AREVAEPRDCPEm Resource

From: Getachew Tesfaye
Sent: Friday, March 06, 2009 5:09 PM
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Cc: Jeffrey Poehler; David Terao; Gerard Purciarello; Steven Bloom; John Segala; Peter Hearn; Joseph Colaccino; ArevaEPRDCPEm Resource
Subject: Draft - U.S. EPR Design Certification Application RAI No. 200 (2280, 2282, 2267), FSAR Ch. 9
Attachments: Draft RAI_200_CIB1_2280_2282_CIB1_SBPA_2267.doc

Attached please find draft RAI No. 200 regarding your application for standard design certification of the U.S. EPR. If you have any question or need clarifications regarding this RAI, please let me know as soon as possible, I will have our technical Staff available to discuss them with you.

Please also review the RAI to ensure that we have not inadvertently included proprietary information. If there are any proprietary information, please let me know within the next ten days. If I do not hear from you within the next ten days, I will assume there are none and will make the draft RAI publicly available.

Thanks,
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Request for Additional Information No. 200 (2280, 2282, 2267), Revision 0

3/6/2009

U. S. EPR Standard Design Certification
AREVA NP Inc.
Docket No. 52-020
SRP Section: 09.01.01 - Criticality Safety of Fresh and Spent Fuel Storage and Handling
SRP Section: 09.03.04 - Chemical and Volume Control System (PWR) (Including Boron Recovery System)
SRP Section: 09.05.04 - Emergency Diesel Engine Fuel Oil Storage and Transfer System
Application Section: 9.5.4

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

09.01.01-18

Background

On page 100/127 of the technical report on Metamic that was completed for Holtec (Reference 1), the following statement was provided as justification for no additional testing:

"Radiation and an aqueous environment do not couple to produce a synergistic effect on the corrosion of metals. The use of aluminum and other metals in wet, high-radiation environments for many years (in reactors, fuel storage facilities, test cells, etc.) has shown the corrosion behaviors of the metals are not affected by radiation. Consequently, no corrosion tests were performed on the Metamic samples following their irradiation, and no tests are planned. Radiation has no effect on the corrosion rate of Metamic."

However, no testing has been performed on Metamic in the specific conditions cited in the original RAI (simultaneous exposure to radiation, peroxide and sulfates in a boric acid solution).

Requested Information

Provide data from the other metallic, neutron-absorber materials that have been in-service (cited in the Metamic report) that supports the assertion that Metamic will not be degraded under conditions of radiation fields (dose rates at the surface of the Metamic when faced with freshly-discharged spent fuel) and chemistry experienced at US PWRs (2800 ppm boric acid, 5 ppm peroxide, 150 ppm sulfates, up to 1 ppm of silica).

References

I. Holtec proprietary report, HI-2043215, Rev. 2, "Sourcebook for Metamic Performance Assessment," Attachment 7 to Letter from Tammy Morin to USNRC dated August 3, 2007, Subject: Response to Request for Additional Information (RAI) on License Amendment Request (LAR) 9261-5 to HI-STAR 100 Certificate of Compliance (CoC) No. ; ADAMS Accession No. ML072550049

09.03.04-19

Background

RAI 09.03.04-16, provided the following background:

Technical Specification 3.4.15 limits the specific reactor coolant activity for Dose Equivalent ^{131}I and Dose Equivalent ^{133}Xe. These are fuel integrity monitoring parameters. If RCS oxygen is not adequately controlled by having significant enough hydrogen concentrations, the fuel integrity cannot be assured. Control of hydrogen in PWRs is usually performed by 100% of letdown flow through the volume control tank (VCT). The VCT is maintained under hydrogen pressure (only) between 20 and 35 psig. The design identified in the FSAR has a significantly different approach to hydrogen control, that it is not well described.

RAI 09.03.04-16 requested the following information:

1. Provide the equations that identify the flow and concentration of hydrogen into the RCS liquid from the letdown system gassifier and VCT.
2. Justify the letdown flow of only 10% being directed through the VCT.
3. In order to assess the concentration of hydrogen in the RCS, the mole fraction of hydrogen in the VCT gas phase must be known. A sample line from the VCT gas space does not appear in the plant design for the NSS. Provide the methodology for determining the %H2 in the VCT gas phase so that the RCS hydrogen in cc/Kg can be properly calculated.

The response to RAI 09.03.04-16, Questions 1-3, can be summarized as follows:

1. The means of calculating the theoretical hydrogen concentration in the RCS will be provided at a later time in the design process.
2. The basis for directing only ten percent of the letdown flow through the VCT is to maintain the boron concentration in the tank in chemical equilibrium with the RCS. (the staff's intent with this question was for the applicant to justify the specific percentage of the letdown flow directed to the VCT)
3. Nitrogen gas will be used to control the VCT gas space pressure and the hydrogen concentration. The RCS hydrogen concentration will be measured using a pressurized RCS sample.

