ArevaEPRDCPEm Resource

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Sent: Friday, June 12, 2009 5:18 PM
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Cc: Ashley, Clinton; ODriscoll, James; Jackson, Christopher; Carneal, Jason; Colaccino, Joseph; ArevaEPRDCPEm Resource
Subject: U.S. EPR Design Certification Application RAI No. 233 (2857, 2872, 2873), FSAR Ch. 6
Attachments: RAI_233_SPCV_2857_2872_2873.doc

Attached please find the subject requests for additional information (RAI). A draft of the RAI was provided to you on May 19, 2009, and on June 12, 2009, you informed us that the RAI is clear and no further clarification is needed. As a result, no change is made to the draft RAI. Per your request, we support future interaction to give you an opportunity to clarify your design regarding Question 06.05.03-1 part d . The schedule we have established for review of your application assumes technically correct and complete responses within 30 days of receipt of RAIs. For any RAIs that cannot be answered within 30 days, it is expected that a date for receipt of this information will be provided to the staff within the 30 day period so that the staff can assess how this information will impact the published schedule.

Thanks,
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Request for Additional Information No. 233 (2857, 2872, 2873), Revision 1

6/12/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.02 - Containment Heat Removal Systems
SRP Section: 06.05.01 - ESF Atmosphere Cleanup Systems
SRP Section: 06.05.03 - Fission Product Control Systems and Structures
Application Section: FSAR Ch. 6

QUESTIONS for Containment and Ventilation Branch 1 (AP1000/EPR Projects) (SPCV)

06.02.02-29

This question is a follow-up question to RAI 111, question 06.02.02-8. The design of the sumps and the protective strainer assemblies is a critical element in ensuring long-term recirculation cooling capability. Regulatory Guide 1.82, Revision 3, as modified and supplemented for PWRs by the Nuclear Energy Institute Guidance Report (NEI GR 04-07) and the NRC safety evaluation (SE) provide guidance for PWR debris evaluations. In addition, guidance exists for head loss testing, coatings and chemical effects. Responses to RAI 111, question 06.02.02-8 were discussed during an audit at the AREVA Twinbrook office on April 22 and 23, 2009, and in two subsequent conference calls. In several cases, the responses appear incomplete and/or did not appear to be in full accord with regulatory guidance (SE & NEI 04-07 and other guidance) and insufficient justification provided to address an alternative. Also, some RAI responses contained information that corrected typographical errors in documents that are incorporated by reference (IBR) into the FSAR or contained design basis information important to a safety evaluation but lacked a commitment to change these documents. Therefore provide additional information in the following areas previously identified in RAI 111 question 06.02.02-8 [also identified as eRAI 1446 Question 5154]:

a. Break Selection - B1, B2
b. Debris Generation/ZOI - C1, C2, C4, C6
c. Debris Characteristics - D1, D2, D3, D4, D5
d. Latent Debris - E1, E2, E3
e. Head Loss - H1, H3
f. Upstream Effects - J4, J6
g. General Items - K1, K2, K3, K9, K14, K16

(Note, as stated previously, these items were discussed at length in the audit and conference calls and only the item number is listed here.)

06.02.02-30

This is a follow-up RAI to eRAI 1446 question 5154 [also identified as RAI 111 Question 06.02.02-8].

Several responses to RAI 111 question 06.02.02-8 (multi part question) referred to head loss testing or strainer related design reports. These reports were the subject of an audit on April 22 and 23, 2009 at the AREVA Twinbrook office. One purpose of the audit was to examine and evaluate this supporting technical information and to identify information that will require docketing to support the basis of the U.S. EPR FSAR Chapter 6 review. Based upon audit materials reviewed, several RAI 111 responses are considered incomplete or not in full accord with regulatory guidance and are listed here:

Related portions of RAI 111 question 06.02.02-8 (multi part question):
Thin Bed - A1, A2
Debris Transport – F4, F8, F9
Head Loss – H1, H8, H10, H17, H23

Several of these items are incomplete due to a lack of assessment or commitment to regulatory guidance - such as NEI 04-07 & associated NRC GSI -191 SE, head loss testing, coatings and chemical effects – and/or absence of an argument demonstrating a conservative, alternative approach or methodology. Therefore, NRC staff requests that the applicant address the following:

1) It is unclear the extent to which the US-EPR design is assessed or committed to meet regulatory guidance from the following sources:
    a. NEI 04-07 GR and the associated NRC SE
    b. Chemical Effects guidance (WCAP 16530)
    c. Other staff guidance related to head loss testing, coatings etc.

   Therefore, clearly define those areas where the US-EPR conforms to the guidance or where an alternate methodology is used for each of the referenced areas listed above.

2) It is not clear what testing or data reports are credited to serve as the US-EPR strainer design basis. The following is a list of observations from the audit held at the AREVA Twinbrook office on April 22 and 23, 2009.

    a. Head loss test reports provided during the audit (see Enclosure 1) were OL3 plant specific reports. (Note: Olkiluoto 3 (OL3), is a Framatome EPR being constructed for the Finnish utility TVO).
    b. No reports were made available to affirm applicability of, or reconcile differences between, the OL3 reports and the US-EPR design.
    c. No US-EPR design specific reports were provided for review.
    d. US-EPR Technical Report ANP-10293 “U.S. EPR Design Features to Address GSI-191” does not provide any technical references when presenting head loss test data, discussing head loss testing program or other technical inputs and assumptions.

Provide revisions to technical report ANP-10293 and list reports credited with establishing strainer performance, and submit all critical report(s) for staff review.

