NRR-PMDAPEm Resource

From: Regner, Lisa
Sent: Thursday, January 14, 2016 4:21 PM
To: Wayne Harrison
Cc: Russell, Andrea
Subject: DRAFT RAI Round, Section A
Attachments: RAI Round 3 DRAFT Section A to licensee.docx

Wayne,

Attached is Section A of the Round 3 RAI. It does not include risk, technical specifications, or final thermal-hydraulic branch questions.
Let's talk on Tuesday and we'll plan a clarification call.

Also, I'd like to get our next public meeting on the docket; are you available Thursday 2:30 – 4, January 28? Staff has it tentatively blocked off on their calendars.

Thanks,
Lisa

Hearing Identifier: NRR_PMDA
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Created By: Lisa.Regner@nrc.gov

Recipients:
"Russell, Andrea" <Andrea.Russell@nrc.gov>
Tracking Status: None
"Wayne Harrison" <awharrison@STPEGS.COM>
Tracking Status: None

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DRAFT Question/Clarifications
STP GSI-191
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<u>Follow-up RAIs from 2009 RAI Responses from RoverD Submittal:</u>

<u>Debris Transport</u>

Follow-up RAI 18 – In the December 23, 2009, RAIs, the NRC staff asked for a justification for an erosion value of 10%. Since the RAI was written, the NRC accepted 10%, but STP uses 7% in their RoverD evaluation. Please justify the use of 7% as an erosion fraction for low density fiber glass (LDFG) in the pool for the deterministic portion of the evaluation. The Alion test report concluded that 10% is a conservative erosion value for plants that can show that the test is applicable to their plant conditions. NRC acceptance of the Alion erosion report states that values less than 10% should not be used. There is no basis for acceptance of the 7% erosion value.

Follow-up RAI 19 – In the December 23, 2009, RAIs, the NRC staff asked the licensee to estimate the quantity of fines that could erode from small pieces of fiberglass debris that were assumed to transport to the strainer, but settled during the head loss test. The NRC staff position is that the small fibrous debris should be accounted for, either as settled in the pool and eroded, or by performing a test that confirms that any fiber that is calculated to transport to the strainer transports to the strainer during the test. The RoverD analysis does not explicitly account for small fibrous debris, in that it only uses the fine debris amounts from the July 2008 test as a datum of comparison to the CASA Grande generated, transported, and eroded fine fiber quantities. Small fiber contributes to the RoverD fiber fines mass through erosion of small fiber retained in structures or settled in the pool. Previous approaches that may have been designed to overestimate the amount of small fiber accumulating on the strainer (in the context of now obsolete head loss computations), would result in underestimates of the amount of fiber fines in the RoverD analysis.

- Provide information on the amounts of small fiber assumed to transport to the strainer and assumed to settle in the pool (and potentially subject to erosion into fiber fines)

- Provide a sensitivity analysis of the RoverD results (e.g., set of critical welds and magnitude of the breaks causing the debris to exceed the tested amount of fiber fines, and changes on the delta core damage frequency) considering the assumptions and uncertainties on the amount of small fiber settling and retained on structures and transported to the strainer, as well as adequate values of erosion fraction (e.g., either 7% or 10% as discussed in the follow up to RAI 18)

Follow-up RAI-26 – The response provided in the August 20, 2015, submittal references sinking metrics for stagnant water. The sump pool is not stagnant, but is significantly turbulent during pool fill up. NRC staff disagrees with the statement that fiber would have mixed with particulate debris resulting in trapping or sediment of the fiber. Existing guidance states that all fine fiber should be considered to transport to the strainer. In addition, the 2008 head loss test is used to determine an acceptable fiber limit for comparison. The comparison amount from the test should reflect the amount of fine fiber that was on the strainer at the test completion. Please provide a justification that placing 25% of the latent fiber into the test flume prior to starting the pump would result in the transportation of the fiber, or that the amount of fiber under consideration is insignificant.

