

**GENERIC ISSUE MANAGEMENT CONTROL SYSTEM (GIMCS) REPORT**

**OFFICE OF NUCLEAR REGULATORY RESEARCH  
3<sup>rd</sup> Quarter of Fiscal Year 2009**

**Generic Issue Management Control System**

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## Generic Issue Management Control System

### **Description**

The Generic Issue Management Control System (GIMCS) provides information relevant to the management and resolution of generic issues (GIs). The resolution of any GI may lead to safety enhancements and the promulgation of new or revised requirements or guidance. GIMCS is part of an integrated system of reports and procedures designed to manage GIs from issue identification through resolution (development of new criteria, management review and approval, public comments, and incorporation into the regulations, as appropriate).

The procedures for processing non-reactor issues are documented in the Office of Nuclear Material Safety and Safeguards (NMSS) Policy and Procedures Letter 1-57, Revision 1, "NMSS Generic Issues Program," dated October 1997. In 1999, Management Directive (MD) 6.4, "Generic Issues Program," was initiated for the processing of all new GIs. For reactor issues, the Office of Nuclear Regulatory Research (RES), Office Instruction (OI) TEC-002, "Procedures for Processing Generic Issues," dated September 29, 2005, was issued to provide guidance for the GI process.

NRC policy document SECY-07-0022, dated January 30, 2007, described the new GI process. A recent draft revision of MD 6.4 reflects the new GI process and is in the approval process. While GI-193 and GI-199 are being conducted under the new process, the remaining older GIs will continue to use the previously established procedures in accordance with their original task action plans. SECY-07-0022 also provided acceptance criteria for issues being processed by the GI program. To date, four proposed GIs have not been accepted into the program because they did not meet the criteria.

In accordance with 10CFR52.47(a)(21), applications for design certification must contain "Proposed technical resolutions of those Unresolved Safety Issues and medium- and high-priority generic safety issues which are identified in the version of NUREG-0933 current on the date up to 6 months before the docket date of the application and which are technically relevant to the design." Similarly, in accordance with 10 CFR52.79(a)(20), applications for combined licenses must contain "Proposed technical resolutions of those Unresolved Safety Issues and medium- and high-priority generic safety issues which are identified in the version of NUREG-0933 current on the date up to 6 months before the docket date of the application and which are technically relevant to the design." As indicated in Pilot MD6.4, dated July 21, 1999, prioritization of GIs was replaced by the screening process, described in this management directive (MD6.4 Section I.B.3.), in which a determination will be made to either establish the proposed issue as a bona fide GI or reject the issue from the program. For the purposes of CFR 52.47(a)(21) and CFR 52.79(a)(20), any GI established by the MD6.4 screening process is considered equivalent to a HIGH-Priority GI.

## Generic Issue Management Control System

### Legend

ACRS	- Advisory Committee on Reactor Safeguards
ASME	- American Society of Mechanical Engineers
BNL	- Brookhaven National Laboratory
BWR	- Boiling-Water Reactor
BWROG	- Boiling Water Reactor Owners Group
DCH	- Direct Containment Heat
CEUS	- Central and Eastern United States
CRGR	- Committee to Review Generic Requirements
DE	- Division of Engineering
DSA	- Division of Systems Analysis
ECCS	- Emergency Core Cooling System
EPRI	- Electric Power Research Institute
FIN	- Financial Identification Number
FRN	- Federal Register Notice
GI	- Generic Issue (same meaning as GSI)
GIMCS	- Generic Issue Management Control System
GL	- Generic Letter
GSI	- Generic Safety Issue
IN	- Information Notice
IPEEE	- Individual Plant Examination of External Events
MD	- Management Directive
NEI	- Nuclear Energy Institute
NMSS	- Office of Nuclear Material Safety and Safeguards
PRA	- Probabilistic Risk Assessment
PWR	- Pressurized-Water Reactor
PWROG	- Pressurized Water Reactor Owners Group
RES	- Office of Nuclear Regulatory Research
RG	- Regulatory Guide
RI	- Regulatory Impact
S	- Subsumed in Another Issue (No.)
SOW	- Statement of Work
SRP	- Standard Review Plan
SSE	- Safe Shutdown Earthquake
STS	- Standard Technical Specification
TAC	- Task Action Control
T/A	- Technical Assistance
TAP	- Task Action Plan
TBD	- To Be Determined
TI	- Temporary Instruction
TS	- Technical Specification
USI	- Unresolved Safety Issue

## Generic Issue Management Control System

### Data Elements

Management and control indicators used in GIMCS are defined as follows:

1. Issue Number            A unique number assigned to each generic issue
2. Title                        Generic issue title
3. Type                        Type designation (generic issue, unresolved safety issue, etc.)
4. Office/Division  
/Branch                        The Office, Division, and Branch of the task manager who has lead responsibility for resolving the issue
5. Task Manager            Name of assigned individual responsible for resolution
6. Action Level            Active – The GI involves actions under the Generic Issues Program  
  
Inactive – No technical assistance funds appropriated for resolution, no task manager assigned, or task manager assigned to other work  
  
Transferred – Issue has been transferred out of the Generic Issues Program for additional research or scoping study  
  
Completed – All necessary work associated with the GI has been completed by the agency  
  
Regulatory Office Implementation – The GI has exited the formal GIP but actions outside the GIP remain, RES actions of safety/risk assessment or regulatory assessment are complete, and remaining actions reside with program offices
7. TAC Number            Task Action Control (TAC) number assigned to the issue
8. Resolution Status        In progress, resolved with requirements, or resolved with no requirements
9. Identification Date        Date the issue was identified
10. Generic Issue  
Acceptance Date            Date the issue was designated as a generic issue
11. Technical  
Assessment                The date and status associated with completion of the technical assessment activity (when applicable)
12. Regulation and  
Guidance  
Development                The date and status associated with completion of the regulation and guidance development activity (when applicable)

## Generic Issue Management Control System

### Data Elements (continued)

- |     |   |   |
|-----|---|---|
| 13. | <u>Regulation and Guidance Issuance</u>         | The date and status associated with completion of the regulation and guidance issuance activity (when applicable)   |
| 14. | <u>Safety Risk Assessment</u>                   | The date and status associated with completion of the safety risk assessment activity (when applicable)   |
| 15. | <u>Regulatory Assessment</u>                    | The date and status associated with completion of the regulatory assessment activity (when applicable)  |
| 16. | <u>Transfer to Regulatory Office for Action</u> | The date and status associated with transfer of the issue to a regulatory office for action   |
| 17. | <u>Completion of Verification</u>               | The date and status associated with completion of verification activities   |
| 18. | <u>Closure</u>                                  | The date and status associated with agency closure of the GI  |
| 19. | <u>Work Authorization</u>                       | Who or what authorized work to be done on the issue   |
| 20. | <u>Work Scope</u>                               | Describes the problem and the technical work necessary to address or resolve the generic issue  |
| 21. | <u>Status</u>                                   | Describes current status of work while also retaining an accurate running narrative discussion of major activities, milestones, and decision points   |
| 22. | <u>Affected Documents</u>                       | Identifies documents into which the technical resolution will be incorporated   |
| 23. | <u>Problem/Resolution</u>                       | Identifies current problem areas and describes what actions are necessary to resolve them. Note: Discussions of previous problems and resolutions are incorporated into the status narrative, as appropriate.   |
| 24. | <u>Reasons for Schedule Changes</u>             | Narrative discussion associated with schedule changes   |
| 25. | <u>Milestones</u>                               | Selected significant dates<br><br>Original – Scheduled dates reflected in the original Task Action Plan, plus additional original milestone dates added During resolution of the GI<br><br>Current – Revised expected date of completion if the original date has changed<br><br>Actual – The actual date the milestone was completed |

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

Issue Number 0163

Type: GI

Office/Division/Branch: NRR/DCI/CSG

Title: Multiple Steam Generator Tube Leakage

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**Resolution Status:** In progress

**Identification Date:** 06/01/1992

**Generic Issue Acceptance Date:**

**Action Level:** Regulatory Office Implementation

**Task Manager:** Emmett Murphy

**TAC Number:** MB7216, MA7147

**Technical Assessment:**

**Regulation and Guidance Development:**

**Regulation and Guidance Issuance:**

**Transfer to Regulatory Office for Action:**

**Completion of Verification:**

**Closure:** 07/30/2009 (Planned/Projected)

**Work Authorization:** January 17, 1997, Memorandum from H. Thompson to D. Morrison

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## WORK SCOPE:

### Description

This issue addresses the safety concern associated with multiple steam generator tube leaks during a main steam line break that cannot be isolated. This sequence could lead to core damage that could result from the loss of all primary system coolant and safety injection fluid in the refueling water storage tank. The issue was opened in response to a DPV filed in late 1991. The DPV (and later DPO) was initially prompted by widespread outer diameter stress corrosion cracking (ODSCC) at the steam generator (SG) tube support plates at Trojan (which the author claimed could not be reliably detected) and also by the staff's approval of alternate repair criteria which would allow many tubes known to contain such cracks to remain in service.