3) Non-prototypical debris sources and non-prototypical test conditions could result in non-conservative head losses during testing. A list of examples is given below.

   a. It appears OL3 test parameters/configuration and debris source term differ significantly from US-EPR:

      i. Coating debris amount and sizing appears non-conservative (by order of magnitude)
      ii. Particulate insulation (micro-porous) amount is non-conservative (33%)
      iii. Fiber amount is very large and may be non-conservative for some tests
      iv. Latent debris amount, types, and sizing is non-conservative
      v. Chemical debris was not tested
      vi. Scaled flow is non-conservative (too low)
      vii. Weir wall height is non-conservative (too high)

   b. The OL3 thin bed testing (V6, V7 tests in report 38-9061053-000) used a particulate to fiber ratio of 0.25/1 (max). In thin-bed testing, particulate to fiber ratios on the order of 10/1 are expected in order to effectively assess head losses due to thin beds.
   c. The OL3 full load test (V3, V8 tests in report 38-9061053-000) identified that 50% of the debris that bypassed the basket (made it through the mesh) settled on the floor and did not make it to the strainer. Testing that takes credit for near-field settlement should either realistically or conservatively simulate the strainer upstream flow and turbulent conditions. Proper analytical evaluation of the similitude between the test tank and the actual plant condition was not provided.
   d. OL3 report 38-9056567-000 states that all the debris is mixed in a homogeneous way. Staff guidance on sequencing the debris for thin bed testing adds 100 percent of the plant particulate load to the test flume and subsequently adds fibrous debris in incremental batches of an appropriate size. No justification for debris sequence was provided.
   e. The testing should demonstrate that the scaling of the test - 1 to 1 for vertical and 1 to 20 for horizontal - provides conservative or prototypical results for head loss testing.
   f. There was no sacrificial strainer area allotted to miscellaneous debris i.e. signs, labels and placards that will likely be installed in containment.

   Evaluate how testing and/or documentation have addressed the above issues.

4) The retaining basket is a very important debris interceptor for the US-EPR defense-in-depth design strategy. Full load testing indicated a 96% filtration efficiency (4% of the debris made it through the basket mesh; also referred to as bypass). It is not clear if the baskets efficiency (or strainer efficiency) varies with debris loading. Discuss the primary mechanisms that result in bypass and how the percentage of bypass changes with varying debris loads for both the basket and strainer.

5) During the audit it was determined that OL3 testing had a gradually increasing strainer head loss and lowering basket head loss (level) at test termination with steady flow. If similar data is used to justify US-EPR strainer performance, provide discussion and analysis to account for the head loss out to the mission time.

06.05.01-1

This question is in regard to clarification of carbon and HEPA filter design parameters. Areas of Review Paragraph 3 of SRP 6.5.1, Revision 3, states the following:

> `For each ESF atmosphere cleanup system, the specific areas of review are as follows: The component design criteria, qualification requirements, and qualification testing of heaters, demisters, prefilters, and high-efficiency particulate air (HEPA) filters, design requirements of the filter and adsorber mounting frames, system filter and adsorber housings, and water drains, the adsorbent used for removal of gaseous iodides (in the preliminary safety analysis report (PSAR)), the physical properties of the adsorbent, and the design of the adsorber section of the filter trains (in the final safety analysis report (FSAR)). Provisions to inhibit off design temperatures in the adsorber section and the design criteria of the system fans or blowers, ductwork, and housings are also reviewed.'

In view of the above, there is insufficient information to determine if the following Regulatory Guide 1.52 values are met with respect to carbon filters:

1. The design average atmosphere residence time should be 0.25 seconds per 2 inches in thickness of adsorbent bed.

2. The maximum charcoal loading for the adsorbent train should be below 2.5 mg/gm ($\leq$ 2.5 mg of total iodine per gram of charcoal).

3. The design percent of the impregnant carbon should be no more than 5% of the total carbon.

4. The maximum component temperature in the adsorber section with normal flow conditions is not specified. The iodine loading post-accident radioactivity-induced heat in the adsorbent should not exceed that design temperature.

5. Under conditions of a failed fan post-LOCA, the charcoal temperature rise resulting from radioactivity-induced heat in the adsorbent should be below the 625 °F charcoal ignition temperature. Is water deluge from a fire protection sprinkler utilized to control this?

In addition, there is insufficient information to determine if the following Regulatory Guide 1.52 parameter is met with respect to HEPA filters:

> For the EPR, the applicant specifies that the design system efficiency for removal of particulates by the HEPA filter resulting from a DBA is 99.97/99.95% tested to ASME N510. There is insufficient information to determine if the HEPA filters have

sufficient design margin to accommodate fission product loading without restricting flow rate.

Provide the additional information necessary to support and meet the requirements listed above.

06.05.03-1

Per SRP 6.5.3, Acceptance Criteria 2, in order to be classified as a secondary containment for the purpose of fission product control, a structure or structures should completely surround the primary containment, and at least should be held at a pressure of 0.6 cm (0.25 in) (water) below adjacent regions under all wind conditions up to the wind speed at which diffusion becomes great enough to ensure site boundary exposures less than those calculated for the design basis accidents, even if exfiltration occurs.

a. During the DBA LOCA, the AVS ESF accident operation maintains a negative pressure in the annulus and the assumed in-leakage to the annulus is based only on the 0.25% allowable primary containment leakage. What is the allowed secondary containment in-leakage from the safeguards and fuel buildings that surround the shield building?

b. What programs are in place to test for secondary containment in-leakage?

c. What is the applicable mixing fraction to be applied to the annulus area?

d. What is the maximum wind speed at which annulus negative pressure can be maintained?