Headloss and Vortexing

Follow-up RAI 33 – In the December 23, 2009 RAIs, the NRC staff asked the licensee to provide the margin to flashing and the assumptions for the calculation. The licensee provided a calculation for the margin to flashing for large break loss of coolant accidents (LOCAs) at the start of recirculation as:

= Containment pressure + submergence – total strainer head loss – vapor pressure

= 43.1 + 0.3 - 1.5 - 39

= 2.3 psi

The licensee stated that post-LOCA containment over-pressure credit is needed to eliminate the issue of flashing. The licensee stated that because the minimum strainer submergence was conservatively determined to be 0.5 inch for small break LOCA (SBLOCA), sump temperature and containment pressure would be lower for a SBLOCA than a large break LOCA (LBLOCA), strainer flow rate would also be lower, and debris transported to strainers would be much less such that there would be open strainer areas. Therefore, flashing is not expected to be an issue for SBLOCAs. Sump temperature should be calculated conservatively high and containment pressure conservatively low to ensure no flashing will occur. It is acceptable to perform a time-based calculation taking viscosity, chemical timing, and strainer submergence into account. Most design basis calculations maximize containment pressure, which is non-conservative from a flashing perspective. Explain in detail how sump temperature and containment pressure were calculated.

Follow-up RAI 34 – In the December 23, 2009, RAIs, the NRC staff asked the licensee to provide an evaluation of the potential for deaeration of the fluid as it passes through the debris bed and strainer and whether any entrained gasses could reach the pump suction. The licensee stated that the net void fraction is 0%, and therefore, void fraction is not an issue for any of the pressure and temperature combinations associated with the post-LOCA fluid. The licensee explained that any void fraction that could occur at the strainer debris bed is minimal and that if any should occur, it is reversed before the strainer discharge water leaves the sump due to significant static head of water above the emergency core cooling system (ECCS) / containment spray system (CSS) pump suction inlets within the sump. The licensee concluded that the net void fraction is therefore zero and not problematic for any STP pressures and temperatures from the strainer to the ECCS/CSS pump suction inlets within the sump. With respect to the RAI response:

a. Do the head loss values listed include clean strainer head loss?

b. How was the SBLOCA value determined?

c. Was containment spray head loss (CSHL) calculated separately?

d. Is the SBLOCA value less than the CSHL value alone due to the lower flow rate?

e. Since head loss is greater at lower temperatures and solubility is greater at lower temperatures were any evaluations done at lower and higher temps to ensure the provided calculation is bounding?

f. As with the flashing evaluation, it is acceptable to use a time-based calculation that includes submergence, temperature, chemical timing, etc. If the values used in the deaeration evaluation are not considered to be design basis values, please provide information regarding how they were calculated. Please provide the design basis values for head loss, SBLOCA, CSHL, and the associated conditions.

g. The staff understands that gas voids will decrease in volume as pressure increases. However, reabsorption of gasses into the fluid may not occur instantly. Please explain what is meant by the reversal of the void fraction due to the static head of the water.

<u>*Net Positive Suction Head*</u>

Follow-up RAI 37 – In the December 23, 2009, RAIs, the NRC staff asked the licensee to provide NPSH margin results for low head safety injection (LHSI), high head safety injection (HHSI), and core spray (CS) pumps, for the LBLOCA and SBLOCA cases, under conditions of hot-leg recirculation. The licensee provided the NPSH margin for the LBLOCA for LHSI, HHSI, and CS. The licensee stated that its SBLOCA scenario will have little to no debris on the strainer to contribute to head loss. The licensee concluded that there is only clean strainer head loss for the SBLOCA case, which is much less than LBLOCA total strainer head loss. The lower flow for the SBLOCA would reduce clean strainer head loss compared to LBLOCA and the NPSH available would be slightly higher for SBLOCA since piping friction loss is less due to lower flow. So, for SBLOCA compared to LBLOCA, NPSH margin would increase somewhat and total strainer head loss would be much less. Please provide additional detail for the basis that near zero debris head loss is justified for the SBLOCA case.