### Work Scope

The staff has considered the DPO concerns as part of its development of a new regulatory framework governing SG tube integrity. The NRC originally planned to develop a rule involving a more flexible and more effective regulatory framework for SG tube surveillance and maintenance activities (compared to existing technical specification requirements) that allows a degradation-specific management approach. The staff discontinued this effort in 1997 after a regulatory analysis indicated that rule making was unnecessary. With Commission approval, the staff undertook an effort to develop a generic letter requesting that all PWR licensees submit proposed changes to their plant technical specifications that would ensure SG tube integrity is maintained. (This generic letter initiative included a draft regulatory guide and sample technical specifications incorporating a programmatic, performance based strategy for ensuring SG tube integrity.)

On December 1, 1997, the industry informed the staff of an industry initiative, NEI 97-06, "Steam Generator Tube Integrity Guidelines," which paralleled the above draft regulatory guide and which all PWR licensees had committed (among themselves) to implement. NEI 97-06 provides a programmatic, performance based approach to ensuring SG tube integrity. With commission approval, the staff put the above generic letter initiative on hold and worked with the industry to identify revised technical specifications which would be aligned with the NEI 97-06 initiative and which would ensure that all PWR licensee's are implementing programs which ensure that SG tube integrity will be maintained. This effort was completed in May 2005 with the staff's approval of the TSTF-449, Rev 4 which includes a new standard technical specification template governing SG tube integrity.

Regarding the DPO, its nature evolved considerably in the years subsequent to 1991, adding additional concerns relating to alternate tube repair criteria, iodine spiking assumptions for radiological analysis, severe accidents, and many other concerns. The staff prepared a DPO consideration document which it provided to the EDO on September 1, 1999. At the EDO's request, the ACRS served as an equivalent ad hoc panel to review the DPO issues. The ACRS met with the DPO author and other members of the NRC staff and reviewed the documentation related to the DPO issues. The ACRS issued NUREG-1740 on February 1, 2001 documenting its conclusions and recommendations. By memorandum dated May 11, 2001, NRR and RES developed a joint action plan to address the conclusions and recommendations in the ACRS report. This action plan and resolution of GI-163 was later incorporated into the NRC Steam

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

Generator Action Plan, the status of which was presented to the Commission in SECY-03-0080 and discussed at a Commission meeting on May 19, 2003. (A copy of the NRC SG Action Plan, milestones, schedule, and current status can be found on the NRC public web page.)

The scope of the DPO issues and followup SG Action Plan tasks relevant to GI 163 are those which could potentially impact needed SG tube inspection, maintenance and repair activities. In contrast, any needed actions to address containment bypass scenarios due to tube failure during severe accidents would likely involve changes to accident management procedures and perhaps hardware modifications not involving the steam generators and, therefore, are outside the scope of GI-163. Similarly, iodine spiking and radiological assessment issues are outside the scope of GI-163. DPO issues outside the scope of GI-163 will continue to be managed under the SG Action Plan umbrella.

## STATUS:

As of September 30, 2007, all PWR licensees have modified their technical specifications in response to NRC Generic Letter 2006-01, "Steam Generator Tube Integrity and Associated Technical Specifications," and in accordance with TSTF-449.

SG Action Plan tasks relevant to resolution of GI-163 have been completed.

The staff has prepared a proposed GI-163 resolution package, consisting of a draft memorandum to the EDO with an accompanying technical report, documenting the staff's proposed closeout of GI-163. By memorandum dated March 9, 2009, (From M. Evans (NRR/DCI) to E. Hackett (ACRS)), this package was submitted to ACRS for their endorsement.

NRR/DCI staff briefed the ACRS on its proposed closeout of GI-163 on May 7, 2009.

By letter to the Chairman dated May 20, 2009, the ACRS concluded that GI-163 can be closed as proposed by the staff.

The staff is targeting July 30, 2009, for issuing memorandum to the EDO documenting the resolution of GI-163 and the supporting technical bases.

## AFFECTED DOCUMENTS:

NUREGs 1430 - 1432 regarding Standard Technical Specifications  
NRC Generic Letter 2006-01  
Plant-specific technical specifications for PWRs

## PROBLEM/RESOLUTION:

None.

## REASONS FOR SCHEDULE CHANGES:

The ACRS briefing on the proposed resolution of GSI 163 has been scheduled for May 2009. The schedule for issuing closeout memorandum to the EDO is unchanged.

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<b>Milestone</b>	<b>Original Date</b>	<b>Current Date</b>	<b>Actual Date</b>
Regulatory Analysis	05/01/1997		05/01/1997
Proposed GL Package	06/01/1997		10/01/1997

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Milestone	Original Date	Current Date	Actual Date
ACRS Endorsement	06/01/1997		10/01/1997
GL Package Placed in Concurrence	10/01/1997		10/01/1997
NEI 97-06 Submitted	12/01/1997		12/01/1997
GL Package Sent to CRGR by NRR	07/01/1997		04/01/1998
CRGR Meeting on GL Package	06/01/1998		06/01/1998
CRGR Meeting on Proposed GL	07/01/1998		07/01/1998
NRR Memo to EDO Putting GL on Hold	09/01/1998		09/01/1998
Commission Paper Recommending Hold on Issuance of GL	11/01/1998		10/01/1998
SRM on SECY-98-248	12/01/1998		12/01/1998
DPO Consideration Document to the EDO	09/01/1999		09/01/1999
EDO Establishes an Independent Panel to Review the DPO	02/01/2000		05/01/2000
ACRS to Perform DPO Review Panel Function	10/01/2000		10/01/2000
ACRS to Provide Conclusions and Recommendations	12/01/2000		02/01/2001
NRR & RES Issue Joint Action Plan	05/31/2001		05/31/2001
Approve TSTF-449	05/31/2005		05/31/2005
Issue Generic Letter 2006-01	01/20/2006		01/20/2006
Issue Revised Technical Specifications - All PWRs	12/31/2007		09/30/2007
Brief ACRS on Proposed GI Resolution	02/28/2009	05/29/2009	05/07/2009
Close Out Issue with Memo to the EDO	02/28/2001	07/30/2009	

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

Issue Number 0186

Type: GI

Office/Division/Branch: NRR/DSS/SBP

Title: Potential Risk and Consequences of Heavy Load Drops in Nuclear Power

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**Resolution Status:** In progress

**Identification Date:** 04/01/1999

**Generic Issue Acceptance Date:**

**Action Level:** Regulatory Office Implementation

**Task Manager:** Steve Jones

**TAC Number:**

**Technical Assessment:** 11/12/2003 (Actual/Complete)

**Regulation and Guidance Development:** 09/18/2008 (Actual/Complete)

**Regulation and Guidance Issuance:** 12/01/2008 (Actual/Complete)

**Transfer to Regulatory Office for Action:**

**Completion of Verification:**

**Closure:** 08/31/2009 (Planned/Projected)

**Work Authorization:** Memo from A. Thadani to S. Collins, "Initial Screening of Candidate Generic Issue #186, 'Potential Risk and Consequences of Heavy Load Drops in Nuclear Power Plants,' dated June 28, 2000."

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## WORK SCOPE:

### Description

In 1985, the staff declared, through GL 85-11, "Completion of Phase II of Control of Heavy Loads at Nuclear Power Plants, NUREG-0612," that licensees need not analyze the potential consequences of a heavy load drop. In 1986, the staff reported that USI A-36 was resolved based on the implementation of NUREG-0612, "Control of Heavy Loads at Nuclear Power Plants - Resolution of Generic Technical Activity A-36." Subsequent review of licensees' programs for the handling of heavy loads revealed that there is a substantially greater potential for severe consequences to result from the drop of a heavy load, than previously envisioned.

### Work Scope

The technical assessment of GI-186 resulted in the following four recommendations that were documented in NUREG-1774, "A Survey of Crane Operating Experience at U.S. Nuclear Power Plants from 1968 Through 2002": (1) Evaluate the capability of various rigging components and materials to withstand rigging errors (e.g., absence of corner softening material, acute angle lifts, shock from load shifts, and postulated human errors). As appropriate, issue necessary guidelines for rigging applications. (2) Endorse ASME NOG-1, "Rules for Construction of Overhead and Gantry Cranes (Top Running Bridge, Multiple Girder)" for Type I cranes as an acceptable method of qualifying new or upgraded cranes as single-failure-proof. As appropriate, issue guidance endorsing the standard. (3) Reemphasize the need to follow NUREG-0612 Phase I guidelines involving good practices for crane operations and load movements. Continue to assess implementation of heavy load controls in safety-significant applications through the Reactor Oversight Process. (4) Evaluate the need to establish standardized load drop calculation methodologies for heavy load drops.

