

## 5 REGULATING AND MONITORING THE CONSTRUCTION OF THE FLAMANVILLE 3 EPR REACTOR

Authorisation for an EPR type reactor on the Flamanville site, where two 1300 MWe reactors are already in operation, was granted to EDF by decree 2007-534 of 10 April 2007. After issue of this authorisation decree and the building permit, and after the site preparation work was completed, construction began in 2007. In 2008, EDF completed the reinforcement and concreting work on the nuclear island building foundation rafts, erection of the turbine hall structures. It prepared the inner metal shell of the reactor building containment, the foundation raft of the pumping station and began to excavate the onshore and offshore discharge outfall structures.

As of the construction stage, ASN carries out its duty to regulate and inspect, to ensure the construction quality of the installation and its ability to meet the defined requirements. For ASN, the construction of a reactor covers the detailed design, in which the design studies define the requirements necessary for construction, and the actual construction activities.

### THE PRINCIPLES GOVERNING CONSTRUCTION REGULATION AND MONITORING FOR THE FLAMANVILLE 3 EPR REACTOR

The installation licensee (holder of the authorisation decree) is responsible for the quality of the construction work. Responsibility for manufacture of the nuclear pressure equipments lies with the manufacturer.

ASN's regulatory objective is to check that these two parties involved in construction assume their primary responsibilities in full and guarantee the construction conformity. With the assistance of its technical support organisations, or other independent organisations, ASN therefore carries out regulation and monitoring that is proportionate to the safety, radiation protection and environmental protection issues involved.

If, during its regulation and inspection duties, ASN identifies a serious or repeated problem with the quality management system, an anomaly or a significant safety event concerning the design or construction of the installation, it may suspend the work or activities concerned. Resumption will be dependent on clearance of the unsatisfactory points brought to light (requiring redesign, compensatory measures, or partial or total reconstruction).

### FROM DETAILED DESIGN TO WORKSITE CONSTRUCTION

Jointly with IRSN, ASN has initiated a review of the detailed design of the reactor in order to rule on its ability to meet the requirements of the regulations and those applicable to the EPR. This review is carried out according to a work programme defined by ASN and IRSN and does not claim to be exhaustive. It will enable ASN to reach a decision with regard to the commissioning of the installation. However, owing to the principle of responsibility of the licensee or the manufacturer, this review of the detailed design studies is not a pre-requisite for initiating construction work.



View of the future Flamanville 3 EPR reactor – January 2009

At the same time, the detailed design production process is covered by a programme of inspections conducted in the licensee or manufacturer engineering departments or at their suppliers, in order to check that the quality management systems of the licensee and manufacturers are implemented in accordance with the regulations.

### REGULATING AND MONITORING CONSTRUCTION

This is built around:

- a programme of inspections;
- review of the impact of the site on the neighbouring reactors in operation and on the environment;
- analysis of the deviations observed during the inspections or notified by EDF and which could affect safety;
- worker protection given the fact that this is a nuclear power generating reactor.

The programme of inspections aims to check on technical aspects of importance for safety. ASN adapts the frequency of the inspections to the volume and diversity of the scheduled activities and to operating feedback from the inspections already performed. ASN may also carry out reactive and unannounced inspections in response to events affecting construction. Apart from systematic IRSN participation in the inspections performed on the worksite, thereby providing ASN with the opinions of recognised experts in each type of activity carried out on the worksite, ASN can also call on independent organisations to carry out technical inspections. The inspection targets are adapted to the progress of the project. This is made possible by constant dialogue between ASN and the licensee or manufacturer and by the supply of the information required concerning construction progress.

### FEEDBACK FROM THE FIRST MONTHS OF CONSTRUCTION OF THE FLAMANVILLE 3 EPR

Responsive and consistent construction regulation is guaranteed by deploying a dedicated team from the Caen division, supplemented by contributions from the Nuclear Pressure Equipment Department (DEP) and the Nuclear Power Plant Department (DCN).

The detailed design review, which hitherto looked primarily at the civil engineering aspects, revealed no discrepancies.

In 2008, ASN conducted 4 inspections in the engineering departments on management and supervision of the contractors and suppliers, on management of deviations and operating feedback, on assessing the importance given to safety and on execution of the civil engineering detailed design.

In 2008, ASN also carried out 13 inspections on the construction worksite with IRSN. These concerned civil engineering, the organisation and management of safety, management of deviations and contractor supervision, assembly

of the reactor building containment inner shell, non-destructive testing (radiographic) and the impact of the worksite on the safety of the Flamanville 1 and 2 reactors.

