

## Technical Notice

### Flamanville EPR reactor

#### Deviations detected in certain welds on the main steam transfer pipes

##### 1. Description of the equipment concerned

The main steam transfer lines (main steam lines) are pipes carrying the steam under pressure, produced in the steam generators, to the turbine. There are four such pipes on an EPR reactor. Some of these lines are situated within the reactor containment.

These pipes are essential for the cooling of the primary system water by the steam generators, and therefore cooling of the nuclear fuel contained in the reactor pressure vessel (RPV).

These pipes are subject to the regulations governing nuclear pressure equipment.

##### 2. Nature and origin of the deviation

On these pipes, which feature 66 welds, EDF implemented a "break preclusion" procedure which implies tightened design, manufacturing and in-service monitoring requirements. These requirements for high quality come in addition to the requirements of the regulations governing nuclear pressure equipment.

These tightened requirements must be sufficient for breaking of these pipes to be considered highly improbable. They relieve the licensee of the obligation to conduct an exhaustive analysis of the consequences of a break of these pipes in the facility's safety case.

EDF has highlighted the implementation of this approach in the creation and commissioning authorisation applications for the Flamanville EPR reactor.

In order to achieve the required high standard of quality, EDF has defined tightened requirements for the mechanical properties among other things, and the impact strength in particular<sup>1</sup>. The manufacturer Framatome has taken up and supplemented these tightened requirements in its own specifications.

EDF informed ASN at the beginning of 2017 that these tightened requirements had not been passed on to the subcontractor responsible for prefabricated welds produced in-plant in 2012 and 2013. The inspections carried out on "weld test coupons"<sup>2</sup> showed that these tightened requirements were not always satisfied in full on these welds.

Further to an inspection conducted on 21st February 2017, ASN noted that these tightened requirements were also not taken into account on the welds produced as from 2016 on the Flamanville site, which led ASN to make a number of demands in its inspection follow-up letter. EDF then analysed this deviation and found that several of these welds did not satisfy these tightened requirements. EDF informed ASN of this situation in August 2017 and then presented a first assessment of its investigations in October

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<sup>1</sup> The impact strength is an indicator of the ability of a material to withstand crack propagation.

<sup>2</sup> When making production welds, "weld test coupons" are produced under conditions that ensure that these weld test coupons are representative of the production welds. The destructive mechanical tests are then carried out on these weld test coupons.

2017. In December 2017 EDF sent ASN a summary of its procedure for handling deviations detected in-plant and on-site.

These deviations taken as a whole call into question the achievement of the high standard of quality required in the context of the "break preclusion" procedure.

### **3. Handling the deviation**

EDF has launched a work programme to restore the conformity of certain welds and justify application of the "break preclusion" procedure on the as-produced main steam transfer lines. This programme includes more specifically a series of complementary mechanical tests to characterise these welds.

Examination of the first elements provided by EDF during 2017 has led ASN to consider that the procedure proposed by EDF should be supplemented in several respects. ASN therefore asked EDF in February 2018 to submit a file detailing firstly the history of the characterisation of the deviation, and secondly the various possible ways of dealing with this deviation.

ASN has in particular asked EDF to study the consequences of abandoning the break preclusion procedure on the reactor safety case, the possibility of repairing the welds or replacing the pipes concerned, and the in-service monitoring measures that could be put in place.

ASN intends to obtain the opinion of the Advisory Committee of Experts for Nuclear Pressure Equipment (GP ESPN) on this subject in the second half of 2018.

**To find out more:** consult the follow-up letter INSSN-CAE-2017-0653 of 21st February 2017.