Draft

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U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 03.09.05 - Reactor Pressure Vessel Internals
Application Section: 3.9.5

QUESTIONS for Engineering Mechanics Branch 1 (AP1000/EPR Projects) (EMB1)

03.09.05-1

(Proj #1366)(Ref. EPR FSAR Tier 1 Table 2.2.1-1):

Revise FSAR Tier 1 Table 2.2.1-1 by addition of the reactor vessel core support structures as ASME Code Section III components identified separately from the RPV.

The ASME Boiler & Pressure Vessel Code, incorporated by reference in 10 CFR 50.55a, provides specific requirements for Code construction of core support structures which are different and separate from the requirements for the RPV. In recognition of these separate requirements, the component identification along with the Code construction requirements for core support structures must be added as a separate line item in Tier 1 Table 2.2.1-1.

Separate identification of RPV core support structures in Table 2.2.1-1 will also enable proper identification of a separate ITAAC for core support structures in Tier 1 Table 2.2.1-5.

03.09.05-2

(Proj #1367)(Ref. EPR FSAR Tier 1 Table 2.2.1-5):

Revise FSAR Tier 1 Table 2.2.1-5 by addition of a separate ITAAC for RPV core support structures which identifies the separate ASME Code construction requirements for the core support structures.

Existing ITAAC Item 3.1 in Table 2.2.1-5 is written to address ASME Code design of pressure boundary components. Core support structures are not pressure boundary components, but do require design and construction in accordance with ASME III, Subsection NG. A separate ITAAC must be added for core support structures including Acceptance Criteria appropriate for a non-pressure boundary, safety-related structure.

03.09.05-3

(Proj #1368) (Ref. EPR FSAR Tier 1 Table 2.2.1-5):

Revise the Acceptance Criteria for ITAAC Item 3.8 in Table 2.2.1-5 by providing reference to documentation which can be used to substantiate the Design Commitment.

The existing Acceptance Criteria states, “The RPV internals can withstand the effects of flow-induced vibration.” This is an inappropriate acceptance criterion, because it does not provide a basis for documenting that the Design Commitment has been met, it does not provide for comparison of documented results to any established standards, and it does not provide any means for inspection verification.

03.09.05-4

(Proj #1369) (Ref. EPR FSAR Tier 1 Table 2.2.1-5):

Revise ITAAC Item 3.15, including both the Design Commitment and the Acceptance Criteria.

The current ITAAC Item 3.15 states that the Design Commitment and Acceptance Criteria are exactly the same. This is an unacceptable ITAAC, because it does not identify a specific design commitment, it does not provide a basis for documenting that the design commitment has been met, it does not provide for comparison of documented results to any established standards, and it does not provide any means for inspection verification.

Provide a design commitment which indicates that the design bases for RPV core support structures conform to the industry Code requirements specified in 10 CFR 50.55a. Provide acceptance criteria that references documentation required to demonstrate that core support structures have been constructed to the requirements of the appropriate industry design Code incorporated by reference in 10 CFR 50.55a.

03.09.05-5

(Proj #1370) (Ref. EPR FSAR Tier 2 Table 3.2.2-1):

Clarify the basis for design and construction of those RPV internal structures whose safety classification is designated “NS-AQ.”

RPV internal structure components listed in Table 3.2.2-1, sheets 2, 8, 9, and 10, are classified as Safety Classification “NS-AQ,” Quality Group Classification “D.” The “Comments/Commercial Code” column identifies these same components as ASME Class CS, which implies that their basis for construction conforms to ASME III, Subsection NG rules. Explain to what extent these non-safety, Quality Group D classified components are designed and constructed to the requirements of ASME III, Subsection NG.

03.09.05-6

(Proj #1371) (Ref. EPR FSAR Tier 2 Table 3.2.2-1):

Justify the different Safety Classifications listed in Table 3.2.2-1, sheet 2, for the various component parts of the RPV internals heavy reflector.

FSAR Section 3.9.5.1.2.7 describes the safety-related core support function of the heavy reflector, but certain component parts of the heavy reflector, i.e. positioning keys and tie

rods, are given a Safety Classification of “NS-AQ” and Quality Group Classification D. Furthermore, these heavy reflector parts are listed as ASME Class CS, implying that they are constructed to ASME III, Subsection NG rules. Provide further explanation to clarify this apparent contradiction in classification.

03.09.05-7

(Proj #1372) (Ref. EPR FSAR Tier 2 Section 3.9.5.1.1):

Clarify and supplement the discussion of the “Flow Path” by adding another figure in the FSAR to illustrate the directions of cooling flow within the RPV showing both the main core cooling flow and the core bypass flow paths. Identify in this added figure, the locations of “RPV dome spray nozzles,” and show the orifices in the upper support plate which allow core bypass flow to travel from the RPV upper dome down to the upper plenum.

Characterize in the FSAR the volume and velocity of the core bypass flow, and discuss whether the bypass flow is sufficient to cause vortex shedding and flow-induced vibration in the internals components located in the RPV upper dome above the upper support plate.

03.09.05-8

(Proj #1373) (Ref. EPR FSAR Tier 2 Sections 3.9.5.3.1.2 and 3.9.5.1.2.5):

The third bullet of section 3.9.5.3.1.2 describes a core support function of the radial keys;

(a) Provide additional discussion in the appropriate FSAR Section clarifying the support function of the radial keys, and further explaining what is meant by the statement, “…fabricated both with and without lateral adjustments.”

(b) Provide an additional figure in the FSAR illustrating the interface among the radial keys, the radial key inserts, the lower support plate, and the reactor vessel shell.

(c) Clarify the support load path for these components, discussed in (b) above, identifying the directions of load restraint (translation and rotation) of the lower support plate with respect to the principal orthogonal coordinate system.

(d) Quantify the “tight lateral clearances” attributed to the radial key inserts described in Section 3.9.5.1.2.5.

03.09.05-9

(Proj #1374) (Ref. EPR FSAR Tier 2 Section 3.9.5.1.2.5):

The second paragraph of Section 3.9.5.1.2.5 mentions a postulated failure of the lower internals.

Provide additional discussion in the FSAR describing, or suitably referencing:

(a) The failure mechanism postulated for the internal structure;
(b) The analytical methodology addressing this accident postulation, including applicable design codes, load definition, and allowable stress and deformation criteria;
(c) Whether or not this is a design basis accident considered in Chapter 15 of the FSAR.

03.09.05-10

(Proj #1375) (Ref. EPR FSAR Tier 2 Sections 3.9.5.2 and Table 3.9.5-1):

The FSAR states, in part, “In accordance with ASME Code, Section III, Subsection NG-1122(c), the internal structures are designed and constructed such that they do not adversely affect the integrity of the core support structures.” However, this statement does not provide the design criteria actually used for construction of the internal structure components which are not designated core support structures.

Provide in the FSAR, for those components classified as “IS” in Table 3.9.5-1, a discussion specifying the industry design code, or specific sections of the applicable design code, used as the design bases for identification of design loadings, loading combinations, material stress limits, and allowable stress and fatigue usage limit criteria.

03.09.05-11

(Proj #1376) (Ref. EPR FSAR Tier 2 Sections 3.9.5.2 and 3.9.5.3):

Provide a tabular summary in the FSAR, including each component of the reactor internals and core support structures, listing the maximum calculated total stress, deformation, and cumulative usage factor for each designated design and service limit defined in ASME Section III, Subsection NG.