

**Industry / NRC Meeting on
Generic Letter 2008-01,
“Managing Gas Accumulation in
Emergency Core Cooling, Decay
Heat Removal, and Containment
Spray Systems”**

September 04, 2008

Agenda

- Welcome and introductions
- Industry overview and status of work
- Industry 9-month template response
- Long term plans
- Public comment
- Next meeting schedule
- Close

Welcome and Introductions

- Introductions
- Web Cast Participant Instructions
 - Send participant names to David Beaulieu at David.Beaulieu@nrc.gov
 - Phones on mute please unless asking a question
 - Time will be allowed for web cast participant questions

Industry Overview and Status of Work

Industry Overview and Status of Work

- Gas Accumulation Team (GAT) overseeing industry efforts
 - Industry coordinated response in progress
 - PWROG, BWROG performing significant work
 - EPRI and INPO also supporting
 - Resource intensive effort at plants

Industry Overview and Status of Work

- Three-Month Response Status
 - Required if GL response cannot be completed by October 11, 2008
 - Common issue - access to systems to identify susceptible high points
 - Many plants deferred system walk downs to next outage
 - All but 10 plants submitted 3-month letters
 - Of the 10, some plants have reconsidered and contacted NRC

Industry Overview and Status of Work

- Nine-Month Response
 - GAT issued industry evaluation guidance
 - Provides detailed evaluation guidance
 - GAT developed detailed response template
 - Describe Owners Groups (OG) engineering evaluation results
 - Provide generic response for longer term actions
 - Response template to be covered in this meeting

Industry Overview and Status of Work

- Resources continue to be a challenge
- Developing gas void acceptance criteria
- Completing detailed system walk downs
- Plant gas void identification and response
- Completing engineering evaluations
- GAT has communicated to industry need to contact NRC if work will not be completed by October 11, 2008

Industry 9-Month Template Response

Generic Letter 2008-01 Principle Concerns

- Licensing basis
- Design
- Testing
- Corrective actions

Licensing Basis Evaluation Industry Response

- The licensing basis review will include the following:
 - Tech Specs (TS) and Bases
 - UFSAR
 - Licensee controlled documents and Bases
 - Responses to NRC Generic Communications
 - Regulatory Commitments

Near Term Plant Specific Licensing Basis

- No TS bases changes will be performed for defining full/filled/and sufficiently full.
- PWR's will address suction piping and containment spray system
- BWR's awaiting results of field walk downs for suction piping

Near Term Plant Specific Licensing Basis

- The dates will be identified when the corrective actions for the changes to be completed
- A commitment to evaluate and implement the applicable changes contained in the TSTF traveler when approved by the NRC

Design Evaluation

- The Design Evaluation review will consist of:
 - Design Basis Documents
 - Calculations
 - Isometric drawings
 - P&IDs
 - Confirmatory system walk down
 - Gas intrusion mechanisms
 - Acceptance criteria

Design Evaluation

- The Design Evaluation review will consist of
 - Plant specific calculations or analyses that confirm the acceptability of gas accumulation in the subject system piping, including any acceptance criteria, if applicable
 - For example -Hot leg injection and containment spray
- New gas volume acceptance criteria to be determined to address where gas can accumulate in the systems
 - Pump suction acceptance criteria
 - Pump discharge piping
 - RCS impact

Areas for Void Evaluations

- Pump suction side
 - Pump acceptance criteria
- Pump discharge side
 - Pressure Pulsations
 - RCS impact
- Walk down
 - Methodology
 - Insulation
 - Areas evaluated by alternate means

Basis for Pump Criteria

- Three areas need to be addressed
 - Preclude mechanical damage
 - Required NPSH
 - Bounded by available NPSH
 - Developed Head
 - Acceptability of impact on system flow rate

Suction Gas Void Criteria

- The following key factors were reviewed
 - Percent gas intrusion (void fraction)
 - Single or multi-stage pumps
 - Number of impellers
 - Pump flow rate
 - Suction line configuration
 - Net Positive Suction Head
 - Pump Mechanical Condition
 - Operating Experience and Event Review

BWROG Suction Gas Void Criteria

- Based on the BWROG evaluation of the gas intrusion data that was reviewed, a bounding 2% continuous suction gas void fraction is acceptable for pump operability.
- If a gas void is found in a suction line, it will likely be a fixed mass and will not cause a continuous gas void flowing through the pump.
- It is appropriate for the licensee to use transient void criteria for their specific situation.

