Request for Additional Information No. 90 (1077), Revision 0

10/3/2008

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 06.02.02 - Containment Heat Removal Systems
Application Section: 6.2.2

QUESTIONS for Component Integrity, Performance, and Testing Branch 1 (AP1000/EPR Projects) (CIB1)

06.02.02-2

Generic Safety Issue (GSI) 191 addresses the potential for debris accumulation on PWR sump screens to affect emergency core cooling system (ECCS) pump net positive suction head margin. The NRC has issued Bulletin 2003-01, "Potential Impact of Debris Blockage On Emergency Sump Recirculation At Pressurized Water Reactors," (Reference 1) and Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors," (Reference 2) related to the GSI-191 resolution. GL 2004-02 requests, in part, that licensees evaluate the maximum head loss postulated from debris accumulation (including chemical effects) on the submerged sump screen. Chemical effects are corrosion products, gelatinous material, or other chemical reaction products that form as a result of interaction between the PWR containment environment and containment materials after a loss-of-coolant accident (LOCA).

To satisfy the requirements of GDC 38 and 10 CFR 50.46(b)(5) regarding the long-term spray system(s) and ECCS(s), the containment emergency sump(s) in PWRs and suppression pools in BWRs should be designed to provide a reliable, long-term water source for ECCS and CSS pumps. In order to meet these regulatory criteria, SRP Section 6.2.2, "Containment Heat Removal Systems," recommends following the guidance of Regulatory Guide 1.82, Revision 3 (Reference 3), as an acceptable method.

For the US EPR design, with respect to addressing the concerns of GSI-191 and GL 2004-02, DCD Rev. 0 Supplement 1, Section 6.3.2.5 referenced the AREVA Technical Report ANP-10293, Rev.0, "U.S. EPR Design Features to Address GSI-191," dated February, 2008 (Reference 4).

Requested Information:

ANP10293 Section 3.3.1 indicates that chemical effects between the buffering solution, insulation material and latent debris are expected to be minimal with regard to the amount of precipitate formation. "NRC Staff Review Guidance Regarding Generic Letter 2004-02 Closure in the Area of Plant-Specific Chemical Effect Evaluation" dated March 2008 (Reference 5) provides a detailed methodology for performing chemical effects evaluations. Using Figure 1 of this report as a detailed guide, or other appropriate guidance**,** please provide a

detailed analysis that shows how the assumptions and chemical effects conclusions reported in ANP10293 are justified.

References

1. Bulletin 2003-01, "Potential Impact of Debris Blockage On Emergency Sump Recirculation At Pressurized Water Reactors, dated June 9, 2003, ADAMS Accession No. ML0316002590
2. Generic Letter (GL) 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized Water Reactors, dated September 13, 2004, ADAMS Accession No. ML0423605860
3. Regulatory Guide 1.82, Revision 3, Water Sources For Long-Term Recirculation Cooling Following A Loss-Of-Coolant Accident, dated November 2003, ADAMS Accession No. ML033140347
4. ANP-10293, Rev.0, "U.S. EPR Design Features to Address GSI-191," dated February, 2008 ML0804201490
5. NRC Staff Review Guidance Regarding Generic Letter 2004-02 Closure in the Area of Plant-Specific Chemical Effect Evaluations, dated March 2008, ADAMS Accession No. ML080380214," Enclosure 3 to letter from William H. Ruland, NRC, to Anthony Pietrangelo, NEI, dated March 28, 2008, Subject "Revised Guidance For Review Of Final Licensee Responses To Generic Letter 2004-02, "Potential Impact Of Debris Blockage on Emergency Recirculation During Design Basis Accidents At Pressurized-Water Reactors"," ADAMS Accession No. ML080230112

06.02.02-3

ANP 10293 does not address the potential for deposition of post LOCA chemical products on the fuel cladding and the consequential effects on clad temperatures. Please provide the rationale and technical bases to reasonably demonstrate that potential deposition of post LOCA chemical products on the EPR fuel cladding are acceptable as they related to compliance with 10CFR50.46(b)(5).