## STATUS:

The report on the potential risk and consequences of heavy load drops in nuclear power plants was completed in June 2003, after NRR comments were addressed by RES. The publication of the report, NUREG-1774, "A Survey of Crane Operating Experience at U.S. Nuclear Power Plants from 1968 through 2002," in July 2003 completed the initial screening stage of the issue. The proposed recommendations resulting from the technical assessment of the issue were discussed with the ACRS Full Committee on September 11, 2003. Three of the RES recommendations on regulation and guidance development were sent to NRR on November 12, 2003. By letter dated February 4, 2004, NRR informed RES that these three recommendations would be implemented through issuance of a Regulatory Issue Summary that clarifies and reemphasizes existing regulatory guidance for control of heavy loads. The remaining recommendation was resolved by DET/RES on May 4, 2004, with the conclusion that existing industry standards were adequate for application to load drop analyses.

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The staff has been participating with the American Society of Mechanical Engineers (ASME) Cranes for Nuclear Facilities Committee in comparing the provisions of the industry crane standard, ASME NOG-1, "Rules for Construction of Overhead and Gantry Cranes," with the NRC guidelines contained in NUREG-0554, "Single Failure-Proof Cranes for Nuclear Power Plants," in support of future endorsement of the industry standard. In September 2004, NRR reported that the Committee action in support of NRC endorsement was delayed. In April 2005, the staff identified an emergent concern with the adequacy of evaluations of postulated reactor vessel head load drops. NRR issued Regulatory Issue Summary (RIS) 2005-25 on October 31, 2005, to clarify and reemphasize existing regulatory guidance for the control of heavy loads.

Though its work with the Committee, the NRR staff has concluded that the industry standard, ASME NOG-1, provides improved guidance for construction of new single-failure proof cranes. Therefore, the staff elected to endorse the ASME NOG-1, 2004, through the Standard Review Plan Update Program in March 2007. The NRC staff understands that the committee will provide the comparison as an appendix to a future revision of ASME NOG-1. The staff also modified the guidelines for slings used with single-failure-proof handling systems in the Standard Review Plan (NUREG-0800), Section 9.1.5, "Overhead Heavy Load Handling Systems," based on a review of operating experience issues. The staff issued Supplement 1 to RIS 2005-25 to notify industry of the changes to SRP Section 9.1.5 and further clarify existing regulatory expectations associated with 10 CFR 50.59 and 50.71(e), as these requirements relate to the safe handling of heavy loads and load drop analyses.

On September 14, 2007, the Nuclear Energy Institute (NEI) notified the NRC that the nuclear industry approved a formal initiative that specifies actions each plant will take to ensure that heavy load lifts continue to be conducted safely and that plant licensing bases accurately reflect plant practices. The initiative is expected to clarify the licensing basis with respect to handling of heavy loads, and the NRC staff is modifying guidance documents to accommodate the initiative. The initiative includes development of guidelines for realistic load drop analyses and for establishing single failure proof crane equivalence for reactor vessel head lifts. On December 13, 2007, February 1, 2008, and April 8, 2008, the NRC staff participated in public meetings with NEI to discuss implementation of the initiative and criteria for acceptable reactor vessel head load drop analyses. On April 17, 2008, the NRC staff participated in a public meeting with NEI to discuss draft guidelines for establishing single failure proof crane equivalence for reactor vessel head lifts.

By letters dated April 17, 2008, and April 22, 2008, NEI submitted the guidelines for reactor vessel head drop analyses and the guidelines for establishing single failure proof crane equivalence for reactor vessel head lifts, respectively. On May 16, 2008, the NRC staff issued a letter providing preliminary endorsement of these guidelines with exceptions regarding the load drop analysis acceptance criteria. By letter dated May 27, 2008, the NRC clarified criteria for acceptable interim analyses where more detailed analyses or crane upgrades cannot be completed prior to the next refueling outage and requested a schedule for completion of a complete guideline document.

By letter dated July 28, 2008, NEI submitted the guidance document NEI 08-05, "Industry Initiative on Control of Heavy Loads," which provides industry-developed guidelines for: (1) managing the risk associated with maintenance involving movement of heavy loads, (2) performing consequence analyses for postulated reactor vessel head drops, (3) establishing single-failure-proof equivalence for handling systems when used for reactor vessel head lifts, and (4) updating the description of heavy load handling programs in the safety analysis report. The staff issued its safety evaluation of NEI 08-05 on September 5, 2008. Through the safety evaluation, the NRC staff endorsed the methods in NEI 08-05 for the specified applications, with certain exceptions and clarifications. The NRC staff issued supplementary inspection guidance addressing implementation of the industry initiative as Revision 2 to Operating Experience Smart Sample (OpESS) FY2007-03, which provides supplementary guidance for refueling inspection activities related to cranes and heavy lifts. This inspection guidance was posted for inspector use and public review on September 18, 2008. The NRC issued RIS 2008-28, "Endorsement of Nuclear Energy Institute Guidance for Reactor Vessel Head Heavy Load Lifts," to notify stakeholders of NRC endorsement of the Guidelines in NEI 08-05.

## AFFECTED DOCUMENTS:

NUREG-1774, "A Survey of Crane Operating Experience at U.S. Nuclear Power Plants from 1968 through 2002"

Standard Review Plan (NUREG-0800), Section 9.1.5

NEI 08-05, "Industry Initiative on Control of Heavy Loads" Revision 0 (ADAMS Accession Number ML082180684)

Safety Evaluation by the Office of Nuclear Reactor Regulation Related to NEI 08-05, Revision 0, "Industry Initiative on Control of Heavy Loads" (ADAMS

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Accession Number ML082410532)

PROBLEM/RESOLUTION:

None

REASONS FOR SCHEDULE CHANGES:

Discussions with ACRS Staff indicated that the ACRS was unlikely to require a brief on the implementation of recommendations related to GI-186. The staff has been assessing the proper closeout method given pending revision of Management Directive 6.4, "Generic Issues Program." The staff will forward a closeout memorandum through the ACRS for review by late July 2009. If an ACRS brief is required, it will be scheduled for a 2009 ACRS meeting. Once ACRS concurs (with or without a brief), the closeout memo will be forwarded to the EDO.

Milestone	Original Date	Current Date	Actual Date
Publish NUREG-1774	06/30/2003		06/30/2003
Meet with ACRS Full Committee	09/01/2003		09/11/2003
ACRS Memo to the EDO on Staff Recommendations	09/24/2003		09/24/2003
Complete Technical Assessment and Transfer Issue to NRR for Regulation and Guidance Development	10/31/2003		11/12/2003
DSARE/RES Memo to DET/RES Requesting Industry Code Committee Evaluation	11/21/2003		11/21/2003
DET/RES Memo to DSARE/RES Concluding Existing Industry Code Adequate for Load Drop Analysis	05/04/2004		05/04/2004
Issue RIS 2005-25 to Clarify and Reemphasize Existing Regulatory Guidance for Control of Heavy Loads	12/31/2004		10/31/2005
Issue RIS 2005-25, Supplement 1 to Address Endorsement of Industry Standard	02/28/2006		05/29/2007
Enhance Inspection Procedures for Heavy Loads	09/30/2007		09/18/2008
Closeout memo to ACRS on Implementation of Recommendations	11/30/2004	07/31/2009	
Issue Closeout Memo to the EDO	08/31/2005	08/31/2009	

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

**Issue Number** 0189

**Type:** GI

**Office/Division/Branch:** NRR/DSS/SBP

**Title:** Susceptibility of Ice Condenser and Mark III Containments to Early Failure from Hydrogen Combustion During a Severe Accident

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**Resolution Status:** In progress

**Identification Date:** 05/17/2001

**Generic Issue Acceptance Date:**

**Action Level:** Regulatory Office Implementation

**Task Manager:** Steve Jones

**TAC Number:** MB7245

**Technical Assessment:** 12/15/2002 (Actual/Complete)

**Regulation and Guidance Development:** 04/23/2007 (Actual/Complete)

**Regulation and Guidance Issuance:** 04/30/2007 (Actual/Complete)

**Transfer to Regulatory Office for Action:**

**Completion of Verification:**

**Closure:** 03/30/2010 (Planned/Projected)

**Work Authorization:** Memo from J. Zwolinski to F. Eltawila, "Resolution Process for Generic Safety Issue 189: "Post-Accident Combustible Gas Control in Pressure Suppression Containments"

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## WORK SCOPE:

### Description

NUREG/CR-6427, "Assessment of the Direct Containment Heat (DCH) Issue for Plants with Ice Condenser Containments," showed that the early containment failure probability of ice condenser containments is dominated by non-DCH hydrogen combustion events. The staff subsequently extended the issue to include BWR MARK III containments because their relatively low free volume and strength are comparable to PWR ice condensers.

### Work Scope

The staff conducted studies to determine whether providing an independent power supply for the igniter systems provides a substantial increase in the overall protection of the public health and safety with implementation costs that are justified in view of the increased protection. The staff continued work on this issue following an initial screening in accordance with MD 6.4.

The staff briefed the ACRS on June 6, 2002, and again on November 13, 2002. The ACRS recommended that the form of regulatory action should be through the plant-specific severe accident management guidelines. RES provided its technical assessment for resolving GI-189 to NRR in a memorandum dated December 17, 2002. RES concluded that further action to provide back-up to one train of igniters is warranted for both ice condenser and MARK III plants.

