

October 5, 2007

MEMORANDUM TO: Vonna L. Ordaz  
Assistant for Operations  
Office of the Executive Director for Operations

FROM: J. E. Dyer, Director */RA/*  
Office of Nuclear Reactor Regulation

SUBJECT: UPDATED COMMUNICATION PLAN FOR GENERIC SAFETY  
ISSUE 191, "ASSESSMENT OF DEBRIS ACCUMULATION ON PWR  
SUMP PERFORMANCE"

I am sending you our updated communication plan for Generic Safety Issue (GSI)-191, "Assessment of Debris Accumulation on Pressurized-Water Reactor (PWR) Sump Performance." We will use this plan to guide our communications with internal and external stakeholders relating to the resolution of GSI-191. Implementation of this plan will facilitate the accomplishment of our openness and effectiveness strategic goals. As you are aware, actions to address GSI-191 have been in progress for some time, and numerous meaningful stakeholder interactions have occurred. As we continue forward toward issue closure, which we expect to occur in 2008, we will continue to pursue appropriate vehicles for communication with stakeholders as discussed in this plan.

ENCLOSURE:  
Communication Plan for GSI-191

CONTACTS: L.E. Whitney, NRR/DSS/SSIB  
301-415-3081  
M.L. Scott, NRR/DSS/SSIB  
301-415-0565

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ADAMS Accession Number: **ML060230398**

NRR-106

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## **COMMUNICATION PLAN FOR GSI-191, “ASSESSMENT OF DEBRIS ACCUMULATION ON PWR SUMP PERFORMANCE”**

### **INTRODUCTION**

This plan describes the methods and tools that the Office of Nuclear Reactor Regulation (NRR) will use for communicating to internal and external stakeholders the Nuclear Regulatory Commission (NRC) safety and regulatory activities relating Generic Safety Issue (GSI)-191, “Assessment of Debris Accumulation on Pressurized-Water Reactor (PWR) Sump Performance.” This plan will facilitate communications within the agency and provide timely, consistent, and understandable information to external stakeholders. This plan is an August 2007 update of the previous plan, which was issued on August 26, 2005.

### **GOALS**

#### Internal Stakeholders

This plan will facilitate communication and coordination within the NRC, as well as facilitate consistency and quality of external communication regarding activities associated with pressurized-water reactor sump performance.

#### External Stakeholders

This plan will facilitate the public’s understanding of the NRC’s safety and regulatory activities relating to PWR sump performance.

### **BACKGROUND**

The NRC established GSI-191 in September 1996 to determine whether the transport and accumulation of debris in PWR containments following a loss-of-coolant accident (LOCA) could impede the operation of any PWR’s emergency core cooling system (ECCS) or containment spray system (CSS). In the event of a LOCA, materials in the vicinity of the break (e.g., thermal insulation, coatings, and concrete) could be damaged and dislodged. A fraction of this material could then be transported to the recirculation sump and may accumulate on its screen. Debris accumulating on the sump screen has the tendency to form a bed of transported material, which, much like a filter, could result in increased head loss across the sump screen. The additional head loss resulting from the accumulation of debris is a safety concern because it has the potential to exceed the net positive suction head (NPSH) margin required to ensure the successful operation of the ECCS and CSS pumps.

Sump blockage was previously evaluated in the early 1980s under Unresolved Safety Issue A-43, “Containment Emergency Sump Performance.” Although the original regulatory guidance to assume 50 percent screen blockage was discredited in 1985, a backfit was not considered justified at the time. Subsequent blockage events at boiling-water reactors (BWRs) and additional research noted that more and finer debris could accumulate uniformly and that the effect of filtration of particulates by fibers of the bed (previously not considered) could result

ENCLOSURE

in higher head losses than previously assumed. In addition, the NRC staff identified concerns with the potential adverse effects that both upstream blockage (holding up water inventory from reaching the sump) and downstream blockage (from material passing through the screens) could have on ECCS performance. Based on the findings of its technical evaluation, the NRC staff concluded that degraded sump performance was a valid concern and recommended detailed plant-specific evaluations to determine the sump-clogging susceptibility of each PWR.

To reduce post-LOCA sump clogging risk during continued operation until resolution of GSI-191 at operating PWRs, on June 9, 2003, the NRC issued Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-Water Reactors" to all PWR licensees. The Bulletin: (1) informed PWR licensees of the potential for additional adverse effects in the event of a high-energy line break (HELB) due to debris blockage of flowpaths necessary for the ECCS and (CSS) recirculation and containment drainage, based on NRC-sponsored research; (2) requested PWR licensees to confirm compliance with 10 CFR 50.46(b)(5) and other existing applicable regulatory requirements, or describe any compensatory measures implemented to reduce the potential risk due to post-accident debris blockage as evaluations to determine compliance proceed; and (3) requested written responses in accordance with 10 CFR 50.54(f). The Bulletin also noted that if the results of the NRC inspections, reviews, or ongoing and planned studies indicate that unsafe conditions exist at any operating PWR, the NRC will take immediate actions to ensure the continued health and safety of the public.

In Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-water Reactors," dated September 13, 2004, the NRC requested that PWR licensees perform an evaluation of the ECCS and CSS functions at their reactor plants and, if appropriate, take actions to ensure system function. Generic Letter 2004-02 requested both a 90-day response and a response due on September 1, 2005. Through Generic Letter 2004-02, the NRC is implementing its plan to have all PWR licensees (1) evaluate the potential for excessive head loss across the containment sump screen, (2) evaluate related upstream and downstream effects, and (3) implement needed plant modifications and procedure changes by December 31, 2007.

On March 31, 2006, the Executive Director for Operations (EDO) signed out a Commission Information Paper ("SECY Paper") to the Commission providing an updated status on the resolution of GSI-191. This paper, SECY-06-0078, included acceptance criteria which the NRC has been and will continue to apply in the review of requests from PWR licensees to extend completion of any corrective actions for Generic Letter 2004-02 beyond December 31, 2007. By August 2007, the NRC had granted 14 extensions to this due date into spring 2008 and one into early winter 2009 for specific PWR units based on low plant-specific risk for operation during the extension period. A table providing information on approved extension requests can be found at the bottom of the following public web page:  
<http://webwork:300/reactors/operating/ops-experience/pwr-sump-performance/generic04-02-correspondence.html>

In May 2004 the Nuclear Energy Institute (NEI) submitted the report, "Pressurized Water Reactor Sump Performance Evaluation Methodology" (NEI 04-07 Volume I) (referred to commonly as the "Guidance Report" or "GR.") for NRC review. The NRC approved this methodology guidance, with exceptions, in a safety evaluation (SE) dated December 6, 2004

(referred to commonly as the "Safety Evaluation" or "SE," and designated as NEI 04-07 Volume II). Volume I and Volume II of NEI 04-07 allow PWR licensees to respond to Generic Letter 2004-02 with an NRC-approved methodology for evaluating plant-specific sump performance. NEI 04-07 provides an acceptable overall guidance methodology for the plant-specific evaluation of ECCS and CSS performance following any postulated accident for which ECCS or CSS sump recirculation is required, with specific attention given to the potential for debris accumulation that could impede or prevent the ECCS or CSS from performing its intended safety functions.

Consistent with ongoing efforts to risk-inform NRC regulations, a risk-informed method for resolving GSI-191 is contained in Section 6 of the NEI GR and addressed in Section 6 of the NRC SE. This approach provides an additional method for performing the evaluations requested under Generic Letter 2004-02. The alternative evaluation approach involves three steps: (1) define a "debris generation" LOCA break size to distinguish between customary and more realistic design-basis PWR sump analyses, (2) perform customary design-basis analyses for break sizes up through the debris generation break size identified above, and (3) analyze long-term cooling and mitigative capability for break sizes larger than the debris generation break size up through the double-ended rupture of the largest reactor coolant system (RCS) piping.

