

Original Due Date: 09/30/2009

Ticket Number: 020090139

Document Date: 06/26/2009

NRR Received Date: 06/26/2009

**From:**

Eric Leeds

**TACs:**

ME1612

**To:**

William Ruland

\*\*\* YELLOW \*\*\*

**For Signature of:**

**Routing:**

Leeds  
Wiggins  
Grobe  
Boger  
NRR MailRoom

**Description:**

Taskings as a Result of Differing Professional Opinion Decision Concerning  
Closure Process for Generic Safety Issue-191 (DPO-2008-001)

**Assigned To:**

DSS

**Contact:**

RULAND, WILLIAM, H

**Special Instructions:**

Provide a memo to Eric Leeds through Jack Grobe with a copy to the DPO  
submitter, providing the results of the three assigned actions by September 30,  
2009.

6/26 Called DSS for pickup @ 4:10

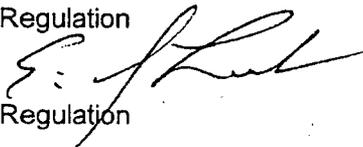
A-12



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001

June 26, 2009

MEMORANDUM TO: William Ruland, Director  
Division of Safety Systems  
Office of Nuclear Reactor Regulation

FROM: Eric J. Leeds, Director   
Office of Nuclear Reactor Regulation

SUBJECT: TASKINGS AS A RESULT OF DIFFERING PROFESSIONAL  
OPINION DECISION CONCERNING CLOSURE PROCESS FOR  
GENERIC SAFETY ISSUE -191 (DPO-2008-001)

On May 27, 2009, a closeout memorandum was issued stating the results of my decision regarding DPO-2008-001. One of the issues resulting from this Differing Professional Opinion (DPO) submittal is a concern that the staff's review process is inefficient and may result in focusing on non-safety significant issues. The DPO Panel indicated that the staff's approach has been inefficient as detailed guidance has evolved as staff and licensees have learned from ongoing industry and NRC-sponsored testing. Staff guidance has only stabilized over the last year or so. However, the Panel also found that the staff's approach resulted in improved plant safety because it required that licensees enact some initial, rapid improvements to address the risk associated with the potential for inadequate safety system performance. I am concerned that the staff's review was not as efficient as it could be and that we should improve our process based on lessons learned from our review of Pressurized Water Reactor (PWR) sump performance. One of the Agency's strategic objectives is that Nuclear Regulatory Commission (NRC) actions are high quality, efficient, timely and realistic, to enable the safe and beneficial use of radioactive materials.

Also, a proposed alternative approach was provided which would assess whether the plants have adequately resolved the risks associated with GSI-191, without making clear-cut compliance determinations. It is possible a rigorous risk assessment was necessary but that the staff was more likely to find issues with Boiling Water Reactor (BWR) sump performance and its impact on Emergency Core Cooling Systems (ECCS) systems than the staff had found with PWRs. I believe this approach should be considered.

The DPO Panel also recommended the staff consider two additional activities to ensure that the risk associated with GSI-191 related issues is acceptable. In short, the Panel recommended:

- (1) that the staff perform an integrated review of the test results from all licensees to ensure that the results are as consistent as practical given the differences in testing approaches, and
- (2) that the staff assesses the consequences associated with ECCS inoperability.

CONTACT: Trent L. Wertz, NRR/OD  
(301) 415-1568

Therefore, I am assigning the following tasks to the Director, Division of Safety System (DSS), in consultation with appropriate staff and management in NRR and RES:

1. Review and revise, as necessary and appropriate, NRC's guidance to its technical review staff in its review of issues relating to GSI-191, to ensure that the Commission's direction in its June 30, 2004, and November 16, 2006, Staff Requirement Memorandums are clear and unambiguous. If necessary, implement appropriate actions to ensure the staff follows the guidance.
2. Conduct a lessons learned from the staff's review of GSI-191 to determine improvements to the process that can be incorporated into the ongoing review of PWR sump issues and in going forward with the review of BWR sump performance.
3. Consider the DPO submitter's proposed alternate review approach, as well as the Panel's recommendations that the staff perform an integrated review of the test results from all licensees to ensure that the results are as consistent as practical given the differences in testing approaches and that the staff assesses the consequences associated with ECCS inoperability.
4. Provide a memorandum to me, through the Associate Director for Engineering and Safety Systems, and with a copy to the DPO submitter, providing the results of the three assigned actions by September 30, 2009.