On January 30, 2003, NRR prepared a reply memorandum that outlined the next steps in the resolution of this GI. NRR prepared a Task Action Plan to complete MD 6.4, Stage 4, Regulation and Guidance Development, based on a preliminary decision to issue an Order. The staff reviewed the proposed regulatory actions and associated draft documents with senior management and OGC, and senior management decided to pursue Rulemaking rather than an Order. The staff held a public meeting on June 18, 2003, to receive feedback from licensees and other stakeholders regarding the need to provide a backup power supply to the hydrogen igniters and NRR's consideration of rulemaking for the resolution of GI-189. NRR staff briefed the ACRS on November 6, 2003, and recommended providing a backup power supply to the hydrogen igniters. On November 17, 2003, the ACRS Chairman wrote the NRC Chairman recommending the NRC proceed with rulemaking to require a backup power supply to the hydrogen igniters for PWR ice-condenser and BWR MARK III plants. The ACRS recommended that rulemaking include a small pre-staged generator with installed cables, conduit, panels, and breakers, or an equivalent diverse power supply. The ACRS also recommended that the rulemaking be accompanied by guidance that specifies the design requirements.

NRR developed design criteria for the backup power supply, and administered a contract to merge and enhance the existing technical assessment into a regulatory analysis. NRR held a public meeting with the public and industry on September 21, 2004, to get external stakeholders' input on the draft design criteria. The BWR owners indicated a willingness to make modifications to supply power from the existing HPCS diesel generator, and agreed to provide additional information regarding implementation cost for the prestaged generator and relative risk contribution of SBO events at each of the four Mark III

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plants. Duke power, representing two PWR ice condenser sites, Catawba 1 & 2, McGuire 1 & 2, indicated a willingness to make modifications to an existing safe shutdown diesel generator that could manually connect to provide backup power source as needed. American Electric Power representatives indicated a willingness to provide backup power source for D. C. Cook 1 & 2 from the large diesel generators intended to support an increased allowed outage time for the emergency diesel generators. TVA, representing two PWR ice condenser sites, Sequoyah 1 & 2, Watts Bar 1, also indicated a willingness to provide a backup power source from a supplemental diesel generator. In November 2004, the staff reached a consensus to evaluate the proposed voluntary initiatives and pursue that path as a preferential solution.

In February and early March 2005, the NRR staff met with representatives of RES, NSIR, and OEDO to develop an understanding of newly identified safety/security interface issues and actions initiated in the security arena that could impact the solution of the issue. On March 30, 2005, the staff met with senior representatives of the six affected utilities to present security-related insights.

On June 14, 2005, the EDO issued a memorandum to the Commissioners to inform the Commission of the regulatory analysis results and recent staff activities on GI-189. The regulatory analysis indicated that the backup power modification may provide a substantial safety benefit at a justifiable cost for the PWRs with an ice-condenser containment, and the proposed voluntary actions provide the majority of the benefit. The costs exceed the benefits for all BWR regulatory options, and none of the options for the BWRs provides a substantial increase in the overall protection of public health and safety. However, external events and security insights were not fully evaluated in the regulatory analysis, and defense-in-depth considerations in improving the balance among accident prevention and mitigation provide an additional un-quantified benefit for both containment types.

## STATUS:

Based on an understanding that many of the voluntary physical modifications had been completed, the staff elected to delay seeking specific commitments while security-related reviews of the facilities were ongoing. On March 1, 2006, the EDO issued a memo informing the Commission of the staff's intent to delay the request for commitments until after the security-related reviews were completed in September 2006. Because this issue was not incorporated in the scope of security-related modifications, the staff held closed meetings in December 2006 and January 2007 to further explore the proper consideration of security insights in the design of the modifications. The staff received industry proposals for modifications that incorporate security insights in late February and early March 2007. The staff reviewed the industry proposals and concluded that the proposed modifications would resolve GI-189 and provide benefit for some security scenarios. On April 23, 2007, the EDO issued a memo informing the Commission of the staff's intent to accept the commitments and perform verification inspections at the affected sites. On June 15, 2007, the NRC staff issued letters to affected licensees accepting the commitments. The NRC staff also notified licensees of the intent to perform verification inspections at the affected sites and clarified the scope of the inspection relative to the commitments. Licensee implementation and NRC verification inspections performed pursuant to NRC Temporary Instruction (TI) 2515/174, "Hydrogen Igniter Backup Power Verification," have been completed at 8 of 9 affected sites. Implementation and verification activities at the final affected site are expected to be complete by early 2010.

## AFFECTED DOCUMENTS:

10 CFR 50.44  
10 CFR 50.34

## PROBLEM/RESOLUTION:

The costs exceed the benefits for all BWR regulatory options, and none of the options for the BWRs provides a substantial increase in the overall protection of public health and safety. However, external events and security insights were not fully evaluated in the regulatory analysis, and defense-in-depth considerations in improving the balance among accident prevention and mitigation provide an additional un-quantified benefit for both containment types. With consideration of security insights, all affected licensees have proposed modifications that adequately address the identified safety issue.

## REASONS FOR SCHEDULE CHANGES:

The staff received initial industry proposals for modifications that incorporate security insights in late February and early March 2007. The staff reviewed the

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

industry proposals and concluded that the proposed modifications would resolve GI-189 and provide benefit for some security scenarios. On April 23, 2007, the EDO issued a memo informing the Commission of the staffs intent to accept the commitments and perform verification inspections at the affected sites. On June 15, 2007, the NRC staff issued letters to affected licensees accepting the commitments. The NRC staff also notified licensees of the intent to perform verification inspections at the affected sites and clarified the scope of the inspection relative to the commitments. Licensee implementation and NRC verification inspections have been completed at 8 of 9 affected sites. Implementation and verification activities at the final affected site are expected to be complete, and this issue is expected to be closed, by early 2010.

Milestone	Original Date	Current Date	Actual Date
Draft Technical Assessment	05/01/2002		05/01/2002
Meet with ACRS	06/01/2002		06/06/2002
Second Meeting on Technical Assessment with ACRS Sub-Committee	10/01/2002		11/05/2002
Final Technical Assessment	11/01/2002		11/10/2002
Meet with ACRS Full Committee	11/01/2002		11/13/2002
Transfer GI to NRR	12/01/2002		12/17/2002
Review RES Technical Assessment	02/28/2003		02/28/2003
Public Meeting with Stakeholders	02/28/2003		02/28/2003
Determine Best Course of Action	02/28/2003		02/28/2003
Finalize CRGR Package	03/26/2003		03/26/2003
Distribute Draft Order and SECY Paper	03/26/2003		03/26/2003
Prepare Guidance and Provide Results to NRR Management	03/26/2003		03/26/2003
Provide Draft Order to OGC and Draft SECY to EDO	03/28/2003		03/28/2003
Meet with Rulemaking Committee	05/05/2003		05/05/2003
Conduct Public Meeting	06/18/2003		06/18/2003
Meet with OPA to Develop Communication Plan	06/24/2003		06/24/2003
Complete Communication Plan	07/10/2003		07/10/2003
Public Meeting to Address Design Criteria	11/06/2003		11/06/2003
NRR Meeting with ACRS	11/06/2003		11/06/2003
Public Meeting with Stakeholders	02/03/2004		02/03/2004
Brief Commissioner Merrifield	03/04/2004		03/04/2004
Public Meeting with Stakeholders	03/31/2004		03/31/2004

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Milestone	Original Date	Current Date	Actual Date
Issue Draft Design Criteria for Comment	08/13/2004		08/13/2004
Public Meeting with Stakeholders	09/21/2004		09/21/2004
Internal Meeting to Discuss Pursuit of Rulemaking	11/02/2004		11/02/2004
Decision on Voluntary Licensee Initiatives as Alternative to Rulemaking	11/30/2004		11/30/2004
Finalize Design Criteria	11/30/2004		11/30/2004
Perform Sensitivity Analysis to Determine Whether 2-Hour Startup Time for BWRs is Acceptable	11/30/2004		11/30/2004
Evaluate Safety/Security Interface	03/31/2005		03/30/2005
Issue Status Paper to Commission	05/31/2005		06/14/2005
Brief Commissioner Jaczko on Regulatory Analysis Results and Safety Significance	07/18/2005		07/18/2005
Meet with Owners to Discuss Safety-Security Interface Issues	08/03/2005		08/03/2005
Update Commission Regarding Licensee Plans for Voluntary Measures	03/01/2006		03/01/2006
Seek Commitment for Implementation of Voluntary Initiatives	08/31/2005		03/09/2007
Request Information from Owners on Voluntary Actions Implemented	12/31/2005		03/09/2007
Complete Regulation and Guidance Development	06/30/2006		04/23/2007
Clarify Commitments to Resolve Any Remaining Issues	12/31/2007		06/15/2007
Complete Verification	06/30/2009	12/31/2009	
Complete Implementation	06/30/2008	12/31/2009	
Close Out Issue with Memo to the EDO	06/30/2010	03/30/2010	

