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Submitter Information

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General Comment

Attached are additional comments on the proposed regulatory guide revision.

Attachments

NRC-2010-0249-DRAFT-0002.1: Comment on FR Doc # 2010-17251

SUNSI Review Complete
Template = ADM-013

E-RIDS = ADM-03
Add = R.A. Jarvey (raj)
M. Case (MJC)

A draft of Regulatory Guide 1.82 Revision 4 (DG-1234) was issued by the NRC in July 2010, and forwarded to the industry by NEI. NEI requested industry comments by August 18, 2010 in order to provide an integrated response to the NRC by September 10, 2010. The following comments were noted on the revised draft regulatory guide:

General:

1. There are significant differences in the draft of Revision 4 from the three previous revisions to RG 1.82, e.g. the break location selection criteria increased from 5 to 8. Will the current analysis of record (both for BWRs and PWRs) need to be revised to comport with Revision 4? If not, what is the NRC's position for when the analysis of record needs to comport with Revision 4 of RG 1.82?
2. Suggest doing a global search for the words "very challenging" and delete, or simply say "are unacceptable."
3. Suggest removing the references to the WCAPs and simply state should be evaluated with approved methods or equivalent or the Staff Review Guidance.
4. Page 9 discussions on flashing: Attachment V-1 of the SER to NEI-04-07 discusses evaluation of two phase condition caused by a pressure drop. The following explanation is provided in the Attachment: "Two-phase condition can result from two causes. As pressure decreases downstream of the screen, noncondensible gas dissolved in the water can come out of solution and/or hot water can flash into steam. Either or a combination of these two phenomena can result in two-phase flow with increased pressure drop." Deareation is based on Henry's law whereas flashing into steam is a thermodynamic phenomenon. The draft revision 4 applies the term "flashing" to both phenomena. "Flashing" usually refers to as the generation of steam. Consistent terminology should be used throughout the proposed regulatory guide revision to describe the two phenomena associated with gas evolution downstream of the strainer.
5. The "NRC Draft Guidance for the Use of Containment Accident Pressure in Determining the NPSH Margin of ECCS and Containment Heat Removal Pumps" provides a good discussion of NPSH, its uses and its limitations. Staff should consider incorporating the discussion of Section 2, 3 and 4 into the RG.
6. The proposed RG is inconsistent in its acceptance criteria between GL 2004-02 and GL 2008-01. The GL 08-01 acceptance criterion of 5% air is inconsistent with the 2% of GL 2004-02.
7. Cavitation is long term degradation mechanism and therefore its use as a short term assessment tool is not appropriate.
8. NPSH is not an absolute when assessing the ability of a pump to perform its function of providing flow at a pressure. Recommend that the ECCS and CSS acceptance criteria be based on reasonable assurance that the pump is able to perform its design basis function for its intended mission time.
9. The RG should note that current compliance with 10CFR50.55a and ASME OM Code for Inservice Testing is adequate to show pump operability.

Specific:

10. 1.3.b The discussion implies that reduction in water level due to upstream debris blockage impacts only NPSH. Reduction in water level could also cause the strainer not to become fully submerged hence air ingestion could occur and once the strainer is uncovered the available NPSH then becomes the submergence height and is decoupled from pump suction NPSH criterion. The discussion should include evaluation of strainer submergence and flag the change in NPSH criterion once the strainer becomes uncovered.
11. 1.3.1.4 The determination of high water temperature appears to be only associated with NPSH. A clarification should be added that the high water temperature calculation also applies to deareation and flashing.
12. 1.3.1.6 Upstream blockage by debris should also be added in the list of issues that need to be addressed in determining the minimum water level at the strainer.
13. 1.3.3 The concept of a partially damaged insulation outside the ZOI (e.g. insulation blown off piping or the portion of a blanket outside the ZOI) contributing to the chemical source term was introduced in the draft revisions to the SER to NEI-04-07. This section on debris generation is mute on this concept. Please indicate if partially damaged insulation outside the ZOI needs to be considered generically.
14. 1.3.3.1
    a. To date all debris generation experiments have been conducted with rupture disk initiated jets and damage pressures calculated at observed distances from the nozzle calculated with various models, e.g. NPARC CFD, ANSI Jet, etc. In none of these experiments or calculations have pressure wave impulse been considered. Please provide guidance on how to factor in pressure wave impulses in debris generation analysis based on the publicly available debris generation tests as reported in NUREG/CR-6808.
    b. Most debris generation calculations have been performed using a spherical ZOI whose radius is based on the volume contained within an isobar whose pressure is the destruction pressure for a particular material. The destruction pressures are derived from experiments of different insulating materials. The spherical ZOI accounts for uncertainties associated with piping separation and piping whip issues, jet direction, impingement forces, material variation, etc. To date, application of the spherical ZOI has been independent of any similitude study between the plant insulation system and the tested material. Please provide guidance on how to perform a similitude analysis for each insulation system and how should the ZOI be adjusted if the plant insulation system is not "identical" to the tested system.
    c. 1.3.3.1.e suggests that a spherical ZOI analysis also requires an additional jet ZOI analysis. Please provide a reference of a spherical ZOI analysis that includes additional jet ZOI analysis. If an example is not available, please provide guidance on how to

perform a jet ZOI analysis, e.g. what jet model should be used, how to consider pipe separation, pipe whipping, direction of the jet, etc.