However, the applicant's response raises some additional concerns:

Since the method of controlling hydrogen proposed for the EPR is essentially a new design, in that operating PWR's typically maintain a hydrogen overpressure only on the VCT, as opposed to a nitrogen overpressure as proposed by the applicant, and typically route 100% of letdown flow through the VCT compared to 10% proposed by the applicant, the staff requires more detail for this design in order to obtain reasonable assurance that the design will perform its intended function.

Helium has the potential to introduce inaccuracy into the calculation of theoretical reactor coolant hydrogen concentration (the theoretical reactor coolant hydrogen concentration is compared to the measured reactor coolant hydrogen concentration and theoretical concentration should typically be within 10% of the measured concentration). Helium is formed as a result of $^{10}B(n,\alpha)^{7}Li$ reactions that occur in the RCS. The alpha particles are simply helium atoms and gain their electrons via interaction with water molecules. Helium is also a fission product. No means to sample the VCT gas space for hydrogen was provided. Measurement of hydrogen in the gas phase is typically performed so that a correction for the helium can be performed in the theoretical hydrogen calculation.

Additionally, the diversion of only 10% of the letdown flow to the VCT (as compared to some higher percentage) was not justified by the applicant.

Finally, a byproduct of the use of nitrogen to control the VCT pressure could be the formation of ammonia in the core when hydrogen and nitrogen gases undergo radiolysis to form free radicals. These free radicals will combine to form ammonia. The higher the concentration of nitrogen the higher will be the concentration of ammonia. This reaction will also limit the available hydrogen in the RCS.

Requested Information

1. Describe the design of the letdown system "gas-separator" that will provide hydrogen control to the RCS and provide the actual equations to be used in the calculations in terms of measurable plant parameters that will allow the theoretical hydrogen concentration to be calculated.
2. With only 10% of the letdown flow going through the VCT,
    a) Provide the duration it will take to ensure that equilibrium in the RCS is established after a change in the hydrogen injection rate based on the theoretical calculations made on RCS hydrogen.
    b) Provide engineering details and calculations that show the details of establishment of the equilibration with the RCS.
3. If VCT pressure is controlled using nitrogen gas:
    a) Provide the mechanism for preventing the build up of helium in the VCT, and describe the conpensation for the interference from helium in the analysis of hydrogen.
    b) The use of nitrogen gas will saturate the RCS with nitrogen.
        I. Provide the projected ammonia concentration in the RCS for this model.
        II. Provide calculations for determining this concentration and describe this concentration's affect on the demineralizer performance for removal of cations.

09.03.04-20

Background

RAI 09.03.04-17 provided the following background:

Technical Specification 3.4.5 identifies the operational requirements for assuring that the boron concentration is "not diluted." GDC 29 also identifies a function of Chemical and Volume Control System (CVCS) as supplying boric acid solution reliably for negative reactivity in the Reactor Coolant System (RCS). This requirement concerns both the total boron and the specific atom % of B-10. The coolant treatment system (CTS) as described in FSAR Tier 2 Section 9.3.4.2 (and accompanying figures 9.3.4-6) uses evaporative techniques to separate pure water from concentrated boric acid solution. The evaporator feed is purified through a demineralizer and then sent to an evaporator where the water is distilled through a series of trays to 'purify' the distillate removing additional boric acid. Concentration of contaminants in the boric acid phase, such as chlorides, silica, sulfate and sodium, and difficulty in maintaining flow continuity at higher boron concentrations and temperatures due to boric acid insolubility at high concentrations, have caused all plants to abandon operations of these systems for recycle purposes. Am/Be neutron sources and their associated BF3 detectors have been difficult to maintain in the past and most plants have removed these systems from their letdown lines.

The staff requires additional information related to the responses to RAI 09.03.04-17, Questions 1and 6.

1. Question 1 requested that the applicant provide additional details regarding the 'trays' in the boron evaporator and their physical functionality (e.g., percent boron removed for each tray).

   The response to Question 1 stated that the boron evaporator design is of a proprietary nature and may vary from the original design but will function to produce water of appropriate quality for re-use in the plant. Since the design details cannot be supplied to the staff at this time, the staff requires an alternate means to obtain assurance of the system's functionality, such as a pre-operational test.

6. Question 6 requested that the applicant provide the methodology for the determination of the B-10 concentration (atom %) in the recycled boric acid and provide the frequency of that determination.

