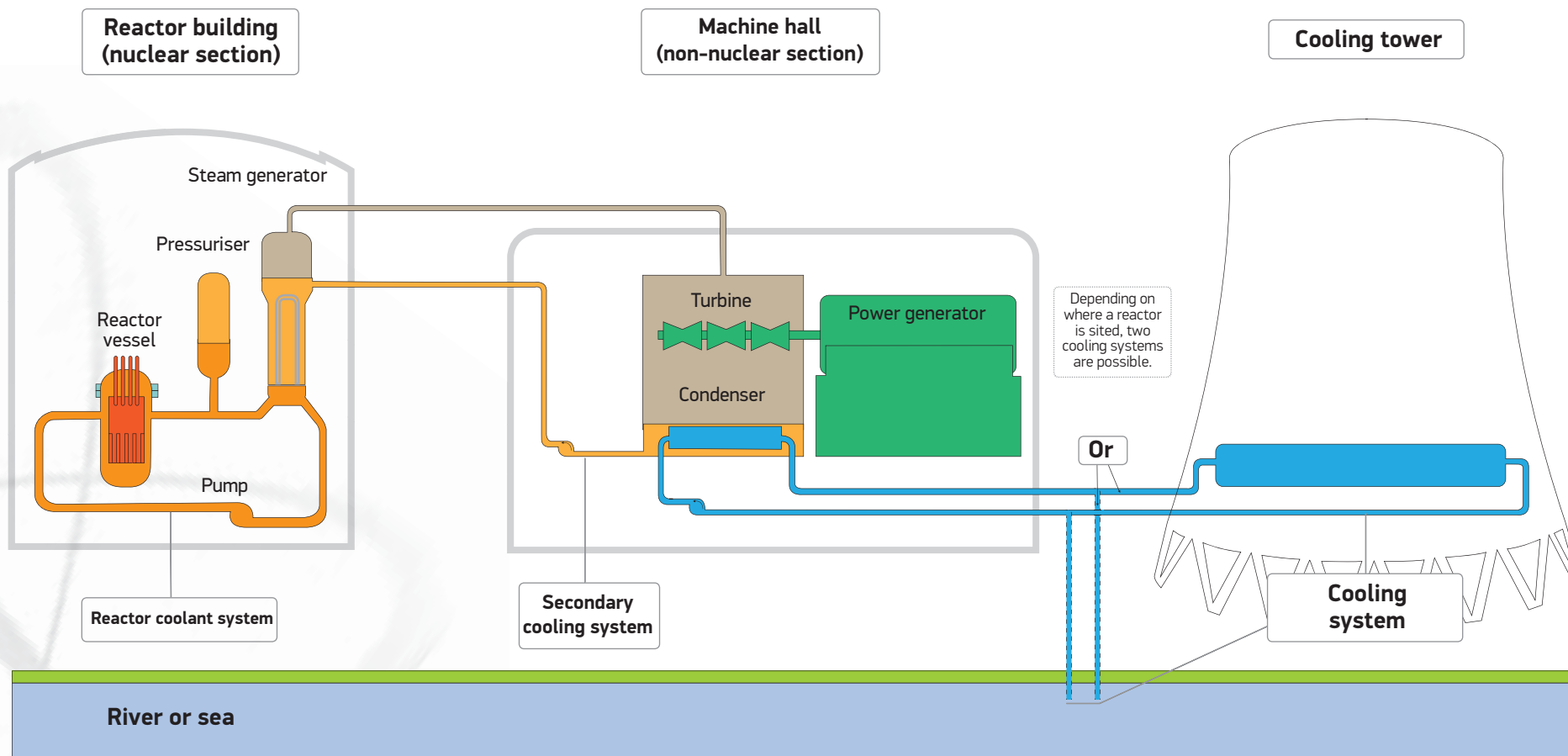
Used internationally since 1991, this scale is based on objective criteria and quality criteria. Used by sixty countries, it is designed to facilitate the media and the public's understanding of the significance of nuclear incidents and accidents.

