

EXECUTIVE SUMMARY

Differing Professional Opinion Appeal Involving NRC Closure Process for GENERIC SAFETY ISSUE -191, "Assessment of Debris Accumulation of PWR Sump Performance," (DPO-2008-001)

Introduction

On June 18, 2009 an appeal to a Differing Professional Opinion (DPO), submitted on October 1, 2008 was received. The DPO and appeal raised concerns about the NRC staff closure process for Generic Safety Issue (GSI) -191, including associated activities to review licensee submittals in response to Generic Letter (GL) 2004-02.

What is the DPO and Appeal About?

The submitter's main theme for the DPO and appeal is that:

- The original resolution to GSI-191 authorized backfit, which caused most licensees to implement major modifications to the plants including installation of new sump screens whereas the closure process for GL 2004-02 is effectively an unauthorized backfit that goes beyond the scope of the original concerns of GSI-191 and the expansion in scope bypassed other stakeholders such as licensee and public;
- Testing and additional analysis in response to request for additional information (RAI)s, consideration for chemical effects, and downstream (in and ex-vessel) effects etc. were not channeled through the Committee to Review Generic Requirements (CRGR) to ensure that these additional requirements are appropriately justified on the basis of NRC's rule's and Commission's backfit policy. The submitter contends that if needed, the right set of plants should be pursued, BWRs or/and PWRS, after making a required case to the CRGR, per established processes; and
- The closure yardstick used by the staff to determine compliance was developed after licensee implemented modifications, is excessively rigorous, takes into account unrealistic scenarios, and is unreasonable for determining residual, post initial modification risk. This is causing inefficiencies and is inconsistent with two SRMs related to the use of realistic scenarios and completing the reviews in a timely manner.

Chronology

- DPO submitted on October 1, 2008
- Nuclear Reactor Regulation (NRR) Director established a DPO ad-Hoc Panel (The Panel) in November 2008.
- Panel submitted a report to the NRR Director on March 19, 2009
- The DPO submitter was informed of the Panel's report as well as the enhancement recommendations by the NRR Director on May 27, 2009.
- DPO Appeal filed on June 18, 2009
- NRR Director provided a statement of views (SOVs) on July 9, 2009 regarding the appeal.

What Did the Panel and NRR Director Conclude?

- Regarding the unauthorized backfit, the NRR Director and Panel disagree with the submitter. They state that the NRC staff is operating under the premise that this issue falls under the compliance backfit rule where the licensees are required to comply with the regulations without regard to backfit considerations.
- The NRR Director and Panel agreed with the DPO submitter's concern of the staff's focus on compliance as compliance with regulatory requirement provides reasonable assurance of safety.
- The NRR Director and Panel disagree with the DPO submitter's concern of the staff being inconsistent with the Commission guidance provided in two SRMs. The NRR Director, and the Panel, determined that the staff was not assessing the GL in context of all possible scenarios. The Director specified that through the establishment of an integrated review team (IRT), of which the DPO submitter is a member, a holistic review is being conducted on a plant-by-plant basis, balancing the safety margins among the various technical review areas, where possible. However, the Director determined that it was appropriate for the staff to re-evaluate its approach to determine whether excluding scenarios based on low probability or risk was feasible.
- Regarding the staff being inefficient and at times focusing on non-safety significant issues, the Director, as the Panel, agreed with the DPO submitter and expressed that the NRC process should be improved from lessons learned as a result of the reviews of PWR sump performance. The NRR Director highlighted that SRM would be adhered to during the review of in-vessel down stream effects. The NRR Director also stated that though inefficient, the strategy has resulted in improved plant safety.
- The NRR Director did agree with the submitter that to the extent feasible, it was important to determine the risks imposed by sump/strainer performance issues for BWRs and PWRs such that resources can be focused on the most safety significant aspects of the issue.

Were there any Additional Actions Assigned by the NRR Director?

