September 28, 2001

MEMORANDUM TO: Samuel J. Collins, Director
Office of Nuclear Reactor Regulation

FROM: Ashok C. Thadani, Director /RA/
Office of Nuclear Regulatory Research

SUBJECT: RES PROPOSED RECOMMENDATION FOR RESOLUTION OF GSI-191, "ASSESSMENT OF DEBRIS ACCUMULATION ON PWR SUMP PERFORMANCE"

REFERENCES: (1) Collins, S. (NRR), Memo to Morrison, D. (RES), "Supplemental User Need Request ..... Containment Sump Screens," June 2, 1997

(2) Russell, W. (NRR), Memo to Morrison, D. (RES), "Third Supplemental User Need ..... Loss-of-Coolant Accident Generated Debris," December 7, 1995.

The Office of Nuclear Regulatory Research (RES) has completed the technical assessment of Generic Safety Issue 191 (GSI-191), "Assessment of Debris Accumulation on PWR Sump Performance." This issue deals with the possibility that debris could accumulate on the Emergency Core Cooling System (ECCS) sump screen resulting in a loss of net positive suction head (NPSH) margin. The loss of NPSH margin to ECCS pumps drawing suction from the sump may impede or prevent the flow of water needed to meet the criteria of Title 10, Section 50.46 of the Code of Federal Regulations (10 CFR 50.46), "Acceptance Criteria for Emergency Core Cooling Systems for Light-Water Nuclear Power Reactors." 10 CFR 50.46 requires that licensees design their ECCS systems to meet five criteria, one of which is to provide the capability for long-term cooling. Following a successful system initiation, the ECCS must be able to provide cooling for a sufficient duration that the core temperature is maintained at an acceptably low value. In addition, the ECCS must be able to continue decay heat removal for the extended period of time required by the long-lived radioactivity remaining in the core.

The scope of GSI-191 was based on two user need memorandums sent to RES by the Office of Nuclear Reactor Regulation (NRR) (see references 1 and 2). The purposes of GSI-191 and the research requested by the user need memorandums were to:

(1) Determine whether debris accumulation on pressurized water reactors' (PWRs) sump screens will cause loss of NPSH margin following a loss-of-coolant accident (LOCA).

(2) Determine if further action needs to be taken for PWRs beyond what was done during the resolution of Unresolved Safety Issue A-43.

This memorandum has two purposes:

(1) Transfer lead for GSI-191 from RES to NRR, as described in Management Directive 6.4 (MD 6.4).

(2) Transmit RES's recommendation for the resolution of GSI-191 to NRR for action.

GSI-191 was established as the programmatic process for evaluating the issues and the need for further action. RES designated the sump screen blockage concern a GSI in 1996, under the generic issue process contained in RES Office Letter 7, "Procedures for Identification, Prioritization, Resolution, and Tracking of Generic Issues," and NUREG-0933, "A Prioritization of Generic Safety Issues." NRC is currently finalizing Management Directive 6.4 (MD 6.4), "Generic Issue Process," to ensure an effective and efficient generic issue process. In order to minimize confusion and take advantage of the improved features of the new Generic Issue Process, GSI-191 has been transitioned into the new generic issue process. As described in MD 6.4, for reactor issues, RES has the lead responsibility during the first three stages of the generic issue process, and NRR has the lead responsibility during the remaining stages. RES has completed the third stage, "Technical Assessment," for GSI-191. A summary of our technical assessment is provided in Attachment 1.

During the course of our technical assessment for GSI-191, we obtained technical assistance from the Los Alamos National Laboratory, who conducted necessary testing and provided parametric evaluations of PWR recirculation sump performance (see Attachment 2). RES has also developed the risk and cost/benefit considerations associated with GSI-191, which is provided in Attachment 3. Further, RES has developed a cost analysis associated with resolution of this issue, which is provided in Attachment 4.

Since 1997, RES staff has held more than a dozen public meetings to keep external stakeholders informed of the progress, interim findings, and analytical/test methods. The public meetings provided a forum for industry representatives and other external stakeholders to provide comments on GSI-191. In addition to participating in public meetings, the industry (1) responded to a sump and containment design survey prepared by RES, (2) participated on a debris transport phenomena identification and ranking table panel, and (3) witnessed selected tests to support the GSI-191 technical basis.