The INES scale is not a tool for assessing or measuring nuclear safety and radiation protection and cannot be used as a basis for determining indemnification or penalties.

It is not intended to be used for international comparison purposes. In particular, it cannot be used to establish a causal relationship between the number of reported incidents and the likelihood of a severe accident occurring at a facility.

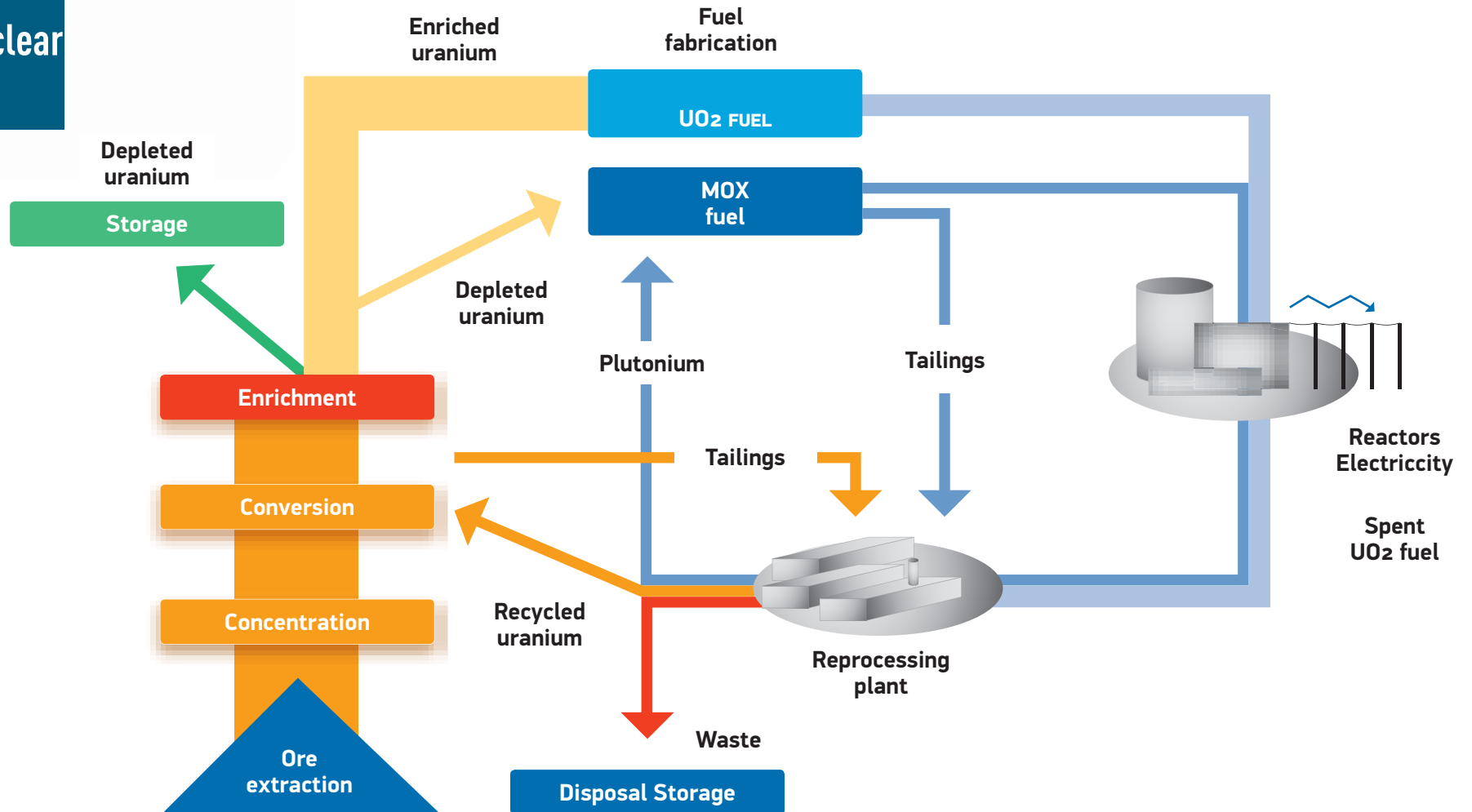
IMPLEMENTATION	OFF-SITE CONSEQUENCES	ON-SITE CONSEQUENCES	DEFENSE IN DEPTH DEGRADATION
7 Major Accident	Major release: considerable effects on health and the environment		
6 Serious Accident	Significant release likely to require implementation of all planned countermeasures		
5 Accident	Limited release likely to require implementation of some planned countermeasures	Severe damage to reactor core/ radiological barriers	
4 Accident	Minor release: public exposure within the specified limits	Significant damage to reactor core/ radiological barriers/death of a worker from radiation exposure	
3 Serious incident	Very low release: public exposure amounting to at least one percentage point of the limits set by the IAEA guide*	Severe contamination/acute effects on a worker's health	Near-miss/loss of barriers
2 Incident		Significant contamination/overexposure of a worker	Incidents with significant failures in safety provisions
1 Anomaly			Anomaly beyond the authorised operating regime
0 Deviation		No safety significance	
Below-scale event	No safety significance		

