FRENCH REPUBLIC

ASN Resolution 2016-DC-0572 of 18th October 2016 prescribing examinations and measurements on the channel head of certain steam generators of the nuclear power reactors operated by Électricité de France – Société Anonyme (EDF-SA)

ASN (Autorité de Sûreté Nucléaire – French Nuclear Safety Authority),

Having regard to the Environment Code, more specifically its Article L. 593-20;

Having regard to decree 99-1046 of 13th December 1999 amended relative to pressure equipment;

Having regard to the order of 10th November 1999 amended relative to the monitoring of operation of the main primary system and the main secondary systems of pressurized water nuclear reactors;

Having regard to the ASN letter to EDF-SA of 22nd April 2016 reference CODEP-DEP-2016-016497 relative to the risk of residual positive carbon macrosegregations in the channel heads of steam generators;

Having regard to the ASN letter to EDF-SA of 14th October 2016 reference CODEP-DEP-2016-040924 relative to the segregated channel heads of steam generators;

Having regard to the EDF-SA letter to ASN on 7th October 2016 reference D4008-10-11-16/0458 concerning the risk of positive carbon macrosegregations in the channel heads of steam generators manufactured by Japan Casting and Forging Corporation (JCFC) from 120-tonne ingots;

Having regard to the EDF-SA letter to ASN of 17th October 2016 reference D4008/10.11.16/0476 relative to the segregated channel heads of steam generators;

Whereas following the detection of residual positive carbon macrosegregations in the domes of the vessel intended for the Flamanville EPR reactor, ASN asked EDF-SA to examine whether such segregations were present in the nuclear pressure equipment installed on its nuclear power generating reactors;

Whereas the data transmitted by EDF-SA to ASN revealed the presence of such segregations in certain channel heads of the steam generators manufactured by Japan Casting and Forging Corporation (JCFC) and by Areva Creusot Forge;

Whereas the presence of residual positive carbon macrosegregations may in particular lead to steel toughness that is lower than expected;

Whereas for the purposes of the nuclear safety case, the quality of the material of the steam generator channel heads should preclude all fracture;

Whereas in particular the prevention of the risk of fast fracture of the steam generator channel heads is more specifically based on high toughness;

Whereas EDF-SA has provided generic demonstrations of the serviceability of the various components concerned, more specifically with regard to the properties of a segregated material, the flaws and thermomechanical loads to be considered in the fast fracture studies and the margin factors;

Whereas these demonstrations are based on a certain number of hypothesis;

Whereas however, since the end of 2014 and the detection of the anomaly affecting the Flamanville EPR vessel closure head and bottom head, numerous EDF-SA hypothesis have been called into question, more particularly with regard to the components concerned, the depth, extent and intensity of segregation, the consequences on the mechanical properties, the thermomechanical loads to be considered in the studies, or the representativeness of the components examined;

Whereas in the above-mentioned letter of 22nd April 2016, ASN asked EDF-SA – during the outages both in progress and scheduled – to carry out carbon concentration measurements on the outer surface and tests using additional non-destructive examinations ;

Whereas the non-destructive surface examinations on the outer skin have since then been performed on Fessenheim NPP reactor n° 1, Tricastin NPP reactor n° 2, Gravelines NPP reactor n° 4 and Civaux NPP reactor n°1;

Whereas the demonstrations provided by EDF-SA, more specifically in the above-mentioned letter of 7th October 2016, are based on the assumption that the potentially segregated channel heads which have not yet undergone inspections and carbon concentration measurements are similar to those which have already been investigated;

Whereas the segregation observed on the channel heads manufactured by JCFC for Tricastin NPP reactors n° 1 and n° 3 is greater than initially anticipated by EDF-SA, that its origin has not yet been determined and that the possibility of other channel heads from the same manufacturer containing an even higher level of segregation cannot be ruled out;

Whereas it is necessary to verify whether each of the potentially segregated channel heads is covered by the hypothesis of the generic file transmitted by EDF-SA to ASN;

Whereas examinations and measurements have already been performed on certain reactors;

Whereas however, on the one hand non-destructive examinations to detect any flaws and on the other carbon concentration measurements on the outer surface to characterize the segregated zones on the channel heads concerned on Fessenheim NPP reactor n° 1, Tricastin NPP reactors n° 2 and 4, Gravelines NPP reactor n° 4 and Civaux NPP reactor n° 1 should be carried out;

Whereas these examinations and measurements should be performed without waiting for the next reactor refuelling outages and in any case within a time not to exceed three months;

Whereas these examinations and measurements require the deployment of an organisation and special resources which must be anticipated by EDF-SA and the licensee was therefore asked to submit its observations within 72 hours concerning ASN's intention to prescribe the performance of inspections on the channel heads of the reactors concerned within three months;

Whereas EDF-SA mentioned in the above-mentioned letter of 17th October 2016 that it will perform the requested inspections within three months,

Hereby issues the following resolution:

Article 1er

EDF-SA carries out non-destructive volumetric examination of the channel heads which potentially contain a residual positive carbon macrosegregation zone in Fessenheim NPP reactor n° 1, Tricastin NPP reactors n° 2 and 4, Gravelines NPP reactor n° 4 and Civaux NPP reactor n° 1.

EDF-SA carries out non-destructive surface examination of the outer skin of the channel heads which potentially contain a residual positive carbon macrosegregation zone in Tricastin NPP reactor n° 4.

The purpose of these examinations is to detect any flaws.

Article 2

EDF-SA caries out carbon concentration measurements on the outer surface of the channel heads mentioned in the first paragraph of article 1 in order to characterize the potentially segregated area.

Article 3

The inspections and measurements prescribed in articles 1 and 2 are performed within three months of notification of this present resolution. The results are then communicated to ASN within the same time-frame.

Article 4

Restart of the reactors mentioned in article 1 following performance of the inspections and measurements prescribed is subject to prior approval by ASN.

Article 5

The ASN Director-General is tasked with enforcement of this resolution, which shall be notified to EDF-SA and published in the ASN Official Bulletin.

Done in Montrouge, 18th October 2016.

The ASN Commission *,

Signed by

Pierre-Franck CHEVET

Jean-Jacques DUMONT

Philippe JAMET

**Commissioners present at the sitting*