Entergy

Entergy Nuclear Northeast
Entergy Nuclear Operations, Inc.
James A. Fitzpatrick NPP
P.O. Box 110
Lycoming, NY 13093
Tel 315-342-3840

Pete Dietrich
Site Vice President – JAF

October 14, 2008
JAFP-08-0107

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

Subject: Entergy Nuclear Operations, Inc.
James A. FitzPatrick Nuclear Power Plant
License No. DPR-59
Docket No. 50-333

Nine-Month Response to NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"

References:

1. NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems", dated January 11, 2008
2. Entergy Letter, Pete Dietrich to USNRC, "Extension Request for Response to GL 2008-01", JAFP-08-0092, dated September 12, 2008
3. ABS Consulting Report 1924850-R-001, Revision 0, Summary Report Associated with NRC Generic Letter (GL) 2008-01, Managing Gas Accumulation in ECCS, Decay Heat and Containment Spray Systems, dated October, 2008
4. ABS Consulting Report 1924850-C-002, Revision 0, GL-2008-01: Evaluation of Acceptable Void Sizes in ECCS, Decay Heat and Containment Spray Systems, dated September, 2008

Dear Sir or Madam:

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 (Reference 1) to request that each licensee evaluate the licensing basis, design, testing, and corrective action programs for the Emergency Core Cooling system (ECCS), Decay Heat Removal (DHR) system or Residual Heat Removal (RHR) system, and Containment Spray systems, 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.

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GL 2008-01 requested each licensee to submit a written response in accordance with 10 CFR 50.54(f) within nine months of the date of the GL to provide the information summarized below:

(a) A description of the results of evaluations that were performed pursuant to the requested actions. This description should provide sufficient information to demonstrate that you are or will be in compliance with the quality assurance criteria in Sections III, V, XI, XVI, and XVII of Appendix B to 10 CFR Part 50 and the licensing basis and operating license as those requirements apply to the subject systems;

(b) A description of all corrective actions, including plant, programmatic, procedure, and licensing basis modifications that were determined to be necessary to assure compliance with these regulations; and

(c) A statement regarding which corrective actions were completed, the schedule for completing the remaining corrective actions, and the basis for that schedule.

In summary, James A. FitzPatrick (JAF) concludes that the subject systems are in compliance with the Technical Specification definition of operability, i.e., capable of performing their intended safety function, and that JAF is in compliance with 10 CFR 50 Appendix B, Criterion III, V, XI, XVI and XVII, with respect to the concerns outlined in GL 2008-01. As discussed in Reference 2, JAF will complete the evaluations of the portions of systems determined to be inaccessible prior to the September 13, 2008 refueling outage and provide a supplement to this response detailing the results by March 31, 2009.

Attachment 1 of this letter contains the nine-month response to NRC GL 2008-01. Attachment 2 contains a list of the eight regulatory commitments made in this letter.

Should you have any questions or require additional information, please contact Mr. Gene Dorman, Acting Licensing Manager, at 315-349-6810.

I declare under the penalty of perjury that the foregoing information is true and correct.

Executed on this 14th day of October 2008.

Sincerely,

Pete Dietrich
Site Vice President

PD:jm

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Attachments:
1. Nine-Month Response to GL-2008-01
2. List of Regulatory Commitments

cc:

Mr. Samuel J. Collins
Regional Administrator
U.S. Nuclear Regulatory Commission, Region I
475 Allendale Road
King of Prussia, PA 19406-1415

Mr. Bhalchandra Vaidya, Project Manager
Plant Licensing Branch
U.S. Nuclear Regulatory Commission
Mail Stop O-8-C2A
Washington, DC 20555

Office of NRC Resident Inspector
James A. FitzPatrick Nuclear Power Plant
P.O. Box 136
Lycoming, New York 13093

Mr. Paul Tonko, President
New York State Energy Research and
Development Authority
17 Columbia Circle
Albany, New York 12203-6399

Mr. Charles Donaldson, Esquire
Assistant Attorney General
New York Department of Law
120 Broadway
New York, New York 10271

Mr. Paul Eddy
New York State Dept. of Public Services
3 Empire State Plaza
Albany, New York 12223-1350

James A. FitzPatrick Nuclear Power Station
Docket No. 50-333

NINE-MONTH RESPONSE TO GENERIC LETTER 2008-01

NINE-MONTH RESPONSE TO GENERIC LETTER 2008-01

This attachment contains the nine-month response to Generic Letter (GL) 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," dated January 11, 2008. In GL 2008-01, the NRC requested "that each addressee evaluate its emergency core cooling, decay heat removal 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".

In response to GL 2008-01, the James A. FitzPatrick Nuclear Power Station (JAF) provides the following information, as indicated below:

Section A — A description of the results of evaluations that were performed pursuant to the requested actions, summarized as follows:

- I. Licensing Basis Evaluation
- II. Design Basis Evaluation
- III. Testing Evaluation
- IV. Corrective Actions Evaluation

Section B — A description of the corrective actions determined necessary to ensure compliance with the quality assurance criteria in Sections III, V, XI, XVI, and XVII of Appendix B to 10 CFR Part 50 and the licensing basis and operating license with respect to the subject systems, and

Section C — A statement regarding which corrective actions have been completed, the schedule for the corrective actions not yet complete, and the basis for that schedule.

The following JAF plant systems were determined to be within the scope of GL 2008-01:

<u>High Pressure Coolant Injection (HPCI) System</u>

The HPCI System consists of a steam turbine which drives a two stage centrifugal main pump, a single stage booster pump, piping, valves, controls and instrumentation. Suction piping comes from the Condensate Storage Tanks (CST) and the suppression pool. The HPCI system does not require a keep-full system. The HPCI pump suction valves are normally open and the pump is physically located below both the CST and torus water levels which ensures adequate positive suction head. HPCI pump discharge is piped to the reactor feed-water pipe at a point just outside containment.