   The response to Question 6 stated that the relative abundance of the B-10 and B-11 isotopes can be determined using mass spectrometry. Acceptable methods include glow discharge mass spectrometry (GDMS), thermal ionization mass spectrometry (TIMS), secondary ion mass spectrometry (SIMS), and inductively coupled plasma mass spectrometry (ICP-MS). The minimum frequency for the isotope abundance determination is once per year. However, the staff is concerned that the boric acid could become depleted in B-10 due to the long interval between determinations of the isotope abundance.

   Requested Information

   1. For the boron evaporator, provide a pre-operational functional test with acceptance criteria in FSAR Chapter 14 that will confirm the acceptability of this system's performance.
   2. Provide a calculation that demonstrates the EBA concentration in the stored tanks will not be depleted in B-10 over the course of a one year interval of sampling and analysis, so that this stored water can readily be used for neutron control during power operation.

09.05.04-17

Background

GDC 17 requires an independent and redundant onsite electric power system for the functioning of SSCs important to safety. RG 1.137 provides the regulatory position on diesel engine fuel oil quality as it relates to GDC 17. FSAR Tier 2 Section 9.5.4.3.1 commits to meeting new fuel-quality guidelines of RG 1.137. Position C.2.a of RG 1.137

recommends the cloud point to be less than or equal to the 3-hour minimum soak temperature or the minimum temperature at which the fuel oil is stored. The Diesel Fuel Oil Testing Program does not specify a minimum cloud point temperature even though the main tank room of the Emergency Power Generating Building (EPGB) has a design minimum temperature of 15°C (59°F) (FSAR Tier 2 Section 9.4.9.1). In addition, NRC Information Notice 94-19 *Emergency Diesel Generator Vulnerability to Failure from Cold Fuel Oil* clearly stresses the importance of specifying the proper cloud point. In RAI 9.5.4-1 dated 10/3/08, the applicant was requested to specify the minimum cloud point for the Diesel Fuel Oil Testing Program. The applicant replied to RAI 9.5.4-1 in its response to Request for Additional Information (RAI) Number 86, dated 11/3/08. The applicant stated the fuel oil cloud point is only a concern during extreme cold weather operations and the diesel fuel oil for the U.S. EPR is stored indoors. As such, cold weather degradation of fuel oil is not a concern.

The staff does not completely agree with the response and finds the cloud point needs to be specified when purchasing Diesel Fuel Oil especially during cold weather. Although the fuel is stored in a heated room, when it is delivered it may sit in a truck outdoors for long periods of time. An improperly specified cloud point may result in the inability to sample or offload the truck. In this case, the cloud point should be based on the minimum expected ambient temperature, which would necessitate a COL item for the COL applicant to specify the cold weather cloud point.

Requested Information

Please include a COL item for the COL applicant to specify the cloud point of the diesel fuel oil.

09.05.04-18

Background

RG 1.137 Position C.2.e recommends the draining of accumulated condensate from day tanks monthly, it is not clear in the application if Surveillance Requirement SR 3.8.3.5 (drain condensate from storage tanks every 92 days) applies to the day tanks; however, the frequency exceeds that recommended by RG 1.137. In RAI 9.5.4-5 dated 10/3/08, the applicant was requested to

- Identify the surveillance requirement that drains accumulated water from the day tanks.
- Provide justification for exceeding the RG 1.137 recommended surveillance requirement frequency of 30 days.

The applicant replied to RAI 9.5.4-1 in its response to Request for Additional Information (RAI) Number 86, dated 11/3/08. The applicant stated that Surveillance Requirement SR 3.8.3.5 is also applicable to the day tanks, however, the applicant did not provide justification for extending the interval. Technical Specification Bases for SR 3.8.3.5 states the surveillance frequency is established by RG 1.137.

Requested Information

The applicant is requested to provide justification for exceeding the recommended frequency for draining condensate from the day tanks.

09.05.04-19

General Design Criteria 2 requires that structures, systems, and component (SSC) important to safety be protected from natural phenomena, including earthquakes. Although the diesel generator fuel oil storage and transfer system (DGFOSTS) is seismic category I and is located in a seismic category I building, the applicant did not state that the non seismic category I SSCs in the Emergency Power Generation Building (EPGB) will have no adverse effect on the DGFOSTS after a safe shutdown earthquake (SSE) Explain the effect of non seismic category I SSCs in the EPGB upon the DGFOSTS after an SSE.
The FSAR should be changed to reflect this information.

[Note: This question was suppose to be part of RAI 152 (1720) Balance of Plant Branch 1 (AP1000/EPR Projects) (SBPA)]