



DIRECTION DES ÉQUIPEMENTS
SOUS PRESSION NUCLÉAIRES

Montrouge, 5th December 2016

Our ref: CODEP-DEP-2016-047228

**For the attention of the Director
Nuclear Operation Division
Site Cap Ampère
1, place Pleyel
93282 SAINT-DENIS CEDEX**

Subject: Serviceability of the steam generator channel heads manufactured by JCFC

References:

- [1] EDF letter to ASN of 7th October 2016 reference D4008-10-11-16/0458 – Risk of positive carbon macrosegregations – JCFC type steam generator channel heads produced from 120 tonne ingots
- [2] EDF letter to ASN reference D40081011160499 of 15th November 2016

Dear Sir,

In letters of 7th October 2016 and 15th November 2016 in references[1] and[2], you sent me a file presenting a generic demonstration of the serviceability of the channel heads manufactured by JCFC from 120 tonne ingots.

ASN examined this file with the assistance of IRSN. The conclusions of this examination were reviewed by the ASN Commission during its session of 5th December 2016.

With a view to the return to service of the main primary system of each of the reactors concerned, I ask you kindly to provide specific files more particularly taking account of the following:

- the results of the measurement, in particular those carried out in the nozzle transition zones greater than 0.32%, in order to determine the mechanical analysis hypotheses;
- mechanical calculations specific to each reactor, using the generic methodology presented in your generic file. These calculations shall take account of the potential presence of underclad flaws.

The other requests resulting from the examination are appended.

Provided that the appended requests are taken into account, I consider that the generic demonstrations you give for the 900 MWe reactors are acceptable and could constitute a basis for the specific files that you will be submitting to me with a view to the restart of each of the reactors concerned.

With regard to the two 1450 MWe reactors concerned, ASN is waiting for additional substantiation in the light of their specific features.

Sincerely yours,

The Director-General

Signed by

Olivier GUPTA

Cc: IRSN

Appendix to letter reference CODEP-DEP-2016-047228

Required supplements to the generic demonstrations

Request N°1:

I ask you, within six months, to define an envelope characterisation of the small primary break situations (N°58) (with and without resumption of natural circulation), cold primary over-pressure situations (N°57) as well as all situations involving “feed-and-bleed” operation, to cover the corresponding potential cold shocks on the steam generator channel heads and to reassess the associated margin factors, with substantiation of the conservative nature of the hypotheses and calculation method adopted.

Request N°2:

I ask you to reassess the risk of the presence of underclad flaws once the test programme on scale one replica parts has determined the inner skin carbon content.

Request N°3:

I ask you, within six months, to propose a test programme to validate the impact of thermal ageing on the behaviour of the segregated zone of the steam generator channel heads manufactured by JCFC, for example by extending that initiated for the anomaly on the Flamanville 3 EPR vessel domes.

Request N°4:

I ask you, within six months, to reassess the susceptibility to the risk of fast fracture of the dissimilar metal joints and evaluate the need to modify your preventive maintenance programme accordingly.

Request N°5:

I ask you, within two months, to propose a binding schedule for implementation of all the test programmes.

Compensatory measures to be implemented or reinforced immediately

Request N°6:

I ask you, as rapidly as possible, to set up the organisation necessary to ensure satisfactory application of the rules of normal operation and the compensatory measures defined to reduce the risks associated with the presence of a carbon segregation zone.

Request N°7:

I ask you to take additional steps to limit the probability of occurrence of a cold shock on a steam generator channel head; you will more specifically examine the possibility of more extensive monitoring by the shift crew and the implementation of provisions designed to prevent the restart of a primary pump following inadvertent opening of the valve controlling the flow in the exchangers of the residual heat removal system.

Request N°8:

I ask you to reinforce the compensatory measures taken when the reactor is in the “maintenance cold shutdown” operating domain, designed to limit the difference between the temperature at the discharge from the residual heat removal system and the temperature of the steam generator emergency feedwater in the event of cycling of these generator.

Request N°9:

I ask you to clarify the fact that the “primary temperature” mentioned in the compensatory measures will indeed be the temperature at the discharge from the residual heat removal system and to modify it if this is not the case.

Long-term operating baseline requirements to be updated

Request N°10:

I ask you to incorporate into the general operating rules, and more specifically the technical operating specifications, the compensatory measures reducing the limits and operating conditions of the 900 MWe reactors concerned by the carbon segregations anomaly.

Additional inspections on the reactors

Request N°11:

I ask you to extend the calibration range of the spark optical emission spectrometry inspections beyond 0.4% for the next measurements and to reinforce performance monitoring.

Request N°12:

I ask you, during outages in which the channel heads are inspected, to conduct a non-destructive examination of the nozzle transition zones with a carbon content higher than 0.25%, in order to detect the presence of longitudinal flaws.

Case of the Saint-Laurent B1 reactor which has not yet undergone a carbon content measurement in the central zone

Request N°13:

For the Saint-Laurent B1 reactor, I ask you to provide a specific calculation note within two months and carry out the carbon content measurements and non-destructive tests not yet performed, no later than at the next scheduled outage.