NRR-PMDAPEm Resource

From: Regner, Lisa
Sent: Tuesday, March 22, 2016 2:04 PM
To: Wayne Harrison
Cc: Michael Murray; Sterling, Lance (lsterling@STPEGS.COM)
Subject: STP GSI-191: DRAFT Risk RAI - Round 3
Attachments: Risk RAIs - round 3 - to licensee.docx

Wayne,

Attached are the round 3 draft RAI questions in preparation for the Audit.
We can plan to discuss at a high level at our weekly call this week, and continue detailed discussions at the public conference call on 3/31, as desired.

Please note that the call this week is shortened to 3 – 4 pm EDT.

Thanks,
Lisa

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South Texas Project Pilot Risk-Informed Resolution to GSI-191
Draft Questions for April 2016 Focused-Scope Audit
3/22/2016

The NRC staff is currently developing a regulation and implementation guidance for licensees wishing to use a risk-informed approach for responding to Generic Letter 2004-02. Although the rule and its guidance (10 CFR 50.46c and Regulatory Guide 1.229 respectively) are not yet finalized, their development has alerted the staff to several new technical insights that are important to consider when quantifying the risk impact of debris. The following audit questions were derived in part from these new insights, which the NRC staff believes are important to reaching a safety decision.

Question 1

Regulatory Guide (RG) 1.174 states that, "the PRA should realistically reflect the actual design, construction, operational practices, and operational experience of the plant." Therefore, whether a particular accident sequence (e.g., secondary side break followed by sump recirculation) is part of a plant's licensing basis is immaterial when performing a risk analysis. For example, accident sequences involving common cause failures are not part of a plant's licensing basis (as UFSAR Chapter 15 design basis analyses require postulation of only a single active failure) yet operational experience shows that they can occur and they therefore must be modeled by the probabilistic risk assessment.

Consistent with this guidance, the risk-assessment of debris should consider all hazards, initiating events, and plant operating modes. It should not be limited to design-basis accidents, licensing basis events, specific plant operating modes, or specific initiating events such as LOCA. The document Enclosure 4-2, Risk-Informed Closure of GSI-191, Volume 2, Probabilistic Risk Analysis (STPNOC, 2013) provides screening rationale and concluded, in Section 12.3: "Medium and large LOCAs from internal events only are retained for further consideration with respect to core damage resulting from GSI-191 phenomena." The Volume 2 document also stated that the full-power analysis bounds consequences of other plant states.

A supplemental analysis was submitted in 2015 (SPNOC, 2015a, Attachment 1-3), which did not supersede previous submittals but purported to be "stand-alone." This raises the question regarding the applicability of the earlier information. Specifically, please confirm that the conclusion in Section 12.3 in the earlier submittal (STPNOC, 2013) applies to the RoverD supplemental analysis (STPNOC, 2015a); that is, confirm that all hazards, initiating events, and plant operating modes were screened out of consideration except medium and large LOCAs and that full power operation is the only operating mode that merits consideration in the detailed RoverD analyses.

Question 2

NUREG-1829 LOCA frequencies include only breaks caused by long-term material degradation. Other potential contributors to LOCA frequency such as seismically-induced LOCA (both direct and indirect) should be evaluated separately. A “direct” seismically-induced LOCA involves rupture of a piping or non-piping component caused by the seismic event itself. An “indirect” seismically-induced LOCA is caused by, for example, failure of piping or component supports that leads to the consequential failure of the piping or non-piping component.

In response to an NRC request for additional information (RAI), STP provided an estimate of the frequency of seismically-induced LOCA (STPNOC, 2014a, Attachment 1, p. 24/86). However, the response did not appear to consider indirect seismically-induced LOCAs. One acceptable approach for evaluating indirect seismically-induced LOCA is for the analyst to use the method described by NUREG-1903, Section 4.6. “Representative” values in the NUREG could be replaced with site-specific fragility and hazard information that, as appropriate, accounts for any effects of material degradation or aging. Alternatively, the analyst may demonstrate that the representative values are bounding for the site in question with consideration of effects due to material degradation or aging.

Clarify whether the analysis documented in the RAI response (STPNOC, 2014a, Attachment 1, p. 24/86) considered indirect-seismic LOCAs. If not, please provide an analysis accounting for indirect damage mechanics eventually leading to rupture of piping and non-piping systems and LOCA events. For both direct and indirect seismically-induced LOCAs, please estimate, bound or screen any increase in seismic risk due to debris.

Question 3

NUREG-1829 LOCA frequencies include only breaks caused by long-term material degradation. Other potential contributors to LOCA frequency, such as water hammer, should be evaluated separately.

One acceptable approach for evaluating water hammer is for the analyst to verify that the potential for water hammer is not likely to cause pipe rupture in the break locations that can produce and transport problematic debris. Water hammer includes various unanticipated high-frequency hydrodynamic events, such as steam hammer and water slugging. To demonstrate that component failure risk due to water hammer is acceptably low, the analyst could take the following actions:

- Assess historical frequencies of water hammer events affecting break locations (piping and non-piping) that could generate and transport debris.
- Evaluate operating procedures and conditions and demonstrate that they are effective in precluding water hammer.
- Alternatively, the analyst can demonstrate the following:
    - Plant changes, such as the use of J-tubes, vacuum breakers, and jockey pumps, coupled with improved operating procedures, have been used to successfully mitigate water hammer events.