The NRR Director assigned the following tasks to the Director, Division of Safety Systems (DSS) in consultation with appropriate staff and management in NRR and RES. These three actions were assigned a due date of September 30, 2009.

- Review and revise as necessary and appropriate, NRC's guidance to its technical review of issues relating to GSI-191 to ensure that the guidance follows the intent of the Commission's direction of the SRMs. In particular, evaluate whether and how focus can be increased on realistic scenarios, for example by using risk tools,
- Conduct an interim lessons learned from the staff's review of GSI-191 to date 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.
- Consider the Panel's recommendation 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 differences in testing approaches.

What were the NRR Director's views on the Appeal?

The office Director, NRR, following a review of the appeal, submitted a Statement of Views that concluded that the submitter had not included any new information that would alter the decision of the DPO. Therefore he found no reason to change any decision or take additional actions than what were in the closeout memorandum dated May, 27, 2009.

Considerations/Recommendations /Thoughts for EDO Briefing

- The licensee is voicing concerns regarding challenges in obtaining plant specific closure of GSI-191 and suggesting that NRC reviews of plant resolution activities are striving for a level of assurances that is difficult to attain.
- Commission Interest, TAs were briefed on August 25. Chairman has requested briefing.
- For a majority of PWRs, potentially significant issues remain or not enough information was provided in the submittal to closeout GL 2004-02. The NRC review of most plants is resulting in a significant number of RAIs being generated. We are well past the original deadline of December 31, 2007 for resolving GSI-191. Most RAIs are related to licensee being unable to defend test results and evaluations protocols.
- The number of RAIs generated during reviews of the vast majority licensee submittals clearly implies difference in expectations on part of licensee and the NRC, and/or issues related to communication of expectations and/or change in expectations on part the NRC. RAIs should be the exception and not the norm.
- BWR licensees are probably already getting a "wind" of resurrection of sump issues for their plants.

Notwithstanding the above, changing course in the closeout process at this juncture and going to the CRGR and other stakeholders is not practical. Though inefficient, the closeout process errs towards safety. The staff reviews have to make a compliance (with 10 CFR 50.46 (b) (5), ECCS Long Term Cooling) determination following a review of highly complex issues with a wide margin of uncertainty that are interdependent. This approach to determine compliance leaves room for engineering judgment.

In response to the DPO, the NRR Director assigned an action to review and revise as necessary and appropriate, NRC's guidance to its technical review of issues relating to GSI-191 to ensure that the guidance follows the intent of the Commission's direction of the SRMs. In particular, the action calls to evaluate whether and how focus can be increased on realistic scenarios, for example by using risk tools.

Looking ahead, implementation of this point has the most potential for addressing the DPO/Appeal as well as other concerning reasonableness of NRC review expectations. The status of this action could be sought and described in the EDO letter to the DPO submitter. NRR could provide a description of changes that may have been made as a result of this review.

The NRR Director did not directly address the proposed alternative approach that would assess whether the plants have adequately resolved the risk associated with GSI-191, without making clear-cut compliance determinations. In this alternative, the staff process would ask whether the issues involved have been adequately addressed, using a holistic viewpoint and considering residual risk, with practical solutions, specifically not evaluating all possible scenarios, making a determination that the safety issue can be closed for the particular plant, while not challenging licensee arguments for compliance.

While not central to the theme, the NRR Director did not specifically address the concern of how a single individual as opposed to the detailed reviewers within an IRT play a role in the holistic decision making process. These items could be better clarified in the response by the EDO.

I had talks with the submitter, Branch Chief (Mike Scott), one of the Panel members, attended a Commissioner/Chairman TA brief, and to OGC (asked a question regarding the possibility of speaking with James Beall , who was suggested by the submitter to be on the panel but is now a Commission TA).

The EDO could speak with the NRR Director regarding an update and choose to speak with the submitter.