Follow-up RAI 38 – In the December 23, 2009, RAIs, the NRC staff asked the licensee to describe the methodology and assumptions used to compute the limiting pump flow rates for all pumps taking suctions from the ECCS sumps. The licensee stated that each of the 3 emergency sumps supplies water to the respective CS pump, LHSI pump, and HHSI pump for that train. The CS pumps discharge to common ring header piping arrangement and the flow used for the NPSH evaluation is based on 2 CS pumps operating resulting in higher flow per pump than if all 3 were operating. Flow rates used for LHSI and HHSI are maximum values per TSs. Please provide additional details on the methodology used to calculate the CS flows. For example, were they calculated by hand, or a hydraulic software package, or some other method?

Follow-up RAI 44 – In the December 23, 2009, RAIs, the NRC staff asked the licensee to identify the volume of holdup assumed for the refueling canal and provide further information that justifies that the refueling canal drains cannot become fully or partially blocked such that additional holdup could occur, or the extent to which holdup could occur. The licensee provided a detailed explanation for why its refueling cavity drain lines will not become blocked. The licensee concluded that the refueling cavity drain lines are not assumed to become blocked and there is no water inventory holdup other than the water below the evaluation of drain lines. Explain in detail the basis for the assertion that large pieces of debris will not reach the refueling cavity. If large pieces may transport to the refueling cavity, explain why they would not block the drain lines.

<u>New RAIs</u>

<u>*Debris Transport*</u>

New SSIB RAI 1 – NEI 04-07 recommends treating labels and tags as 100 percent fines or small pieces or fibers unless transport of labels is shown to be important for deteriorating strainer performance. The December 11, 2008 submittal, section 3b states that the miscellaneous debris term is bounded by 100 square feet. Section 3d states that the 100 square feet was implemented in the debris generation and transport analysis. Section 3f states that transport testing was completed that determined that the miscellaneous debris objects would not transport to the strainer so they were not included in the test. .Please explain the effect that miscellaneous debris has on the RoverD evaluation.

New SSIB RAI 2 – Based on NRC staff review of the RoverD submittal, it appears that large pieces of debris do not reach the sump pool since they are eroded at 1%, as would be expected for debris held up on gratings. Please confirm that large pieces of debris do not reach the pool and provide details on what prevents any large pieces from falling into the pool. It may be beneficial for the NRC staff to review the detailed transport calculation that provides inputs to RoverD using an audit or some other method.

New SSIB RAI 3 – The NRC staff needs additional information to verify the RoverD computations. For all debris types and sizes, provide a summary table of the fractions of:

a) all debris transported to the recirculation pool and the strainer,
b) the debris retained in structures, and
c) the debris settled in the pool.

New SSIB RAI 4 - The NRC staff needs additional information to verify how each debris type and size is bounded by the July 2008 test or otherwise accounted for in RoverD.

a) Provide an explicit comparison of RoverD transported debris amounts and the 2008 test amounts for each type and size of debris that could be produced in a LOCA event. Note that some qualified coating types listed as present in containment in Item 3.h, 1 do not appear to be explicitly considered in the RoverD approach (e.g., qualified alkyds and baked enamel).

b) Provide a clear illustration of how each individual type and size of debris that is predicted to transport to the strainer by RoverD is accounted for in the test. That is, show which test surrogate was assigned to each RoverD debris type.

c) The RoverD submittal states that the amount of Microtherm and unqualified epoxy included in the 2008 head loss test was deficient, but excess amounts of Marinite and IOZ address the deficiency. Explain in detail the basis for the assumption that the Marinite and IOZ account for the debris that was not included in the test. Provide the deficient amount of Microtherm and unqualified epoxy, and the amount and type of each test surrogate that is used to account for the deficient test amounts. The staff has observed that Microtherm (and Min-K) has had a significantly larger impact on head loss than Marinite during strainer tests, and Marinite has been observed to have a larger effect on head loss than coatings.

d) Show that each debris type predicted by RoverD to transport to the strainer is bounded by the surrogate included in the 2008 test, using appropriately conservative bounding transport assumptions for each debris size (e.g., smalls are maximally transported when considering the RoverD surrogate for smalls but are maximally eroded when considering the RoverD surrogate for fibers).