On March 3, 2006, the NRC issued a letter to NEI accepting an NEI-proposed alternative approach to responding to the February 2006 NRC Requests for Additional Information (RAIs) regarding licensee responses to Generic Letter 2004-02. In order to allow licensees to focus on designing and installing modified strainers and other components, and in recognition that much of the information needed to address the RAIs would not be available until ongoing testing activities are completed, the NRC agreed that licensees for PWR units completing their strainer modifications in 2006 could provide Generic Letter 2004-02 supplemental responses by December 31, 2006. Licensees for PWR units completing their strainer modifications in 2007 would provide Generic Letter 2004-02 supplemental responses within 90 days of the strainer installation outage but not later than December 31, 2007. The NRC letter stated that if the Generic Letter 2004-02 supplemental response provided adequate information to support GSI-191 issue closure, the RAIs would be considered to have been addressed. The NRC followed up on this letter with letters to licensees on the same subject.

In late 2006, it became clear that licensees would not be able to fully address effects of chemicals on sump clogging issues by the end of 2006. Therefore, on November 14, 2006, the NRC informed NEI by letter that licensees could provide final Generic Letter supplemental responses as soon as testing and analysis activities are complete, but not later than December 31, 2007. Similar information was subsequently provided to each PWR licensee by letter.

The NRC staff is currently addressing remaining technical issues and questions related to sump clogging. Activities include review of industry-developed topical reports that address chemical effects and downstream effects, both inside and outside the reactor vessel. The staff is developing guidance for staff reviewers of Generic Letter supplemental responses in several areas, including chemical effects, impact of coatings debris, and head loss testing methods. RES has been requested to evaluate a number of open questions related to chemical effects, with an initial report on whether additional actions are needed to address those questions expected by September 2007.

Generic Letter 2004-02 contemplated potential use of sample audits to verify adequacy of licensee corrective actions. Since spring 2006, the NRC staff has conducted onsite audits of seven plants, and three additional audits are planned. The staff expects licensees subjected to an audit to address in their supplemental Generic Letter responses any unresolved issues (referred to as “open items”) identified in the audit.

In early 2008, the NRC staff will review three sets of inputs to support closure of Generic Letter 2004-02 and GSI-191. The staff will review the aforementioned final Generic Letter responses from each licensee. The purpose of these limited reviews will be to verify that licensees’ corrective actions appear to be sufficient to demonstrate adequate long-term core cooling after a hypothetical loss-of-coolant accident in accordance with 10 CFR 50.46(b)(5). The staff will also review the results of inspections conducted under TI-2515/166, “Pressurized Water Reactor Containment Sump Blockage (NRC Generic Letter 2004-02),” that are intended to verify that licensees have made the corrective actions to which they have committed. Finally, the staff will consider the results of sampling audits of licensee corrective actions. The NRC will notify each licensee by letter of the results of this review, including the staff’s assessment as to whether Generic Safety Issue 191 and Generic Letter 2004-02 have been satisfactorily addressed at that licensee’s plant(s).

The Office of Nuclear Reactor Regulation maintains a public web site on PWR sump performance at:  
<http://www.nrc.gov/reactors/operating/ops-experience/pwr-sump-performance.html#reports>.

A folder titled “GSI-191 PWR Sump Performance” in the NRC’s ADAMS Document Manager facilitates retrieval of specific documents related to the GSI-191 issue.

## **AUDIENCE**

### Internal Stakeholders

- Commission
- Office of the Executive Director for Operations (EDO)
- Office of Nuclear Reactor Regulation
  - Executive Team and Leadership Team
  - Division of Operating Reactor Licensing (DORL), including project managers for PWRs
  - Division of Component Integrity (DCI)
  - Division of Engineering (DE)
  - Division of Inspection and Regional Support (DIRS)
  - Division of Policy and Rulemaking (DPR)
  - Division of Risk Assessment (DRA)
  - Division of Safety Systems (DSS)

- Office of Nuclear Regulatory Research
  - Division of Fuel, Engineering and Radiological Research
  - Division of Risk Assessment and Special Projects
- Office of New Reactors
  - Division of Safety Systems and Risk Assessment
  - Division of New Reactor Licensing
- Advisory Committee on Reactor Safeguards
- Committee to Review Generic Requirements
- Office of Congressional Affairs
- Office of Public Affairs
- Office of Enforcement
- Office of the General Counsel
- Office of State and Tribal Programs
- Office of the Inspector General
- Regions I, II, III, and IV

#### External Stakeholders

- Members of the public
- Congress
- Governor-appointed State Liaison Officers
- Media (e.g., *Inside NRC*)
- Public interest groups (e.g., Union of Concerned Scientists)
- Nuclear industry organizations (e.g., NEI and PWR Owners' Group)
- PWR licensees
- Foreign regulators

#### **KEY MESSAGES**

- The NRC assesses the design and operation of nuclear power plants on an ongoing basis to ensure that public health and safety are maintained.
- Through reviews conducted under Generic Safety Issue-191, the NRC has concluded that PWR containment sump screens/strainers may clog with debris during loss-of-coolant accidents. Because water from the sumps would be used to cool the reactor core and reduce containment pressure after a LOCA, debris clogging of sump strainers could lead to inadequate reactor core cooling and excessive containment pressure.



- NRC Bulletin 2003-01 requested PWR licensees to confirm compliance with regulations for post-LOCA long-term core cooling, or describe compensatory measures implemented to reduce the potential risk from post-accident debris which may block sump screens. All licensees responded, and the NRC found the Bulletin 2003-01 responses to be satisfactory.
- The NRC decided that additional actions, including plant-specific evaluations of the debris problem, were needed to ensure that public health and safety are maintained. Therefore, Generic Letter 2004-02 requested licensees to evaluate their post-LOCA plant conditions and implement any additional corrective actions necessary by December 31, 2007.
- Generic Letter 2004-02 stated that the interim continued operation of PWRs would not result in undue risk to the public because of safety margins in emergency system analyses and design, measures licensees had already taken to reduce risk, and the low probability of a large-break LOCA.
- In December 2004 the NRC issued a safety evaluation approving, with some supplementary information, an industry methodology (NEI Document 04-07) for PWR licensees to use in analyzing PWR containment sump performance.
- Temporary inspection procedure TI-2515/166 directs NRC inspectors to ensure licensees are completely and properly meeting their Generic Letter 2004-02 corrective action implementation commitments. (These inspections are currently in progress.)
- Information Notices IN 2005-26 and IN 2005-26 Supplement 1 on chemical effects provide important research results for PWR licensee use in developing their Generic Letter 2004-02 corrective actions. The results showed the potential for significant increases in screen/strainer head loss because of chemical reactions occurring in the sump pool.
- The NRC agrees with licensees' focus on making major increases to sump/strainer size to reduce vulnerability to sump clogging. By the end of 2007, almost all plants will have made such modifications. Additional actions, such as removal of problematic materials from containment, may be needed at some PWR reactor plants.
- Audits of actions to address Generic Letter 2004-02 at a sample of reactor plants will help the staff confirm whether the modifications and procedure changes implemented by PWR licensees are adequate to address GSI-191. The NRC has conducted seven such audits and plans three more.
- The NRC has conducted confirmatory research on chemical effects, downstream effects, coatings transport, and debris-laden sump strainer head loss. NRC confirmatory research results are being made public and will be used in evaluating the adequacy of licensee actions to address Generic Letter 2004-02.
- By mid-2008 the NRC plans to have written Generic Letter 2004-02 closeout letters to each PWR licensee, and by fall 2008 the NRC plans to have written an internal GSI-191 closeout memorandum discussing resolution of the sump clogging issue for U.S. PWRs.

## COMMUNICATION TEAM

The primary responsibility of the communication team is to ensure that it conveys a consistent, accurate, and timely message to all stakeholders. The team consists of the project management, technical, and communication staff named in the table below.