LongTerm Considerations beyond the DPO Appeal:

There have been three SECY Paper (updates) issued on this so far and consider if there is a need for one. The previous ones being:

- SECY-06-0078: Status of Resolution of GSI-191, "Assessment of [Effect of] Debris Accumulation on PWR Sump Performance"

- SECY-04-0150 Alternate Approaches for Resolving the Pressurized Water Reactor Sump Blockage Issue (GSI-191), Including Realistic and Risk-Informed Considerations

- SECY-03-0089: Proposed Bulletin: "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors," June 2, 2003

Lessons learned from GL 2004-02 closure should be applied to future GLs, such as that related to gas intrusion in RCS, such that expectations are firmed up and communicated reasonably in advance of licensee submittals.

AUGUST 31, 2009 SUMMARY

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Introduction

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The DPO took issue with the NRC closure process for GL 2004-02 and stated that the staff procedure and process had resulted in a review that is unnecessarily focused on compliance versus a determination that the underlying safety issue has been satisfactorily addressed. The DPO also stated that the staff's approach is inconsistent with Commission guidance provided in a Staff Requirements Memoranda (SRM) with regard to efficiency and focus on non-safety significant issues.

Nuclear Reactor Regulation (NRR) established a DPO ad-Hoc Panel (The Panel) in November 2008. The Panel concluded that the staff's approach for resolving GSI-191 is appropriately focused and consistent with Commission guidance. There were recommendations made by the panel to enhance the review process and the Director, Division of Safety Systems (DSS) was tasked to review and adopt the Panel recommendations as appropriate. The DPO submitter was informed of the Panel's report as well as the enhancement recommendations by the Director of NRR on May 27, 2009. Following a review of the appeal that was submitted on June 18, 2009, the Director of NRR provided a statement of views (SOVs) on July 9, 2009 regarding the appeal. The SOV concluded that the DPO (appeal) submitter had not included any new information to alter the initial disposition of the DPO and that there was no compelling reason to alter any decision or actions associated with the DPO as a result of the appeal.

Background

Applicable Regulations and Processes

10 CFR 50.46 (b) (5) requires power reactors to have capability for long term cooling after successful initiation and operation of the Emergency Core Cooling Systems (ECCS). GSI-191 was established to determine whether generation, transport, and accumulation of debris in Pressurized Water Reactor (PWR) containments following a Loss of Coolant Accident (LOCA) would impede the long term operation of ECCS and containment spray systems (CSS). Debris accumulation on sump screens has a tendency to form a bed which would result in increased head loss across the sump screens and impact the capability of ECCS and CSS pumps which take suction from the sump during long term recirculation. GSI-191 determined that the previous industry standard assumption of 50 per cent blockage across the PWR containment sump screens was not acceptable. GSI-191 applied to PWRs only. A similar issue related to Boiling Water Reactor (BWR) plants torus suction had been addressed by the industry prior to GSI -191 being issued.

To address GSI-191, NRC issued GL 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Base Accidents at PWRs," which required PWR

licensee's to perform plant specific analysis of LOCA debris generation and transport and perform modifications as necessary to assure the long term recirculation capability of the ECCS and CSS equipment. Temporary Instruction (TI) 2515/166, PWR Containment Sump Blockage, was issued to support the NRC review of licensees' activities in response to GL 2004-02.

In general, the plant modifications included increase in sump screen surface area, reduction in detrimental debris, and program controls to maintain the integrity of the new screen design and control containment materials. The modifications were required to be implemented as soon as possible to address this safety issue. The industry had not yet developed sophisticated debris generation and transport analysis nor had they developed a test methodology to assess filter bed accumulation on sump screens and subsequent head loss impact. The general industry approach was to install the largest screens possible limited by the containment space available and pursue verification of the adequacy of design as the industry developed appropriate analysis and test capability. Debris generation due to post-LOCA chemical effects within containment and down stream in-vessel obstruction by debris are also detrimental to long term cooling.