New SSIB RAI 5 - Justify the selection of fiber fines to define the sole failure criterion in RoverD. The 2008 test included fines and larger size fiber debris. Explain why only fine fiber amount should be used as the failure criteria. Please address the 2008 test conditions and findings when performing this evaluation.

New SSIB RAI 6 - In defining test amounts of epoxy coatings that need to be accounted for in the evaluation, it was assumed that coatings in the reactor cavity would not transport to the strainer. However, welds located inside the reactor cavity may allow unqualified coatings to fail and transport even if not within a zone of influence (ZOI).

a) Provide more detail on the technical basis for test amounts, considering breaks inside the reactor cavity.

b) The Updated Final Safety Analysis Report (UFSAR) markup states that 100% of unqualified coatings fail as particulate. Table 16 in attachment 1-2 states that 2008 pounds of unqualified epoxy were considered to fail as chips during the 2008 test. Please explain how this is accounted for in the evaluation.

c) Provide a breakdown of the sizing of the unqualified epoxy outside the reactor cavity, including an explanation of why only 48% transports to the strainer.

d) Evaluate whether amounts of epoxy particles in the July 2008 tests are truly bounding for cases of breaks inside the reactor cavity.

e) If the coating amounts from the test are not bounding, provide an evaluation of the effects of excess coatings on the evaluation or provide a listing of the surrogates that were included in the test in excess that can be assigned to account for epoxy that may not have been adequately represented in the test.

<u>Current Licensing Basis Changes</u>

New DORL RAI 1 - Provide a specific list of all licensing basis changes, in the application, for which you are requesting NRC review and approval via 10 CFR 50.90.

<u>Coatings</u>

New ESGB RAI 1 - Provide additional details and clarification with respect to the manner in which the total mass of unqualified coatings was calculated. Attachment 1-2, page 67 of 95 states that, “the weight of applied coatings are determined based on a theoretical coating spread rate(s) (sq. ft per gallon at 1mil thick) instead of specific vendor coating spread rates.” If a 1 mil thick coating was assumed for inorganic zinc or epoxy coatings, the analysis may be significantly underestimating the amount of coating debris. Describe the thickness used in the analysis for both epoxy and inorganic zinc coatings since the mass of epoxy within the ZOI may be impacted and the mass of unqualified inorganic zinc throughout containment may be impacted.

<u>Thermal-Hydraulic Analysis:</u>
Note: these questions were previously provided by 12/11/15 email from the DORL PM to STP.

New SNPB RAI 1 - During the November 2015 audit at Texas A&M, STP was considering performing the long term core cooling analysis with the core bypass open to allow flow in the axial direction. Does STP intend to make this change and allow flow axially through the bypass or will STP continue with the bypass completely blocked? If STP is crediting the use of the bypass, they should provide analysis to demonstrate that the bypass will not block during the scenarios. If they are not crediting the bypass, they should inform the NRC that they plan to continue with their current model.

