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Waterford 3

W3F1-2008-0068

October 14, 2008

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

Subject: Nine-Month Response to NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"
Waterford Steam Electric Station, Unit 3 (Waterford 3)
Docket No. 50-382
License No. NPF-38

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 W3F1-2008-0036 to the NRC, "Three-Month Response to Generic Letter 2008-01, Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," dated May 12, 2008.
3. NRC letter to Kevin Walsh, Waterford Steam Electric Station-Re: Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," Proposed Alternative Course of Action, dated September 9, 2008.
4. Entergy letter W3F1-2008-0064 to the NRC, "Response to Request for Additional Information regarding Generic Letter (GL) 2008-01 Proposed Alternative Course of Action and Request for a Revised 3-Month Response Letter Waterford Steam Electric Station, Unit 3," dated September 23, 2008.

Dear Sir or Madam:

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 dated January 11, 2008 (Reference 1), to request that each licensee evaluate their licensing basis, design, testing, and corrective action programs for the Emergency Core Cooling Systems (ECCS), Shutdown Cooling System (SDC), and Containment Spray Systems (CSS) to ensure that gas accumulation is maintained less than the amount that challenges

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operability of these systems, and that appropriate actions are taken when conditions adverse to quality are identified.

The GL 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 following information:

a. A description of the results of evaluations that were performed pursuant to the requested actions of the GL. 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 of the GL.

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

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

Entergy has evaluated the accessible portions of those Waterford 3 systems that perform the functions described in GL 2008-01 and has concluded that these systems are operable, as defined in the Waterford 3 Technical Specification, and are in conformance with Waterford 3 commitments to the applicable General Design Criteria as stated in the Waterford 3 USFAR.

Entergy will complete its evaluation of the inaccessible portions of these systems by startup from the next scheduled refueling outage in the Fall 2009 and will provide a supplement to this response within 90 days thereafter.

This letter contains five commitments in Attachment 2. Commitments 2, 3, 4, and 5 are new commitments; commitment 1 supersedes, in its entirety, previously specified commitment numbers 2 and 3 in Reference 2 and commitment 2 in Reference 4.

Please contact me or Robert J. Murillo, Manager, Licensing at (504) 739-6715 if there are any questions regarding this submittal.

I declare under penalty of perjury that the foregoing is true and correct. Executed on October 14, 2008.

Sincerely,

TJG/GCS/ssf

Attachments: 1. Nine-Month Response to NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems"
2. List of Regulatory Commitments

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Attachment 1

W3F1-2008-0068

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

This Attachment contains the Waterford 3 Nine-Month response to NRC 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 ECCS, DHR 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 following information is provided in this response:

a) a description of the results of evaluations that were performed pursuant to the requested actions (see Section A of this Attachment),

b) a description of the corrective actions determined necessary to assure 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 (see Section B of this Attachment), and

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 (see Section C of this Attachment).

The following systems were determined to be in the scope of GL 2008-01 for Waterford 3:

- Emergency Core Cooling System (ECCS) consisting of High Pressure Safety Injection (HPSI) and Low Pressure Safety Injection (LPSI)
- Shutdown Cooling System (SDC)
- Containment Spray System (CS)

A. EVALUATION RESULTS

The following are the results of evaluations that were performed pursuant to the requested actions:

Licensing Basis Evaluation

The Waterford 3 licensing basis was reviewed with respect to gas accumulation in the Emergency Core Cooling (ECCS), Shutdown Cooling (SDC), and Containment Spray (CS) Systems. This review included the Technical Specification (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. Summarize the results of the review of these documents:

The above documents and regulatory commitments were evaluated for compliance with applicable regulatory requirements. The evaluation was performed utilizing Entergy's licensing document search engine, Autonomy, to ensure that all applicable licensing documents concerning the gas accumulation in ECCS, SDC and CS were identified and reviewed for compliance. Licensing documents associated with the gas accumulation issue were reviewed to ensure that there were no conflicts with any system or component function or testing methodologies. The review determined that there were no weaknesses or deficiencies in the reviewed licensing basis documents.