Current Status of GL 2004-02

The regional offices performed onsite inspections to verify the actions implemented in response to GL 2004-02 were complete and, where applicable, were programmatically controlled. Regional inspection responsibilities related to TI 2515/166 were completed on Dec. 31, 2007. NRR continued to review the adequacy of licensee submittals. These reviews of licensee submittals have particularly focused on confirmatory testing and analysis in technical areas such as chemical effects, progress of licensee corrective actions, review of test protocols, and head loss testing. As of August 24, 2009, of the 69 PWRs, the NRR review of approximately one third of the plants was complete or near complete. The remainder of the plants were in some stage of review with numerous issues still pending resolution. The obstacles to completion were related to the licensees providing adequate information to support their plant specific debris analysis and head loss test methodology. For these plants, in general, the industry developed various generic testing and debris generation analyses but plants did not provide adequate plant specific information to demonstrate the analyses and testing bounded their specific condition.

Specifically, Byron, Braidwood, Davis Besse, North Anna, Oconee, Prairie Island, Crystal River, and Palo Verde (16 of 69 units) are considered effectively complete with possible exception of in-vessel downstream effects.

Surry, Comanche Peak, Watts Bar, Sequoyah, ANO, and San Onofre (11 of 69) are nearing completion, and

For the remainder of the 42 units, potentially significant issues remain or not enough information was provided in the submittal to determine whether the modifications were acceptable .

Chronology

DPO Summary(October 1, 2008)

The DPO took issue with part of the NRC closure process for GL2004-02.

In summary,

- The DPO submitter's concern was that the staff was "unnecessarily" focusing on compliance rather than the underlying safety issue.
- The staff's current approach would not likely be justified by a regulatory analysis to evaluate the appropriateness of backfit measures.
- The staff was being inconsistent with the Commission guidance provided in two SRMs, specifically those on staff's use of realistic scenarios rather than all possible scenarios.
- The DPO submitter also suggested that if viewed with the same scrutiny, BWRs would be more challenged than PWRs in meeting ECCS long term cooling requirements due to higher and more immediate flow requirements coupled with smaller strainers and potentially higher iron oxide levels.

The DPO submitter proposed an alternative approach of using risk assessment to determine if plants have adequately addressed ECCS performance concerns. Further, the DPO suggested that the staff should use more realistic design basis events versus worst case scenarios in determining compliance. The submitter further states that a more holistic viewpoint should be taken by the staff that considered (post modification) residual risk. The submitter recommended that the detailed area reviewers (of GL licensee responses) be assigned to play a role in the holistic decision making process. As the current process stands, the decision making is essentially the sole province of a set of senior reviewers that are not as familiar with the detailed issues involved in the decision for a particular plant and when a licensee package is screened as requiring Request for Additional Information (RAIs), the potential for a holistic pass is only assessed by a single individual.

DPO Panel Report (March 29, 2009)

The DPO panel was formed on November 4, 2008 and, after completing their reviews, including discussions with the DPO submitter on November 26, 2008, issued a report on March 19, 2009.

With regard to the DPO submitter's concern regarding staff's "unnecessary" focus on compliance rather than the underlying safety issue, the Panel, agreed that the staff's approach for resolving ECCS performance was focused on compliance (with 10 CFR 50.46 (b) (5)). The Panel determined this approach to be appropriate as compliance with regulatory requirements presumptively assures that adequate safety is maintained.

Concerning the DPO submitter's suggestion that the staff's current approach would not likely be justified by a regulatory analysis to evaluate the appropriateness of backfit measures, the Panel identified that the staff was in-fact operating under the premise that this issue falls under the compliance exception of the backfit rule. The Panel determined that it was not pertinent to conduct a regulatory analysis because licensees are required to comply with the regulations regardless of backfit considerations. Additionally, given the uncertainties and complexity of the issue, it would be challenging to perform a rigorous regulatory analysis with sufficient accuracy to evaluate backfit considerations.