cc: J. Grobe, NRR  
B. Sheron, RES  
R. Pedersen, OE  
R. Architzel, NRR

September 25, 2009

MEMORANDUM TO: Eric J. Leeds, Director  
Office of Nuclear Reactor Regulation

THRU: John A. Grobe, Associate Director */RA/*  
Associate Director for Engineering and Safety Systems  
Office of Nuclear Reactor Regulation

FROM: William H. Ruland, Director */RA by SXB for/*  
Division of Safety Systems  
Office of Nuclear Reactor Regulation

SUBJECT: RESPONSE TO TASKINGS AS A RESULT OF DIFFERING  
PROFESSIONAL OPINION DECISION CONCERNING  
CLOSURE PROCESS FOR GENERIC SAFETY ISSUE 191  
(DPO-2008-001)

In response to your memorandum dated June 26, 2009, tasking the Division of Safety Systems to accomplish three tasks associated with the subject Differing Professional Opinion (DPO). This memorandum reports completion of these tasks, as discussed below. This completes the staff's actions for the yellow ticket 020090139.

TASK 1: Review and revise, as necessary and appropriate, the Nuclear Regulatory Commission's (NRC) guidance to its technical review staff in review of issues related to GSI-191, to ensure that the guidance follows the intent of the Commission's direction in its June 30, 2004, and November 16, 2006, Staff Requirement Memorandums (SRM). In particular, evaluate whether and how focus can be increased on realistic scenarios, for example by using risk tools.

RESPONSE: The Commission guidance relevant to this task is as follows: 1) from the June 30, 2004, SRM, "Both the Advisory Committee on Reactor Safeguards and the staff should focus their attention, resources, and additional research, if needed, on evaluating realistic scenarios rather than all possible scenarios"; and 2) from the November 16, 2006, SRM, "The staff and industry should make a concerted effort to look at resolution of this issue holistically. Such an approach should include understanding the interdependence of changes in water chemistry on debris accumulation and sump performance."

CONTACT: Michael L. Scott, NRR/DSS  
301-415-0565

The staff considers the guidance on focus on realistic scenarios and the guidance on holistic evaluation to be related, though not identical. We believe the intent of both sets of guidance is to have the staff look beyond the many details of the Pressurized Water Reactor (PWR) sump performance issue, which is extraordinarily complex with numerous irresolvable uncertainties. Ideally, various tools can be used to allow closure in the presence of remaining uncertainties. However, this has been challenging for GSI-191 for a number of reasons:

- (1) There is no reliable model for predicting strainer performance as a function of specified physical parameters, despite past efforts to develop such models.
- (2) Emergency Core Cooling System (ECCS) strainer testing has not revealed a minimum thickness of a full-coverage debris bed on a strainer beneath which there is no concern for strainer performance.
- (3) The transition from a strainer with open surface area to a full-coverage debris bed can lead to large increases in head loss with a relatively small increment of debris.
- (4) The head loss across the ECCS strainer is very sensitive to changes in some input parameters to the test (such as order of arrival of debris).
- (5) It takes a relatively small amount of fibrous debris to effectively cover the ECCS strainer and begin to filter particulate debris passing through the strainer, leading to a filter bed that can cause high head loss and impede ECCS flow.

These factors have led the staff to conclude that there are only two acceptable ways to show adequate strainer performance:

- (1) Conduct a strainer head loss test that can be shown to be conservative or prototypical of the plant the testing is intended to represent; or
- (2) Show through analysis and/or testing that very little debris is capable of impinging on the strainer, such that significant open strainer area will remain and a filtering debris bed will not form.

The uncertainties associated with strainer performance challenge the ability of a risk model to provide useful insights. However, risk models have been useful for understanding the more likely initiating event scenarios. For example, the staff has existing guidance that allows licensees to invoke less stringent criteria for very large pipe breaks, whose risk is reduced by the very low probability of the initiating event. The guidance states that, for breaks in the Reactor Coolant System main-loop piping (hot, cold, and crossover piping) greater than approximately 196.6 square inches, licensees must demonstrate mitigative capability, but design-basis rules may not necessarily apply.