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

Issue Number 0191

Type: GI

Office/Division/Branch: NRR/DSS/SSIB

Title: Assessment of Debris Accumulation on PWR Sump Performance

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**Resolution Status:** In progress

**Identification Date:** 09/01/1996

**Generic Issue Acceptance Date:**

**Action Level:** Regulatory Office Implementation

**Task Manager:** Michael Scott

**TAC Number:** MA6454, MB4864

**Technical Assessment:** 09/15/2001 (Actual/Complete)

**Regulation and Guidance Development:** 09/24/2004 (Actual/Complete)

**Regulation and Guidance Issuance:** 09/30/2004 (Actual/Complete)

**Transfer to Regulatory Office for Action:** 12/31/2007 (Actual/Complete)

**Completion of Verification:**

**Closure:** 09/30/2010 (Planned/Projected)

**Work Authorization:** Memo to D. Morrison from W. Russell, "Third Supplemental User Need Request...Accident Generated Debris," 12/07/95

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## WORK SCOPE:

### Description

This issue concerns the possibility that debris accumulating on the emergency core cooling system (ECCS) sump screen in PWRs may result in a loss of the net positive suction head (NPSH) margin. Loss of NPSH margin could impede or prevent the flow of water from the sump, which is necessary to meet the criteria of 10 CFR 50.46.

### Work Scope

The goals of the NRC's reassessment are to: (1) determine if the transport and accumulation of debris in containment following a LOCA will impede the operation of the ECCS in operating PWRs; (2) if it is shown that debris accumulation will impede ECCS operation, develop the technical basis for revising NRC's regulations, or guidance to ensure that debris accumulation in containment will not prevent ECCS operation; (3) if it is shown that debris accumulation will impede ECCS operation, provide NRC technical reviewers with sufficient information on phenomena involved in debris accumulation and how it affects ECCS operation to facilitate the review of any changes to plants that may be warranted; and (4) issue Generic Communication and work with the industry plan to evaluate and resolve GI-191 for all PWRs.

Preliminary parametric calculations were completed in July 2001 indicating the potential for debris accumulation for 69 cases. These 69 cases were representative of, but not identical to, the operating PWR population. The staff's Technical Assessment concluded that GI-191 was a credible concern for the population of domestic PWRs, and that detailed plant-specific evaluations were needed to determine the susceptibility of each U.S.-licensed PWR to ECCS sump blockage. Following the ACRS agreement with the staff's Technical Assessment of the issue in 09/2001, the issue was forwarded to NRR in a memorandum dated September 28, 2001. Consistent with Management Directive 6.4, NRR has the lead for Stages 4 through 6 of the Generic Issues Process for GI-191. NRR has evaluated the technical assessment, and prepared a Task Action Plan for developing appropriate regulatory guidance and resolution of GI-191.

## STATUS:

The NRC issued Bulletin 2003-01 to PWR licensees on June 9, 2003 to: (1) confirm their compliance with 10 CFR 50.46 (b)(5) and other existing applicable regulatory requirements, or (2) describe any compensatory measures that have been implemented to reduce the potential risk due to post-accident debris blockage, as evaluations to determine compliance proceed. All PWR licensees provided a response to the Bulletin, indicating interim compensatory measures and candidate operator actions that would be implemented. The Safety Issues Resolution Branch (SSIB) reviewed and evaluated the information provided and determined that the licensee's actions were responsive, and consistent with the guidance of Bulletin 2003-01. The Division of Reactor Licensing (DORL) issued close-out letters to the PWR licensees as these reviews were completed. Generic close-out of Bulletin 2003-01 was completed in December

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# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

2005.

Generic Letter (GL) 2004-02 was issued in September 2004, requesting licensees to perform plant-specific mechanistic evaluations of sump performance following LOCA and high-energy line break (HELB) events, and to implement corrective actions as required to ensure compliance with regulatory requirements. The Nuclear Energy Institute (NEI) provided a guidance report (GR) to the staff in May 2004 containing the industry's proposed evaluation methodology for performing the plant specific evaluations. The staff reviewed the GR and issued a draft Safety Evaluation (SE), which supplemented the GR. The final SE was issued in December 2004, resulting in an NRC-approved evaluation methodology.

Generic Letter 2004-02 required licensees to respond within 90 days to document the actions planned by the licensees to perform the sump evaluation, and the proposed schedule for completion. All PWR licensees responded to the GL on schedule in September 2005. All PWR licensees committed to modify their containment sump strainer, except for three plants who had modified their containment sump strainers within the previous five years. The staff evaluated all 90-day responses to Generic Letter 2004-02 and in early 2006 issued comments to licensees to be addressed in their final response submittals.

To address concerns regarding the potential for chemical precipitates and corrosion products to significantly block a fiber bed and increase the head loss across an ECCS sump screen, a joint NRC/Industry Integrated Chemical Effects Testing program was started in 2004 and completed in August 2005. Chemical precipitation products were identified during the test program, and follow-up testing and analyses were conducted to address the effect on head loss. Information Notice (IN) 2005-26, "Results of Chemical Effects Head Loss Tests in a Simulated PWR Sump Pool Environment," was issued on September 16, 2005.

The NRC conducted additional research in certain areas to support evaluation efforts and provide confirmatory information. These areas include research on chemical effects to determine if the pressurized-water reactor sump pool environment generates byproducts which contribute to sump clogging, research on pump head losses caused by accumulation of containment materials and chemical byproducts, and research to predict the chemical species that may form in these environments. The staff completed reports on the chemical effects on ice condenser containments on 01/13/2006 (ML053550433), and on other PWR containments on 01/20/2006 (ML060190713). Supplement 1 to IN 2005-26 was issued on January 26, 2006 to specifically provide additional information regarding test results related to chemical effects in environments containing dissolved phosphate.

NRR expected that recipients would review the information for applicability to their facilities and consider taking actions, as appropriate, to avoid similar issues. Research was also conducted and documented on the transportability of coating chips in containment pool environments, and on the effect of ingested debris on downstream valve performance.

Between July and September 2006, the staff completed research on: (1) the thermodynamic simulation of containment sump pool chemical constituents, to predict the chemical reactions/byproducts in the pools; (2) the pressure loss across containment sump screens due to fiber insulation, chemical precipitates, and coating debris; and (3) a literature survey to summarize the knowledge base to date on the potential contribution of material leached from containment coatings to the chemical products formed in the containment sump pool, after a loss-of-coolant accident. Additional research activities included development of a revised head-loss correlation and completion of a peer review of the NRC's chemical effects research program. All planned NRC-sponsored research activities for GI-191 are now complete and documented, though some follow-up work regarding questions identified by a chemical effects peer review is ongoing. Information obtained as the staff reviews industry activities to support issue closure may indicate the need for additional NRC-sponsored research.

Planned strainer modifications are now complete at all PWRs. These modifications typically increased strainer size by one to two orders of magnitude. The NRC believes these modifications have significantly reduced the risk of strainer clogging.

As part of the plan to confirm adequate implementation and resolution of GI-191, the NRC conducted detailed plant audits examining the analyses and design changes used to address the technical issues. Two pilot audits were performed in 2005 (Crystal River Unit 3 and Fort Calhoun) to provide opportunities to exercise and improve the NRC evaluation process. Nine full-scope plant audits have been performed; no additional full-scope audits are planned. To support the audits, the NRC staff also made some visits to sump strainer vendor facilities to observe ongoing head loss and chemical effects testing, and the staff is reviewing vendor head loss testing protocols. Additional limited-scope audits were conducted in 2008 and 2009 to address chemical effects.

In addition to the plant audits identified above, the staff is using inputs from review of licensee responses to GL 2004-02 (received in 2008 and 2009) and

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

items identified from Regional inspections using Temporary Instruction TI-2515/166 to support closure of GI-191. Initial review of licensee GL responses is essentially complete. These reviews identified the need for additional information from most licensees in order for the NRC to conclude that the licensees have fully addressed the sump issues. Licensee responses to these requests for additional information will be submitted and reviewed by the NRC staff in early to mid 2009. Inspections by regional staff will verify proper implementation of planned modifications.

An additional issue that needs to be resolved to close GI-191 regards in-vessel downstream effects, the potential for debris to bypass the sump strainers and enter the core. The NRC staff determined in 2008 that additional industry-sponsored testing was necessary to support resolution of this issue. The testing, which is complete, resulted in submittal of a topical report to the NRC in April 2009. The NRC expects to issue a safety evaluation on the topical report in February 2010; the report will provide guidance to licensees regarding use of the industry-developed test results and topical report. Licensees will be expected to evaluate the potential for in-vessel effects on a plant-specific basis by mid 2010.

The need for additional licensee information and the in-vessel downstream effects issue discussed above have resulted in delay in projected closure of GI-191, to mid 2010. GI-191 has proven to be very challenging to close, but it remains a high priority for the NRC, and substantial safety improvements have been made as a result of work to date.