Core Spray (CS) System

The Core Spray (CS) system consists of two independent, 100% capacity centrifugal pumps driven by their respective electric motors. When the system is actuated, water is taken from the suppression pool. The pumps are located in the reactor building below the water level of the suppression pool. CS suction can also be lined up to the CST(s). A keep-full system is provided for both core spray discharge lines to keep the system filled with water and prevent water hammer.

Residual Heat Removal (RHR) System

The Residual Heat Removal (RHR) system consists of four AC motor driven centrifugal pumps and two heat exchangers. A keep-full system is provided to keep the system full of water and prevent water hammer. The RHR system has several modes of operation.

In the Low Pressure Coolant Injection (LPCI) mode, the RHR pumps transfer water from the suppression pool to the reactor coolant recirculation loops.

In the Suppression Pool Cooling (SPC) mode, the RHR pumps take suction from the suppression pool and pump the water through the RHR heat exchangers where cooling takes place. The cooled fluid is then discharged back to the suppression pool.

In the Containment Spray mode, the RHR pumps transfer water from the suppression pool through the RHR heat exchangers and to the redundant spray headers.

The RHR Shutdown Cooling System is excluded from the scope of GL 2008-01 due to the fact the system is a manually initiated mode of the RHR System and is placed in service during normal shutdown and cool-down, which requires manual venting and filling of the system prior to start. This ensures no voids are present.

The RHR Torus Spray and Drywell Spray piping are included in the scope of GL 2008-01 except for the portions of piping from the inboard isolation valve to the injection point which have been excluded from the scope of GL 2008-01. These pipe segments are excluded on the basis that they are open to the containment atmosphere and not required to be water filled prior to system actuation. Filling of these lines on containment spray initiation is included in the system design.

A. EVALUATION RESULTS

I. <u>Licensing Basis Evaluation</u>

The JAF licensing basis was reviewed with respect to gas accumulation in the High Pressure Coolant Injection (HPCI), Residual Heat Removal (RHR), and Core Spray (CS) Systems. This review included the Technical Specifications (TS), TS Bases, Updated Final Safety Analysis Report (UFSAR), Technical Requirements Manual (TRM), TRM Bases, responses to NRC generic communications, Regulatory Commitments, and License Conditions.

1. Licensing Basis Document Review Summary:

The above documents and regulatory commitments were evaluated for compliance with applicable regulatory requirements. The following are the results of the review:

<u>Operating License (OL)</u>

The OL does not contain any specific license conditions that address gas accumulation in the subject systems.

<u>Technical Specifications (TS)</u>

The TS Limiting Condition for Operations (LCO) and Surveillance Requirements (SR) search for references to gas accumulation or periodic venting in Emergency Core Cooling Systems (ECCS) identified the following:

- LCO 3.5.1, ECCS - Operating, states "Each ECCS injection/spray subsystem and the Automatic Depressurization System function of six safety/relief valves shall be OPERABLE."
    - o SR 3.5.1.1 states, "Verify, for each ECCS injection/spray subsystem, the piping is filled with water from the pump discharge valve to the injection valve." Frequency-31 days.
    - o The Bases for SR 3.5.1.1 states, "The flow path piping has the potential to develop voids and pockets of entrained air. Maintaining the pump discharge lines of the HPCI System, CS System, and LPCI subsystems full of water ensures that the ECCS will perform properly, injecting its full capacity into the Reactor Coolant System (RCS) upon demand. This will also prevent a water hammer following ECCS initiation signal. One acceptable method of ensuring that the lines are full is to vent at the high points and observe water flow through the vent. Another acceptable method is to verify that the associated "keep full" level switch alarms are clear. The 31 day Frequency is based on the gradual nature of void buildup in the ECCS piping, the procedural controls governing system operation, and operating experience."

- LCO 3.5.2, ECCS - Shutdown, states "Two low pressure ECCS injection/spray subsystems shall be OPERABLE."
    - o SR 3.5.2.3 states, "Verify, for each ECCS injection/spray subsystem, the piping is filled with water from the pump discharge valve to the injection valve." Frequency-31 days.
    - o The Bases for SR 3.5.2.3 states, "The flow path piping has the potential to develop voids and pockets of entrained air. Maintaining the pump discharge lines of the HPCI System, CS System, and LPCI subsystems full of water ensures that the ECCS will perform properly, injecting its full capacity into the RCS upon demand. This will also prevent a water hammer following ECCS initiation signal. One acceptable method of ensuring that the lines are full is to vent at the high points and observe water flow through the vent. Another acceptable method is to verify that the associated "keep full" level switch alarms are clear. The 31 day Frequency is based on the gradual nature of void buildup in the ECCS piping, the procedural controls governing system operation, and operating experience."

<u>Updated Final Safety Analysis Report (UFSAR)</u>

The UFSAR was searched for any reference to gas accumulation or periodic venting and the following statement concerning the operation of the Core Spray pump was identified. No discussion concerning gas accumulation or periodic venting associated with HPCI or RHR was found in the UFSAR.

- Operation of a Core Spray pump, other than in performance of its accident mitigation function, is performed with that pump train declared inoperable. Analysis performed in support of the ECCS suction strainer replacement, during the 1998 refueling outage, identified a potential for gas entrainment into a Core Spray pump if a Loss of Coolant Accident (LOCA) were to occur while the pump was operating. The limiting conditions for operation ensure that the minimum complement of ECCS subsystems is available in the event the operating Core Spray pump is degraded when the LOCA down-comers clear. [UFSAR Section 6.6]
- Due to the configuration of the suction strainer and down-comer, in the Core Spray system, the above statement only applies to the Core Spray system and not to RHR and the HPCI system suction.