TEAM MEMBER	POSITION	ORGANIZATION	PHONE
Joe Golla	Project Manager	NRR/DPR	301-415-1002
Michael Scott	Branch Chief/Team Leader	NRR/DSS	301-415-0565
Allen Hiser	Branch Chief	NRR/DCI	301-415-5650
Kamal Manoly	Branch Chief	NRR/DE	301-415-2765
Matthew Yoder	Technical Staff	NRR/DCI	301-415-4017
Paul Klein	Technical Staff	NRR/DCI	301-415-4030
Steve Unikewicz	Technical Staff	NRR/DCI	301-415-3819
John Burke	Technical Staff	NRR/DSS	301-415-1529
Michelle Hart	Technical Staff	NRR/DRA	301-415-1840
Ervin Geiger	Technical Staff	NRR/DSS	301-415-5680
John Lehning	Technical Staff	NRR/DSS	301-415-1015
Leon Whitney	Technical Staff	NRR/DSS	301-415-3081
Ralph Architzel	Technical Staff	NRR/DSS	301-415-2804
B.P. Jain	Technical Staff	RES/DFERR	301-415-6303
Rosetta Virgilio	Communication Staff	STP	301-415-2367
Scott Burnell	Communication Staff	PA	301-415-8204
Christine Tucci	Communication Staff	NRR/PMDA	301-415-2008
Undine Shoop	Communication Staff	EDO	301-415-2063
Raeann Shane	Communication Staff	OCA	301-415-1699

## COMMUNICATION TOOLS

The team will use the tools described below to communicate with stakeholders.

### Agencywide Documents Access and Management System (ADAMS)

Meeting notices and meeting summaries will be placed in ADAMS and will be publicly available through ADAMS from the NRC's external Web site. Technical and regulatory documents that may improve stakeholders' understanding will be placed in ADAMS.

### Internal Briefings and Meetings

Internal briefings will be conducted at various points in the GSI-191 resolution process to keep internal stakeholders (primarily senior management, regional staff, advisory committees, and resolution team members) informed of the staff's activities and messages. Key messages will be repeated throughout the briefing. The timeline of communication activities in Attachment 1a includes known points of interaction with internal stakeholders.

### Email

An email address has been established (PWR Sumps) for the GSI-191 communication team and other GSI-191 cognizant internal stakeholders to send questions and receive timely support for GSI-191 activities.

### Web Page

A public PWR Sump Performance Web page is being maintained to distribute information to members of the public to support their understanding of the GSI-191 issue and NRC activities to resolve GSI-191. To increase this Web page's visibility, the staff worked with NRR Web Services to ensure that the public can easily locate the Web page. The Web site address is <http://www.nrc.gov/reactors/operating/ops-experience/pwr-sump-performance.html>.

### EDO Daily Notes

After selected public meetings with industry on PWR sump performance, a member of the communication team will prepare and submit an EDO daily note on the meeting outcome by 12 p.m. on the next business day. This will raise awareness of the meeting outcome at the EDO and Commission level.

### Office Newsletters

To raise staff awareness on the progress of resolving PWR sump issues, the communication team will consider the use of division newsletters and the NRR *Have I Got News for You* newsletter, when appropriate. This will enable the team to keep NRR staff and management and regional management informed of new challenges, progress made, and any teams formed to resolve this issue.

### Weekly Highlights and Plan of the Week

The staff will report the status of meetings, NRC-produced reports (e.g., SEs), and incoming documents in the NRR or RES plan of the week. In addition, the staff will prepare weekly highlights concerning the issuance of public documents and describing the outcome of public meetings. The team will use these reports to communicate important GSI-191-related events and/or significant changes in plans or policies.

### Public Meetings

Public meetings will be held to discuss the status of issue resolution, as recommended in the guidance for generic communications and generic issue processes. Key messages will be repeated throughout the meetings. In addition, public meetings will be held to discuss recommendations that the industry or other external stakeholders have concerning the resolution of GSI-191. Before a public meeting, the staff will hold a pre-meeting to discuss the key messages for that meeting, the objective for the meeting, and roles of the staff attending the public meeting. The timeline of communication activities in Attachment 1a includes known points of interaction with external stakeholders.

### Press Releases and Media Interviews

The communication team will coordinate with OPA to issue press releases and arrange media interviews and meetings with publication editorial boards, as appropriate. Press releases will be issued to announce the publication of generic communications.

### Availability of Technical and Regulatory Documents

In addition to making documents publicly available through ADAMS, all publicly available technical and regulatory documents will be placed on the GSI-191 Web page. Before releasing documents to the public, the staff will inform at least division-level management in both NRR and RES. The staff will include in the background section, executive summary, and/or conclusion of documents released to the public a brief statement that describes the contribution of the document to the resolution of GSI-191.

### **TIMELINE OF ACTIVITIES RELATED TO GSI-191**

See Attachment 1a.

### **VALIDATION OF SUCCESS**

The staff will evaluate the effectiveness of the communication plan on a periodic basis to ensure that its goals are achieved. The staff will measure its success in communicating through formal and informal feedback from internal and external stakeholders (i.e., through assessing public meeting feedback forms and routine interfaces). The staff will make appropriate modifications to its communication strategy based on these assessments.

### Internal Stakeholders

The communication team will measure its success in communicating GSI-191-related messages among internal stakeholders by self-assessing the efficiency and effectiveness of GSI-191 communication and coordination within the NRC. By keeping all levels of staff and management informed through informal (i.e., periodic staff discussions or email) and formal interactions (i.e., memos, planned briefings, or meetings), the GSI-191 team will enhance its ability to deliver a consistent message regarding activities associated with PWR sump performance.

### External Stakeholders

The communication team will measure its success in communicating GSI-191 related messages by: (1) assessing feedback from users of the public PWR Sump Performance web page (stakeholders may provide feedback via the “Contact a Public Affairs Officer” page of the NRC Public Web Site, accessible via the “Public Involvement” link on the top banner of each public web site page); (2) monitoring media reports to determine success in conveying information consistently and accurately (i.e., assessing news articles to ensure that they accurately reflect key messages, yet being careful to avoid the perception of news management); and (3) reviewing public meeting feedback forms to determine the public’s perception of these meetings. All comments received will be used to improve future public meetings and external communications vehicles.

The staff will make appropriate modifications to its future and ongoing communication strategy based on these assessments.

## **FINAL CLOSURE**

Final closure of the GSI-191 issue involves completing NRC verification of the adequacy of licensee PWR sump performance evaluations and their implementation of necessary sump and other ECCS and CSS modifications. GSI-191 will be closed when NRR has determined that adequate actions have been implemented in response to Generic Letter 2004-02. The GSI-191 team will meet with the ACRS to obtain a letter endorsing GSI-191 issue closure. The GSI-191 team then will prepare a closeout memorandum in accordance with NRR Office Instruction LIC-504, “Generic Communications Affecting Nuclear Reactor Licensees.” A copy of this document will be provided to the Generic Issues Program (GIP) Manager in RES and the Director of RES to support closure of GSI-191 in the GIP. The following is the plan for closure:

- Licensee Verification– Licensees will respond to NRC requests for additional information (RAIs) related to their responses to Generic Letter 2004-02, or, alternatively, provide equivalent information needed to address Generic Letter 2004-02 completion status in supplemental Generic Letter 2004-02 responses (see NRC letter to NEI dated March 6, 2006 [see ADAMS document ML060620050]).
- NRC Verification (Responsible Organizations: DSS, DCI, DE, Regions) – The NRR staff will review all licensee responses to Generic Letter 2004-02 using guidance the staff has developed or plans to develop, will review audit report results, and will review inspection reports on licensee implementation of sump modifications and program changes.

- Closure Memorandum (Responsible Organization: DSS) – The GSI-191 team will issue a memorandum in accordance with LIC-503 with a copy to the GIP Manager and the Director of RES indicating the basis for declaring GSI-191 closed. This memo will refer to an ACRS letter regarding appropriateness of closing the GSI-191 issue.

When GSI-191 is closed out, the communication team will survey stakeholders (e.g., NRR, RES, and regional staff; NEI; licensees and the public) for their impressions on effective communication strategies and areas for improvement. The communication team will document the findings in a memorandum.

## **QUESTIONS AND ANSWERS**

See Attachment 1b.

## TIMELINE OF ACTIVITIES RELATED TO GSI-191

Note: (C) by a date in table annotates a completed activity. Dates not so annotated are target dates.