Entergy is continuing to support the industry and NEI Gas Accumulation Management Team activities regarding the resolution of generic TS changes via the Technical Specification Task Force (TSTF) traveler process and other on-going industry efforts. After NRC approval of the traveler, Entergy will evaluate its applicability to Waterford 3 and evaluate adopting the traveler to either supplement or replace the current TS requirements.

Entergy's continued support of the industry and NEI Gas Accumulation Management Team activities also includes participation in on-going industry research. Entergy will evaluate subsequent NEI recommendations resulting from that research for applicability to Waterford 3 and will evaluate those recommendations for implementation.

2. Summarize the changes to licensing basis documents (corrective actions):

The review determined that there were no weaknesses or deficiencies in any Licensing documents, and therefore no corrective actions are required.

Entergy is involved with the TS improvement endeavor being addressed by the TSTF, which will provide enhancements to current plant licensing documents which will be evaluated for implementation at Waterford 3.

3. **Provide a detailed list of items that have not been completed, a schedule for their completion, and the basis for that schedule.**

TS improvements are being addressed by the TSTF to provide an approved TSTF traveler for making changes to individual licensee's TS related to the potential for unacceptable gas accumulation. The development of the TSTF traveler relies on the results of the evaluations of a large number of licensees to address the various plant designs. Entergy is continuing to support the industry and NEI Gas Accumulation Management Team activities regarding the resolution of generic TS changes via the TSTF traveler process. After NRC approval of the traveler, Entergy will evaluate its applicability to Waterford 3 and evaluate adopting the traveler to either supplement or replace the current TS requirements.

Design Evaluation

The Waterford 3 design basis was reviewed with respect to gas accumulation in the Emergency Core Cooling, Shutdown Cooling, and Containment Spray Systems. This review included Design Basis Documents, calculations, engineering evaluations, and vendor technical documentation.

1. **Discuss the results of the review of the design basis documents. This discussion should include a description of any plant specific calculations or analyses that were performed to confirm the acceptability of gas accumulation in the piping of the affected systems, including any acceptance criteria if applicable. This describes the "as found" (pre Generic Letter) condition prior to any corrective or enhancement actions.**

As an overview of Waterford 3's history in management of gas accumulation in ECCS systems, condition reports have been initiated and evaluated as early as 1993. In 1996 and after, it was determined that nitrogen entrainment in system water was the cause of gas accumulation, at which time "allowable" gas accumulation sizes were calculated and operability limits established for piping systems/loops affected by gas accumulation. Tasks were established for periodic ultrasonic testing (UT) to monitor "as-found" gas accumulation volumes, and tasks were established for periodic venting of gas accumulation from ECCS systems.

Allowable gas accumulation volumes have been refined over the years for operability determinations, and allowable gas accumulation volumes have been determined for "operable but degraded" conditions. Current gas accumulation allowable volume limits are as follows:

- LPSI 'A' Loop

  Operable and Full of Water Limit - A 0.7 ft^3 gas accumulation in each injection leg (at valves SI-133A and SI-1402A) and a 0.7 ft^3 gas accumulation in each injection leg (at valves SI-134A and SI-1412A) is acceptable as evaluated by

Engineering Request ER-W3-2002-0468-000, Section 3.1, page 7, "Pressure Spike." This allowable gas accumulation applies to pump discharge piping in both the injection mode and in the Shutdown Cooling mode of operation. The specified allowable gas accumulation size is limited by the hydraulic transient force which would exceed the set pressure of relief valve SI-132A during shutdown cooling (pump discharge). Vortexing and NPSH were evaluated by Calculation ECM07-001, "NPSH Analysis of Safety Injection and Containment Spray Pumps," and by Engineering Change EC-1002 and determined to have adequate margin to ensure operability.

Operable But Degraded Limit - A 4 ft^3 gas accumulation was determined to be acceptable for the 'A' loop per CR-WF3-2002-0818 and ECP02-004, "Operability Evaluation of LPSI A Discharge Piping (Study Calculation)." The 4 ft^3 gas accumulation may be at each containment injection leg penetration (38 and 39) or at each high point vent (SI-133A and SI-134A) simultaneously, but the total for each leg is still limited to 4 ft^3 total. This allowable gas accumulation applies to pump discharge piping in both the injection mode and in the Shutdown Cooling mode of operation.