<u>Technical Requirements Manual (TRM)</u>

The TRM was searched and the following requirement for the Emergency Core Cooling Systems (ECCS) Discharge Line Keep Full Alarm Instrumentation was identified.

- Perform a CHANNEL FUNCTIONAL TEST of the Core Spray and RHR System discharge line keep full alarm instrumentation on a frequency of 92 days.

Docketed Correspondence and Licensing Commitments

JAF's docketed correspondence and licensing commitments were searched. The results of this effort identified several licensing commitments relating to maintenance of plant systems in order to avoid gas accumulation.

Relevant JAF Licensing Commitments

- A-1273 NRC Inspection 50-333/75-04 – 4/2/1975

  Summary: During routine plant inspection, found damaged pipe restraints and broken snubber on containment spray line. Probable cause was due to operating the RHR system with the discharge piping not full of water. Operating only one side of RHR in shutdown cooling mode, the keep full system was not available to the other side.

  Action: Add a keep full system to the "A" RHR System.

- A-1485 Damaged Containment Spray Line Pipe Support – 3/21/1975

  Summary: During routine plant inspection, found damaged pipe restraints and broken snubber on containment spray line. Probable cause was due to operating the RHR system with the discharge piping not full of water. Operating only one side of RHR in shutdown cooling mode, the keep full system was not available to the other side.

  Action: Modify Core Spray System to provide a keep full system to avoid water hammer.

- A-2232 Proposed change to Technical Specifications - 7/25/1977

  Summary: Added level switches to the discharge piping of the Core Spray and RHR systems to monitor the discharge piping.

  Action: Add level switches to Core Spray and RHR Keep Full Systems

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- A-2583 NRC Inspection 50-333/78-19 – 11/8/1978

  Summary: On August 6, 1978, when the High Pressure Coolant Injection (HPCI) system became inoperable due to a failed suction valve the system was not declared inoperable and the required operability demonstrations of the other core cooling systems were not performed.

  Action: To support demonstration of operability revise procedures to ensure the RHR System Keep Full System is, in fact, kept full.

Docketed Correspondence and Licensing Commitments (continued)

- A-5408 NUREG-0737 Item II.B.1– New York Power Authority (NYPA) Response to NRC - 3/19/1982

  Summary: NUREG-0737 Item II.B.1

  Action: Venting of the RHR heat exchanger is accomplished through two safety related motor operated valves, installed in series and operated from the control room. Operating procedures provide the operator with guidance for venting the heat exchanger to prevent accumulation of non-condensable gases.

- A-11262 Proposed Change to Technical Specifications - 6/12/1990

  Summary: The proposed amendment to the JAF Technical Specifications updates Tables 3.7-1 ("Primary Containment Isolation Valves") and 4.7-2 ("Exception to Type C Tests") to reflect the Containment Isolation Valves in the RHR and Core Spray keep-full systems.

  Action: The RHR Keep Full System will be installed during the 1990 refueling outage and will not be declared operational until this proposed Technical Specification change has been issued by the NRC Staff. Until then, the RHR Keep Full minimum flow discharge lines will remain isolated and active equipment will be de-energized.

In summary, JAF has identified the following Licensing Basis Documents that may require change based upon recent industry collaborative efforts:

- The Technical Specification (TS) Surveillance Requirements (SR) do not address suction side piping, pump casing or discharge piping up to the discharge isolation valve. JAF recognizes that there is vulnerability for gas voiding in these areas. However, JAF does not consider this a significant safety concern since the suction piping from the Torus and CST creates a positive pressure up to the pump and there is minimal potential for gas intrusion once the suction lines are shown to be full of water and free of voids. Based upon the results of the walk downs performed by ABS, seven potential void areas were identified in suction side piping. Four of these potential voids were located in suction side dead legs and were evaluated and determined to be acceptable (Reference 3). The remaining three potential void areas were examined using Ultrasonic Testing (UT) and no voids were identified. Furthermore, under normal power operation conditions the systems have not exhibited any adverse operational characteristics indicative of air intrusion (such as pump cavitations, water hammer or vapor bound heat exchangers where applicable, etc.). Analyses performed by the Boiling Water Reactors

Owners Group (BWROG) and GE - Hitachi also agree that it is highly unlikely that suction voids will cause a concern in a BWR.

TS improvements relating to the concerns identified in the GL are being addressed by the Technical Specifications Task Force (TSTF). TS improvements under consideration include the requirement that the subject systems are maintained sufficiently filled with water. JAF continues to support the industry and Nuclear Energy Institute (NEI) Gas Accumulation Management Team activities regarding the resolution of generic TS changes via the TSTF Traveler process.

JAF will evaluate and implement as applicable approved changes to the TS and the TS Bases following NRC publication of the Notice of Approval of the TSTF Traveler in the Federal Register.

- The TS Bases for the SR currently states "Maintaining the pump discharge lines of HPCI, CS, and LPCI systems full of water ensures that the ECCS will perform properly, injecting its full capacity into the RCS upon demand." The current TS Bases does not address ensuring that suction and discharge piping up to the discharge isolation valve, including the pump casing, is sufficiently filled with water.

  JAF will evaluate and implement as applicable the appropriate TS Bases changes to support any agreed upon TS SR changes associated with the TSTF Traveler process.

- A discussion concerning gas accumulation or periodic venting associated with HPCI or RHR was not found in the UFSAR. Reference is given to the ECCS availability in the event a CS pump is rendered inoperable as a result of gas entrapment during a LOCA. The current UFSAR does not address ensuring that the subject systems remain sufficiently filled with water in order to be relied upon during design basis accidents.