BWROG Suction Gas Void Criteria

- Based on the results of this review, to evaluate a void of a known volume, the following bounding condition was determined to be acceptable.
 - An average void fraction of less than 10% can be tolerated by the pump for a period of 5 seconds.
 - This acceptance criteria is comparable to Westinghouse findings.

PWROG Suction Gas Void Criteria

Criteria to Preclude Mechanical Damage

	<i>Single-Stage</i>	<i>Multi-Stage</i>	<i>Multi-Stage</i>
	-	Stiff Shaft	Flexible Shaft
Steady-State	2%	2%	2%
Transient	5% for 20 sec.*	20% for 20 sec.*	10% for 5 sec.&
Pump Type (transient data)	WDF	CA	RLIJ, JHF
Transient criteria based on pump test and vendor supplied information.			

- WDF - Ingersoll-Rand 8x20 WDF
- CA - Ingersoll-Rand 4x11 CA x8
- RL-IJ - Pacific 2.5" RL-IJ
- JHF - Pacific 3.0" JHF
- * - Duration of transient divided by factor of 10 for conservatism (APS data.)
- & - RL-IJ limit is due to possible air-binding of first impeller (Flowserve.)

Example Method for Determining Suction Side Acceptance Criteria

- Choose a void fraction for pump suction high point
- Determine pump flow rate (Froude number) as function of RCS pressure
- Determine resulting void fraction at pump inlet under flowing conditions
- Verify selected void fractions meet acceptance criteria

Sample Implementation SIP Suction Void Fraction Evaluation

5% void in the suction header

RCS Pressure	Flow	Froude Number	Void Peak First 5 sec.	Void Tail	% BEP
1500	110	0.14	-	-	25%
1000	400	0.55	< 1%	< 1%	90%
500	550	0.68	< 2%	< 1%	120%
0	660	0.82	< 5%	<1%	150%

Design Evaluations

- Pipe slope can be determined for sections of piping where the insulation is tightly wrapped, in good condition and does not have marginal slope
- Exclusion can be taken from walk downs and evaluations for sections of piping that are usually void (containment spray discharge downstream of CS isolation valve)

Design Evaluation

- PWR Containment Spray pump discharge piping downstream of the isolation valve that is normally closed during power operation as the riser and spray header are filled
 - The allowable gas accumulation limits will ensure that the net force from the pressurization of the Containment Spray header during the filling transient is a small fraction of the dead weight of the filled piping, i.e., within the margin of the pipe hangers
- Plant specific calculations of the force imbalances during the Containment Spray header can be utilized, if available

Design Evaluation

- The effect on the ECCS core cooling function of a specified amount of non condensable gas entering the RCS was assessed and found not to be limiting with respect to allowable void size

Design Evaluation

- Summary of changes
 - Preparation of calculations to determine acceptance criteria
 - Revisions to fill and vent procedures to incorporate new vents or different venting sequences
 - Revisions to maintenance procedures to incorporate post maintenance verification
 - The procedures changes that have been made and a schedule for those that need to be made will be identified

Design Evaluation

- Potential Corrective Actions
 - Install new vent valves
 - Modify existing vent valves
 - Revise procedures
 - Implement new procedures
 - Revise calculations

Testing Evaluation

- The Testing Evaluation will consist of a review of applicable procedures
 - Periodic venting or surveillance procedures
- Revisions to surveillance procedures to incorporate acceptance criteria
- Revisions to procedures to monitor and trend; for example, UT

Corrective Actions Evaluation

- The results of evaluations of how gas accumulation is addressed by the licensee in the Corrective Action Program will be summarized

Evaluation Summary

- A list of evaluation items (Licensing, Design, Testing, Corrective Actions) that have not been completed, and a schedule and basis for that schedule will be provided

Nine-Month Response Template

- A description of the Corrective Actions that were determined to be necessary to assure compliance with the applicable regulations will be provided
- A summary of Corrective Actions that were completed, a schedule for completing the remaining Corrective Actions, and the basis for that schedule will be provided

Long Term Plans

Long Term Plans

- TS Traveler to be developed to address appropriate surveillance requirements and bases
- Gas transport in pump suction piping
- Pump acceptance criteria
 - Decision analysis

Public comment

Next meeting schedule

Close