AUTORITÉ DE SÛRETÉ NUCLÉAIRE

The Chairman

RÉPUBLIQUE FRANÇAISE

Montrouge, 19 June 2019

Ref.: CODEP-CLG-2019-027253

The Chairman of EDF
22/30 avenue Wagram
75008 Paris

Subject: Flamanville 3 EPR reactor – VVP pipe welds
Penetration welds in the reactor containment
Deviations from the break preclusion approach

References:

[1] Decree 2007-534 of 10 April 2007 authorising the creation of the BNI referred to as Flamanville 3, comprising an EPR type nuclear reactor, on the Flamanville site (Manche *département*);

[2] Letter ASN CODEP-DCN-2018-000199 of 2 February 2018

[3] Letter ASN CODEP-DEP-2018-048051 of 2 October 2018

[4] EDF note D305118007912 revision A of 3 December 2018

[5] GP ESPN opinion reference CODEP-MEA-2019-017616 of 11 April 2019 issued following the session of 9 and 10 April 2019

[6] Letter EDF 2019-004 XU/JV of 7 June 2019

Dear Mr. Chairman,

For the lines of the main steam system (VVP) of the Flamanville EPR reactor, EDF wished to apply reinforced requirements aiming to make their break highly improbable, so that the reactor safety case did not have to take account of this break hypothesis. One of the main results of this approach, known as break preclusion, is not to have to make provision for managing the consequences of such a break. II-1 of Article 2 of the creation authorisation decree of 10 April 2007 in reference [1] regulated this approach, which is a key element required by the protection of the interests mentioned in article L. 593-1 of the Environment Code.

These reinforced requirements were not achieved on certain welds of the Flamanville EPR main steam system, notably on the eight welds situated between the two walls of the reactor containment.

ASN wishes to point out that these reinforced requirements are not stipulated in the regulations but were proposed by EDF and that equivalent requirements on the penetration welds were achieved on the other EPR reactors built abroad. Moreover, the level of quality corresponding to these requirements was easily achieved on the penetration welds of the last N4 series reactors built in France.

In the case of Flamanville 3, failures occurred at various steps in the production of these welds: in the specification of the requirements for the subcontractor in charge of producing the welds, during qualification of the weld procedures, in the choice of filler materials and during the acceptance tests, during production of the control assemblies and during the non-destructive inspections. These failures led to deviations not only from the break preclusion requirements, but also from the manufacturing code used by yourselves.

Faced with this situation, in a letter of 2 February 2018 in reference [2], ASN asked you to examine the possibility of repairing these welds and re-procuring the pipes concerned. In a letter of 2 October 2018 in reference [3], ASN reminded you that repair of the welds to ensure compliance with their initial manufacturing baseline requirements was the preferred option and asked you to take steps along these lines without delay, notably with regard to procurement.

In the note of 3 December 2018 in reference [4], you proposed an initial strategy which was to maintain these welds as-is, stating *"the highly improbable nature of the break risk with a high level of confidence",* by means of a specific test programme designed to define the mechanical properties of the welds.

Following the review of this first proposal, which included a consultation of the Advisory Committee for nuclear pressure equipment (opinion in reference [5]), **ASN considers that, given the number and nature of the deviations affecting these welds, their break can no longer be considered as highly improbable and that a break preclusion approach can no longer be applied to them.**

You were informed of this ASN position at the EDF hearing on 29 May last.

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In a letter dated 7 June 2019 in reference [6], you asked ASN for its opinion on a new strategy for dealing with the deviations found on these welds.

You observe that *"the possibility of abandoning the break preclusion principle was examined but is not technically accessible"*. You consider that "*the mechanical properties of these welds are sufficient to ensure their integrity and guarantee the functioning of the installation in complete safety"*. In the light of your assessment of the *"major challenges involved in this modification",* you propose repairing these welds in 2024, after commissioning of the installation that you hope to see take place in 2020. You however consider that you are in a position to repair these welds for commissioning by the end of 2022, depending on the repair scenario chosen.

Postponement of the repair operations until after reactor commissioning would pose a number of problems.

Firstly, given that you confirm the technical feasibility of upgrading the penetrations, repair after commissioning would need to be justified for the interim period, by comparison with repair before commissioning. In your letter, however, you provide no justification for deferred repair, for example based on the particular characteristics of this interim period (reduced loadings owing to specific operating conditions, absence of physical phenomena such as ageing).

Secondly, given that a break on these lines can no longer be considered highly improbable, it would then be necessary to include this in the safety case, as part of the defence in depth approach applicable to the nuclear industry. With regard to robustness, you simply propose carrying out pipe break studies applying rules adapted from those normally used. Your approach should on the contrary be part of a more general structured demonstration, should consider all the consequences of a break in these welds, should specify the level of guarantee you consider able to achieve given the study rules proposed, which would also need to be validated beforehand, as well as the adequacy of the modifications envisaged prior to commissioning of the reactor, notably in the light of the study results.

The possibility of compiling such a dossier would at this stage appear to be highly uncertain. For example, ASN has already identified a number of obstacles:

- it would appear to be difficult, as you envisage, to take no account of the aggravating factor represented by non-closure of the steam shut-off valve of the neighbouring steam generator, because it is probable that this valve would be damaged in the event of a weld break;
- unless it can be demonstrated that a release of steam into the annulus is not possible in the event of a penetration weld break, the consequences of steam propagation in this space must be studied using specific methods yet to be determined.

The time-frame that you evaluated and on which you base the interest of repairs after commissioning, does not take account of the time needed to carry out and then review such studies.

Moreover, ASN notes that you intend to transmit the final data enabling the weld properties to be determined in May 2020. These data are needed to verify that these welds meet the requirements applicable to nuclear pressure equipment even if not covered by break preclusion. The first available test results show that considerable work still needs to be done before being able to demonstrate this compliance.

Ultimately, there is nothing to guarantee that your approach would succeed and, if it did, that it would do so within a shorter time-frame than that of repair.

In any case, repair after commissioning would mean that the compliance of the installation with its creation authorisation decree at the moment of start-up could not be demonstrated. ASN would therefore be unable to authorise this commissioning without prior modification of the break preclusion approach provisions contained in this decree. A dossier submitted by yourselves would then have to be reviewed as part of a request for modification of the decree to the competent authority.

In this context and in response to your request for an opinion, ASN considers that the hypothesis of repair after commissioning entails major problems, such as to compromise its practical implementation: this would entail, for a limited period, constructing an entirely new safety approach comparable to waiving of break preclusion which, even with appropriate study rules, would appear to be difficult on an installation which was not designed for this. ASN therefore considers that repair of the penetration welds before commissioning of the reactor remains the baseline solution.

Yours sincerely,

ASN Chairman,

Signed by

Bernard Doroszczuk