  JAF will revise the UFSAR to add a statement that the subject systems are kept sufficiently filled with water to ensure that the systems remain operable and perform properly.

- Licensing Commitment A-5408 commits to venting the RHR Heat Exchangers (HX) from a piping location configured lower than the high point. Venting from the committed location does not allow for the full venting of the RHR Heat Exchanger Inlet header.

  JAF will revise the current Licensing Commitment A-5408 to reflect the use of manual vent valves in conjunction with the motor operated valves on the RHR HX and inlet header configuration.

2. Summary of Completed Changes to Licensing Basis Documents:

There have been no changes to the Licensing Basis Documents in response to the concerns identified in the GL at this time.

3. Summary of Proposed Licensing Basis Document Changes.

As itemized in Item 1 of this section, JAF proposes the following changes to the plant Licensing Basis Documents:

a. JAF will revise the UFSAR to add a statement that the subject systems are kept sufficiently filled with water to ensure that the systems remain operable and perform properly.

   CR No: LO-LAR-2008-00020 CA-00011

   Completion date: 4/30/2009

   Basis: Provides time to prepare and process the revision.

b. JAF will revise Licensing Commitment A-5408 to reflect the use of manual vent valves in conjunction with the motor operated valves on the RHR HX and inlet header configuration.

   CR No: LO-LAR-2008-00020 CA-00012

   Completion date: 4/30/2009

   Basis: Provides time to prepare and process the revision.

c. JAF will evaluate and implement as appropriate proposed changes to the plant TS based upon the final, approved TSTF Traveler following NRC publication of the Notice of Approval of the TSTF Traveler in the Federal Register.

   CR No: LO-LAR-2008-00020 CA-00013

   Completion date: 90 days following NRC publication of the Notice of Approval of the TSTF Traveler in the Federal Register

   Basis: Provides time to prepare and process the revision.

d. JAF will evaluate and implement as appropriate a change to the TS Bases SR 3.5.2.3 to change the term "full" of water to become "sufficiently full of water".

   CR No: LO-LAR-2008-00020 CA-00014

   Completion date: 90 days following NRC publication of the Notice of Approval of the TSTF Traveler in the Federal Register

   Basis: Provides time to prepare and process the revision.

II. Design Evaluation

The James A. FitzPatrick Nuclear Power Plant (JAF) design basis was reviewed with respect to gas accumulation in the Emergency Core Cooling, Residual Heat Removal, and Containment Spray Systems. This review included Design Basis Documents, Calculations, Engineering Evaluations, and Vendor Technical Manuals.

1. Design Basis Document Review Summary

The JAF review did not identify any specific design requirements relating to acceptable void size for the subject systems. The review of the design basis included design requirements relating to the following:

a. Surveillance requirements for ensuring discharge piping are periodically vented to ensure piping is sufficiently filled with water.

b. Requirements to have keep-fill systems for the RHR and CS systems that are provided to ensure that the pump discharge piping remains sufficiently filled with water.

c. Statements about the HPCI system's elevation with respect to the elevation of the CST that ensures a net positive suction head.

d. Statements on modes of operation (e.g., RHR Containment Spray) that include empty sections of pipe (i.e., where the systems inject into the reactor vessel).

e. Statements about system realignments (e.g., HPCI Suction transfer from CST to Torus) and how system remains full of water.

f. Vortex correlations used to establish minimum water level set-points.

g. Statements about how the specific Design Criteria are met and applied to the station design.

h. Mission times for system operations (e.g., system initiation times, time to rated flow requirements).

System Walk-downs

Elements addressed during the walk-downs included:

a. Verification that vents are in the proper location for both horizontal and vertical pipes.

b. Verification that piping is sloped in the proper direction.

c. Verification that horizontal runs of pipe do not contain local high points.

All susceptible piping in each of the identified systems was walked down, the pipe slope measured and recorded, and the vent locations identified. This included pump suction piping from the Condensate Storage Tank (CST) and the suppression pool and pump discharge piping up to the containment penetrations. Pump flow test lines that return to the suppression pool have been evaluated and all piping on the pump suction side, with the possibility of transporting accumulated gas to the pump suctions under postulated post-accident flow scenarios, have been evaluated. In addition, discharge piping that could either deadhead gas pockets or sweep gases into the Reactor Coolant System (RCS) or containment have also been evaluated.

The RHR Torus Spray and Drywell Spray piping are included in the scope of GL 2008-01 except for the portions of piping from the inboard isolation valve to the injection point which have been excluded from the scope of GL 08-01. These pipe segments are excluded on the basis that they are open to the containment atmosphere and not required to be water filled prior to system actuation. Filling of these lines on containment spray initiation is included in the system design. The Reactor Core Injection Cooling (RCIC) System, although credited in the FSAR for the loss of feed water transient, is not considered an Emergency Core Cooling System (ECCS) therefore is being excluded from the evaluation of this Generic Letter. The exclusion of this system is consistent with industry peers.

The Shutdown Cooling System is excluded from the scope of GL 2008-01 due to the fact that this system is a manually initiated mode of the RHR System and is placed in service during normal shutdown and cool down, which requires manual venting and filling of the system prior to start. This ensures no voids are present.

2. Applicable Gas Volume Acceptance Criteria, Corrective Actions, and Schedule.

a. <u>ECCS Suction Piping</u>

Based on evaluation of the gas intrusion data that was reviewed by the BWROG and GEH, a bounding 2% by volume continuous suction gas void fraction is acceptable. However, due to the lack of test data or operating experience of pump operation above 120% of the Best Efficiency Point (BEP), it is recommended that pumps which operate above this point be limited to a 1% allowable continuous void fraction. System operability would still need to be assessed for either limit above, including such factors as required NPSH versus available NPSH, duration of gas flow, and transients for which the system is credited.