The staff recently considered (again) attempting to eliminate one or more classes of Loss of Coolant Accident (LOCA) from consideration for ECCS strainer performance, but found no basis for so doing. This effort was consistent with the Commission's intent to focus on realistic scenarios, but it was unsuccessful because of the factors discussed above.

The staff's review process for Generic Letter 2004-02 contains measures intended to incorporate a holistic review, consistent with Commission direction. This process has been briefed to the Commission Technical Assistants. The integrated review team (IRT) is a three-person team intended to evaluate each licensee's holistic safety case in light of issues the individual staff reviewers have identified with the licensee's submittals. While the process has been slower than we would have liked, licensees are gradually reaching the point for which the IRT is able to conclude that the licensee's actions are adequate, even though uncertainties remain for that licensee's post-LOCA plant conditions.

In conclusion, we do not believe changes to our guidance or processes, beyond those already implemented, are needed to meet the intent of Commission direction. The staff is very sensitive and receptive to ideas intended to speed issue resolution for sump performance. We have been innovative in incorporating holistic review into our processes, consistent with Commission direction. While we do not believe additional changes to our review guidance are necessary at this time, we remain open to new ideas as they come up.

TASK 2: Conduct an interim lessons learned from the staff's review of GSI-191 to determine improvements to the process that can be incorporated into the ongoing review of PWR sump issues and in going forward with the review of Boiling Water Reactor (BWR) sump performance.

RESPONSE: The staff has accomplished this task. In May 2009, management convened two 4-hour sessions of the GSI-191 team to solicit lessons learned on the review process to that time and suggestions on how to move forward more effectively. Several staff ideas were implemented, and management provided feedback to the staff on all the ideas put forth (E-mail from Michael Scott, dated May 27, 2009, entitled "Results of GSI-191 Brainstorming/Lessons Learned Evaluation," ADAMS accession number ML092400021). Changes implemented as a result of the staff inputs included:

- Using public meetings to discuss issues of concern to multiple licensees;
- Facilitating licensee sharing of success stories;
- Implementing a coordinated effort to address debris loading issues that affect multiple plants; and
- Discouraging plants with open issues from retesting prior to staff and licensee reaching mutual understanding on likelihood of success for licensee's proposed path forward.

In addition, management has evaluated challenges with the first round of licensee responses to the staff's Request for Additional Information (RAI). Licensees often either did not understand the questions being asked, or the licensees were not paying sufficient attention to the intent of the RAIs. For example, the RAI for many plants questioned the adequacy of the licensee's strainer testing protocols. Some licensees responded by amplifying their initial responses but taking no additional action to strengthen the technical basis for their solution set. This would lead to the same RAI being asked again. Now the staff will implement a new interactive review process to (1) ensure licensees understand each RAI, (2) ensure the staff understands how the licensees plan to respond, and (3) either resolve differences between staff expectations and licensee plans or move forward with regulatory escalation. Based on feedback from licensees

and progress made on moving specific licensees closer to a status of "approaching completion," management believes that the recently implemented process changes are working. These and other lessons learned are being implemented as the staff takes steps to address BWR strainer performance questions. For example, the staff recently met with the Boiling Water Reactors Owners Group (BWROG) to discuss their planned actions. As a result of lessons learned from the PWR effort, the staff will review BWROG test plans before the testing is begun, and also will observe some of the testing at an early stage. The staff has also emphasized to the BWROG the need for BWR licensees to note the staff's existing guidance regarding certain strainer testing practices, and to note the types of RAIs being provided to PWRs. Further, the staff plans to develop an updated knowledge base document based on the PWR work that will be available to BWRs and to the NRC staff reviewing BWR strainer Submittals.

In summary, this task is considered implemented. The staff has self-assessed its process and made changes to address lessons learned. The staff will continuously self-assess the effectiveness of its approach going forward.

