

POLICY ISSUE (Information)

June 2, 2003

SECY-03-0089

FOR: The Commissioners

FROM: William D. Travers
Executive Director for Operations /RA/

SUBJECT: PROPOSED BULLETIN: "POTENTIAL IMPACT OF DEBRIS BLOCKAGE ON EMERGENCY SUMP RECIRCULATION AT PRESSURIZED-WATER REACTORS"

PURPOSE:

To inform the Commission of the staff's intention to issue the attached bulletin to address debris blockage of pressurized-water reactor (PWR) containment sumps and flow restrictions upstream and downstream of containment sump screens.

BACKGROUND:

Generic Safety Issue (GSI) 191 was opened to determine whether the accumulation of debris in PWR containments following a loss-of-coolant accident (LOCA) would impede the long-term operation of the emergency core cooling system (ECCS) or containment spray system (CSS). In the event of a LOCA, material in the vicinity of the break, such as thermal insulation, protective coatings, and concrete, would be damaged by jet impingement and dislodged. Some of this material would then be transported to the recirculation sump and accumulate on the sump screen. Suspended debris accumulating on the sump screen tends to form a bed over the entire screen surface area, which, much like a filter, results in an increased head loss across the sump screen. The head loss due to the accumulation of debris is a safety concern because it could exceed the net positive suction head (NPSH) margin required to assure the successful operation of the ECCS and CSS pumps and could have additional adverse effects.

The staff identified and resolved a similar debris blockage issue for boiling-water reactors (BWRs) in the 1990s.

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DISCUSSION:

The original regulatory guidance for sump design assumed that 50 percent of the screen surface area would become blocked. In 1985, the Nuclear Regulatory Commission (NRC) determined that this assumption usually results in a nonconservative analysis for screen blockage effects and that debris blockage should be assessed on a plant-specific basis. Although the staff removed the 50 percent blockage assumption from the regulatory guidance for future plants at this time, the staff's analysis did not justify a backfit for existing plants. However, subsequent blockage events at BWRs and follow-up research by the Office of Nuclear Regulatory Research (RES) showed that more and finer debris than previously thought could accumulate uniformly over the entire screen area, and that filtration of particulates by fibers, previously not considered, would increase head losses. These increased head losses could exceed the NPSH margin for the ECCS and CSS pumps (potentially resulting in pump degradation and failure) and result in unacceptable structural loadings on the sump screen surface. RES's technical assessment also noted that debris blockage of containment drainage flowpaths upstream of the sump screen could reduce the available NPSH for the ECCS and CSS pumps by holding up significant volumes of water in certain areas of containment. Additionally, RES found that blockage from debris passing through the screens at downstream flow restrictions could impair ECCS performance. Based upon the findings of its technical assessment, RES concluded that GSI-191 was a valid concern and recommended that detailed plant-specific evaluations be performed to determine the susceptibility of each PWR to debris blockage.

The Office of Nuclear Reactor Regulation (NRR) concurred with RES's conclusion and has begun preparing a generic letter to request information from PWR licensees on whether they are in compliance with existing regulations in light of these adverse debris blockage effects. The NRC staff has also begun revising Regulatory Guide (RG) 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-Of-Coolant Accident," in accordance with the findings of RES's technical assessment of GSI-191. The staff has briefed the Advisory Committee on Reactor Safeguards (ACRS) on both the draft generic letter and the draft revision to RG 1.82, and in a letter dated February 20, 2003, the ACRS endorsed issuance of the draft generic letter and the draft RG to expedite resolution of GSI-191.

During the review of the draft generic letter, the NRC staff became concerned that licensees of PWRs with potentially degraded ECCS and CSS recirculation functions should promptly consider implementing interim compensatory measures at their facilities. These concerns were based on (1) two Davis-Besse licensee event reports (LERs) declaring the containment recirculation sump and the high-pressure injection pumps inoperable due to potential effects of debris blockage, (2) research and analysis demonstrating significant increases in core damage frequency if sump recirculation is lost due to debris blockage, (3) a recent report by Los Alamos National Laboratory that analyzed operator actions to recover from sump clogging events and showed that significant risk reductions are achievable through interim compensatory measures, and (4) increasing concerns by the ACRS that the staff should address the sump blockage issue expeditiously.

In response to these concerns, the staff modified its original generic communication plan for GSI-191. The staff's modified plan is a two-pronged approach that consists of a bulletin to address near-term safety concerns, and a generic letter to address longer-term corrective actions. As explained below, the modified plan will satisfy both the need for promptness in addressing near-term safety concerns and the objective of considering stakeholder input for longer-term corrective actions.

The proposed bulletin, which will be issued without public comment, will request information from PWR licensees within 60 days concerning whether the implementation of interim compensatory measures is appropriate for their facilities. Specifically, the bulletin will allow addressees the option of either (1) confirming that their ECCS and CSS recirculation functions are in compliance with existing regulatory requirements in light of the recent research findings regarding the adverse debris blockage effects identified in the bulletin, or (2) describing any interim compensatory measures that they have implemented or will implement to reduce the potential risk due to post-accident debris blockage until an evaluation to determine compliance can be completed. The bulletin provides examples of compensatory measures that would reduce the potential risk associated with debris blockage for a typical PWR.

The proposed generic letter, which will undergo public comment, will request information from PWR licensees concerning the evaluations that they may find necessary to determine whether their ECCS and CSS recirculation functions comply with existing regulations in light of the debris blockage effects associated with GSI-191. Guidelines for performing sump evaluations are being developed by the Nuclear Energy Institute (NEI), and the staff has held regular public meetings with representatives of NEI and the PWR owners groups regarding these guidelines. In addition to continuing these regular public meetings, the staff plans to hold a public meeting approximately two weeks after issuance of the bulletin to further explain the staff's rationale for issuing the bulletin.

The staff intends to issue this bulletin approximately five working days after the date of this information paper.

COORDINATION:

The Committee To Review Generic Requirements (CRGR) was briefed on the draft bulletin on April 8, 2003, and approved issuance with comments. The NRR staff incorporated changes to comply with the committee's comments, and the CRGR has endorsed this bulletin.

The Office of the General Counsel (OGC) has reviewed this bulletin and has no legal objections to its content. In addition, OGC has determined that this bulletin does not constitute a "rule" under the Small Business Regulatory Enforcement Fairness Act of 1996.

The Commissioners

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NRR coordinated with RES staff in the development of the bulletin, and RES reviewed and concurred upon the package dated April 2, 2003, which transmitted the draft bulletin to the CRGR.

/RA by William F. Kane Acting For/

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Attachment: Proposed NRC Bulletin: "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors"

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*See Previous concurrence Accession Number: ML031060640 (package) ML031060624 (memo) ML031060638 attachment)

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