Diagram of a nuclear power plant



The nuclear fuel cycle

Diagram of the stages of the nuclear fuel cycle



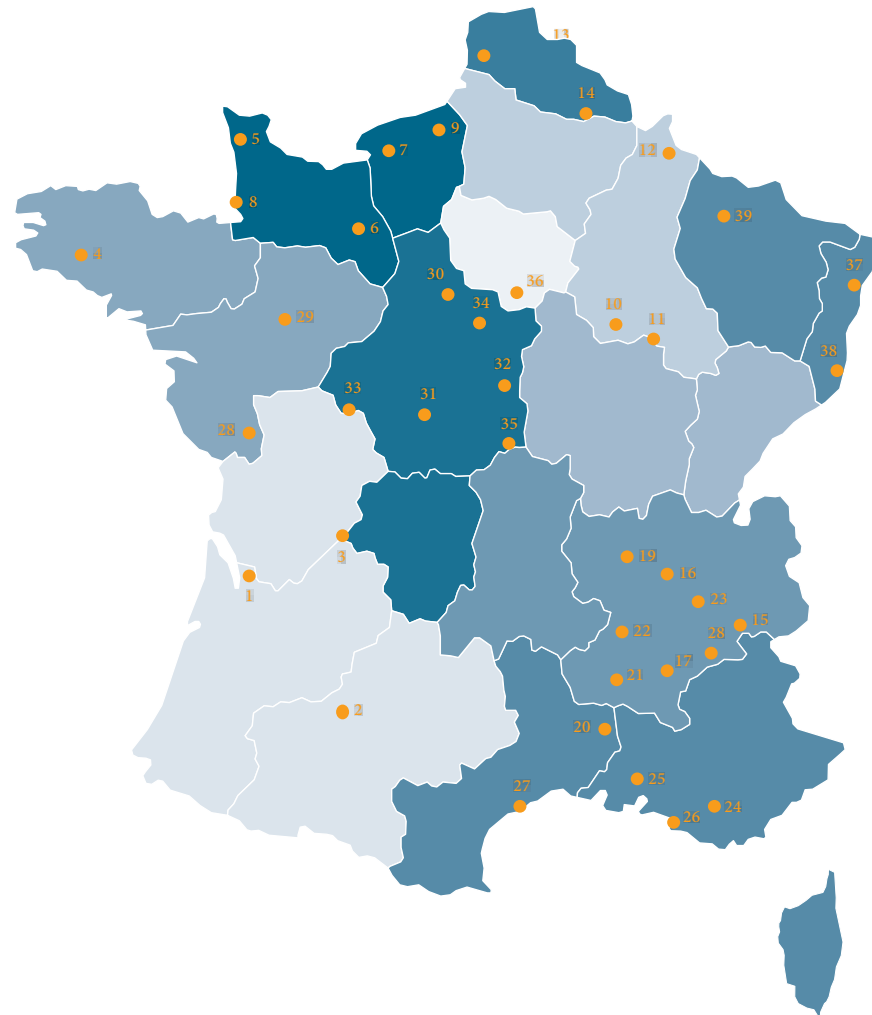
Map of basic nuclear facilities (INBs) in France