<b>ACTIVITIES FOR INTERNAL AND EXTERNAL STAKEHOLDERS</b>	<b>OFFICE LEAD</b>	<b>DATE</b>
Document closeout of GSI-191 in a memorandum in accordance with NRR Office Instruction LIC-503	NRR	10/2008
Meet with ACRS on GSI-191 Closeout. Obtain ACRS letter regarding appropriateness of GSI-191 issue closeout	NRR and RES	09/2008
Complete reviews of licensee GL supplemental responses and issue plant-specific GL 2004-02 closure letters to the licensees	NRR	09/2008
Complete plant audits	NRR	06/2008
Complete Temporary Instruction 2515/166 inspections of licensee implementation of plant changes in response to GL 2004-02	Regions I - IV	06/2008
Complete review of topical report on in-vessel downstream effects	NRR	02/2008
Meet with ACRS full committee on chemical effects and in-vessel downstream effects	NRR	02/2008
Issue final review guidance for scaling, chemical effects, and coatings	NRR	02/2008
Licensees submit final supplemental responses to GL 2004-02	NRR	12/31/2007
Meet with ACRS Subcommittee on Thermal Hydraulics to discuss chemical effects testing results and draft topical report on in-vessel downstream effects	NRR	11/2007
Complete reviews of industry topical reports on downstream effects and chemical effects	NRR	11/2007
Public meeting with NEI and stakeholders - chemical effects and path toward issue resolution	NRR	10/2007
Issue draft review guidance for scaling, chemical effects, and coatings	NRR	09/2007 (C)

<b>ACTIVITIES FOR INTERNAL AND EXTERNAL STAKEHOLDERS</b>	<b>OFFICE LEAD</b>	<b>DATE</b>
Provide Commission Information paper to inform NRC Commissioners of current status and plans to close out GSI-191	NRR	10/2007
Issue guide to industry regarding content for final licensee responses to GL 2004-02	NRR	08/2007 (C)
Public Meeting with NEI and Stakeholders - Vendor strainer testing with chemical effects, Supplemental Responses to GL 2004-02, NRC review of Topical Reports	NRR	08/2007 (C)
Public Meeting with NEI Stakeholders - chemical effects, Draft GL 2004-02 Supplemental Response Content Guide, Topical Report Status, Remaining Technical Questions, Audit Status, Qualified Coatings Assessments	NRR	06/2007 (C)
Meet with ACRS Subcommittee on Thermal Hydraulics to discuss GSI-191 activities	NRR and RES	05/2007 (C)
Public Meeting with NEI and Stakeholders - chemical effects, Supplemental Responses to GL 2004-02, remaining technical questions, Topical Reports, audit status, head loss testing, coatings	NRR	04/2007 (C)
Public meeting with NEI and Stakeholders - sump screen backflush methods	NRR	03/2007
Meet with ACRS full committee to discuss chemical effects	NRR and RES	03/2007 (C)
Public Meeting with NEI and Stakeholders - water management, downstream effects, buffer change out, chemical effects, coatings	NRR	02/2007 (C)
Meet with NEI and other stakeholders to discuss activities related to GSI-191	NRR	02/2007 (C)
Meet with ACRS Subcommittee on Thermal Hydraulics to discuss research related to GSI-191	RES	02/2007 (C)
Publish NUREGs supporting resolution of GSI-191	RES	01/2007 (C)
Public Meeting with NEI and Stakeholders - buffer change out, issue resolution path forward, chemical effects, qualified coatings assessments	NRR	12/2006 (C)



<b>ACTIVITIES FOR INTERNAL AND EXTERNAL STAKEHOLDERS</b>	<b>OFFICE LEAD</b>	<b>DATE</b>
Brief NRC Commission on GSI-191 Activities	NRR and RES	10/2006 (C)
Meet with NEI and other stakeholders to discuss activities related to GSI-191	NRR	10/2006 (C)
Public Meeting with NEI and Stakeholders - sump screen bypass testing	NRR	08/22/06 (C)
Public Meeting with NEI and Stakeholders - downstream effects	NRR	08/02/06 (C)
Meet with ACRS Subcommittee on Thermal Hydraulics to discuss vendor testing issues and licensee amendment requests	NRR	08/2006 (C)
Meet with ACRS Subcommittee on Thermal Hydraulics on GSI-191 Research and Implementation Activities	NRR and RES	06/2006 (C)
Meet with NEI and sump strainer vendors to discuss and agree on path forward.	NRR	05/2006 (C)
Issue Commission Information Paper SECY-06-0078, "Status of Resolution of GSI-191, 'Assessment of [Effect of] Debris Accumulation on PWR Sump Performance'"	NRR	03/2006 (C)
Meet with ACRS full committee on GSI-191 status	NRR	03/2006 (C)
Issue Temporary Instruction 2515/166 for verification of implementation of modifications and procedure changes in response to GL 2004-02	NRR	03/2006 (C)
Meet with ACRS Subcommittee on Thermal Hydraulics on GSI-191 status	NRR	02/2006 (C)
Issue requests for additional information to PWR licensees based on licensees' second (September, 2005) response to GL 2004. Alternative to the requested 60 day RAI response schedule contained in NRC letter to NEI dated March 3, 2006 (ML060620050)	NRR	02/2006 (C)
Public Meeting with NEI and Stakeholders - Information Notice 2005-26 on potential head loss from chemical precipitate from tri-sodium phosphate sump water pH buffer and calcium in containment.	NRR and RES	02/2006 (C)

<b>ACTIVITIES FOR INTERNAL AND EXTERNAL STAKEHOLDERS</b>	<b>OFFICE LEAD</b>	<b>DATE</b>
License amendment requests in support of GSI-191 plant modifications and procedural changes to be submitted	NRR	Ongoing receipt and processing
10 audits of licensee responses to GL 2004-02 (through early CY 2008)	NRR	Ongoing
Two pilot plant reviews of licensees' PWR sump performance evaluation methodology	NRR	01/2006 (C)
Licensee's second response to GL 2004-02	NRR	09/2005 (C)
Issue Audit Plan for internal NRC use for GL 2004-02 PWR audits	NRR	11/2005 (C)
Public Meeting with NEI and Stakeholders - Status of GSI-191 resolution, ongoing research, 90-day GL 2004-02 responses, and pilot plant audit	NRR	04/2005 (C)
PWR licensees' first response to GL 2004-02 (90 days from issuance of the SE on NEI 04-07)	NRR	03/2005 (C)
Publish the NRC SE of NEI evaluation guidelines	NRR	12/2004 (C)
NEI workshop on PWR sump performance evaluation	NRR	12/2004 (C)
Meet with vendors performing PWR sump evaluations	NRR	10/2004 (C)
Brief Commissioners' technical assistants on NRC SE of NEI guidelines	NRR	10/2004 (C)
Brief EDO on NRC SE of NEI guidelines	NRR	10/2004 (C)
Brief CRGR on NRC SE of NEI guidelines	NRR	10/2004 (C)
Brief ACRS full committee on NRC SE of NEI guidelines	NRR	10/07/2004 (C)
Brief ACRS subcommittee on NRC SE of NEI guidelines	NRR	09/22/2004 (C)
Issue GL 2004-02 on the potential impact of debris blockage on emergency recirculation during design-basis accidents at PWRs	NRR	09/13/2004 (C)
Submit draft SE on NEI guidelines to ACRS	NRR	09/08/2004 (C)
LANL TER regarding NEI guidelines	NRR	08/19/2004 (C)
Brief CRGR on GL 2004-XX	NRR	08/10/2004 (C)
LANL draft technical evaluation report (TER) on the NEI evaluation guidelines	NRR	08/19/2004 (C)