Plant-specific issues led to many licensees identifying a need to request an extension beyond the NRC-identified date of December 31, 2007 for completion of certain corrective actions for GL 2004-02. In particular, some licensees requested additional time to complete one or more specific modifications, such as removal of problem insulation. Others requested additional time to complete strainer testing. Licensees have been challenged to develop and implement a conservative test for showing that their strainers will not experience excessive head loss in the presence of debris and chemical effects. Because they are plant-specific, these extension requests have been evaluated on a case-by-case basis. Extension requests were approved for most PWR units based on, for example, strong sets of interim compensatory measures, significant interim or final sump screen area, fibrous insulation removal or lack of fibrous insulation issues, installation of debris interceptors, and short periods of extension. Most extensions were granted for relatively short periods (i.e., less than six months), and most have since expired, indicating that the affected licensee believes its corrective actions for GL 2004-02 are complete. However, several licensees received longer extensions. The NRC has indicated to such licensees that they must show the plant can be operated safely for the extension period and that the extension is necessary (i.e., actions cannot reasonably be performed sooner). Very recently, testing results have led some licensees to conclude that additional modifications are needed to fully address GI-191. The NRC expects these licensees to commit to near-term comprehensive testing of a complete suite of modifications that can be shown to fully resolve the issue. Further, the NRC expects the licensees to install any necessary additional modifications as soon as practicable.

To provide open communication on NRC activities associated with GI-191 resolution, public meetings and/or conference calls with NEI and industry representatives continue to be held regularly, as schedules allow and developments regarding issue resolution indicate the need for an interaction. Briefings of ACRS have been scheduled periodically to provide opportunities for communication on technical issues and additional public involvement.

## AFFECTED DOCUMENTS:

- (1) Regulatory Guide 1.82, Rev. 3
- (2) NUREG-0800
- (3) Generic Letter 85-22
- (4) Bulletin 2003-01
- (5) Generic Letter 2004-02

## PROBLEM/RESOLUTION:

Activities will occur in 2009 that are needed to support issue closure. Licensees have submitted supplemental responses to GL 2004-02 in 2008 and 2009. The staff's initial review of GL responses is essentially complete. However, reviews completed to date have identified the need for more information from many licensees. Staff reviews of the additional information will occur in 2009.

## REASONS FOR SCHEDULE CHANGES:

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

The schedule for issuance of the NRC's final safety evaluation regarding in-vessel downstream effects has been adjusted slightly as a result of a re-evaluation of the activities needed to support issuance of the document, given the size and complexity of the document received in late April 2009. The time required for NRC review of final licensee submittals has been adjusted for the same reason. These changes are expected to cause little impact on the final closure date for the GI.

The schedule for completion of final licensee modifications to address the GI has also changed. While many plants have already completed their corrective actions, a few plants have determined that removal of fibrous insulation in containment is needed. These modifications require extensive planning and procurement time, in some cases involving more than one outage. The revised date reflects the latest expected completion date for any plant.

Given the complexity of GI-191, additional schedule changes are possible as new information becomes available from licensee-sponsored testing.

RES changed the status of GI-191 to Regulatory Office Implementation (see ML071630094). This change is part of improvements to the Generic Issues Program (GIP) described in SECY-07-0022, "Status Report on Proposed Improvements to the Generic Issues Program," (ML063460239). This improvement obviates the need for milestones specifically associated with the Generic Issue Program after the implementation phase begins. Issue closure will occur in accordance with applicable NRR Office programs as indicated in the remaining milestones.

Milestone	Original Date	Current Date	Actual Date
NRR User Need Request Sent to RES	12/01/1995		12/01/1995
User Need Request Assigned to GSIB/RES	01/01/1996		01/01/1996
Reassessment Declared a New GSI	09/01/1996		09/01/1996
Issue SOW for Evaluation of GSI A-43	11/01/1996		11/01/1996
Complete Evaluation of GSI A-43	04/01/1997		03/01/1997
Issue SOW for Reassessment of Debris Blockages in PWR Containments Impact on ECCS Performance	09/01/1998		09/01/1998
Complete Collection and Review of PWR Containment and Sump Design and Operation Data	12/01/1999		12/01/1999
Complete All Debris Transport Tests	09/01/2000		08/01/2000
Complete Parametric Evaluation	07/01/2001		07/31/2001
Proposed Recommendations to the ACRS	08/31/2001		08/31/2001
ACRS Review Completed	09/30/2001		09/14/2001
Issue Transferred from RES to NRR	09/28/2001		09/28/2001
Complete Reassessment of Debris Blockages in PWR Containments Impact on ECCS Performance	09/30/2001		09/28/2001
Prepare Memo Discussing Proposed Recommendations (End of Technical Assessment Stage of Generic Issue Process)	04/01/2002		09/28/2001

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Milestone	Original Date	Current Date	Actual Date
Complete Estimate of Average CDF Reduction, Benefits, and Costs	04/01/2002		09/28/2001
Issue Bulletin 2003-01	05/01/2003		06/01/2003
Complete Development of Models and Methods for Analyzing Impact of Debris Blockages in PWR Containments on ECCS Performance	04/01/2001		06/09/2003
Discuss Reg. Guide 1.82, Rev. 3 with ACRS SubCommittee on Thermal-Hydraulic Phenomena	08/20/2003		08/20/2003
Present Final Version of Reg. Guide 1.82, Rev. 3 to ACRS Full Committee	09/11/2003		09/11/2003
ACRS Letter on Final Version of Reg. Guide 1.82, Rev. 3	09/30/2003		09/30/2003
Draft Industry Guidance for Plant-Specific Analyses	10/30/2003		10/31/2003
Issue Reg. Guide 1.82, Rev.3	09/30/2003		11/30/2003
NRC Meeting with Stakeholders	03/23/2004		03/23/2004
NRC Meeting with Stakeholders	05/25/2004		05/25/2004
Receive Industry Guidance for Plant-Specific Analyses	09/30/2003		05/28/2004
NRC Meeting with Stakeholders	06/17/2004		06/17/2004
Brief ACRS SubCommittee on Proposed Generic Letter	06/22/2004		06/22/2004
NRC Meeting with Stakeholders	06/29/2004		06/29/2004
Develop Generic Letter for Resolution of GI	07/07/2004		07/07/2004
Brief Full ACRS Committee on Proposed Generic Letter	07/07/2004		07/07/2004
Meet with CRGR on Proposed Generic Letter	08/10/2004		08/10/2004
Issue Generic Letter 2004-02	09/13/2004		09/13/2004
Meet with ACRS on Safety Evaluation of NEI 04-07	10/07/2004		10/07/2004
ACRS Response on Safety Evaluation of NEI 04-07	10/18/2004		10/18/2004
Brief Commissioners Jaczko and Lyons on Status	07/18/2005		07/18/2005
EDO Briefing of ACRS on Status	09/09/2005		09/09/2005
Receive All GL Responses Addressing Plant-Specific Analyses	05/31/2005		09/15/2005
Issue Information Notice 2005-26	09/16/2005		09/16/2005
Complete Review of Licensee Responses to GL 2004-02	01/20/2006		01/20/2006

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Milestone	Original Date	Current Date	Actual Date
Issue Supplement 1 to IN 2005-26	01/20/2006		01/20/2006
Complete Research Programs Evaluating Coating Transportability and Surrogate Throttle Valve Debris Ingestion	02/28/2006		02/28/2006
Brief ACRS on Staff Evaluation of Licensee Responses to GL 2004-02 and Results of Chemical Effects Tests	03/09/2006		03/09/2006
Complete Testing and Analysis Associated with Initial Phase of Chemical Effects Research	05/30/2006		05/30/2006
Complete Containment Material Head Loss Testing	06/15/2006		06/15/2006
Complete Thermodynamic Simulation of Containment Sump Pool Chemical Constituents	09/30/2006		09/30/2006
Complete Last Audit Report	05/23/2008	06/20/2008	06/19/2008
Regions Complete TI Inspections	06/30/2008		06/30/2008
Receive Last TI Verifications From Regions	08/11/2008		08/11/2008
Complete Review of TI Verifications	08/25/2008		06/30/2009
Complete Review of Licensee GL 2004-02 Responses for Adequacy (except in-vessel downstream effects)	12/31/2007	11/30/2009	
Issue final safety evaluation for in-vesel downstream effects	06/30/2009	02/04/2010	
Complete Review of Licensee GL 2004-02 Responses for in-vessel downstream effects	03/31/2010	07/09/2010	
Prepare Closure Memo for GL-2004-02 Responses	11/23/2008	09/06/2010	
Complete NRR Review and Approval of GL Closure Memo	12/28/2008	09/30/2010	
Licensees Complete GL-2004-02 Activities	01/31/2007	06/30/2011	

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

Issue Number 0193

Type: GI

Office/Division/Branch: RES/DRA/OEGIB

Title: BWR ECCS Suction Concerns

**Resolution Status:** In progress

**Identification Date:** 05/10/2002

**Generic Issue Acceptance Date:**

**Action Level:** Active

**Task Manager:** John C. Lane

**TAC Number:** KC0140

**Safety Risk Assessment:** 11/01/2010 (Planned/Projected)

**Regulatory Assessment:** 03/31/2011 (Planned/Projected)

**Transfer to Regulatory Office for Action:**

**Completion of Verification:**

**Closure Date:** (To Be Determined)

**Work Authorization:** Memorandum to A. Thadani from F. Eltawila, "Results of Initial Screening of Generic Safety Issue 193, 'BWR ECCS Suction Concerns,'" October 16, 2003

## WORK SCOPE:

### Description

The Generic Safety Issue (GI) - 193, "BWR ECCS Suction Concerns" (initiated in 2002) evaluates possible failure of the emergency core cooling systems (ECCS) pumps (or degraded performance) due to unanticipated, large quantities of entrained gas in the suction piping from suppression pools in BWR Mark I, II, and III containments during LOCA conditions that could cause gas binding, vapor locking, or cavitation.

