

UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, DC 20555-0001

August 23, 2013

**NRC REGULATORY ISSUE SUMMARY 2013-09  
NRC ENDORSEMENT OF NEI 09-10, REVISION 1a-A, "GUIDELINES  
FOR EFFECTIVE PREVENTION AND MANAGEMENT OF SYSTEM GAS  
ACCUMULATION"**

**ADDRESSEES**

All holders of, and applicants for, power reactor operating licenses issued under Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," except those that have permanently ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

All holders of and applicants for a power reactor early site permit, combined license, standard design certification, standard design approval, or manufacturing license under 10 CFR Part 52, "Licenses, Certifications, and Approvals for Nuclear Power Plants."

**INTENT**

The U.S. Nuclear Regulatory Commission (NRC) is issuing this regulatory issue summary (RIS) to inform stakeholders that the NRC endorsed Nuclear Energy Institute (NEI) 09-10, Revision 1a-A, "Guidelines for Effective Prevention and Management of System Gas Accumulation" (Agencywide Documents Access and Management System (ADAMS) Accession No. ML13136A129) as an acceptable and recommended approach to managing gas accumulation in power reactor piping systems. This RIS does not transmit any new requirements and does not require any specific action or written response on the part of an addressee.

**BACKGROUND INFORMATION**

Instances of gas accumulation in nuclear power plant fluid systems have occurred since the beginning of commercial nuclear power plant operation. Several gas intrusion mechanisms can result in gas accumulation in system piping, and some gas may come out of solution because of changes in temperature and pressure during normal operation. However, the existence of gas in system piping is not a condition that was accounted for in the initial analyses of system performance during transients and accidents. Gas accumulation has been a continuing problem that potentially jeopardizes operability of systems that are important to safety.

The NRC has published 21 information notices (INs), three generic letters (GLs), and a NUREG (NRC technical report designation) related to this issue. In addition, the NRC interacted with the nuclear industry numerous times related to these publications and in response to gas accumulation events. However, the problems continued because a comprehensive, in-depth resolution of the issue was not achieved. This situation changed because the Institute of

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Nuclear Power Operations (INPO) issued significant operating event report (SOER) 2-05, Revision 1, "Gas Intrusion in Safety Systems" (January 9, 2008), and the NRC issued GL 2008-01 "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems" (January 11, 2008) (ADAMS Accession No. ML072910759).

GL 2008-01 requested that each addressee evaluate its emergency core cooling system, decay heat removal system, and containment spray system licensing basis, design, testing, and corrective actions to ensure that gas accumulation is maintained less than the amount that challenges operability of these systems. The INPO SOER 2-05 Rev. 1 also recommended that licensees take appropriate action when conditions adverse to quality are identified. The combination of GL 2008-01 and INPO SOER 2-05 Rev. 1 resulted in an in-depth industry effort to address many of the issues. This effort has resulted in a significant and continuing improvement in addressing gas management issues, although further improvement is needed for some issues, such as gas transport and vortexing.

For most licensees, the current design basis for the subject systems is a water-solid condition. The desired objective during operation is to achieve this condition, but where this is not practical, an acceptable objective of gas control measures is to limit the gas accumulation volume to a quantity that does not jeopardize system operation. An acceptable volume depends on a variety of factors including, but not limited to, the following:

- total volume
- location
- flow rate
- type of pump
- gas volume fraction at the pump impeller
- pressure changes experienced by the system when it is activated
- obstacles to downstream flow from accumulated gas
- effects of gas on core cooling

The amount and location of gas are both important in addressing the impact on system operation. An evaluation to develop and apply criteria is necessary to determine the amount of gas that could affect system operation.

NEI 09-10, Revision 1a-A addresses issues that were identified in GL 2008-01 and INPO SOER 2-05 Rev. 1, during evaluations of industry operations, and in meetings and workshops. It provides recommendations and guidance to nuclear power plant licensees for development and implementation of programs and processes to prevent and manage gas intrusion and gas accumulation in plant systems.