The Panel did not agree with the DPO submitter's concern regarding the staff being inconsistent with the Commission guidance provided in two SRMs, specifically those on staff's use of realistic scenarios rather than all possible scenarios. The Panel determined that the staff was not assessing the GL in context of all possible scenarios. The Panel noted that the staff had

balanced conservative and non-conservative margins and that bounding assumptions were made to simplify this very complex issue to minimize the number of scenarios considered. The assessment at times by the staff is qualitative and relies on engineering judgment.

Regarding the concern of the process utilized by the staff being inefficient and at times could focus on non-safety significant issues. The Panel agreed with the DPO submitter. Though inefficient, the strategy has resulted in improved plant safety. The strategy in the resolution of ECCS performance issues has been approached in a non-traditional way. Normally, plant modifications are made to meet specifically developed technical bases. In this case, licensees initially modified the plants to enact initial, rapid safety improvements to address the risk associated with potentially inadequate ECCS and CSS performance before completing the evaluation to demonstrate the adequacy of modifications.

The DPO Panel reviewed the proposed alternative approach of using risk assessment to determine if plants have adequately addressed ECCS performance concerns. The Panel concluded that such an approach would be extremely difficult given the complexities and uncertainties associated with the tests and analysis and may ultimately result in more licensee modifications.

The Panel agreed with the submitter that risks associated with BWR ECCS performance should be reassessed. The staff should continue internal evaluation as well as interaction with the BWR community.

Overall, the Panel found the staff's approach for resolving GSI-191 to be appropriately focused on compliance and consistent with Commission guidance. The Panel also concluded that the staff should continue with the planned GL review process and that the proposed alternate approach by the DPO submitter was not preferable.

The Panel also recommended that the staff consider two additional activities to ensure that the risk associated with GSI-191 related issues is acceptable. The recommendation was 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 and that the staff assess the consequences associated with ECCS inoperability.

DPO Decision (May 27, 2009)

On April 13, 2009, the Director, Office of Nuclear Reactor Regulation (NRR) provided a copy of the Panel report and discussed the content with the DPO submitter. Additional insights were provided by the DPO submitter during the meeting. The Director of NRR issued a decision regarding the DPO to the submitter in a letter dated May 27, 2009.

The NRR Director agreed with the DPO submitter's concern of the staff's focus on compliance. The NRR Director concurred with the Panel that compliance with regulatory requirements will provide reasonable assurance of safety.

The NRR Director did not agree with the DPO submitter's concern of the staff being inconsistent with the Commission guidance provided in two SRMs, specifically those on staff's use of realistic scenarios rather than all possible scenarios. The NRR Director, concurred with the Panel which determined that the staff was not assessing the GL in context of all possible scenarios. The Director specified that through the establishment of an integrated review team (IRT), of which the DPO submitter is a member, a holistic review is being conducted on a plant-

by-plant basis, balancing the safety margins among the various technical review areas, where possible. However, the Director determined that it was appropriate for the staff to re-evaluate its approach to determine whether excluding scenarios based on low probability or risk was feasible.

Regarding the concern of the process utilized by the staff being inefficient and at times could focus on non-safety significant issues, the Director, as the Panel, agreed with the DPO submitter and expressed that the NRC process should be improved from lessons learned as a result of the reviews of PWR sump performance. The NRR Director highlighted that SRM would be adhered to during the review of in-vessel down stream effects. The NRR Director also stated that though inefficient, the strategy has resulted in improved plant safety.

The NRR director did agree with the submitter that to the extent feasible, it was important to determine the risks imposed by sump/strainer performance issues for BWRs and PWRs such that resources can be focused on the most safety significant aspects of the issue.