Basic nuclear facilities in France:

- | | |
|------------------------|------------------------------|
| 1. Blayais ▲ | 23. Creys-Malville ▲ |
| 2. Golfech ▲ | 24. Cadarache ● |
| 3. Civaux ▲ | 25. Marcoule ▲🌿● |
| 4. Brennilis ▲ | 26. Marseille ○ |
| 5. La Hague 🌿■ | 27. Narbonne 🌿 |
| 6. Caen ○ | 28. Pouzauges ○ |
| 7. Paluel ▲ | 29. Sablé-sur-Sarthe ○ |
| 8. Flamanville ▲ | 30. Saclay ● |
| 9. Penly ▲ | 31. Saint-Laurent-des-Eaux ▲ |
| 10. Nogent-sur-Seine ▲ | 32. Dampierre-en-Burly ▲ |
| 11. Soulaïnes-Dhuys ■ | 33. Chinon ▲ |
| 12. Chooz ▲ | 34. Orsay ●○ |
| 13. Gravelines ▲ | 35. Belleville-sur-Loire ▲ |
| 14. Maubeuge ○ | 36. Fontenay-aux-Roses ● |
| 15. Grenoble ● | 37. Strasbourg ○ |
| 16. Bugey ▲ | 38. Fessenheim ▲ |
| 17. Romans-sur-Isère 🌿 | 39. Cattenom ▲ |
| 18. Veurey-Voroize 🌿 | |
| 19. Dagneux ○ | |
| 20. Tricastin ▲🌿○ | |
| 21. Cruas-Meyssse ▲ | |
| 22. Saint-Alban ▲ | |

Facility type

- ▲ Nuclear power plants
- 🌿 Plants
- Research centres
- Waste disposal facility
- Other



Map of nuclear power reactors in Europe



GLOSSARY

AREVA: French nuclear group.

ARS: *Agence Régionale de Santé* – regional health agency.

ASN: *Autorité de Sûreté Nucléaire* – Civil Nuclear Safety Authority.

ASND: *Autorité de Sûreté Nucléaire de Défense* – Nuclear Safety Authority for Defense-Related Facilities and Activities.

BCP: business continuity plan.

BVA: *bureau de veille et d'alerte* – monitoring and alert bureau of the SGDSN.

CAI: public reception and information centre set up as part of the post-accident doctrine.

CARE: reception and regroupment centre set up under the ORSEC plan.

CBRN plan: plan on chemical, biological, radiological and nuclear risks.

CCA: Crisis Coordination Arrangement, coordination arrangements for major emergencies or crises in the EU.

CCE: *cellule de continuité économique* – economic continuity unit of the minister of the economy.

CDC: *centre de crise* – emergency response centre of the Ministry of Foreign Affairs.

CEA: *Commissariat à l'énergie atomique et aux énergies alternatives* – Atomic Energy and Alternative Energies Commission.

CEA/DRI: International Relations Department of the CEA; the CEA's director of international relations is the French governor to the International Atomic Energy Agency (IAEA).

CIC: *cellule interministérielle de crise* – interministerial emergency-response unit.

CICNR: *comité interministériel aux crises nucléaires ou radiologiques* – interministerial committee for nuclear or radiological emergencies.

CMCP: Community Mechanism for Civil Protection.

CMIR: *cellule mobile d'intervention radiologique* – mobile radiological response unit.

CMVOA: *centre ministériel de veille opérationnelle et d'alerte (Environnement - Transport - Énergie)* – ministerial unit for operational monitoring and alerts (Environment-Transport-Energy).

COBER: *centre opérationnel de Bercy (Économie - Finance)*, operations centre of the Ministry of the Economy and Finance.

COD: *centre opérationnel départemental* – departmental operations centre.

CODIRPA: *comité directeur post-accidentel* – post-accident management steering committee.

COFRAC: *centre opérationnel de la fonction garde-côtes* – coast guard operations centre.