## **SUMMARY OF ISSUE**

The NRC staff reviewed NEI 09-10, Revision 1a-A (the report), and documents that were referenced in the report to determine if its guidance would contribute to effective prevention and management of system gas accumulation at nuclear power plant facilities. The review considered both regulatory compliance and technical approach, including compliance with license amendment and license renewal requirements to allow licensees the option of incorporating the report guidelines by reference in plant-specific licensing actions. In its safety evaluation (SE), the NRC staff found the report acceptable without qualification. However, qualifications were identified for use of documents referenced within the report. For use by a

licensee as referenced in licensing actions, the licensee must ensure the action is consistent with the current licensing basis. To be consistent with the NRC staff's findings, qualifications regarding use of the references that are stated in the NRC SE must be considered when implementing NEI 09-10, Revision 1a-A, and any licensees referencing or using this report should qualify the use of the references.

The report states that the primary objective of the submittal is to provide insights and attributes to implement an acceptable approach to effectively prevent and manage gas intrusion and accumulation in plant systems. The report is intended to aid in the identification of susceptible systems, outline principles and practices designed to effectively prevent, identify, manage and monitor accumulation of gas that may challenge the capability of a system to satisfy its design functional requirement(s), and identify training to ensure plant personnel can readily recognize and effectively respond to gas intrusion and accumulation in susceptible systems. The NRC SE provides conclusions, findings, and endorsement of the practices and requirements that can be referenced by a licensee to support the development and implementation of effective gas management programs in plant systems.

The NRC staff found that the report reinforces previously established NRC regulations and guidelines as noted within the SE. The NRC staff determined that the report is an acceptable method for addressing gas management issues and may be voluntarily implemented by licensees or referenced in licensing actions. It adds value to both NRC and industry activities by detailing methods of resolving gas accumulation issues.

Systems that the report considers to be within scope are those fluid systems that are necessary to reasonably ensure continued core cooling and prevention of any significant release of radioactive material. This includes safety related systems and, where appropriate, nonsafety-related systems. The report is specific to the occurrence of gas transport in systems that are designed to be full of liquid, including piping, valves, pumps, etc. The report covers the mechanical aspects of gas management in liquid filled systems.

Some aspects of gas behavior, such as application of computer codes to address gas movement and details associated with entrance of gas into systems caused by vortexing, are outside of the report's scope. These must be addressed on a plant-specific basis that includes supporting detail until the NRC issues or endorses acceptable generic methods.

At present, there is no acceptable generic methodology for assessing pipe void volume and void transport behavior other than identified in the SE. Assessment of conditions not covered by the SE should be addressed on a plant-specific basis.

The report does not provide guidance on meeting potentially related 10 CFR regulations, including 10 CFR Part 20 in controlling and monitoring gaseous effluent releases and complying with Part 50, Appendix I design objectives and ALARA provisions whenever gas venting is conducted. All 10 CFR Part 50 regulations must be met on a plant specific basis.

## **BACKFITTING AND ISSUE FINALITY**

This RIS informs stakeholders that the NRC has endorsed industry guidance concerning the management of gas accumulation in power reactor piping systems. The RIS requires no action or written response on the part of any addressee. Inasmuch as the RIS does not require any action, the RIS does not represent backfitting as defined in 10 CFR 50.109(a)(1), and is not

otherwise inconsistent with any issue finality provision in 10 CFR Part 52. Therefore, the NRC did not prepare a backfit analysis for this RIS or further address the issue finality criteria in Part 52.

### **FEDERAL REGISTER NOTIFICATION**

The NRC did not publish a notice of opportunity for public comment on this RIS in the *Federal Register* because the RIS is informational and does not depart from current regulatory requirements and practices.

### **CONGRESSIONAL REVIEW ACT**

This RIS is not a rule as defined by the Congressional Review Act (5 U.S.C. §§ 801–808).

### **PAPERWORK REDUCTION ACT STATEMENT**

This RIS does not contain new or amended information collection requirements subject to the Paperwork Reduction Act of 1995 (44 U.S.C. 3501 et seq.). Existing requirements were approved by the Office of Management and Budget (OMB), approval number 3150-0011.

### **PUBLIC PROTECTION NOTIFICATION**

The NRC may not conduct or sponsor, and a person is not required to respond to, a request for information or an information collection requirement unless the requesting document displays a currently valid OMB control number.

## CONTACTS

Please direct any questions about this matter to the contact listed below.

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Note: NRC generic communications may be found on the NRC public Web site,  
<http://www.nrc.gov>, under NRC Library/Document Collections.

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