NRR ACTION PLAN
March 2011

GAS MANAGEMENT

TAC NO. ME3939

Last Update: March 2011
Lead Division: DSS
Supporting Divisions: DPR, PGCB, PRPB, ITSB
Supporting Office: RES

Item No. (TAC No.)	Milestone	Date (T=target) (C=Complete)	Lead	Support
1	**Close Generic Letter (GL) 2008-01**	06/30/11 (T)	SRXB W. Lyon	PGCB E. Bowman
	a. Issue GL	01/11/08 (C)	SRXB W. Lyon	
	b. Receive Licensee 3-Month Responses	04/11/08 (C)	DORL PM	
	c. Review 3-Month Responses	08/11/08 (C)	SRXB W. Lyon	
	d. Receive Licensee 9-Month Responses	11/11/08 (C)	DORL PM	
	e. Issue Assessment Guidance to Industry	05/28/09 (C)	SRXB W. Lyon	
	f. Issue Temporary Instruction (TI) 2515/177	06/09/09 (C)	SRXB W. Lyon	
	g. Complete Initial GL 2008-01 Response Reviews, Provide RAIs	12/30/10 (C)	SRXB J. Gall	
	h. Receive RAI Responses	04/01/11 (T)	DORL PM	
	i. Complete GL Response Reviews	04/30/11 (T)	SRXB J. Gall	
	j. Send Inspection Guidance for TI 2515/177 to Regions	04/30/11 (T)	SRXB J. Gall	
	k. Send Individual Closure Memos to Licensees	06/15/11 (T)	DORL PM	
	l. Complete GL Closure Memo	06/30/11 (T)	DSS W. Ruland	
	m. Final NEI/NRC/Industry Workshop	08/31/11 (T)	NEI/ SRXB W. Lyon	

2	**Create Comprehensive Gas Management Document**		SRXB J.Gall	RES T. Koshy
	a. Nuclear Energy Institute (NEI) 09-10 Rev 1 Meetings	09/30/10 (C) 03/28/11 (T)	SRXB W. Lyon	
	b. Complete Staff Review of NEI-09-10 Document	07/30/11 (T)	SRXB W. Lyon	PLPB S.Stuchell
	c. As Appropriate from NEI-09-10, Issue safety evaluation and regulatory issue summary (RIS)	04/30/12 (T)	SRXB J.Gall	PLPB S.Stuchell
	i) Complete User Need Request for development of RG	Not Needed	SRXB A. Ulses	RES T. Koshy
	ii) Define Acceptable Vortexing Methodology	12/31/11 (T)	SRXB W. Lyon	
	iii) Define Acceptable In-Depth Void Analysis Methodologies	10/31/11 (T)	SRXB W. Lyon	
	iv) Define Acceptable Approximate Void Transport Methodology	07/01/11 (T)	SRXB W. Lyon	
	v) Define Acceptable Approximate Water Hammer Methodology	12/31/11 (T)	SRXB W. Lyon	
	vi) Define Acceptable Pump Suction Void Fractions	06/30/10 (C)	SRXB W. Lyon	
	vii) Define Acceptable Use of Computer Codes for Gas Transport and Void Acceptance Criteria	08/30/11 (T)	SRXB J. Gall	RES S. Bajorek
3	**Engage Licensees to Modify Technical Specifications (TSs) to Ensure Adequate Protection**		ITSB M.Hamm	
	a. Technical Specification Task Force (TSTF) 523 Meeting with Industry	09/30/10 (C) 01/12/11 (C)	SRXB W. Lyon	PRPB M. Honcharik
	b. Accept Industry TSTF for Review	03/11 (T)	SRXB W. Lyon	PRPB M. Honcharik
	c. Agreement with Industry on Acceptable TSTF	06/01/11 (T)	SRXB W. Lyon	PRPB M. Honcharik
	d. Approve Industry TSTF	12/31/11 (T)	SRXB W. Lyon	ITSB M.Hamm
	e. Approve Plant TS Amendment Requests	08/31/13 (T)	DORL	SRXB ITSB

Description:

A review of operating experience and U. S. Nuclear Regulatory commission (NRC) inspection results shows recent instances of gas accumulation events involving Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems that have rendered or potentially rendered these risk-significant systems inoperable. The number of identified gas accumulation events and their significance at some facilities raise concerns about whether similar unrecognized design, configuration, and operability problems exist at additional facilities. Subject system designs vary widely regarding potential gas sources and capability to control gas. It is important that the subject systems are sufficiently filled with water to ensure that they can reliably perform their intended functions under all LOCA and non-LOCA conditions that require makeup to the RCS. The final safety analysis reports (FSARs) at many facilities state that the subject systems are full of water and technical specification (TSs) often require periodic surveillances to confirm this condition. Some plant TSs have incomplete surveillance requirements (SRs) that cover only portions of the system. Current staff thought is that standard SRs are needed to ensure compliance and adequate protection to the health and safety of the public. The staff is pursuing TS changes with Industry through the TSTF.