Additionally, Calculation ECM03-003, "Shutdown Cooling Operation with Suction Piping Air Intrusion," evaluates normal operation and small break Loss of Coolant Accident (LOCA) with and without operation of reactor coolant pumps and finds that a maximum allowable gas accumulation size of 37.4 ft^3 at SI-405 (suction side for Shutdown Cooling) was acceptable.

- LPSI 'B' Loop

Operable and Full of Water Limit - A 0.8 ft^3 total gas accumulation for discharge piping and the combined total of each injection leg is acceptable as evaluated by ER-W3-2003-0112-000, Page 7, "Pressure Spike." This allowable gas accumulation applies to pump discharge piping in both the injection mode and in the Shutdown Cooling mode of operation. The specified allowable gas accumulation size is limited by the hydraulic transient force which would exceed the set pressure of relief valve SI-132B during shutdown cooling (pump discharge). Vortexing and NPSH were evaluated by Calculation ECM07-001 and by Engineering Change EC-1002 and determined to have adequate margin to ensure operability.

Operable But Degraded Limit - A 1.802 ft^3 gas accumulation at Penetration 36 or 1.229 ft^3 gas accumulation at Penetration 37 was determined to be acceptable for the 'B' train per ECM97-002, "Water Hammer Analysis-LPSI 'B'." This allowable gas accumulation applies to pump discharge piping in both the injection mode and in the Shutdown Cooling mode of operation.

Additionally, Calculation ECM03-003 evaluates normal operation and LOCA (small break) with and without Reactor Coolant Pumps and finds that a maximum allowable gas accumulation size of 37.4 ft^3 at SI-405 (suction side for Shutdown Cooling for either train) was acceptable.

- HPSI 'A' Loop

  Operable and Full of Water and Operable But Degraded Limits - Since HPSI has not historically been a system at Waterford 3 which has experienced gas accumulation in either pump discharge or suction piping, no allowable gas accumulation sizes have been calculated. Gas accumulation in the HPSI system pump suction has been evaluated as not a credible failure mechanism due to Refueling Water Storage Pool (RWSP) supply and system/injection operation as documented in Condition Report CR-WF3-2008-4161. Vortexing and NPSH were evaluated by Calculation ECM07-001 and by Engineering Change EC-1002 and determined to have adequate margin to ensure operability. Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," is performed at least once per 31 days to detect any gas accumulation to ensure system operability.

- HPSI 'B' Loop

  Operable and Operable But Degraded Limits - Since HPSI has not historically been a system at Waterford 3 which has experienced gas accumulation in either pump discharge or suction piping, no allowable gas accumulation sizes have been calculated. Gas accumulation in the HPSI system pump suction has been evaluated as not a credible failure mechanism due to RWSP supply and system/injection operation as documented in CR-WF-2008-4161. Vortexing and NPSH were evaluated by Calculation ECM07-001 and by Engineering Change EC-1002 and determined to have adequate margin to ensure operability. Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," is performed at least once per 31 days to detect any gas accumulation to ensure system operability.

- Containment Spray (CS)

  Although pump discharge was evaluated to be not susceptible to gas intrusion per Pressurized Water Reactor Owners Group (PWROG) Calculation FAI/08-78, Waterford 3 Study Calculation ECP03-003, "Determination of Permissible Void Sizes In CS Piping," determined gas volume acceptance criteria for the affected piping to be 0.5 ft^3 per train. For gas accumulation to form in this piping, there would have to be leakage past the Containment Isolation Valves CS-125A (B) with only head pressure motive force, or gas accumulation would have to migrate from the Safety Injection Tanks (which are monitored for gas accumulation in LPSI), through the Shutdown Cooling Heat Exchangers and into the Containment Spray Pump discharge piping.