<b>ACTIVITIES FOR INTERNAL AND EXTERNAL STAKEHOLDERS</b>	<b>OFFICE LEAD</b>	<b>DATE</b>
Submit information paper to the Commission on the risk-informed GSI-191 resolution option	NRR	08/2004 (C)
LANL draft technical letter report regarding screen penetration (small-sized debris passing through a sump screen)	RES	08/2004 (C)
Review of NEI proposed guidance for the risk-informed GSI-191 resolution option	NRR	08/2004 (C)
LANL technical letter report regarding blowdown/washdown transport	NRR	07/2004 (C)
Receive final NEI guidelines	NRR	07/15/2004 (C)
Receive NEI Chapter 6 (risk-informed option) evaluation guidelines	NRR	07/13/2004 (C)
Brief ACRS full committee on GL 2004-XX	NRR	07/07/2004 (C)
Develop technical basis for the risk-informed GSI-191 resolution option break size and frequency	NRR	07/2004 (C)
Finalize GL 2004-XX on the potential impact of debris blockage on emergency recirculation during design-basis accidents at PWRs	NRR	07/2004 (C)
Public meeting with NEI to continue the discussion on the risk-informed GSI-191 resolution option	NRR	06/29/2004 (C)
Brief ACRS subcommittee on GL 2004-02	NRR	06/22–23/2004 (C)
Public meeting with NEI to continue the discussion on the risk-informed GSI-191 resolution option	NRR	06/17/2004 (C)
Receive NEI responses to requests for additional information on baseline guidelines	NRR	06/10/2004 (C)
LANL technical letter report regarding latent debris characterization and head loss	RES	06/2004 (C)
Receive NEI supplemental guidelines	NRR	05/28/2004 (C)
Public meeting with NEI regarding the risk-informed GSI-191 resolution option	NRR	05/25/2004 (C)
Public meeting with NEI regarding the interim safety assessment	NRR	05/19/2004 (C)
Public meeting with stakeholders to discuss draft GL 2004-XX	NRR	05/19/2004 (C)

<b>ACTIVITIES FOR INTERNAL AND EXTERNAL STAKEHOLDERS</b>	<b>OFFICE LEAD</b>	<b>DATE</b>
Define the risk-informed GSI-191 resolution option approach	NRR	05/2004 (C)
Public meeting with NEI, utility groups, and stakeholders to discuss the integrated chemical effects test plan and the test facility that will be used to conduct the tests	RES	04/28/2004 (C)
Receive NEI baseline guidelines	NRR	04/19/2004 (C)
LANL technical letter report regarding calcium silicate debris	RES	04/16/2004 (C)
Public meeting with NEI and stakeholders to discuss the draft NEI PWR containment sump evaluation methodology and NRC comments regarding the methodology	NRR	03/23–24/2004 (C)
Issue proposed GL 2004-XX for public comment	NRR	03/2004 (C)
NEA/NRC workshop on debris impact on emergency coolant recirculation	RES	02/25–27/2004 (C)
Public meeting with NEI and Westinghouse Owners Group (WOG) to discuss WOG activities regarding candidate operator actions for generic emergency response guidelines and the status of these activities	NRR	01/22/2004 (C)
Public meeting with NEI and stakeholders to discuss the chemical effects test plan and potential facilities that will be used to conduct the tests	RES	01/08/2004 (C)
Implement redesigned PWR sump Web page	NRR	12/2003 (C)
LANL preliminary technical letter report regarding chemistry effects tests	RES	12/2003 (C)
Public meeting with NEI and stakeholders to discuss the status of NEI activities regarding the evaluation guidelines, chemical precipitation, and the status of activities related to the resolution of GSI-191	RES	11/19/2003 (C)
LANL technical letter report regarding the effects of chemical reactions on debris-bed head loss	RES	11/2003 (C)
Issue Regulatory Guide 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," Revision 3	NRR	11/2003 (C)
Issue Temporary Instruction 2515/153 related to Bulletin 2003-01	NRR	10/2003 (C)
Brief ACRS full committee	RES	09/11/2003 (C)

<b>ACTIVITIES FOR INTERNAL AND EXTERNAL STAKEHOLDERS</b>	<b>OFFICE LEAD</b>	<b>DATE</b>
Public meeting with stakeholders to discuss the testing and analysis necessary to address the chemical precipitation issue on a timescale which is consistent with the NRC's current plan for resolving GSI-191	RES	09/10/2003 (C)
Brief ACRS thermal hydraulics subcommittee	RES	08/19/2003 (C)
NEI sump performance workshop	NRR	07/30–31/2003 (C)
Public meeting with stakeholders to discuss the status of the industry's methodology regarding debris generation, the LANL chemical effects tests, and the NRC generic communications related to GSI-191	NRR	07/01/2003 (C)
Public meeting with NEI, utility groups, and stakeholders regarding Bulletin 2003-01	NRR	06/30/2003 (C)
Prepare press release for Bulletin 2003-01	NRR	06/09/2003 (C)
Issue Bulletin 2003-01, "Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized Water Reactors"	NRR	06/09/2003 (C)
Issue Commission SECY Paper SECY-03-0089, "Proposed Bulletin: 'Potential Impact of Debris Blockage on Emergency Sump Recirculation at Pressurized-water Reactors'"	NRR	06/02/2003 (C)
Draft proposed bulletin on compensatory measures regarding sump performance	NRR	04/30/2003 (C)
Public meeting with stakeholders to discuss the industry's outline process for determining breach size in support of local debris generation following a design-basis loss-of-coolant accident	NRR	04/29/2003 (C)
Brief the Committee to Review Generic Requirements (CRGR)	NRR	04/08/2003 (C)
Brief ET	NRR	03/17/2003 (C)
Brief Leadership Team	NRR	03/13/2003 (C)
Public meeting with University of New Mexico laboratories regarding activities to support efforts related to GSI-191	RES	03/05/2003 (C)
Los Alamos National Laboratory (LANL) technical letter report regarding the impact of recovery from debris-induced loss of emergency core cooling system (ECCS) recirculation on PWR core damage frequency	RES	02/2003 (C)
Brief ACRS thermal hydraulics subcommittee	NRR	02/04/2003 (C)
Public meeting with stakeholders regarding the current status of GSI-191	NRR	12/12/2002 (C)

<b>ACTIVITIES FOR INTERNAL AND EXTERNAL STAKEHOLDERS</b>	<b>OFFICE LEAD</b>	<b>DATE</b>
Public meeting with NEI and stakeholders regarding the current status of GSI-191	NRR	10/24/2002 (C)
NEI 02-01, "Condition Assessment Guidelines: Debris Sources Inside PWR Containments"	NRR	09/2002 (C)
Public meeting with stakeholders regarding the current status of GSI-191	NRR	08/29/2002 (C)
Public meeting with stakeholders regarding the current status of GSI-191	NRR	07/02/2002 (C)
Public meeting with interested stakeholders regarding the current status of GSI-191	NRR	05/30/2002 (C)
Public meeting with interested stakeholders regarding the current status of GSI-191	NRR	03/28/2002 (C)
Brief Executive Team (ET) on current status of GSI-191	NRR	02/11/2002 (C)

## QUESTIONS AND ANSWERS

### General Q&As

#### **1. Does this issue affect all types of reactors?**

No, it only affects pressurized water reactors (PWRs). However, boiling-water reactors (BWRs) had previously addressed strainer blockage issues raised by Nuclear Regulatory Commission (NRC) Bulletin 96-03, "Potential Plugging of Emergency Core Cooling Suction Strainers by Debris in Boiling-Water Reactors."

#### **2. What effect would reduced-suction performance in the containment sump have on a reactor's ability to handle accidents?**

Following loss-of-coolant accidents (LOCAs), water from a tank outside the containment is pumped into the core to keep the fuel cooled, and it is sprayed into the containment to reduce containment pressure and remove radioactivity in the containment atmosphere. Water leakage from the reactor coolant system accumulates in the containment sumps. After all external water is exhausted, the pumps draw water from the sumps. A buildup of debris on the sump screens could act like a clogged filter, reducing or stopping the flow needed for core and containment cooling.

#### **3. What other problems could debris cause in the sump water flowpath?**

Blockage at points downstream of the sump could prevent flow to cool the reactor core and the containment or could cause damage to emergency cooling pumps. Blockage upstream of the sumps could prevent water from reaching the sump.