As a result of the initial screening (ML0329407080) completed in October 2003, a Task Action Plan (TAP) for the technical assessment of this issue was approved in May 2004 (ML0414502080). Staff completed a literature search for information on ECCS pump performance during intake conditions at high voiding in March 2005. Staff also found experimental evidence that gas may reach the ECCS pumps during a loss-of-coolant accident. Although it appears the pumps can recover given a limited amount of void fraction, the impact of voiding on the continued operation of the pumps is a concern.

The TAP to resolve this GI involves an evaluation of suppression pool designs, the dynamics of air entrainment in the suppression pool, and the impact on ECCS pump performance. A review of wetwell and suppression pool designs was made to establish bounding parameters. Relevant experiments on pool dynamics were reviewed to identify pre-existing sources of data.

Completed portions of the TAP resulted in a basic understanding of the overall phenomena and a preliminary assessment that continued work on the GI is warranted. The next phase will involve a multi-step estimation of the maximum potential void fraction (MPVF) occurring at different stages of a Large and Medium loss of coolant accident (LOCA). The MPVF appears to be influenced by a number of phenomena many of which overlap in time, such as the gas/liquid jet coming from the downcomer and non-condensable gas injection from the drywell. It is an attempt to quantify an upper bound for voids present at the ECCS pump suction strainer in the wetwell. An estimate of the MPVF based on a simplified, worst-case scenario for a generic containment will be made. Ultimately, it is expected that this may provide licensees with guidance of how to calculate the MPVF based on their plant specific geometrical and operational characteristics. Initial emphasis will be placed on the calculations for the Mark I containment.

## STATUS:

In 2005, a detailed literature search was completed as part of the initial phase of the TAP. It was documented in a status report issued in November 2005 (ML0531901950).

In 2006, discussions were initiated with NRR regarding commonality of concerns between GI-193 and those being addressed in a proposed Generic Letter (later issued as GL 08-01) addressing gas accumulation in ECCS suction piping covering all reactors. It was decided initially that the resolution of GI-193

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would be pursued by RES independently, but with appropriate coordination with the NRR activities on gas management issues. After consideration of a research project to model the central issue in GI-193 (i.e., ability of BWR ECCS pumps to tolerate short periods of high void fraction operation), RES reached a decision in favor of working with NRR to issue an appropriate generic communication to affected licensees and revised milestones accordingly. Discussions with NRR ensued on the specifics of the generic communication and the schedule for its issuance.

In 2007, RES and NRR agreed not to include this activity in the upcoming GL 08-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems." Also in 2007, RES and NRR agreed to request BWR Owners Group cooperation to support the ongoing assessment of this GI. This approach is consistent with the principles described in SECY-07-022, "Status Report on proposed Improvements to the Generic Issues Program." The BWROG provided references to two research reports from the Lappeenranta University of Technology laboratory in Finland (ML071640273 and ML071640280).

In 2008, the BWROG agreed to provide additional input which will provide insights into the geometric configuration of the ECCS suction strainers in relation to the downcomers. Input is expected in 2009. Also in 2009, in-house staff efforts are under way to estimate MPVF via calculation. In addition, an experimental testing program has been proposed and is being planned to promote understanding of complex void phenomena. The results of the experimental program, in conjunction with the input from the BWROG, are expected to shed light on the behavior of the BWR Mark I design in regards to the transport of bubbles resulting from the LOCA blowdown. This, in turn, should enable the staff in developing a strategy for resolution of the generic issue.

## AFFECTED DOCUMENTS:

To be determined.

## PROBLEM/RESOLUTION:

As described above, some elements of the original TAP were deferred in favor of attempts made by the staff to pursue other avenues of resolution. For example, the staff attempted to incorporate a request for licensee input via inclusion in GL 08-01. Ultimately, this approach was not chosen. Similarly, the staff attempted to consider international research from Finland as supportive of a resolution. This also did not meet with the success originally envisioned. The BWROG has agreed to support this effort by providing selected Mark I wetwell downcomer and pump suction geometry details, and LOCA/ECCS pump initiation accident timelines.

## REASONS FOR SCHEDULE CHANGES:

The initial intent to include this issue in the scope of the GL on the topic of gas accumulation in suction piping of ECCS pumps being developed by NRR proved to be impractical due to fundamental differences and the development status of the GL in relation to the GI. Later developments that placed information from Finland on the resolution path extended the time needed to review potential BWROG data but both those avenues ultimately proved not supportive of resolution.

The Task Action Plan activities have been clarified and calculations are envisioned to estimate the contribution of the various factors in creating and transporting voids. Following the calculation phase, the results will be evaluated to determine if they appear to warrant further industry involvement in assessing emergency core cooling pump capability in an environment with voids present.

An experimental testing program was proposed in 2009 to help assess the phenomenology involved with bubble injection and transport into the containment wetwell and ECCS suction strainers. In late 2009, the experimental facility will be adapted to simulate the creation and behavior of voids in a BWR suppression pool. Actual model testing is expected by the end of the year.

Milestone	Original Date	Current Date	Actual Date
Complete Task Action Plan for a Technical Assessment Third Quarter, FY09	03/31/2004		05/24/2004

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Milestone	Original Date	Current Date	Actual Date
ECCS Pump Performance Literature Search	03/31/2005		03/31/2005
Issue RFP to BNL for Technical Assistance	04/26/2005		04/26/2005
Receive Proposal for Technical Assistance from BNL	06/03/2005		06/03/2005
Request Information from Technical Research Center of Finland	09/12/2005		09/12/2005
Evaluate Experimental Results on Thermal-Hydraulic Phenomena	09/30/2005		09/30/2005
Complete Literature Search for Two Specific Thermal-Hydraulic Phenomena	09/30/2005		09/30/2005
Assign New Task Manager	05/15/2006		05/15/2006
RES Decision to Work with NRR on Generic Communication	08/31/2006		08/31/2006
Arrange Meeting With BWROG and Obtain Their Input	06/30/2007		06/06/2007
Review BWROG Data and Determine Regulatory Action	09/30/2007	12/31/2007	12/31/2007
Assign New Task Manager	04/15/2008		04/15/2008
Query BWROG for background information	09/04/2008		09/04/2008
Query Finnish researchers to share current information	11/30/2008		01/30/2009
Establish agreement and workscope for experimental program to study void transport phenomena	05/01/2009	07/01/2009	
Receive BWROG response to staff information request	12/31/2008	09/30/2009	
Conduct experimental testing	11/01/2009	12/31/2009	
Evaluate test results	12/30/2009	02/28/2010	
Perform multi-stage calculations to estimate MPVF	09/30/2009	04/30/2010	
Compare MPVF with BWR ECCS pump capability	12/30/2009	07/01/2010	
Initiate Appropriate Follow-On Action Commensurate with Risk-Significance	06/30/2010	09/01/2010	
Complete Safety and Risk Assessment Phase of GIP	09/30/2010	11/01/2010	
Proceed to Regulatory Assessment stage or close	03/31/2011		

# GENERIC ISSUE MANAGEMENT CONTROL SYSTEM

Issue Number 0199

Type: GI

Office/Division/Branch: RES/DRA/OEGIB

Title: Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern U.S. on Existing Plants

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Resolution Status: In progress

Identification Date: 05/25/2005

Generic Issue Acceptance Date: 02/01/2008

Action Level: Active

Task Manager: John Kauffman

TAC Number: KC0030

Safety Risk Assessment: 07/31/2009 (Planned/Projected)

Regulatory Assessment: 12/31/2009 (Planned/Projected)

Transfer to Regulatory Office for Action:

Completion of Verification:

Closure Date: (To Be Determined)

## Work Authorization:

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### WORK SCOPE:

#### Description

Recent data and models indicate that estimates of the potential for earthquake hazards for some nuclear power plants in the Central and Eastern United States (CEUS) may be larger than previous estimates. While it has been determined that currently operating plants remain safe, the recent seismic data and models warrant further study and analysis. This further analysis will allow the NRC to better understand the current margins at operating plants for earthquakes.