COGIC: *centre opérationnel de gestion interministérielle des crises* – interministerial emergency-management operations centre (Ministry of the Interior).

COP: *centre opérationnel police*, police operations centre (Ministry of the Interior).

CORRUSS/CCS: *centre opérationnel de réception et de régulation des urgences sanitaires et sociales/centre de crise sanitaire* – operations centre for the receipt and dispatch of health and humanitarian emergencies/emergency health unit.

COZ: *centre opérationnel de zone* – zone operations centre.

CPCO: *centre de planification et de conduite des opérations* – centre for the planning and conduct of operations (Ministry of Defense).

CRM: *centre météorologique régional spécialisé* – regional specialized meteorological centre.

CROGEND: *centre de renseignement et d'opérations de la gendarmerie nationale* – intelligence and operations centre of the national gendarmerie.

ECURIE: European Community Urgent Radiological Information Exchange.

EDF: *Electricité de France*.

ENSREG: European Nuclear Safety Regulators Group, a high-level group within the European Union on nuclear safety and waste management, comprising senior officials from safety authorities in the EU and the EC.

ESI: *équipement spécialisé d'intervention* – special emergency-response equipment.

ETSON: European Technical Safety Organizations Network.

HERCA: Heads of European Radiological protection Competent Authorities.

HFDS: haut fonctionnaire de défense et de sécurité – senior defense and security official.

HMT: hazardous material transport operations.

IAEA: International Atomic Energy Agency.

INB: *installation nucléaire de base* – basic nuclear facility. Due to their nature or the amount or activity of the substances used in them, INBs are subject to the Nuclear Security and Transparency Act of 13 June 2006 (TSN Act). They are authorised by decree following a public inquiry and the assent of the ASN. Their design, construction, operation (both at power and shutdown) and dismantling are regulated.

INBS: *installation nucléaire de base secrète* – basic nuclear facility classified as secret. Its classification as secret relates to French national defense.

INES: International Nuclear Event Scale. Used to inform the public of the extent of nuclear incidents and accidents in a straightforward manner.

InVs: *Institut de Veille Sanitaire* – national health-watch institute.

IRSN: *Institut de radioprotection et de sûreté nucléaire* – Institute for Radiation Protection and Nuclear Safety.

MAE: *ministère des affaires étrangères* – Ministry of Foreign Affairs.

MAE/ASD: *ministère des affaires étrangères, direction des affaires stratégiques, de sécurité et du désarmement* – Ministry of Foreign Affairs, Department of Strategic Affairs, Security and Disarmament.

NEA: Nuclear Energy Agency, a specialised agency within the Organization for Economic Cooperation and Development (OECD).

NPP: nuclear power plant.

NUCMAR plan: plan for dealing with nuclear risks at sea.

ORSEC: *organisation de la réponse de sécurité civile* – general emergency-response plan

PE: *périmètre d'éloignement*, relocation area implemented as part of the post-accident doctrine.

PM: prime minister.

PPI: *plan particulier d'intervention* – off-site emergency plan.

PUI: *plan d'urgence interne* – on-site emergency plan.

R&D: Research and Development.

RANET: Response and Assistance NETWORK.

SCFCAH: EU Standing Committee on the Food Chain and Animal Health.

SGDSN: *secrétariat général de la défense et de la sécurité nationale* – general secretariat for defense and national security.

SIG: *service d'information du Gouvernement* – government information service attached to the prime minister.

SPRA: *service de protection radiologique des armées* – French Army Radiological Protection Service.

TMR: radioactive material transport operations.

TSN Ast: French nuclear security and transparency act.

WANO: World Association of Nuclear Operators.

WENRA: Western European Nuclear Regulators Association.

WHO: World Health Organization.

WMO: World Meteorological Organization.

ZIPE: *zone d'intervention de premier échelon* (level-1 emergency response zone) of the CEA or AREVA.

ZPP: *zone de protection des populations* – population-protection zone within the framework of the post-accident doctrine.

ZST: *zone de surveillance renforcée des territoires* – heightened land-monitoring zone within the framework of the post-accident doctrine.