#### **4. How did reactor designs originally account for debris in the containment sump?**

Regulatory Guide (RG) 1.82, "Water Sources for Long-Term Recirculation Cooling Following a Loss-of-Coolant Accident," provides regulatory guidance on issues such as screen mesh areas, mesh size, and assumed blockage (50 percent) of the screens.

#### **5. Are alternative water sources acceptable to use if sump recirculation fails?**

Yes. For accidents for which sump recirculation fails, if alternative sources of water are not used to cool the reactor core, core damage will result. Therefore, the NRC indicated in Information Notice 2003-01 that licensees should consider availability of alternative water sources to cool the reactor core and containment, consistent with containment design considerations and accident response guidelines.

## **Q&As on Risk to Public Safety**

### ***1. Does this generic issue mean that the original safety assessments of nuclear power plants are fundamentally flawed?***

Yes, in the sense that the analyses on which conclusions about sump performance were based did not consistently and rigorously consider how much debris could be produced after a LOCA and cause blockage of the sump strainer. The NRC initiated GSI-191 to reassess the safety significance of recirculation performance. Generic Letter 2004-02 requested licensees to evaluate their plant-specific debris loading and make any necessary modifications by December 31, 2007, to ensure sump performance is adequate.

### ***2. Are the plants safe now? Why is the NRC not issuing orders to licensees to shutdown while taking their corrective actions?***

Yes. Generic Letter 2004-02 concluded that continued operation until the target date for licensees to fully address GSI-191 (December 31, 2007) was justified, based on the low probability of a LOCA, the fact that some smaller LOCAs may not require the use of recirculation from the ECCS sump, the existence of design features which would tend to prevent blockage of the ECCS sumps, and the compensatory measures taken by licensees in response to Bulletin 2003-01. Based on information available now, the conclusions in the Generic Letter remain valid. In fact, most plants have now significantly increased the size of their sump strainers, making blockage much less likely.

If NRC inspections, audits or ongoing or planned research studies indicate that unsafe conditions exist at any operating PWR, the NRC will take immediate actions to ensure the continued health and safety of the public (up to and including ordering immediate shutdowns, as appropriate). In addition, if a licensee discovers that it is not in compliance with NRC regulations or its licensing basis during the implementation of the requested actions in Generic Letter 2004-02, it is required to take prompt corrective actions.

### ***3. Why is it safe to allow some plants more time beyond 2007 to complete corrective actions?***

The NRC has authorized certain plants a few months more time to complete certain specified corrective actions. The NRC has granted such requests based on information provided by the licensee that shows it is safe for the plant to operate for the period requested. Typically, only one or a few corrective actions remain in such cases, with many or most corrective actions already having been implemented.

## **Q&As on Bulletin 2003-01**

### ***1. Could interim measures from Bulletin 2003-01 result in licensees inadvertently terminating all flow to the core, in the manner of Three Mile Island, unless formal risk evaluations are performed?***

The NRC believes that the benefit of the measures discussed in Bulletin 2003-01 could exceed the risk of operators inappropriately shutting off flow to the core. The bulletin does not require any particular measure be taken at any plant, and individual licensees are responsible for ensuring that any compensatory measures chosen can and will be safely implemented.



**2. Did the NRC rush by issuing Bulletin 2003-01 and pursuing actions that may be adverse to safety?**

No. The NRC staff has analyzed the example interim compensatory measures in Bulletin 2003-01 and considers them to be appropriate for PWR licensees to ensure the continued safe operation of their facilities. All interim compensatory measures implemented by licensees in response to Bulletin 2003-01 were reported to the NRC by licensees, reviewed by the NRC staff, and that review documented in a plant-specific Bulletin 2003-01 closeout letter to the licensee. Licensees are required to demonstrate the safety of any changes to their facilities before implementing them.

**3. Has the NRC staff reviewed all PWR licensee responses to Bulletin 2003-01?**

All interim compensatory measures implemented by licensees in response to Bulletin 2003-01 were reported to the NRC by licensees, reviewed by the NRC staff, and that review documented in a plant-specific Bulletin 2003-01 closeout letter to the licensee.

## **Q&As on Generic Letter 2004-02**

### ***1. Why did the NRC issue a generic letter after it has issued a bulletin?***

The staff used a two-pronged generic communication strategy to address the PWR sump clogging issue. This strategy included Bulletin 2003-01 and Generic Letter 2004-02. The staff chose this approach because it allowed the near-term safety issues to be addressed with Bulletin 2003-01. The Generic Letter addressed corrective actions that are needed to bring the issue to closure.

### ***2. When will the NRC require licensees to use the results of the analysis performed in response to the Generic Letter in operability determinations?***

The staff determined that the NRC will not require licensees to be in compliance with sump clogging analyses intended to address the Generic Letter using an NRC-approved methodology until after all plant modifications (if required) are completed in accordance with the resolution schedule in the Generic Letter (i.e., December 31, 2007). However, if a noncompliance with the existing licensing design basis that affects the operability of an ECCS or CSS design feature is identified while taking actions in response to the Generic Letter, licensees are required to comply with established regulatory requirements.

The NRC has authorized certain plants a few months more time to complete certain specified corrective actions. The NRC has granted such requests based on information provided by the licensee that shows it is safe for the plant to operate for the period requested. Typically, only one or a few corrective actions remain in such cases, with many or most corrective actions already having been implemented.

### ***3. When will the NRC require licensees to comply with applicable regulations using the results of the analysis performed in response to the Generic Letter?***

The staff determined that the NRC will not require licensees to be in compliance using the analysis to address Generic Letter 2004-02 until after all plant modifications (if required) are completed in accordance with the resolution schedule in the Generic Letter (i.e., December 31, 2007).

The NRC has authorized certain plants a few months more time beyond 2007 to complete certain specified corrective actions. In such cases, the licensee has been granted some additional time to update its licensing bases to reflect the analyses and modifications called for in Generic Letter 2004-02.

### ***4. If licensees find that they do not comply with their current licensing bases while responding to the Generic Letter, what actions are they expected to take?***

If a noncompliance with the existing licensing design basis that affects the operability of a plant safety system is identified while taking actions in response to the Generic Letter, licensees are required to take actions as required by established regulations.

**5. *What process will the NRC use to close the Generic Letter?***

In 2008, the NRC will review all licensee final supplemental responses to GL 2004-02. The NRC expects these responses to summarize the combination of measures and evaluations that each licensee has used to show that each plant's sump strainer will perform satisfactorily and that the NRC's regulation for long-term core cooling [10CFR 50.46(b)(5)] has been met. In addition, the staff will consider the results of comprehensive audits of licensee corrective actions that the NRC staff has performed at a sample of PWRs. Finally, the staff will consider the results of the staff's inspections at each PWR to confirm that licensees have taken actions to which they have committed. Once the review of all this information results in a conclusion that a given PWR has satisfactorily addressed the Generic Letter, the NRC will send a letter to that licensee notifying it of the NRC staff's conclusion that the Generic Letter is closed for that plant.

**Q&As on History and Background**

***1. If the issue was dealt with in BWRs in 1996, why did the NRC wait until now to approach the issue in PWRs?***

The NRC began to assess the impact on PWRs of information obtained regarding BWRs shortly after such information became available. For example, the NRC research staff evaluated the potential for sump screen clogging at PWRs during an accident because of new information learned during the development of Bulletin 96-03. The staff learned that more debris could be generated than previously assumed, and that the debris could be finer than previously expected. With more and finer debris, the potential for clogging of the screen became greater, prompting the staff to re-evaluate the potential for clogging of PWR sumps. Generic Safety Issue 191 was initiated in 1996 to address PWR sump performance. However, the issue is very complex and has required a substantial amount of time to evaluate and address.

## **Q&As on Industry and Plant-Specific Responses**

### ***1. How are licensees required to respond to this issue?***

Bulletin 2003-01 requested information from PWR licensees, within 60 days of the bulletin's issue date, concerning whether interim compensatory measures are appropriate for their facilities if they could not confirm that they were meeting all existing regulatory requirements.

Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors," requested licensees to mechanistically evaluate the potential for the adverse effects of post-accident debris blockage to impede or prevent the recirculation functions of the emergency core and containment cooling systems. The Generic Letter also requested that licensees implement any plant modifications that their evaluations identify as necessary to ensure system functionality.

### ***1. What would happen to a licensee that fails to appropriately respond?***

In accordance with 10 CFR 50.54(f), "Conditions of Licenses," the PWR addressees were required to submit written responses to Generic Letter 2004-02, and all licensees did submit responses. The staff found that replies to the Generic Letter were not generally adequate to fully address the Generic Letter, and the staff subsequently asked for additional information to be provided by December 31, 2007. If a licensee is unwilling to ultimately provide an adequate response, the NRC will consider issuance of an NRC order and enforcement action, since the Generic Letter was issued pursuant to 10 CFR 50.54(f). No such actions against licensees have been required to date.

### ***2. How does this issue relate to the reported potential problem with the high-pressure injection pumps at the Davis-Besse plant?***

GSI-191 addresses the effects of debris passing through the screens at PWRs and causing blockage at or damage to downstream components, which relates to an issue identified at Davis-Besse. On March 5, 2003, the Davis-Besse licensee submitted a report to the NRC explaining that the high-pressure injection pumps had been declared inoperable as a result of the potential for debris to damage the pump internals during the recirculation phase of accidents when the high-pressure injection pumps are required to take suction from the containment recirculation sump. This report also stated that, when a high-pressure injection pump draws from the recirculation sump at Davis Besse, small particles of debris could erode surfaces around rotating parts and that the entrained debris could block the flow of sump water that lubricates the pump bearing, resulting in bearing damage. These issues noted at Davis-Besse are being addressed at all PWRs as part of GSI-191.

## **Q&As on Risk-Informing GSI-191**

### ***1. Why is the staff considering an alternate evaluation approach which includes risk-informed and realistic elements for resolving GSI-191?***

This alternate approach is consistent with the NRC's increasing focus on risk-informed regulation. For the last several years, the NRC has recognized that probabilistic risk assessment (PRA) has evolved to the point that it can be used increasingly as a tool in regulatory decisionmaking. Through its policy statement on PRA, the NRC has expressed its expectation that implementation of the policy statement will improve the regulatory process (1) through safety decisionmaking enhanced by the use of PRA insights, (2) through more efficient use of agency resources, and (3) through a reduction in unnecessary burden on the licensees. Risk-informed regulation allows the NRC to consider the deterministic data and PRA in an integrated fashion, which enhances the staff's ability to make technically sound decisions to support the safe operation of nuclear power plants.

### ***2. What type of alternative approach would the staff consider?***

The alternative approach would need to include elements which are both realistic and risk-informed. For such an approach, licensees would continue to perform design-basis long-term cooling evaluations and satisfy design-basis criteria for all LOCA break sizes up to a new debris generation break size. For larger breaks considered through risk analysis to be highly unlikely, long-term cooling must be assured, but the evaluation may be more realistic than a customary design-basis evaluation. Additionally, any physical modifications to plant equipment or operator actions credited to demonstrate mitigative capability for these larger breaks would not necessarily need to be safety related or single-failure proof. Changes to the existing facility designs and credit for operator actions would include risk calculations, consistent with RG 1.174, "An Approach for Using Probabilistic Risk Assessment in Risk-Informed Decisions on Plant-Specific Changes to the Licensing Basis." Licensees would have to ensure that the changes to the facility design would have sufficient reliability to provide reasonable assurance that structures, systems, and components will perform their intended functions. Such an alternative approach might require plant-specific license amendment requests or requests for exemptions from the regulations, depending on each licensee's chosen resolution approach.

### ***3. Where can I find additional information regarding risk-informed regulation?***

The following information will assist in understanding risk-informed regulation:

- The NRC's policy statement on PRA (ADAMS Accession No. ML021980535)
- RG 1.174  
(<http://www.nrc.gov/reading-rm/doc-collections/reg-guides/power-reactors/active/01-174/01-174.pdf>)
- RG 1.200 for Trial Use, "An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk-Informed Activities"  
(<http://www.nrc.gov/reading-rm/doc-collections/reg-guides/power-reactors/active/01-200/01-200.pdf>)

**Q&As on Nuclear Energy Institute Sump Performance Evaluation Methodology and the Staff Safety Evaluation**

***1. Is the NRC staff safety evaluation (SE) of the Nuclear Energy Institute (NEI) methodology the only method acceptable to the staff for resolving PWR containment sump performance?***

No. The NEI Sump Performance Evaluation Methodology (guidance report or GR) and the accompanying NRC SE identify acceptable methods for resolving some aspects of the PWR sump performance issue (note that Chapter 6 of each of these documents addresses a risk-informed methodological approach to resolving GSI-191). Licensees are free to choose alternative methods, provided that they include adequate technical justification to allow NRC staff to perform an adequate acceptability review.

***2. Must a PWR licensee resolve this issue before the NRC will issue a license renewal or power uprate for an affected plant? If not, why not?***

No. GSI-191 is a current operating issue that is not in scope of license renewal or power uprate reviews. No operating PWR exists for which the current license would expire and for which the period of license extension would commence before the time that GSI-191 is expected to be resolved. For the case of power uprates, the interim measures taken as discussed in Bulletin 2003-01 to help ensure compliance with 10 CFR 50.46(b)(5) would also apply to a given reactor at an uprated power level.

***3. Considering that the Advisory Committee on Reactor Safeguards (ACRS) recommended not issuing the staff SE on the NEI methodology, would plant implementation of this methodology result in a decrease in plant safety?***

No. The ACRS recommended that the SE not be issued because of concerns about technical errors and limitations in the knowledge base. The staff recognized that knowledge limitations continue to exist despite substantial experience and knowledge gained by the NRC and industry over the years (through addressing sump blockage issues for BWRs, performance of the volunteer plant analyses, gaining NRC and industry experience with coatings, and receiving research test results). However, the staff did not agree that these limitations should preclude issuance of the SE. The staff understood the knowledge limitations and the conditions for methodology application, and identified and addressed them in the SE. The staff addressed the uncertainties in data by using conservative assumptions to ensure a robust defensible solution. Consequently, the staff concluded that the SE provides an acceptable methodology to support resolution of GSI-191. By encouraging progress in addressing GSI-191, the NRC staff believes the issuance of the SE enhanced safety.

***4. Will the NRC review the long-term resolution of every PWR plant? If not, why not?***

The NRC will perform detailed and comprehensive audits of corrective actions at a sample of licensees. The audits will review analyses, equipment configuration changes, and procedural changes related to Generic Letter 2004-02. Separately, the NRC will review all licensee Generic Letter 2004-02 responses, expected to be received from licensees by December 31, 2007. The staff has issued TI-2515/166 for regional inspectors to verify the

implementation of plant modifications and procedural changes identified in licensee responses to Generic Letter 2004-02.

***5. Does the resolution of ECCS screen performance at BWR plants conform, for the most part, to the staff SE on the NEI methodology? If not, what regulatory action is being considered for BWR plants?***

Yes. The BWR evaluation methodology for emergency core cooling system suction blockage was similar, for the most part, to the staff SE on the PWR sump performance methodology under GSI-191 (the PWR methodology). There are some differences, some of which are due to differences in plant configuration. Other differences exist because of differences in the state of knowledge of debris-induced phenomena at the time the BWR issues were addressed in the 1990s vs. the state of knowledge now. The NRC staff is currently considering how best to resolve differences in treatment of PWR and BWR strainer performance issues.

## **Q&As on Chemical Effects**

### ***1. What are “chemical effects” and how may they influence PWR sump performance?***

GSI-191 addresses the potential for debris accumulation on pressurized water reactor (PWR) sump screens to affect emergency core cooling system (ECCS) pump net positive suction head margin. Chemical effects can occur when the PWR containment environment interacts with containment materials after a loss-of-coolant accident (LOCA) to produce substances capable of clogging the sump screen head loss, or damaging or clogging components downstream of the sump screen.

