Technical notice: technical clarifications on the manufacturing anomalies liable to affect the steam generator channel heads

Steam generator channel head

A steam generator (SG) is a heat exchanger between the water in the primary system, raised to high temperature (320°C) and high pressure (155 bars) in the reactor core, and the water in the secondary system which is converted into steam and drives the turbine. Each steam generator comprises several thousand U-tubes, which allow the exchange of heat between the water in the primary system and that in the secondary system, to produce the steam driving the turbine. The 900 MWe pressurised water reactors comprise three steam generators, while the higher power reactors comprise four.

The steam generators are equipment important for safety. They form a part of the second and third containment barriers.

The channel head is a steel component with the shape of a portion of a sphere, situated at the base of the steam generator. It contributes to the containment of the water in the primary system.

The channel heads installed in the nuclear power reactors were manufactured using different technologies. The channel heads liable to be concerned by the anomaly were forged from solid, or "conventional" steel ingots.

Carbon concentration anomaly in the steel

In the central zone of the channel heads, the analyses conducted revealed a high carbon concentration. This is called carbon segregation and should normally be eliminated from the final part during the forging operations, which was not the case with the manufacture of the heads liable to contain an anomaly.

This mechanical properties of this zone, in particular its resistance to crack propagation, are lower than anticipated.

Investigations requested by ASN

At the request of ASN, EDF is currently carrying out investigations into the channel heads concerned, the aim of which is to:

- precisely locate the zone with the high carbon concentration. This is done by means of non-destructive measurements on the outer surface;
- check that there are no defects in the head (cracks in particular) liable to lead to fracture of the part. These checks are carried out using ultrasound inspections.

EDF also intends to carry out a test programme on available representative channel heads.

ASN will review the results of the investigations carried out by EDF to ensure that the equipment is able to perform its safety functions.