- Measures used to abate water hammer frequency and magnitude have been effective over the licensing period of the plant.

Please evaluate the relevance of water hammer events in the context of GSI-191 and estimate, bound or screen any increase in risk due to water hammer events.

Question 4

Please provide values of total risk estimates (also including water hammer and seismically-induced LOCA) for the plant expressed as CDF and LERF. Those values are not available in the recent RoverD analysis (SPNOC, 2015a, Attachment 1-3). This information is needed to compare pairs {CDF, ΔCDF} and {LERF, ΔLERF} to risk acceptance guidelines in RG 1.174.

Question 5

10 CFR 50.46(b)(5) *Long-term cooling*, and Appendix A to 10 CFR Part 50, General Design Criteria 35 *Emergency core cooling*, state, in part, that the emergency core cooling system must provide core cooling for extended periods following postulated LOCAs. Licensing basis analyses used to demonstrate compliance with these regulations have historically analyzed the effects of debris in a deterministic manner. STPNOC has submitted a pilot license amendment request and a series of exemptions that, if approved, would change its licensing basis by using a risk-informed treatment of debris. RG 1.174 contains five key principles for performing risk-informed changes to a plant's licensing basis. Principle 5 states that an implementation and monitoring program should be utilized to ensure that the conclusions reached by the staff (e.g., that the increase in risk is small) remain valid after the change is implemented.

The NRC staff has determined that it does not yet have adequate assurance that principle 5 of RG 1.174 is met and that there are sufficient regulatory controls of the key elements of the STP risk-informed assessment of debris.

Specifically, the NRC requires regulatory assurance of the continued applicability of the results of the risk-informed approach for consideration of debris in order to grant the requested license amendment and associated exemptions. In order to obtain this regulatory assurance, certain aspects of the risk-informed approach must (1) be subject to an ongoing monitoring program consistent with principle 5 of RG 1.174; (2) be periodically updated; (3) continue to use methods acceptable to the NRC; and (4) be subject to reporting and corrective action when the risk-informed acceptance criteria are not met. The NRC also requires regulatory assurance that the risk-informed approach will not be employed for plant design changes that would increase the problematic debris source term without prior NRC review and approval.

Provide assurance of appropriate regulatory considerations:

1. Prior to changing the key methods, approaches and data of the risk-informed analysis set forth in (reference).

2. Prior to using the risk-informed approach to justify future plant design changes that would increase the problematic debris source term compared to the level that existed as of (Date).

3. STPNOC will implement and maintain a program to monitor key assumptions and data used in the risk assessment and the evaluation of defense in depth and safety margins. The monitoring program must assess the effects of design or plant modifications, procedure changes, as-found conditions, identified changes or errors in the analysis, industry operating experience, and any other information that could result in increased risk, or decreased defense-in-depth or safety margins, under the alternative risk-informed approach. The results of the monitoring program should be retained onsite for inspection.

4. STPNOC will update the risk informed evaluation no later than 48 months after initial NRC approval or the latest update and compare the risk results, CDF, LERF, ΔCDF, and ΔLERF, to the acceptance criteria in the safety evaluation that accompanies the requested LAR (reference). The results of the monitoring program should be retained onsite for inspection.

5. In the event that the acceptance criteria for the risk-informed analysis are not met:
   a. STPNOC will notify the NRC in accordance with 10 CFR 50.72 or 50.73 that the acceptance criteria has been exceeded; and,
   b. STPNOC will take timely action to ensure that the acceptance criteria are met.

   These requirements are in addition to and separate from the reporting requirements in 10 CFR 50.46(a)(3).

References

STPNOC. "South Texas Project Units 1 and 2 –Supplement 2 to STP Pilot Submittal and Requests for Exemptions and License Amendment for a Risk-Informed Approach to Address Generic Safety Issue (GSI)-191 and Respond to Generic Letter (GL) 2004-02." South Texas Project Nuclear Operating Company: Wadsworth, TX, August 20, 2015a. (ADAMS Accession No. ML15246A126)

SPTNOC. Letter, G. T. Powell, STPNOC, to NRC Document Control Desk, "Description of Revised Risk-Informed Methodology and Responses to Round 2 Requests for Additional Information Regarding STP Risk-Informed GS1-191 Licensing Application." Document NOC-AE-15003220. South Texas Project Nuclear Operating Company: Wadsworth, TX, March 25, 2015b. (ADAMS Accession No. ML15091A440)

STPNOC. "South Texas Project Units 1 and 2 —First Set of Responses to April, 2014, Requests for Additional Information Regarding STP Risk-Informed GSI-191 Licensing Application Revised." South Texas Project Nuclear Operating Company: Wadsworth, TX, May 1622, 2014a. (ADAMS Accession No. ML14149A434)

STPNOC. "Enclosure 4-2, Risk-Informed Closure of GSI-191, Volume 2, Probabilistic Risk Analysis." Document STP-RIGSI191-VO2, Revision 2. South Texas Project Nuclear Operating Company: Wadsworth, TX, October 22, 2013a. (ADAMS Accession No. ML13323A189)