### ***2. Why is this issue suddenly of concern at this time? Wasn't this concern known for years and resolved in the past?***

Chemical effects are a relatively new part of the GSI-191 issue. In 2003, the Advisory Committee on Reactor Safeguards raised questions about potential chemical effects because a gelatinous (jelly-like) material was found in the sump pool at the Three Mile Island plant after the 1979 accident. The NRC has sponsored a series of tests since that time with the objective of determining whether chemical products would form in a post-LOCA PWR containment pool environment, and, if so, what the consequences would be for performance of sump strainers and other components.

### ***3. What specific testing is NRC doing to understand chemical effects?***

The NRC has sponsored research at several facilities. Initially, NRC contracted with Los Alamos National Laboratory (LANL) to do some limited-scope chemical effects tests. Though the tests were not intended to be representative of plant conditions, the results showed that gelatinous material, if formed, can result in significant head loss across a fibrous debris bed. Therefore, NRC and the nuclear industry jointly developed an integrated chemical effects test (ICET) program. The five ICET tests showed that chemical reaction products can form in environments representative of actual plant containment conditions at some plant types. As a result, the NRC sponsored additional tests at Argonne National Laboratory to assess the head loss consequences associated with some of these chemical products. Those effects were found to be significant in some cases.

### ***4. How does the NRC staff safety evaluation (issued 12/6/04) of the Nuclear Energy Institute (NEI) methodology address chemical effects?***

The SE recognized that chemical effects would be addressed on a plant-specific basis and that testing was needed to help develop a technical basis for evaluating chemical effects. To address chemical effects on a plant-specific basis, licensees need to evaluate the results from the joint NRC/Industry ICET Program relative to their plant-specific conditions. Licensees must provide a technical justification for using results from the chemical effects tests in plant-specific evaluations. For those chemical effects observed during the ICET tests, licensees will need to evaluate the consequences.



**5. When will the public be notified of the ongoing chemical effects test results?**

The reports from the ICET test series are available to the public in the NRC's ADAMS system. These reports are also available with other GSI-191 information on the NRC's Sump Performance web page:

<http://www.nrc.gov/reactors/operating/ops-experience/pwr-sumppperformance.html>. The initial head loss test results for a trisodium phosphate environment containing calcium silicate insulation were provided in NRC Information Notice 2005-26 and 2005-26, Supplement 1. NUREG/CR-6913, "Chemical Effects Head-Loss Research in Support of Generic Safety Issue 191," reports on NRC-sponsored head loss testing in the presence of chemical effects, including tests in other chemical environments. This report is also on the Sump Performance web page.

**6. How does the NRC expect the industry to react to the data provided in Information Notice (IN) 2005-26, and IN 2005-26, Supplement 1?**

As stated in the IN, NRC anticipates that recipients will review the information for applicability to their facilities and consider taking actions, as appropriate, to avoid similar issues in their current plant configurations.

**7. What do the results from tests so far tell us about the impact on the performance of components downstream of the sump screen?**

Some environments in the ICET series have shown that the precipitates may form in lower temperature regions in the ECCS recirculation loop. Licensees with these environments need to evaluate how precipitates could affect downstream components. NRC staff will be reviewing the results of evaluations of downstream effects, on components both inside and outside the reactors vessel. The NRC is currently reviewing two topical reports the industry has submitted with proposed methodologies for evaluating such effects.

**8. What can licensees do to solve this problem? Is the nuclear industry doing their own testing?**

Licensees are installing much larger sump strainers to reduce the possibility that their sump strainers could clog as a result of chemical and/or other effects. Licensees are also sponsoring chemical effects and head loss testing performed by strainer vendors to help evaluate the ability of the new strainers to function satisfactorily in the presence of plant-specific chemical effects.

**9. How can licensees be expected to adequately address chemical effects within the required Generic Letter 2004-02 time frame given the uncertainties associated with this technical issue?**

Licensees have a number of options to address chemical effects as they resolve the issues related to GSI-191. Licensees will need to evaluate their plant-specific combination of materials and sump water environment. In some cases, plant attributes (e.g., few chemicals present) may be sufficient to address concerns about chemical effects. In other cases, plant-specific head loss testing may be necessary to ensure chemical effects are adequately addressed. Licensees not able to develop a sufficient technical basis to address chemical effects in time to support an initial new sump screen design have the option of making conservative assumptions

in the screen design or implementing a screen design that can be readily modified if additional chemical effects head loss testing indicates the need for further screen modifications. The NRC believes that most plants will be able to complete testing and complete corrective actions for Generic Letter 2004-02 by the December 31, 2007 target. Plants needing additional time will need to correspond with the NRC to justify the need and show an acceptable level of safety for the proposed additional time needed.

***10. What basis and acceptance criteria will the NRC use to determine if the licensee evaluations have adequately addressed chemical effects?***

Consistent with the SE, the NRC staff expects each PWR licensee to perform a plant-specific evaluation of their containment materials and containment environment. After determining the plant-specific conditions, the licensee must evaluate the consequences for sump screen performance of chemical effects in an integrated manner with other effects. The NRC is currently developing evaluation guidance to assist the NRC staff in its review of licensee submittals that address this issue.

***11. Is the industry or the NRC planning additional research to support the evaluation of chemical effects in light of results from the ICET program?***

Planned research in chemical effects is largely complete, though the NRC is sponsoring limited additional confirmatory experiments related to chemical effects. The NRC will continue to evaluate whether additional confirmatory research is needed as the staff reviews licensee submittals such as topical reports and Generic Letter 2004-02 responses. In addition, the NRC sponsored a peer review of its chemical effects research program. The peer review resulted in identification of a number of potential gaps in the knowledge base for relevant chemical effects; the NRC staff is currently evaluating whether additional research is warranted in some or all of these areas.

***12. If plants are found not to have adequately considered chemical effects, what will be the required time frame for enacting any required additional modifications?***

As stated in Generic Letter 2004-02, licensees have until December 31, 2007, to modify their design basis and complete any plant modifications to ensure ECCS operability. If after that date a licensee discovers that its analysis did not adequately address chemical effects, any modifications will be handled under existing regulations and in the time frames specified by the regulations.

***13. How does the existence of chemical byproducts in the ICET program affect the GSI-191 justification for operation discussed in Generic Letter 2004-02? Should plants be shut down because of the possible implications of these effects?***

The existence of chemical byproducts does not directly impact the justification for operation discussed in Generic Letter 2004-02. The results of the ICET program and head loss tests are not specific to any plant. The identification of a new generic debris source does not invalidate the justification for operation but does identify another factor to be addressed in the plant-specific evaluations. The primary arguments of this justification for operation are independent of the debris sources for an individual plant.

## **Q&As on Coatings**

### ***1. Why are protective coatings a concern for sump blockage?***

Coatings are of potential concern because, if they fall off the surface to which they are applied, they could become sources of debris that could migrate to the sump and potentially contribute to clogging of the sump strainer. Some containment coatings have not been shown to survive the temperatures and pressures associated with a LOCA. These coatings will likely fail and become a debris source if a LOCA were to occur. The majority of containment coatings were qualified prior to application in the plant. This means that, if the coatings are applied properly and they do not degrade over time, they are expected to remain adhered in case of a LOCA. Qualified coatings become a potential debris source if they are degraded because of mis-application, mechanical damage or aging.

### ***2. What testing has been performed or is planned for coatings in relation to GSI-191?***

The NRC has sponsored a series of tests designed to better characterize the transportability of coating chips under the flow conditions expected inside containment during a LOCA. Preliminary results of this testing indicates that, if coatings fail as chips, the majority of the coating debris would not transport to the strainer surface. However, many coating types would fail as particulate debris which would readily transport and contribute to sump blockage. Unless licensees can provide data that indicates their specific coating types would fail as chips, the NRC expects them to treat the debris in a conservative manner and assume it is particulate that will transport to the sump.

The industry has performed testing to attempt to show that not all unqualified coatings will fail during a LOCA, and to reduce the distance from a pipe break that qualified coatings are assumed to fail. The NRC is currently reviewing results of this testing.