Background:

Instances of gas accumulation in various plant systems have occurred since the beginning of commercial nuclear power plant operation. The NRC has published 20 information notices (INs), two generic letters (GLs), and an NRC technical report designation (NUREG) related to this issue and has interacted with the nuclear industry many times in relation to these publications and in response to gas accumulation events.

GL 2008-01 was issued to require 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, and that appropriate action is taken when conditions adverse to quality are identified. The NRC is aware of more than 46 potentially significant gas intrusion events that have occurred since this GL was issued for comment.[1] To assess the licensees' evaluations and actions, the NRC requested the licensees "submit information to demonstrate that the subject systems are in compliance with the current licensing and design bases and applicable regulatory requirements, and that suitable design, operational, and testing control measures are in place for maintaining this compliance." The NRC further stated that it would "collect the requested information to determine if additional regulatory action is required." The licensees were requested to submit a written response consistent with the requested actions and information within 9 months of the issuance of the GL. A preliminary assessment of each 9-month licensee response was completed by the NRC staff to determine whether sufficient information was provided to complete the review and close out the GL.

The reviews determined that the FSAR at many facilities states that the subject systems are full of water and plant TS often require periodic surveillances to confirm this condition. Some plant TSs have incomplete surveillance requirements that cover only portions of the systems. Since the subject systems could be rendered inoperable or degraded by gas accumulation in any

[1] 39 instances of discovery of gas at one site were identified in one licensee document during a recent inspection at a two unit site. The document also identified multiple cases of unexpected accumulator level changes.

section of piping, the regulations require assessment of gas accumulation to establish operability. Some level of gas accumulation may not affect operability as determined by licensee void acceptance criteria that are acceptable to the NRC.

In addition, Criterion III of Appendix B to 10 CFR Part 50 and the plant's operating license identify regulatory requirements for the design of the subject systems. The failure to translate the design basis (such as the system being maintained full of water) into drawings, specifications, procedures, and instructions would be contrary to Criterion III of Appendix B to 10 CFR Part 50. Subject system designs vary widely regarding potential gas sources and capability to control gas. Potential gas sources and symptoms of gas leakage from these sources should be identified and potential gas accumulation locations should be known and provisions made to address gas accumulation at these locations.

Additionally, Criteria V and XI of Appendix B to 10 CFR Part 50 and the plant operating license require licensees to perform testing using written test procedures that incorporate the requirements and acceptance limits contained in applicable design and licensing documents. Criterion XVII requires keeping appropriate records. Testing of portions of piping and components in the subject systems where unacceptable gas accumulation may occur is necessary to confirm acceptance limits and operability unless it has been acceptability established that some portions may be excluded. Surveillance and testing that do not ensure operability prior to the next surveillance are not consistent with this testing requirement.

Lastly, the reviews identified that some licensees have treated the accumulation of substantial gas quantities as an expected condition rather than a nonconforming condition and have not documented the condition when discovered even when it involved a substantial volume of gas that clearly constituted a significant condition adverse to quality and safety.

Meetings were conducted with the NEI, owners groups, several industry organizations, and licensees to identify additional information needed to be submitted to the NRC. On May 28, 2009, the NRC issued an assessment guidance document to clarify to the licensees what information was needed to be submitted to the NRC to facilitate close out of the GL. Licensees used this assessment guidance to determine if they wanted to supplement their original submittal. The staff is completing the detailed review of the licensee responses to GL 2008-01. The reviews assess the information provided by the licensees to support a conclusion that there is a reasonable assurance that the subject systems are operable. As plant responses are received, reviewed, and accepted, the staff will issue individual plant closure letters. The staff will also provide the regions with inspection guidance for TI 2515/177. After all individual plant closure letters have been issued, the staff will issue a GL 2008-01 closure memorandum. The closure of GL 2008-01 closes the immediate operability issue as defined in the GL. However, it does not close out the gas accumulation and management issue since the GL was limited to three systems and the concerns apply to a number of other systems that are important to safety. The overall gas concerns will be addressed with respect to all potentially affected systems in NEI-09-10, the RG, and/or the RIS.

The regulations in Appendix A to 10 CFR Part 50 or similar plant-specific principal design criteria[2] provide design requirements, and Appendix B to 10 CFR Part 50, TSs, and licensee

[2] These apply to facilities with a construction permit issued before May 21, 1972, that are not licensed under Appendix A.

quality assurance programs provide operating requirements. Appendix A requirements applicable to gas management in the subject systems include the following:

- General Design Criterion (GDC) 1 requires that the subject systems be designed, fabricated, erected, and tested to quality standards.
- GDC 34 requires a residual heat removal (RHR) system designed to maintain specified acceptable fuel design limits and to meet design conditions that are not exceeded if a single failure occurs and specified electrical power systems fail.
- GDC 35, 36, and 37 require an emergency core cooling system (ECCS) design that meets performance, inspection, and testing requirements.