15. 1.3.3.3. Concrete erosion has not been considered in most debris generation analysis. There are currently no publicly available concrete damage pressures for which to derive a ZOI. Please provide an example of a debris generation analysis that quantifies and characterizes the concrete debris source term and characteristics. If such an analysis is not available, please provide guidance on how to quantify and characterize a concrete debris source term.
16. 1.3.4.3 Agglomeration of material has been observed in several experiments, e.g. debris head loss experiments where particulate agglomerates on fibers. Please indicate if agglomeration can be considered thereby reducing the quantity of material reaching the strainer.
17. 1.3.9 This Strainer Structural Analysis section is silent on the impact of fluid temperature. Please provide guidance on how fluid temperature needs to be considered.
18. Appendix A provides guidance that the strainer should be sufficiently submerged to prevent downstream gas formation. Attachment V-1 of the SER to NEI-04-07 suggests that "In order to prevent water flashing, the pressure downstream of the sump screen must always remain above the saturation pressure at the sump water temperature." The guidance of Appendix A should comport with the previous NRC criteria on downstream gas formation.
19. Section B, Background; Appendix A and Section A.3 - With regard to evaluating the effect of air ingestion – the RG states that the only pump acceptance criterion is NPSH margin. It also states 2% max is the acceptance criteria. Please provide a technical basis as to how this absolute criterion applies to all pumps regardless of its design and operating conditions. GL 08-01 criteria is now included stating that 5% air is OK from a pump performance perspective – using the same NPSHr adjustment leads to a 3.5XNPSHr requirement – GL 04-02 and 08-01 are inconsistent.
20. NUREG/CR-2792, Reference 10 – specifically states that the NPSHr correction factor used in Appendix A is "arbitrary". It also states that the relationship significantly over-predicts the effect of air on NPSH. Please explain how this arbitrary relationship applies to actual pump performance.
21. Background, 1.2.12, A.5 and Table A-1; The RG statement that "No cavitation is allowed" is inconsistent with pump physics. NPSHr is based upon a pump cavitating. In reality, the ingestion of small amounts of air (not allowed by the RG without NPSH penalty) actually reduces cavitation and is beneficial to pump health and long term reliability.
22. RG Section 1.1.1.10 refers to WCAP-16406-P, Reference 17. This document is not publically available and is not available for use without purchase or licensing agreement with the PWROG. The associated SE, Reference 18, does not provide details to enable a non-purchaser of the proprietary document to be able to assess pump performance. No non-proprietary version of the WCAP is publically available.
23. It is noted that use of WCAP-16406-P alone does not provide a complete answer to the acceptability of ECCS or CSS performance under post-LOCA conditions. RG Section 1.1.1.10 should be clarified.
24. Typo – ADAMS # for WCAP-16406 is not ML081000027.

25. Typo – Appendix A, Figure A-1 "Ingestion" not "Injection".
26. Appendix A – the Statement that "The Primary Acceptance criterion for is that adequate net positive suction head...under all postulated LOCA conditions." Does not physically relate to the ability of the pump to provide its design criteria of providing adequate flow at pressure.
27. Section 1.3.11.4 (page 26) states that strainer designs should be validated through testing, and analytical or empirical head loss correlations should not be used to calculate debris bed head losses. This guideline appears to be too restrictive since the NRC has stated that it is acceptable to use correlations (such as the one in NUREG/CR-6224) for operability evaluations or parametric analyses provided that the correlation is used within the specified limitations. Suggest rephrasing to state that correlations should not solely be used to predict head losses and should be used within the range of applicable test data.
28. In Figure 3 (page 28), the Debris Generation box should include "debris quantities" and "material properties" or something similar.
29. Section 1.3.12.g (page 29) states that flow downstream of the strainer may be sampled to determine the amount of debris passing through the strainer. This section should be clarified to specify that an appropriate sampling frequency should be used to adequately characterize the total debris bypass.
30. Section A-2 (page A-3) states that vortex formation is a strong function of the Froude number and the submergence level. Submergence level is actually one of the terms in the Froude number, so this statement is somewhat redundant. Another important factor that is not included in the Froude number is the geometry of the flow approach path. For example, a plant with a sump drawing suction in a wide open pool is less likely to form a vortex than a plant where flow has to turn a sharp corner just before reaching the sump.
31. The reference from which figures 5 and 6 were taken should be provided in the same format as the reference noted in figure 4.