New SNPB RAI 2 - During the audit, the NRC staff identified a number of sensitivity studies which would be important for the review of the proposed long term core cooling evaluation methodology. STP should perform the following sensitivity studies and submit plots of the relevant figures of merit and important timings for long term core cooling analysis:

a) Appendix K decay heat load with single worst failure and steam generator tube plugging
b) Axial power shape
c) Small break sensitivity study with appropriate break size resolution

<u>*Component Performance*</u>

New EPNB RAI 1 - In Attachment 1-2, page 4 of 95, of the August 20, 2015 submittal, the licensee stated that the large main steam and feedwater line breaks were not evaluated because recirculation is not required under the plant licensing basis for STP. The NRC staff notes that if the main steam or feedwater lines inside the containment break, the exiting water or steam jet from the break location will impinge on the insulation of nearby pipes and generate debris. Even though the main steam and feedwater lines are not required for recirculation,

(a) discuss whether the debris from the main steam or feedwater line breaks will not obstruct the sump strainers,
(b) discuss whether the containment sump and associated pumps have sufficient capacity to handle the amount of the debris generated by the main steam or feedwater line breaks,
(c) confirm that if either a main steam or feedwater line breaks, the pumps associated with the strainers will operate and that clogging of the strainers and loss of the intended safety function associated with flow through the strainers due to accumulation of debris will not occur.
(d) discuss whether any ASME Code Class 2 piping inside the containment, besides the main steam and feedwater lines, are evaluated for debris generation. If none, provide an explanation why Class 2 piping inside the containment were not evaluated.

New EPNB RAI 2 - In Attachment 1-4, page 22 of 32, of the August 20, 2015 submittal, under the heading, "Reactor Coolant System Weld Mitigation," the licensee stated that "…all STP large bore RCS welds susceptible to pressurized water stress corrosion cracking (PWSCC) have been replaced with Alloy 690 material which is not susceptible to PWSCC (SG nozzles) or overlaid with non-susceptible Alloy 52/52M/152 material (pressurizer piping safe ends) with the exception of the reactor vessel nozzle welds…"

a. Clarify whether "the reactor vessel nozzle welds" discussed in the above statement are the J-groove welds associated with the reactor vessel closure head penetration nozzles to house the control rod drive mechanisms (i.e., CRDM nozzles), or the full-penetration butt welds associated with the hot leg nozzles that are attached to the reactor vessel shell.
b. Discuss whether the CRDM nozzles in both units are made of Alloy 600 material and the associated J-groove welds are made of Alloy 82/182 welds. If not, discuss the material. If CRDM nozzles and J-groove welds are made of Alloy 600/82/182 material, discuss why break locations were not selected at the CRDM nozzles.
c. Discuss the original construction weld material used in all full-penetration butt welds on the primary loop piping (i.e., hot leg, cold leg and crossover piping) and branch connection pipes (e.g., pressurizer surge line, accumulator line, and safety injection

piping). If the weld materials are made of Alloy 82/182 in primary loop piping and branch connection pipes, confirm that these welds have been mitigated by the weld overlay using Alloy 52/52M/152 weld material. Identify each Alloy 82/182 weld that has not been mitigated.

New EPNB RAI 3 - Discuss the reason why breaks from pressurizer heater sleeves and reactor vessel bottom mounted instrumentation nozzles were not considered as a source of debris generation.

LOCA Containment Response

New SCVB RAI 1 - UFSAR Section 6.2.1.3, "Mass and Energy Release Analyses for Postulated Loss of Coolant Accidents" states the use of Westinghouse WCAP-10325-P-A methodology for LOCA mass and energy (M&E) release analysis. Westinghouse has issued Nuclear Safety Advisory Letter (NSAL)-06-6, NSAL-11-5, and NSAL-14-2, and InfoGram (IG)-14-1 reporting errors in this methodology. Also, the GOTHIC methodology was used for the LOCA containment analysis, and the mass and energy input to GOTHIC needs to be corrected based on the NSALs and IG. Submit the following revised licensing basis containment analysis for NRC review. For the following analyses, include discussions of 1) the basis and changes in inputs compared to the current analysis, 2) the basis and changes in assumptions from the current analysis, and 2) the results of the analyses:

a) LOCA containment mass and energy release analysis
b) Pressure and temperature response analysis for containment integrity
c) Peak temperature analysis for equipment environmental qualification
d) Sump temperature and level response for net positive suction head analysis
e) Minimum containment pressure response for emergency core cooling system analysis