06.02.02-4

ANP10293, Revision 0 provides some of the assumptions and analysis performed to determine the debris transport under post LBLOCA accident conditions. Please provide the following detail regarding these assumptions and analysis:

1. It is reported that the amount of material dislodged from the limiting zone of influence (ZOI) was conservatively estimated. Please provide the details on how this estimate was performed.

2. It is assumed that latent debris, paint chips and metal debris will settle and not be transported because of their density. Please provide the calculations or tests results to support this assumption.

3. It is reported that non safety related coatings will not be used in containment ZOI's. However, section 6.1.2 of the FSAR indicates that Service Level 2 coatings will be used in containment. How will it be ensured that non safety related coatings will not be exposed to the potential ZOI's or transferred by other means to the IRWST since the principal heat transfer mechanism for limiting containment pressure following a LBLOCA is through condensation on heat sink surfaces and drainage to the IRWST?

4. Regulatory Guide 1.206 Section C.I.6.1.2 Organic Materials specifies that "The applicant should identify and quantify all organic materials that exist in significant amounts within the containment building. Such organic materials include wood, plastics, lubricants, paint or coatings, electrical cable insulation, and asphalt. Plastics, paints and other coatings should be classified and references listed. Coatings not intended for 40-year service without overcoating should include total coating thickness expected to be accumulated over the service life of the substrate surface." How are these organic materials accounted for, if at all, in the evaluation and testing performed and reported in ANP 10293?

5. Regulatory Guide 1.206 Section C.I.6.1.1.2 (1) states: "All soluble acids and bases within the containment building should be identified and quantified." How are these soluble acids and bases accounted for, if at all, in the evaluation and testing performed and reported in ANP 10293?

6. Regulatory Guide 1.206 Section C.I.1.1.2 (6) states: "Provide information concerning the proposed approach to control the chemistry of the water used for ECCS and CSS and during the operation of the systems. Describe the methods and bases to evaluate the short term-term compatibility (during the mixing process) and long-term compatibility of the water used for the ECCS and CSS with all safety –related components within the containment." The US-EPR does not use the CSS for DBAs. However, how do the testing results in ANP 10293 support and satisfactorily fulfill the above expected evaluations for short and long term compatibility of the post LBLOCA sump water with the safety-related components within the containment?

7. EPR FSAR Section 15.0.3.12 provides an evaluation of post accident Reactor Building water chemistry control. What impact or relationship, if any, does this water chemistry control evaluation have on the results of the testing performed and reported in ANP 10293? Were the concentrations of nitrates, chlorides and organic matter resulting from the hypalon, PVC and electrical cable degradation accounted for as contaminant components in the testing program summarized in ANP 10293?

06.02.02-5

ANP10293, Revision 0 reports sump screen testing results. Please provide the following details regarding the reported testing:

1. The details of the evaluation of the empirical data that were used to come to the conclusions in the report. What were the chemical tests performed, (if any) the measured concentrations of Al, Si, and Ca as a function of time

and temperature, and the actual measured pH during the testing? Did these measured values match the predicted values?

2. ANP-10293, Appendix B, Table B-1; GL 2004-02 Item 2.(d)(iii); Requested Information states, in part, "In addition to debris generated by jet forces, from the pipe rupture, debris created by the resulting containment environment (thermal and chemical) and CSS washdown shall be considered in the analysis. Examples of this type debris are disbonded coatings in the forms of chips and particulates and chemical precipitants caused by chemical reactions in the pool." AREVA's Observation/Comment in response to this item is "Approved coatings will be used based on assessment of the chemical effects on materials relative to debris generation." Although AREVA does not use the CSS in response to a LBLOCA event, significant washdown does occur since the heat sink surface area in the AREVA containment building design is nearly twice that of a comparable dry PWR containment. How does AREVA take into consideration, if at all, the other containment debris mention above and its generation both thermally and chemically in the AREVA design and confirmatory testing reported in ANP-10293?

