

Technical notice

Results of the detection of the Flamanville EPR vessel anomaly

The detection of an anomaly in the chemical composition of the central part of the Flamanville EPR vessel closure and bottom heads led ASN to ask Areva NP and EDF to conduct a full experience feedback analysis with regard to this event. Three processes are currently under way:

- on other components of the EDF reactors, the search for technical anomalies similar to that detected on the Flamanville EPR vessel. This search led ASN to issue a communication concerning the channel heads of certain EDF reactor steam generators on 23rd June 2016;
- quality reviews of parts manufactured in the past by the Creusot Forge plant. This review enabled Areva NP to detect irregularities concerning which ASN issued communications on 3rd May and 16th June 2016. The irregularity affecting the lower shell of the Fessenheim NPP reactor 2 steam generator was detected thanks to these reviews;
- initiation of a review of BNI licensee monitoring of contractors and subcontractors, of ASN oversight and of the alert mechanisms.

Steam generator lower shell

The steam generators are heat exchangers which use the energy from the primary system of nuclear reactors to transform the water in their secondary systems into steam, thus driving the turbine producing electricity. Their exchange system comprises a tube bundle consisting of several thousand tubes through which the primary water circulates at high temperature (320°C) and high pressure (155 bars). These tubes confine the primary system water and allow heat exchange while avoiding any contact between the primary and secondary fluids. The steam generators are thus particularly important pressure equipment items. They take part in two key safety functions: cooling of the reactor core and containment of radioactive substances.

The 900 MWe pressurised water reactors, such as that at Fessenheim, comprise three steam generators. Each stands about twenty metres high and weighs about 300 tonnes.

The lower shell of a steam generator is a hollow cylinder more than four metres high and three metres in diameter. It constitutes the lower part of the outer containment of the steam generator's secondary part. It is made of steel.

Irregularity detected on the lower shell of one of the Fessenheim NPP reactor 2 steam generators

The lower shell of the Fessenheim NPP reactor 2 steam generator was manufactured by Areva NP in its Creusot Forge plant by forging a steel ingot of about 95 tonnes.

The hollow ingot from the steel mill was subsequently forged with a press to create the cylindrical part and stretch it to its final properties and dimensions. During this forging process, the ends of the part are cut and scrapped. Owing to the ingot solidification process, the metallurgical, chemical and mechanical characteristics of these ends are degraded.

In 2008, during forging of the lower shell of one of the steam generators for the Fessenheim NPP reactor 2, Creusot Forge decided not to scrap one of the two ends of the ingot, called the “feedhead”. Most of this is thus present in the final part, which can lead to inclusions being present in the steel and to a local chemical composition of the material which could degrade its weldability, its ageing and its mechanical properties.