At a public meeting on July 26 and 27, 2001, RES presented the results of the (1) parametric evaluation, (2) benefit estimates, and (3) core damage frequency contribution estimates. The industry, through NEI, has provided comments on the research findings presented at the July 2001 public meeting. Attachment 5 contains the letter transmitting the industry's comments and Attachment 6 contains RES responses to those comments. RES will transmit these responses to NEI by letter within a short period of time. In order to address the primary industry concerns about the availability of reports documenting the GSI-191 technical assessment, RES is planning to release technical reports to the public by the end of December 2001.

RES staff has briefed the Advisory Committee on Reactor Safeguards (ACRS) on the GSI-191 technical assessment on July 12, 2001 and September 5, 2001. In a memorandum to the EDO (see Attachment 7), the ACRS stated that they agree with the staff that potential issues associated with the performance of PWR containment sumps have been identified and that the staff should expeditiously resolve GSI-191.

During the Technical Assessment Stage of GSI-191, RES staff has worked closely with the NRR staff to ensure that the transfer of the lead responsibility for GSI-191 is completed in an effective manner. RES staff regularly shared work progress, plans for test programs/analyses, and interim technical reports with NRR staff. NRR staff have observed some of the tests and participated in public meetings concerning GSI-191. In May 2001, RES briefed the NRR leadership team and executive team on the findings of the GSI-191 technical assessment. RES staff will support, as requested, NRR during the fourth stage, "Regulation and Guidance Development," and other generic issue stages. One area that RES anticipates providing support to NRR during the Regulation and Guidance Development Stage of GSI-191 is the development of guidance that reviewers may use to assess plant specific analyses or that licensees may follow to ensure adequate ECCS operation.

In summary, based on our technical assessment as described in the attachments listed below, we conclude that additional actions, beyond the resolution of USI A-43, may be warranted to ensure adequate NPSH margin for PWR ECCS pumps taking suction from the containment sump in accordance with the requirements of 10 CFR 50.46. Therefore, we recommend that plant-specific analyses be conducted to determine whether debris accumulation in PWR containments will impede or prevent ECCS operation during recirculation. If it is determined that debris accumulation will impede or prevent ECCS operation, then appropriate corrective actions should be implemented.

Attachments:

(1) Technical Assessment Summary for GSI-191, "Assessment of Debris Accumulation on PWR Sump Performance"
(2) Rao, D., et. al., "GSI-191: Parametric Evaluations for Pressurized Water Reactor Recirculation Sump Performance," LA-UR-01-4083, Los Alamos National Laboratory, Los Alamos, New Mexico, August 2001.
(3) Buslik, A., Risk Considerations and Benefits Associated with GSI-191, "Assessment of Debris Accumulation on PWR Sump Performance," U.S. NRC, August 8, 2001.
(4) Feld, S., Cost Analysis for GSI-191, "Assessment of Debris Accumulation on PWR Sump Performance," U.S. NRC, August 14, 2001.
(5) Marion, A. (NEI), Letter to Mayfield, M. (NRC), "Comments on NRC Contractor Draft Report, LA-UR-XXX, GSI-191: Parametric Evaluations for Pressurized Water Reactor Recirculation Sump Performance," August 31, 2001.
(6) RES responses to NEI comments.
(7) Apostolakis, G. (ACRS), Memo to Travers, W. (EDO), "Generic Safety Issue-191 Assessment of Debris Accumulation on PWR Sump Pump Performance," September 14, 2001.

cc: W. Travers, EDO
J. Larkins, ACRS

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(5) Marion, A. (NEI), Letter to Mayfield, M. (NRC), "Comments on NRC Contractor Draft Report, LA-UR-XXX, GSI-191: Parametric Evaluations for Pressurized Water Reactor Recirculation Sump Performance," August 31, 2001.
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cc: W. Travers, EDO J. Larkins, ACRS Distribution: See next page

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