The Director, NRR, assigned the following tasks to the Director, Division of Safety Systems (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 of issues relating to GSI-191 to ensure that the guidance follows the intent of the Commission's direction of the SRMs. In particular, evaluate whether and how focus can be increased on realistic scenarios, for example by using risk tools,
2. Conduct an interim lessons learned from the staff's review of GSI-191 to date 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 Panel's recommendation 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 differences in testing approaches.

These three actions were assigned a due date of September 30, 2009.

The Director, NRR, thanked the submitter for participating in the DPO process and stated that an open and thorough debate about how we carry out our regulatory programs is essential to keeping these programs effective.

DPO Appeal Submittal (Issues Raised by Submitter) (June 18, 2009).

- The DPO appeal filed on June 18, 2009, practically restates the original points of the DPO regarding the detailed review portion of NRC staff closure process for GSI 191 (GL 2004-02).
- The DPO appeal states that the guidance available to reviewers for determining licensee responses to GL 2004-02 came after licensees were expected to have completed all actions to address GSI 191. The licensee made their compliance decisions at the time of their implementation of the modifications.
- NRC review process of each submittal involves a detailed area review followed by a "consolidated" review by an IRT. The IRT then determines a) if applicable regulations are met, b) need for RAls, and c) defer recommendation. There is provision for a minority opinion in the IRT review. The appeal highlights that most IRTs conducted thus

far have resulted in RAIs. These RAIs are the cause of NRC reviews that are unnecessarily focused on compliance versus a determination that the underlying safety issue has been satisfactorily addressed. Further, the attributes for determining compliance with GL 2004-02 was developed later than the issuance of GL 2004-02.

- NRC approach does not align with Commission SRM regarding resolving PWR sump issues with a practical solution within a reasonable period of time, focusing on evaluating realistic scenarios.
- The DPO appeal discusses that on several licensee submittals, the DPO submitter was comfortable concluding a “no need for RAIs” and finding the licensee packages acceptable, meeting all rules and regulations based on a holistic approach. These cases were “best cases” for licensee having adequately resolved GSI-191, yet the NRC process led to RAIs.
- The DPO appeal reiterated more a role for the detailed reviewers in the alternate holistic method versus leaving that decision up to senior reviewers, thus holding them accountable for the overall outcome.
- A slight change in the appeal was that the submitter proposed a compliance determination should be deferred to a later time. These determinations should be revisited when the BWR head loss and testing issues are reviewed. Vulnerability for BWR sumps is projected in the appeal and the appeal questions the “illogic” of pursuing compliance questions for PWRs, yet not BWRs.
- The appeal states that if GSI 191 is viewed in context of backfit /cost benefit, any additional modifications or changes to modifications already completed would be difficult to justify.
- The DPO appeal states that GSI 191 should be closed like the closure of NRC Bulletin in 1996 involving BWRs, which was based on a qualitative assessment using holistic judgment by staff. Here licensee “statements of compliance” were accepted and staff detailed reviewers played a more active role in the holistic judgment. This point was not addressed by the Panel, but was not critical to the DPO according to the submitter.
- The appeal restates that GSI 191 should be closed based on licensee completing the sump modifications. The submitter believes that only vulnerable plants should be reassessed. The appeal suggests that the current test to success method expected in the submittals is random in nature and the resultant modifications relative to retest and analysis could result in un-quantified safety benefits.
- The DPO appeal submitter states that contrary to the Panel report, he never concurred on a “statement of concerns” which states that the risk of sump failure and downstream and chemical effects is insignificant. The submitter’s position is that the improvements have mitigated the most risk significant issues related to GSI 191. The submitter questions the impact of this on the DPO Panel report. The DPO submitter goes on to say that there is not a strong relationship between the Panel report and the DPO.

Office Director Views on DPO Appeal (July 09, 2009)

The office Director, NRR, following a review of the appeal, submitted a Statement of Views that concluded that the submitter had not included any new information that would alter the decision of the DPO. Therefore he found no reason to change any decision or take additional actions than what were in the closeout memorandum dated May, 27, 2009.

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