Gas accumulation in the suction lines of BWR ECCS systems is not expected to occur. If a gas void is found in a suction line it will be a fixed volume and will not cause a continuous gas void flowing through the pump. As such it is overly conservative to apply the above void criteria to these types of voids.

To evaluate pump and system effects of a void of a fixed known volume, it is appropriate to use the guidance developed by GEH and the BWROG, that an average void fraction less than 20% can be tolerated by the pump for a period of 5 seconds. However, since this criterion is qualitative in nature, a more conservative guideline of an average 10% void fraction for no greater than 5 seconds is recommended for use.

This guidance is generic and conservative. It is intended for evaluating short term system operability due to a void found in the ECCS suction piping and not for long term design basis. A plant specific evaluation of any voiding discovered in the suction piping is not precluded and may provide a larger acceptable void fraction.

The ABS analysis (Reference 4) determines acceptable void sizes that could potentially be found in pump suction piping in the ECCS and determines the maximum pressure and pipe segment pressurization rate that could result from void compression following pump start. These systems included RHR, HPCI and CS.

b. Discharge Piping Susceptible to Pressure Pulsation.

A significant flow transient can result when a water mass is accelerated into a non-condensable gas volume as the result of a pump start or the opening of a valve. This acceleration is due to a pressure difference acting on the available water mass with the subsequent motion compressing the gas volume thereby increasing the pressure. Eventually, the gas volume pressure exceeds the pump shutoff head pressure or the stagnation pressure of the water upstream of the valve and the water begins to decelerate. If this deceleration process occurs faster than the resulting compression pressure waves caused by the continued compression of the gas volume, the hydrodynamic process is essentially governed by the acoustic transmission of these pressure waves through the water in the piping. Consequently, this evolves into a gas-water water hammer event and the accompanying force imbalances on the piping segments can be sufficient to challenge the piping supports and restraints.

The BWROG and GEH work demonstrates that any voids for the sections of piping downstream of the first normally closed motor operated isolation valve will not create a water hammer that could challenge the operability of those systems when required to mitigate any postulated events. Any pressure transients occurring due to voids are accounted for in the original piping design margin.

Given the above, the concerns of GL 2008-01 are addressed for the Low Pressure Coolant Injection (LPCI), High Pressure Coolant Injection

(HPCI) and Core Spray (CS) systems. Containment Spray systems are designed to be voided in standby. No further actions in verifying the piping's actual configuration are necessary to address GL 2008-01 for the discharge piping downstream of the isolation valves.

A joint Owner's Group program evaluated pump discharge piping gas accumulation. Gas accumulation in the piping downstream of the pump to the first closed isolation valve or the RCS pressure boundary isolation valves will result in amplified pressure pulsations after a pump start. The subsequent pressure pulsation may cause relief valves in the subject systems to lift, or result in unacceptable pipe loads, i.e., axial forces that are greater than the design rating of the axial restraint(s). The joint Owner's Group program establishes a method to determine the limit for discharge line gas accumulation to be utilized by the member utilities. The method uses plant specific information for piping restraints and relief valve set points in the subject systems to determine the acceptable gas volume accumulation such that relief valve lifting in the subject systems does not occur and pipe loading is within acceptable limits, i.e., axial forces that are less than the design rating of the axial restraint(s).

Entergy has established the applicable limits for gas accumulation in the discharge piping of the subject systems based upon the joint Owners Group methodology. JAF procedures provide assurance that any gas in the subject systems discharge piping is limited to within the acceptance criteria determined by the JAF specific application of the joint Owner's Group program method.

c. <u>ECCS Downstream Piping</u>

An analysis of ECCS piping downstream of the injection valves has been completed and a determination made that the existence of air voids in this piping except for HPCI will have no adverse consequences related to accident conditions. Even if small voids did exist the pressure transient would not be greater than the normal injection pressure.

The BWROG and GEH work demonstrates that any voids for the sections of piping downstream of the first normally closed motor operated isolation valve will not create a water hammer that could challenge the operability of those systems when required to mitigate any postulated events. A portion of piping that discharges into the vessel, or lines directly connected to the vessel, will void (due to flashing) during vessel de-pressurization and are designed accordingly. Any pressure transients occurring due to voids are accounted for in the original piping design margin.

d. <u>Affects of RCS Gas Ingestion</u>

A conservative "worst case" scenario evaluation providing a limiting LOCA Peak Clad Temperature (PCT) heat-up rate of 12 °F/s is determined for the entire U.S. BWR fleet. Using this heat-up rate, 48 °F of

PCT impact is assessed with a maximum of 4-second delay in the ECCS actuation.

An assessment justified that gas voids passing through the core do not pose an additional safety concern mainly because of the unlikely path for air to get into the core and high void conditions in the core present during LOCA.

Assessments on the Loss Of Feed Water (LOFW) and Anticipated Transient Without Scram (ATWS) events concluded that a delay of 5 seconds in ECCS flow would affect the analysis results insignificantly and have no impact on meeting the acceptance criteria. The evaluation of station blackout events indicates that a delay of 10 seconds would not impact the ability of the water makeup system to maintain the vessel water level above the top of active fuel. Similarly, it is concluded that a delay of 10 seconds would have an insignificant impact on meeting the acceptance criteria in Appendix R fire safe shutdown analysis.

3. Design Basis Document Change, Corrective Actions and Schedule Summary

No changes to the existing Design Basis Documents are required.