The regulations in 10 CFR 50.46 provide specified performance criteria.

- GDC 38, 39, and 40 require a containment heat removal system design that meets performance, inspection, and testing requirements.

Quality assurance criteria provided in Appendix B that apply to gas management in the subject systems include the following:

- Criteria III and V require measures to ensure that applicable regulatory requirements and the design basis, as defined in 10 CFR 50.2, “Definitions,” and as specified in the license application, are correctly translated into controlled specifications, drawings, procedures, and instructions.

Regulatory Outcome:

GL-2008-01 has been issued. As plant responses are received, reviewed and accepted, the staff will issue individual plant closure letters. The staff will also provide the regions with inspection guidance for TI 2515/177. After all individual plant closure letters have been issued, the staff will issue a GL 2008-01 closure memorandum. The closure of GL 2008-01 closes the immediate operability issue as defined in GL 2008-01. It does not, however, close out the gas accumulation and management issue. As stated above, the concerns apply to a number of other systems that are important to safety.

The staff will continue to work with industry through NEI on a comprehensive gas management document. It is anticipated that there will be safety evaluation report (SER) followed by a RIS to announce endorsement of NEI 09-10 Revision 1. This document will contain acceptable staff positions for evaluating the design, detection, prevention, operability testing, and corrective actions for gas accumulation concerns in susceptible systems that will include, but not necessarily be limited to, the following: system operability, system functionality, gas intrusion, gas accumulation and location, void transport, vortexing (gas ingestion from hot leg pipes, storage tanks, and recirculation sumps), gas volume control and acceptance criteria, pump operation and acceptable gas void fractions, water hammer and acceptable gas quantity, net positive suction head, fill and vent, void determination methods, and TSs including surveillance.

The staff will work with industry through the TSTF to develop acceptable gas management TSs to further ensure adequate protection of the public. The goal of gas management TSs is to address safety system SRs and acceptance criteria for gas voiding in an enforceable manner. A path to achieve this is to create a Gas Surveillance Program (GSP) in Section 5,

Administrative Controls, of the TSs and have the SR in the TSs read "Verify that the system gas volumes are within limits in accordance with the GSP." Industry has submitted a TSTF that would remove the SRs from the TSs and only insert gas management operability information into the Limiting Condition for Operation (LCO) Bases. The submitted TSTF would also add a gas management program to the updated FSAR. The staff accepted the TSTF for review in March 2011.

Current Status:

GL 2008-01 responses are being reviewed and individual plant closure memos will be sent out as they are completed.
RAIs Sent: 104
Inspection Guidance Sent: 84
Closure Memos Sent to DORL: 58

The NRC staff is continuing to meet with NEI/Industry on NEI 09-10 Revision 1. Wednesday March 9th from 3:30 PM – 5:00 PM is the RIC session "Status and Path Forward on the Management of Gas Accumulation in Safety System Piping."

The NRC staff has reviewed the proposed TSTF, ML1018001751. ITSB Staff met with TSTF staff on July 15, 2010 to discuss status. ITSB staff sent the message that entirely removing the gas volume SR from the TSs will not be acceptable and a technical meeting would be appropriate. The technical meeting was held on September 30, 2010. The meeting summary is available, ML102861959. Another meeting was held on January 12, 2011 (ML110140850) in which the industry provided an in-depth coverage of its proposed TSTF. There were no changes made to the TSTF as a result of the September 30th meeting. The NRC continued to express concern over removing the surveillance requirement.

The SRXB staff will develop a RIS with the assistance of the Generic Communications branch. Staff has developed recommendations for acceptable technical specifications for the TSTF to consider.

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Tony Ulses (BC) 415-8539.

References:

1. **The Generic Letter (GL):** "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," NRC Generic Letter 2008-01, ML072910759, January 11, 2008.

2. **The Temporary Instruction:** "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Contain Spray Systems (NRC Generic Letter 2008-01)," Temporary Instruction 2515/177, ML082950666, June 9, 2009.

3. **NRR expectations for licensee GL responses:** Ruland, William H., "Preliminary Assessment of Responses to Generic Letter 2008-01, 'Managing Gas Accumulation in emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems,' and Future NRC Staff Review Plans," NRC letter to James H. Riley, Nuclear Energy Institute, ML091390637, May 28, 2009.

4. **Guidance for NRR Reactor Systems Branch (SRXB) reviews including pump void criteria: "**Guidance To NRC/NRR/DSS/SRXB Reviewers for Writing TI Suggestions for the Region Inspections," ML102300053, August 18, 2010.

5. **User Need Request for Development of a Regulatory Guide for Gas Management:** memorandum from Eric J. Leeds, Director NRR to Brian W. Sheron, Director RES. ML100810109, under development.

6. **Yellow Ticket No.** Y020100159