Finally in 2008, either directly or by delegating the work to an approved notified organisation, ASN carried out 50 inspections on the manufacture of nuclear pressure equipments at AREVA NP, its suppliers and their subcontractors.

Pursuant to its strategy of regulating and monitoring the construction activities on the worksite, ASN in May 2008 asked EDF to suspend the concreting operations on structures that are important to safety. As a result of the numerous deviations observed in the reinforcement or concreting of the foundation rafts for the nuclear island, ASN considered that the repetitive nature of this type of deviation, albeit with no safety consequences, highlighted a lack of rigour on the part of the licensee with regard to the worksite construction activities, problems with supervision of the contractors and organisational shortcomings. ASN considered that the conditions in which concreting took place on the worksite did not guarantee the required level of quality for a nuclear installation. Consequently, on 26 May 2008, ASN asked EDF to suspend the concreting operations on the works of importance for safety, to analyse the problems highlighted and to implement the necessary corrective measures. In particular, ASN asked EDF to improve the stringency of the technical supervision carried out by its contractors and indeed its own surveillance. After a stoppage of 23 days, and on the basis of the action plan put into place by EDF, ASN authorised resumption of concreting on the works important for safety.

The inspections also revealed the problems being encountered by EDF and its suppliers with the performance of welds on the reactor building metal shell. These problems led ASN to ask EDF to carry out additional inspections on the welds already made and those still to be made, in order to check for defects liable to compromise the tightness of this shell.

During one inspection, ASN had an independent laboratory collect concrete samples from the worksite during concreting of the reactor building platform. The series of samples indicated the satisfactory mechanical strength of the concrete used during this operation.

With regard to the manufacture of nuclear pressure equipments, which is the responsibility of the manufacturer AREVA NP, ASN detected a deviation during the inspection carried out at the Italian company Società delle Fucine, one of the AREVA NP subcontractors, in charge of the manufacture of some of the steel parts of the pressuriser. This deviation, which involved the use of testing equipment that was not in conformity with the standards, constitutes a breach of the procedures for the production of forged parts subcontracted by the manufacturer AREVA NP and involves incorrect use of the applicable mechanical testing documentation for checking the quality of the manufactured parts. ASN considers that this deviation indicates shortcomings in the quality system of both AREVA and the subcontractor.



Computer model of the future Finnish EPR reactor at Olkiluoto



EPR worksite at Olkiluoto (Finland) – January 2009

The regulations state that the manufacturer, AREVA NP, is responsible for part conformity, including when it partially subcontracts manufacturing: AREVA NP is therefore required to implement an appropriate quality system and ensure effective surveillance of the entire subcontracting chain, in order to maintain the level of confidence in the operations performed. ASN noted that the level of surveillance exercised by AREVA NP failed to detect non-compliance with the procedures by its subcontractor.

Consequently, on 24 October 2008, ASN asked AREVA NP to demonstrate the conformity of the parts produced.

In April 2008, AREVA NP failed to comply with a number of ASN hold points concerning the production of the reactor coolant system legs, thereby restricting ASN's ability to conduct inspections. ASN therefore asked AREVA to perform additional tests on the equipment concerned, in order to obtain satisfactory guarantees regarding the quality of the parts produced.

Based on the inspections carried out, ASN considers that safety is taken into account by project management and construction activities. However, ASN did find a number of deviations indicative of problems with implementation of the EDF reference documentation on the worksite and a lack of rigour in the performance and supervision of the construction and manufacturing activities. With regard to

the nuclear pressure equipments, the main difficulties stem from the manufacture of certain items before their detailed design is actually finalised. ASN considers that these deviations show that there is still room for improvement in the implementation of the requirements of the order of 10 August 1984 and that the safety culture at the various participants in the project needs to be improved.

## CONCLUSION

The aim of ASN regulation and supervision is to ensure that EDF and the manufacturers maintain the highest possible level of rigour in each of the steps involved in the construction of the Flamanville 3 reactor.

ASN also take part and will take part in international exchanges and cooperation with foreign nuclear safety authorities concerning the construction of new reactors, in order to enhance operating feedback.

ASN considers that the remedial measures taken by EDF following the events of 2008 should help maintain the quality of installation construction. Nonetheless, in the light of these events, ASN considers that EDF needs to improve its surveillance and enhance contractor awareness of the need for quality and for compliance with the requirements applicable to a nuclear installation.