4. Piping and Instrument Drawing (P&ID) and Isometric Drawing Reviews

The walk-down drawings for RHR, CS, and HPCI are included in Reference 3 to aid personnel performing the reviews. The grade elevation drawings were developed using the support stress isometrics, P&IDs and walk-down data. They show the component and pipe elevation relative to the system flow path, reactor, CST and Torus. A table top review of drawings (flow and isometrics) was conducted to identify potential gas accumulation areas.

5. New Vent Valve Locations, Modifications, Corrective Actions

No new vent valve locations, modifications to existing vent valves, or utilization of existing vent valves that were previously considered to be in inaccessible areas, were identified based on the drawing review.

6. Summary of System Walk-Downs

JAF has completed the system walk-downs of piping inside and outside containment, both insulated and non-insulated. The results are summarized as follows:

<u>Walk-Down Exceptions</u>

A walk-down of piping, both non-insulated and insulated, inside and outside of containment, has been completed with the exception of the inaccessible pipe areas identified below:

- HPCI suction piping from CST Pit to Reactor Building Wall – Buried
- RCIC suction piping from CST Pit to Reactor Building Wall – Buried
- CS suction piping from CST Pit to Reactor Building Wall – Buried
- CS suction piping from CST in East Crescent – inaccessible without scaffolding
- Portion of RHR Train B Containment Spray line overhead at 300' RX BLD NE – inaccessible without scaffolding
- Portion of RHR Trains A to LPCI in West Crescent – inaccessible without scaffolding
- Portion of RHR Trains B to LPCI in East Crescent – inaccessible without scaffolding

Due to the satisfactory results of the piping that was accessed for the walkdowns and the history of few air voiding events at JAF, it was not necessary to perform walkdowns of the inaccessible sections of this piping. In addition, collegial reviews of systems piping diagrams did not cite areas where gas intrusion may be of concern in the piping that was not walked down. The aforementioned review conclusion was corroborated by the ABS evaluation which did not require additional walkdowns and void testing of the piping that was not walked down.

Portions of Systems in Containment, High Radiation Areas, etc

A walk-down of piping inside containment, both insulated and non-insulated, was completed during RO18 in September, 2008.

Walk-down Priorities

A prioritized walk-down list of piping sections was developed based on the Core Damage Frequency number assigned by the site specific PRA. All walk-downs have been completed. No further walk-downs are scheduled.

Walk-Down Documentation

All aspects of the walk-down activities are documented in Reference 3. A walk-down of piping inside containment, both insulated and non-insulated, was completed during RO18 in September, 2008.

As-Built Discrepancies

No as built discrepancies were identified as a result of the walk-downs.

Vent Location Verification

Based on a review of Reference 3 and the ABS generated isometrics, all vents were found to be located properly along the length of the piping sections and around the circumference of the pipe.

Areas Vulnerable to Gas Accumulation

In Reference 3, 13 areas of potential concern for gas voiding were identified. Two of these locations are located in the RCIC system which is not within the scope of this evaluation. The remaining eleven locations were inspected using ultrasonic testing methods. No locations were found to have areas of voiding that exceeded the engineering criteria for acceptability.

High Points Due to Closed Valves in Vertical Runs

High points identified under this attribute were associated valves 10MOV-27A & B were identified by ABS (Reference 3). These valves are listed in Table 4.5 of that report as ID numbers 8 and 9. UT examination demonstrated that these areas were full of water and were, therefore, not a concern.

System Heat Exchanger U-Tubes

The RHR Heat Exchangers (HX) are lower than the system high point vent valves. Entrained air within the shell side of the RHR heat exchangers will migrate out of the heat exchanger to the high point vent valves due to elevation difference. The RHR HX have vent valves to vent air voids from the shell side; however, sufficient procedural guidance does not exist to address system / equipment venting following maintenance activities and on a prescribed frequency during normal plant operation.

OP-13D was enhanced September 2008 to include RHR HX vents (10RHR-451A &B) to ensure system venting to lessen the likelihood of a Shutdown Cooling System trip on pump start due to hydraulic transient.

Traps Resulting From Horizontal Pipe Diameter Transitions

This attribute was addressed and bounded by ABS evaluation (Reference 3).

Tees Where Gas Can Pass Into Stagnant Piping

This attribute was addressed and bounded by ABS evaluation (Reference 3).

Valve Bonnets

Valve bonnets were addressed and bounded by ABS evaluation (Reference 3).

Pump Casings

Pump casings were addressed and bounded by ABS evaluation (Reference 3).

7. New Vent Valve Locations Resulting from Plant Walk-downs

The walk-downs inside and outside containment did not identify the need for any additional vent valves.

8. Fill and Vent Activities, Procedures and Reviews

A review of JAF procedures for filling and venting determined that adequate procedural guidance is in place to ensure that the subject systems are sufficiently filled with water. This determination is validated by the results of UT exams conducted during R18 which demonstrated that the subject systems remain sufficiently filled with water.

Procedural areas identified for revision are to further enhance existing plant methods and processes. These include enhancements which ensure the filling and venting of piping in the subject systems and the venting of locations where gas may accumulate.

JAF does not have high point locations that do not currently contain vents. There are some high point vents that are not currently used for venting however; procedural enhancements are being made to correct this issue.

JAF currently has no plans to utilize dynamic venting methods for filling and venting plant systems. Utilizing vacuum filling methodology is also not being considered due to the limited amount of air voiding evidenced in the subject systems.

9. Fill and Vent Procedure Revisions, Corrective Actions, and Schedules

As discussed above JAF will implement the following enhancements to the existing procedural guidance

a. Revise system operating procedures for systems within the scope of this response to ensure each section of piping is filled and vented.

   CR No. LO-LAR-2008-00020 CA-00015

   Completion date: 4/30/2009

   Basis: Provides time to prepare and process the revision.