TASK 3: Consider the panel's recommendations that the staff perform an integrated review of the test results from all licensees to ensure that the results are as consistent as practical given the differences in testing approaches and that the staff assesses the consequences associated with ECCS inoperability.

RESPONSE: This task contains two parts. The first is that the staff should consider performing an integrated review of licensee test results. The staff does not consider such an effort likely to be fruitful. The PWR licensees have used multiple strainer vendors to resolve the PWR sump performance issues. The designs of the strainers vary significantly, so their response to debris loading likewise varies significantly. Some designs encourage uniform debris accumulation, while others do not. All have complex geometries, and the geometries are very dissimilar among the vendors. In addition, insulation types and containment configurations vary widely among the licensees. Some plants contain mostly reflective metal insulation, while many others contain some combination of fibrous and particulate material. This variability and complexity likely yield inconsistent or disparate test results from plant to plant and vendor to vendor. This potential limitation on usefulness of the proposed integrated review is explicitly recognized in the Panel's recommendation. To be of most use, the study would likely require the staff to obtain additional data from licensees, since licensees often perform multiple tests but have not been required to report results of all tests to the NRC. This would add to the resource burden and the time frame to complete the study. Accordingly, the staff does not believe that the resource expenditure to do the study would be worthwhile.

While we do not endorse the proposed study as a stand-alone to support issues resolution, the staff plans to create an updated knowledge base for PWR strainer performance to capture the information that has been obtained while addressing GSI-191. The staff will consider addressing the concept of consistency among test results reported to the NRC in the knowledge base task.

The second part of the recommendation is to assess the consequences associated with ECCS inoperability. The implied goal is to use this information to assess the significance of sump inoperability.

The staff's issue resolution effort for GSI-191 has focused on compliance with 10 CFR 50.46(b)(5), which requires long-term core cooling. The ECCS systems are designed to provide this function and are required to be operable, and sump recirculation is considered in the plant licensing bases to be a required part of the ECCS function. The focus for issue resolution has been on showing that the recirculation function would perform as designed and required, and therefore that ECCS would be functional (operable).

In NRC Bulletin 2003-01, the NRC stated to licensees that they were expected to identify "interim compensatory measures that have been implemented or that will be implemented to reduce the risk which may be associated with potentially degraded or nonconforming ECCS and CSS recirculation functions until an evaluation to determine compliance is complete." All licensees have implemented such measures, so the staff believes that loss of ECCS function would likely not result in complete loss of core cooling. However, the staff has not seen the presence of such measures (e.g., refilling the Refueling Water Storage Tank (RWST) and resuming injection) as obviating the need for licensees to show successful ECCS recirculation function. The staff does not believe it is prudent to accept a nonconservative licensee test/evaluation of strainer performance on the basis that the plant would have other ways to keep the core cooled even if recirculation fails. Further, there is no requirement that, once a licensee has addressed GL 2004-02, it need keep the interim measures in place.

This DPO panel recommendation has led the staff to consider whether one or more of the interim compensatory measures could or should be added to a plant's licensing basis to reduce vulnerability to the consequences of sump clogging. For example, could some plants inject enough water to keep the core cooled for some or all LOCAs without reliance on recirculation? Considerations would include the impacts of flooding the containment to the level of a postulated break and under what circumstances the RWST could be refilled fast enough for this purpose. There are other possible design measures, whose effectiveness is not well established and likely would vary by plant. The staff has added evaluation of the interim measures to the task statement for the PWR knowledge base document currently being planned. The results of the evaluation will be used to determine whether it is feasible and appropriate to retain some of the interim measures to reduce consequences of an unexpected failure of the ECCS in recirculation mode.

In summary, the staff has addressed this two-part tasking. The staff has evaluated the recommendation regarding an integrated review of licensee test results. We do not support such a review for reasons stated above, fundamentally that we do not believe it will speed issue resolution or add significantly to our perspective on the issue.

While the staff has not performed a detailed assessment of the consequences of ECCS inoperability, we do plan to further evaluate the usefulness of previously implemented interim compensatory measures to provide additional assurance of core cooling even in the unlikely loss of ECCS recirculation.

cc: J. Ibarra  
R. Pederson  
R. Architzel

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cc: J. Ibarra  
 R. Pederson  
 R. Architzel

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