

## SUBJECT 10

### MANAGEMENT OF HAZARDS POSED BY THE PLANT

Being an industrial plant, the new Flamanville 3 unit contains intrinsically **dangers**. Firstly, the nuclear reactor contains radioactive substances, which lead to specific precautionary measures. Furthermore, the plant is also equipped with pressurized systems and rotating machines and contains chemical products used in its process. These dangers lead to **possible risks** in case of **failure** of equipment by dysfunction or hazard. The design and the operation of the plant are oriented to tackle all these risks by reducing the **probability of failure occurrence** and also the **consequences** of these failures outside the site. The more important the consequences may be, the lower the probability of event occurrence must be so that the risk can be acceptable.

Hazards management is integrated in the nuclear safety framework all along the life of the nuclear plants. It leads to introduce several successive defence lines to reach a high level of control.

The hazards identified for the Flamanville 3 unit are related both to the operating phase and to the building site.

#### Operating phase

During operation, the inventory of hazards takes into account the failures of the nuclear part of the plant and also of other equipment, which are necessary for the operation. For each hazard are defined:

- Initiating events : dysfunction of an equipment or internal (pipe break) or external (earthquake) hazard,
- Possible consequences outside the site and inside the site in terms of damage to the plant itself.

The interactions between the equipments of Flamanville 3 and the other units of the site presenting dangers are also taken into account in the risk analysis : impact of Flamanville 3 on Units 1 and 2 and the contrary.

There are three kinds of operating hazards:

- Internal hazards of a nuclear origin: initiation of a nuclear reaction outside production time, loss of reactivity control during production, loss of control of fuel cooling, dissemination of radioactive material, external exposure to the public,
- Internal hazards of a non-nuclear origin: fire, explosion, flood, mechanical shock (load drop, missile), loss of power supply (electrical loss), human error,
- External hazards: earthquake, external flooding, extreme weather conditions, lightning and electromagnetic interference, hazards connected to external industries and thoroughfares, risks related to hazardous facilities present on the site, risk of aircraft crash, risk of malicious acts.

Under nuclear safety and environmental protection procedures, all of these risks have been the subject of design and operating measures which, through the introduction of successive steps, allow:

- the occurrence of incidents and accidents on the Flamanville 3 unit to be reduced,
- the unit to be monitored and maintained under safe operating conditions,
- the consequences of incidents and accidents to be limited on the plant and in the environment.

Thus, on the basis of the extensive feedback from France and Germany provided by the pressurized water nuclear plants in use, the unit is designed to tackle in a reinforced manner a range of internal events which could be triggered by one source with a probability occurrence going from 1 out of 100 to 1 out of 1 million per year. For this purpose, the unit is equipped with monitoring and protection systems and also with multiple and diverse safeguard equipment. These systems, whose function is to bring the reactor in a safe state, whatever the operating conditions are, allow to:

- ensure the nuclear reaction is kept under control regardless of the situation,
- keep the fuel cooled under all circumstances,
- limit the pressure and temperature in the reactor building in the case of an accident.

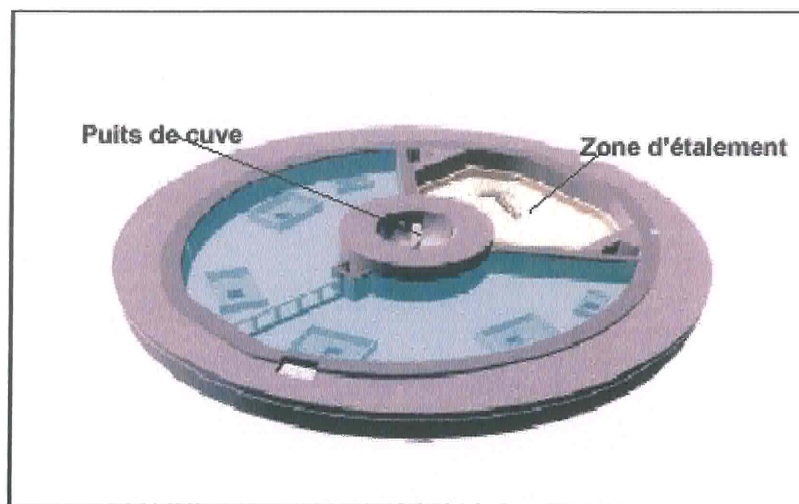
These systems are quadrupled on Flamanville 3. The complete separation of the 4 systems, each implemented in distinctive buildings, allow to tackle an incident on one of the systems without the 3 other ones being affected.

Furthermore, the equipment, which is important for safety is designed to resist high levels of internal and external stress (earthquake, aircraft crash, ...).



The 4 safeguard systems

EPR reactor is also designed to tackle multiple faults going as far as the hypothetical and extreme situation of core meltdown. In the eventuality of such an accident, a device, specifically designed to stabilize and cool core melt, is located under the pressure vessel.



Device of core melt retention

The unit's operating regulations introduced under the nuclear safety and radiation protection procedures for operational plants also guarantee the unit's optimal operating and maintenance conditions under normal operating conditions as well as the organisational and material means to tackle any possible incidents or accidents.

### Construction phase

During the building phase, the hazards that could lead to consequences outside the site or inside the site by damage of Flamanville 1 and 2 units are taken into account. They are related to the presence of ICPE<sup>17</sup> facilities in the building area and to the potential impact the works could have on the safety of the operating units of Flamanville 1 and 2. These hazards are managed through the implementation of specific steps (use of micro-loads for galleries dig by mining, forbidden areas for crane flying operation, ...).

☞ **TO FIND OUT MORE**, please see:

- **Document 5** *Pièce D - Chapters II, III, IV, VI, VII, VIII : Risks analysis of hazards study*

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<sup>17</sup> Installations Classified for Environment Protection