10. Potential Gas Intrusion Mechanisms

a. RCS Leakage Resulting in Steam pockets or Hydrogen Coming Out of Solution.

   Leakage coming from the RHR or CS systems will not form a steam pocket or result in hydrogen coming out of solution. Leakage from these systems does not create a drop in system pressure since the pressurized keep full supply constantly pressurizes the systems. Additionally, any leak path from RHR or CS would be discovered during Operations and system engineering walkdowns.

b. Pressure Reduction Through Valves, Orifices, Elevation Changes, Venting, etc.

   ECCS systems are typically in standby. There are no High / Low pressure interfaces. The keep full systems are a Low / Low pressure interface. During system operation gas that comes out of solution as a result of a pressure drop due to orifice, control valve, or screen geometries, would be flow induced and will be swept away.

c. Inadvertent Draining, System Realignments, etc.

   JAF level alarm indication in the control room ensures that systems are operable following realignments. These instruments undergo periodic functional testing which demonstrate that they can be relied upon.

d. System Response to Loss of Keep-Full System

   Procedural guidance is provided, including adequate warnings on water hammer issues, during system restoration in the event air intrusion occurs.

e. Air In-leakage Through System Pathways Allowing Drain Back

   Air in-leakage through system pathways which allow drain back to the system would not occur unless a leak was present. The suction piping for the RHR and CS are pressurized from the torus. The discharge piping is continuously pressurized with a keep-full system. The HPCI suction and discharge piping is pressurized from the CST. Should a leak occur that could cause air in leakage, this would be noticed by operator rounds or by level indications in the Torus or the CST.

f. Failure of Tank Level Indication on Pump Suction Sources

   Tank Level Instrumentation for the HPCI and RCIC Systems provides instrumentation redundancy for each system (HPCI and RCIC) as well as a tertiary tank level indication independent of the two systems. While there is a potential for a singular level instrument failure to occur, the likelihood of a total loss of CST level indication is unlikely. Therefore, gas intrusion due to a failure of CST level indication is not probable.

g. Leakage Through Isolation Valves or Check Valves

Air in-leakage through system pathways which allow drain back to the system would not occur unless a leak was present. The suction piping for the RHR and CS are pressurized from the torus. The discharge piping is continuously pressurized with a keep-full system. The HPCI suction and discharge piping is pressurized from the CST. Should a leak occur that could cause air in leakage, this would be noticed by operator rounds or by level indications in the Torus or the CST.

h. Leakage Through Vent Valves

The local system pressure will not be less than nominal atmospheric pressure, as the RHR & Core spray suction is pressurized to Torus head of water and the discharge is pressurized to keep full system pressure.

i. Elevated Temperatures Resulting From Thermal Contact With RCS Piping or Isolation Valves.

Leakage through ECCS injection isolation valves could result in high pressure and high temperature reactor coolant entering low pressure discharge lines. At JAF, leak testing requirements, including 10CFR Appendix J, of the discharge isolation and check valves reduces the feasibility of this scenario.

j. Vortices and System Draining Anomalies

Evaluation of HPCI and RCIC vortexing in the CST determined that there is sufficient submergence depth to prevent vortexing in the CST. Gas bubbles on the top surface that are formed from return lines flowing into the CST suction line are currently being evaluated by Alden Research Lab. The results of the Alden Research Lab analysis will be discussed in JAF's supplemental response to be provided by March 31, 2009.

HPCI, RCIC, RHR and CS torus suction strainer vortexing has been evaluated and determined that vortexing will not occur at suction strainers based on the submergence depth being sufficient to prevent vortexing.

k. Air-Operated Valve Design Vulnerabilities

Air operated valves have diaphragm operators that actuate the valve. The air operator does not communicate with the pipe pressure boundary where the concern exists for air intrusion.

I. Plant Specific Methods of Gas Intrusion.

Off-gassing of non-deoxygenated water used during system filling and venting following maintenance activities (given enough time) will provide a gas intrusion mechanism. This concept is thought to be equally applicable following system operation in support of plant operations or surveillance testing. For these reasons, the recommendation for consideration of conducting periodic system venting was developed. Otherwise, there are no other methods of gas intrusion that have not already been identified.

11. Actions Not Yet Completed, Schedule and Basis

a. Revise system operating procedures for the RHR heat exchangers to include instructions for venting via the high point vent valves.

CR No. LO-LAR-2008-00020 CA-00016

Completion date: 04/30/2009

Basis: Provides time to prepare and process the change.

b. Evaluate RHR Heat Exchanger vent line for a configuration enhancement to reduce dose when venting and use of level switches to monitor for gas accumulation.

CR No. LO-LAR-2008-00020 CA-00017

Completion date: 04/30/2009

Basis: Provides time to prepare and process the change.

III. Testing Evaluation

1. Procedure Reviews, Corrective Actions, and Schedule

A review of JAF test procedures determined that adequate procedural guidance is in place which ensures that the subject systems are sufficiently filled with water. Procedural areas identified for revision are to further enhance existing plant methods and processes. The following items will be considered for improving current procedural guidance:

- Periodic venting of Level Switches and installed system vent locations. Consideration of venting at installed system vent locations could be an enhancement to the existing surveillance tests (which would address frequency of performance).
- Enhanced procedural guidance will be considered for filling / venting systems following maintenance activities.

2. RHR in Shutdown Cooling (SDC) Mode

The Shutdown Cooling System is excluded from the scope of GL 2008-01 due to the fact this system is a manually initiated mode of the RHR System. SDC is placed in service during normal shutdown and cool down, and it requires manual venting and filling of the system prior to start. This ensures no voids are present.