3. ANP-10293, Appendix A, Items 2.3.1.7 and 2.3.2.3 include AREVA's commitment to provide an estimate of the resident material debris in the IRWST prior to the LBLOCA event. What is the AREVA estimate of the resident material debris in the IRWST, the bases of the data on which the estimate was developed and the process under which the estimate was calculated?

4. AREVA's Conformance Assessment response in ANP-10293, Appendix A, to Item 1.1.2.3 states: "The need to address the potential impact of chemical reaction with the debris sources, filter differential pressure and other downstream effects is recognized by the U.S. EPR design program. This issue will be further assessed based on the results of industry consensus regarding confirmation of downstream effects." Please provide AREVA's plan and schedule for the resolution of this Item 1.1.2.3 of Appendix A.

5. What was the differential pressure on the screen material as a function of time? What was the corresponding temperature profile of the test?

6. The no calcium-silicate insulation statement and other items mentioned on the bottom of page 1-1 refer only to insulation type materials to be use (or not used) on the reactor coolant system (RCS), and not the total of other materials that may be subjected to the post-LBLOCA harsh environment in the containment building. At the bottom of page 2-10, the last sentence is another insulation related statement regarding "only the RCS insulation." Please confirm that cal-sil material is not used in the containment building as stated on page 5-1. If cal-sil is used in the containment building please provide the rationale for excluding this material consideration in the testing performed and reported in ANP-10293.

7. What was the identity of the precipitated material collected on the sump screens during the testing and was it expected in both chemical form and quantity?

06.02.02-6

The materials and their quantities listed at the bottom of FSAR page 3-8 were used in the testing reported in ANP-10293 and only represent debris postulated from AREVA's determined zone of influence (ZOI) only and do not include the other potentially available sources from the entire containment building. Therefore, the staff requests the following information:

1. What is the mass of all other insulating materials (non-RMI) that is used in the plant design and how was it represented in the testing performed and report, if at all?

2. ANP-10293, Appendix A page A-20 RG 1.82 item 1.3.3.5, under AREVA's "Conformance Assessment" includes the statement "As part of the U.S. EPR design program, testing with different ratios of particulate to fiber volume will validate the above assumption (i.e. assess thin bed layer effects)." Has this testing referred to in Appendix A been completed and if so what were the results? If this testing has not been performed what is the current schedule for the completion of these tests and reporting the evaluation results?

06.02.02-7

The EPR FSAR provides only a very limited description of the TSP-C material packaging and its location. the description, in Tier 2 section 6.3.2.2 pages 6.3-9 - 6.3-10 reads as follows: "Coolant pH adjustment baskets containing granulated trisodium phosphate dodecahydrate (TSP-C) are strategically placed in the inlet flow path to the IRWST within the boundary perimeter of the weirs at the four heavy floor openings of the Reactor Building." (RB) "Flow through the baskets dissolves the TSP-C into the coolant that returns to the IRWST to passively neutralize entrained acids and maintain the alkalinity of the coolant." Drawings and figures in the FSAR and ANP-10293 do not show any components in the locations mentioned above except the retaining baskets. However, the location described above does allow drainage from the containment annular flow path to bypass the TSP material and flow into the IRWST thereby provide a diluting stream of primary coolant condensate following a LBLOCA event. Please provide:

1. Information (drawings, figures, schematics, etc.) that shows the specific locations of the TSP-C packaged material and their support structures. In addition, provide a description of the coolant condensate drainage flow paths and estimated quantities that are directed towards the TSP-C material and those that bypass the TSP-C material.

2. A description of the impacts on pH control of the IRWST considering the bypass flow that does not come in contact with the TSP-C packaged material before entering the IRWST and the potential blockage of expected condensate flow paths to the TSP-C packaged material.

3. The purity specifications that have been developed by AREVA for the TSP-C material particularly related to low concentration impurities such as lead (Pb) (since TSP-C is also a chelating agent), which is a common impurity of TSP-C.