#### Work Scope

The following paragraph reflects background information in the Generic Issue request memo dated May 26, 2005. Regulatory Guide 1.165, developed in the early 1990s, specifies a reference probability for exceedance of a safe shutdown earthquake (SSE) ground motion, i.e., seismic hazard, at a median annual value of 1E-5. This reference probability value is based on the annual probability of exceeding the SSEs for 29 CEUS nuclear power sites and is used to establish the SSEs for future nuclear facilities. Based on preliminary results from work performed by the United States Geological Survey (USGS) in 2004, it appears the reference probability for the 29 CEUS has increased to about 6 to 7E-5. The increase in the reference probability value is primarily due to recent developments in the modeling of earthquake ground motion in the CEUS. When the staff first identified this issue, no new plants had applied for a Construction Permit or Early Site Permit (ESP) since 10 CFR Part 100 was revised and Regulatory Guide 1.165 was issued in 1997. When the staff began review of the ESP applications, the staff realized the impact of the revised regulation and the regulatory guide as they relate to future plants and operating reactors.

From the staff's review of the ESP applications with support from the 2004 USGS draft report, it appeared that the perception of seismic hazard for operating plants in the CEUS region may have increased for some sites. Based on the evaluations of the Individual Plant Examination of External Events (IPEEE) Program, the staff had determined that seismic designs of operating plants in the CEUS provided an adequate level of protection. However, in light of the preliminary results from the review of the USGS work of 2004 and ESP applications, the staff also recognized that the probability of exceeding the SSE at some of the currently operating sites in the CEUS may be higher than previously understood. Therefore, the staff initiated this GI to assess the impact of increased estimates of seismic hazards on selected current nuclear power plants in the CEUS region that might be impacted by the updated seismic research, information, and models.

#### STATUS:

In August 2005, the NRC Office of Nuclear Regulatory Research (RES) issued a task order for a contractor to develop a probabilistic screening analysis for the increased probabilities of exceedance of the safe-shutdown earthquake ground motion on current nuclear power plants in the CEUS. The contractor was

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to use information provided by the NRC to perform this task in accordance with guidelines of Section 3.3 and Appendix B.3.2 of NUREG-1489, "A Review of NRC Staff Uses of Probabilistic Risk Assessment." The information to be provided by the NRC included Electric Power Research Institute (EPRI) Report NP-6395-D, "Probabilistic Seismic Hazard Evaluations at Nuclear Power Plant Sites in the Central and Eastern United States: Resolution of the Charleston Earthquake Issue," April 1989. In May 2007, the NRC and the contractor agreed to stop work on this task order because the NRC and EPRI had not resolved issues with releasing the copyrighted EPRI Report NP-6395-D to the NRC contractor for performing this task.

The NRC Office of RES had decided, in April 2007, to complete the USGS update of seismic hazard assessment of CEUS plants and then use this information to perform the screening analysis for this GI. In May 2007, the staff developed a plan to complete the screening analysis for GI-199 by February 2008, and began work on initial tasks described in this plan. In June 2007, the staff decided to focus the screening analysis efforts on using existing USGS seismic hazard information to address the seven criteria for screening GIs described in SECY-07-0022, "Status Report on Proposed Improvements to the Generic Issues Program," dated January 30, 2007 (ML063460239). In July 2007, the staff completed their preliminary screening analysis and in August 2007, provided it to the screening analysis review panel.

In October 2007, the staff determined that the screening analysis should consider seismic hazard data and models besides those available from the USGS. This determination was based on the staff's ongoing interactions with stakeholders to develop a new performance-based approach for assessing seismic hazards for new reactors as described in a memorandum to the Commission, "A Performance-Based Approach to Define the Safe Shutdown Earthquake Ground Motion," dated July 26, 2006 (ADAMS Accession No. ML052360044).

The staff completed the screening analysis using guidance contained in MD 6.4 and SECY-07-0022 in December 2007, and reconvened the screening panel in January 2008. On February 1, 2008, the RES Director approved the screening panel recommendation (ML073400477) to begin the Safety/Risk Assessment Stage of the Generic Issue Process. On February 6, 2008, the staff met with the public and stakeholders to discuss the results of the Screening Stage of Generic Issue 199. The meeting took place at NRC headquarters located in Rockville, MD.

RES staff is collecting and analyzing seismic hazard information from USGS and other sources, and seismic risk information from IPEEE analyses. Additionally, EPRI reported that they have calculated mean seismic hazard results for all nuclear power plant sites in the CEUS. With these results, EPRI is performing an independent evaluation of the implications of changes in seismic hazard estimates. The staff met with EPRI at EPRI Headquarters on March 17 and 18, 2009 to discuss data, methodology, and outcomes from the methodology. The staff plans to review this information and, if it is acceptable, incorporate this information in the Safety/Risk Assessment of the GI.

This GI is in the Safety/Risk Assessment Stage of the Generic Issue Process.

## AFFECTED DOCUMENTS:

None Identified.

## PROBLEM/RESOLUTION:

Progress on performing the screening analysis was delayed due to issues with releasing the copyrighted EPRI Report NP-6395-D to the NRC contractor. To overcome this issue, RES re-assessed alternatives for proceeding with the screening assessment of GI-199 in accordance with MD 6.4 and SECY-07-0022. From April 2007 through September 2007, staff performed the initial screening analysis of GI-199 using currently available seismic hazard information from the USGS. Then, in October 2007, the staff determined that the screening analysis should consider seismic hazard data and models besides those available from the USGS. The RES staff worked with technical experts from NRR and NRO to complete an acceptable screening analysis and to develop an approach for the Safety/Risk Assessment Stage. We consider the previous problems to be resolved.

## REASONS FOR SCHEDULE CHANGES:

Schedule delays involving the initial screening analysis were caused by not identifying an amenable solution for EPRI release of NP-6395-D to the NRC contractor for performing the screening analysis task. Based on discussions with the USGS, the staff determined the time frame for obtaining current seismic

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hazard update information for CEUS plant sites would be mid-2008 as opposed to October 2007. Accordingly, the staff changed the date for the milestone: "Receive Seismic Hazard Update Results for Selected CEUS Plants from USGS," from 10/30/2007 to 6/30/2008. In support of completing the screening analysis, consistent with timeliness targets described in SECY-07-0022, the staff decided to base the screening analysis on currently available seismic hazard information from the USGS. Following this approach, the staff completed the milestone: "Generate Screening Analysis," on July 27, 2007, and then completed the milestone: "Screening Panel Meeting," on September 12, 2007.

In October 2007, the staff determined that the screening analysis should consider seismic hazard data and models besides those available from the USGS. This determination is based on the staff's ongoing interactions with stakeholders to develop a new performance-based approach for assessing seismic hazards for new reactors as described in a memorandum to the Commission, "A Performance-Based Approach to Define the Safe Shutdown Earthquake Ground Motion," dated July 26, 2006 (ADAMS Accession No. ML052360044). The staff's ongoing work on this performance-based approach resulted in issuance of NRC Regulatory Guide 1.208, "A Performance-Based Approach to Define the Site-Specific Earthquake Ground Motion," dated March 2007 that endorses the performance-based approach. After the Director of RES approved the Screening Panel's recommendation (ML073400477) to conduct a Safety/Risk Assessment Stage, a milestone was added for completion of this stage.

Because of the complexity of additional evaluations and the desire for internal and external stakeholder agreement, the safety/risk assessment panel meeting and the ACRS briefing have been extended by five months. A public meeting is now planned for September 2009 and will extend the remaining schedule.

Milestone	Original Date	Current Date	Actual Date
Issue RFP to ISL for Technical Assistance	07/07/2005		07/07/2005
Receive Proposal from ISL	08/11/2005		08/11/2005
Generate Screening Analysis	10/31/2006	12/31/2007	07/27/2007
Screening Panel Meeting	11/30/2006	01/31/2008	09/12/2007
Prepare Screening Analysis Applying Criteria from MD 6.4 and SECY-07-0022	12/15/2007	12/31/2007	12/31/2007
Reconvene Screening Panel	12/15/2007	01/13/2008	01/11/2008
Provide Screening Panel Recommendation Memo for RES Director Approval	01/31/2007	02/15/2008	01/25/2008
Issue RES Director Approved Screening Analysis and Panel Recommendation	12/31/2006	02/28/2008	02/01/2008
Receive Seismic Hazard Update Results for Selected CEUS Plants from USGS	10/30/2007	10/15/2008	10/15/2008
Receive Information from EPRI	05/30/2008	12/31/2008	12/03/2008
Schedule and Conduct Safety/Risk Assessment Panel	09/30/2008	07/31/2009	
Conduct Public Meeting	06/30/2009	09/30/2009	
Presentation to ACRS	11/05/2009	11/05/2009	
Brief ACRS	03/31/2009	11/30/2009	
Proceed to Regulatory Assessment stage or close	06/30/2009	12/31/2009	