3. Inadvertent Draining Due to Valve Manipulations, System Realignments, etc.

JAF work management system requires work to be performed on a divisional basis, thereby, preventing cross connecting divisional loops which is the pre-cursor to inadvertent drain down. Additionally, JAF procedures provide notes and cautions for manipulations that could cause inadvertent drain downs.

3. Documenting and Trending Documented Gas Voids

Current surveillance test procedures as referenced in section 6.1 of Engineering Report JAF-RPT-2008-00015, were revised to ensure that "any" air noticed during venting operations gets documented per a condition report. Actual volume is not determined since air quantities currently cannot be accurately measured in an effective and cost efficient manner.

While no acceptance criteria have been established to quantity gas volume, procedure ST-4B, Revision 56, "HPCI Monthly Operability Test" does require a determination of the amount of air released during venting. The amount of air must be characterized as either "significant" or "insignificant" based on the following definition. A significant amount of air is defined as requiring "more than 1 minute to obtain a solid stream of water from hose".

JAF will continue to monitor this issue with the industry as they determine the best means available for performing this task. If acceptance criteria are developed along with measurement means, JAF will evaluate and revise the venting procedures as appropriate at that time to incorporate the standards.

5. Corrective Actions Not Yet Completed, Schedule and Basis

a. Revise test procedures to ensure venting information is trended.

   CR No. LO-LAR-2008-00020 CA-00018

   Completion date: 04/30/2009

   Basis: Provides time to prepare and process the change.

b. Develop a program to monitor and trend gas accumulation in ECCS systems within the scope of this report. The program intent would be to conduct monitoring and could be suspended if trending indicates no issues have developed in the specific systems.

   CR No. LO-LAR-2008-00020 CA-00019

   Completion Date: 04/30/2009

   Basis: Review and analysis of R018 walkdowns and industry initiatives regarding managing gas accumulation need to be assessed in developing the program.

IV. Corrective Actions Evaluation

1. Review Summary of the Results

No immediate corrective actions are required based on the evaluation performed for GL-2008-01. Walkdowns identified potential void areas that were verified to be full of water or analyzed as acceptable. No Plant damage has been identified as attributable to gas accumulation.

UT examinations were performed on the eleven areas identified in Reference 3 that were within the scope of this evaluation. No as-found, non-conforming gas accumulations were discovered as a result of these examinations.

2. Actions Not Yet Completed, Schedule and Basis

This review identified several enhancements to licensing bases documents and procedures to fully implement the guidance in GL 2008-01. Those enhancements, their scheduled completion dates and the bases for the scheduled dates are addressed in Sections A.I, A.II and A.III above.

V. Conclusion

Based upon the evaluations completed and documented herein, JAF concludes that the evaluated systems are in compliance with the current licensing basis, design bases and applicable regulatory requirements and are operable. Upon completion of the identified enhancements, suitable design, operations and testing control measures are or will be in place for maintaining compliance.

The open actions cited above are considered to be enhancements to the existing programs/processes/procedures for assuring continued operability of the subject systems.

As committed in Reference 2, JAF will complete the evaluations of the portions of systems determined inaccessible prior to the September 13, 2008 refueling outage and provide a supplement to this report detailing the results by March 31, 2009. If it is determined that additional actions are required based on the completed evaluations, such actions will be specified in the supplement and will include a schedule for completion and the basis for the schedule.

B. DESCRIPTION OF NECESSARY CORRECTIVE ACTIONS

Based on the evaluations documented in Engineering Report JAF-RPT-2008-00015 no corrective actions are required to ensure compliance with the applicable regulations.

C. CORRECTIVE ACTION SCHEDULE

As discussed in Section B above, the evaluation documented in Engineering Report JAF-RPT-2008-00015 did not identify any corrective actions. Section one documents a number of licensing bases and procedural enhancements to ensure continued compliance with the regulatory requirements. The specific enhancements, schedule for their completion, and the bases for the schedule is addressed in Sections A.I, A.II, and A.III of this response. Those Items which are required to ensure continuing compliance with the regulatory requirements are identified in Attachment 2 as Regulatory Commitments.

Attachment 2 to JAF-08-0107

James A. FitzPatrick Nuclear Power Station
Docket No. 50-333

LIST OF REGULATORY COMMITMENTS

LIST OF REGULATORY COMMITMENTS

The following table identifies those actions committed to by Entergy in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments.

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Revise the UFSAR to add a statement that the subject systems are kept sufficiently filled with water to ensure that system remains operable and performs properly.	X		04/30/09
Revise Licensing Commitment A-5408 to reflect the use of manual vent valves in conjunction with the motor operated valves on the RHR HX and inlet header configuration.	X		04/30/09
Evaluate and implement as appropriate proposed changes to the plant TS based upon the final, approved TSTF Traveler following NRC publication of the Notice of Approval of the TSTF Traveler in the Federal Register.	X		90 days following NRC publication of the Notice of Approval of the TSTF Traveler in the Federal Register
Evaluate and implement as appropriate the TS Bases SR 3.5.2.3 to change the term "full" of water to become "sufficiently full of water"	X		90 days following NRC publication of the Notice of Approval of the TSTF Traveler in the Federal Register

COMMITMENT	TYPE (Check one)		SCHEDULED COMPLETION DATE
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
Revise system operating procedures to ensure each section of piping is filled and vented.	X		04/30/09
Revise system operating procedures for the RHR heat exchangers to include instructions for venting via the high point vent valves.	X		04/30/09
Revise test procedures to ensure venting information is trended.	X		04/30/09
Develop a program to monitor and trend gas accumulation in ECCS systems within the scope of this report. The program intent would be to conduct monitoring and could be suspended if trending indicates no issues have developed in the specific systems.	X		04/30/09