  Although Containment Spray header piping (from the containment isolation valves CS-125 A(B) through check valve to the spray nozzles) was evaluated to be not susceptible to gas intrusion per PWROG Calculation FAI/08-78, no

"allowable" gas accumulation sizes have been calculated. For gas accumulation in this piping, there would have to be leakage past the containment isolation valves CS-125A(B) with only head pressure motive force, or gas accumulation would have to migrate from the Safety Injection Tanks (which are monitored for gas accumulation in LPSI), through the Shutdown Cooling Heat Exchangers and through the Containment Isolation valves CS-125A(B) and into the Containment Spray header piping.

Since the pump suction piping in the injection mode has been determined to be not susceptible to gas intrusion per CR-W3-2004-2251, no "allowable" gas accumulation sizes have been calculated. Vortexing and NPSH were evaluated by Calculation ECM07-001 and by Engineering Change EC-1002 and determined to have adequate margin to ensure operability.

Since the pump suction piping in the recirculation mode from the Safety Injection Sump has been determined to be not susceptible to gas intrusion per CR-W3-2004-2251, no allowable gas accumulation sizes have been calculated. Vortexing and NPSH were evaluated by Calculation ECM07-001 and by Engineering Change EC-1002 and determined to have adequate margin to ensure operability.

2. **Discuss new applicable gas volume acceptance criteria for each piping segment in each system where gas can accumulate where no acceptance criteria previously existed and summarize the Corrective Actions, and schedule for completion of any Corrective Actions.**

There are no new applicable gas volume acceptance criteria required to confirm the acceptability of gas accumulation in the piping of the affected systems. Existing acceptance criteria provide adequate operational margin, and existing coordinated testing (UT) and venting frequencies work in conjunction to ensure ECCS systems are maintained capable of performing their safety functions.

- LPSI/HPSI

  Operations' Surveillance Procedure OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," provides gas volume acceptance criteria for both the Low and High Pressure Safety Injection systems and includes the guidance for performance of post maintenance and periodic UT/venting activities each 31 days. UT/venting is completed at areas known to have historically contained gas volumes as well as areas that have the potential for containing gas volumes due to system piping configuration as determined by completion of system walk downs. Specific acceptance criteria are included in the procedure for piping system locations which have historically been known to have contained gas volumes. The acceptable gas volume criteria were established by completion of ER-W3-2002-468 and ECP02-004 for ECCS train 'A' and ER-W3-2003-0112-000 and ECM97-002 for ECCS train 'B'. For those areas with the potential for containing gas volumes, but without a history of having contained gas volume, the acceptance is no gas

accumulation. Engineering documentation shows that the provided gas volume acceptance criteria is adequate for protection of the HPSI/LPSI pumps and piping and will prevent challenge to pipe restraints and relief valve setpoints. Surveillance Requirement completion results require Shift Manager or Control Room Supervisor review and are forwarded to Systems Engineering personnel for trending.

- Switchover to Hot Leg Recirculation

  Waterford 3 does not perform a switchover to hot leg recirculation but instead initiates flow to the hot leg of the reactor coolant system while maintaining simultaneous cold leg injection flow. The PWROG methodology for assessment of when a significant gas/water waterhammer could occur during the switchover concludes that, "If the upstream valve has an opening time of approximately 10 seconds and the downstream path to the Reactor Coolant System (RCS) is only restricted by check valve(s), no significant waterhammer would occur, i.e., none of the relief valves in the subject systems would lift, or none of the piping restraints would be damaged." Two series motor operated valves are opened to commence simultaneous hot/cold leg recirculation. These valves both have opening stroke times greater than ten seconds with their fastest allowable Inservice Testing (IST) required open stroke time being 30 seconds. The valve opening times will slowly increase flow to the downstream piping, restricted by two series check valves and a single orifice which is designed to allow equalizing the flow between the hot and cold legs, meeting the PWROG methodology.

- Containment Spray

  Waterford 3 is performing a calculation evaluating the plant specific piping response as the Containment Spray header is filled under EC-10775. Until this plant specific calculation is completed the site will invoke the PWROG methodology proving that the net force resulting from the pressurization of the Containment Spray header during the filling transient is a small fraction of the dead weight of the piping, and therefore the filling transient is well within the margin of the pipe hangers.

  The Containment Spray Pump suction piping used in the injection and recirculation modes was determined not to be susceptible to gas intrusion by CR-WF3-2004-2251. The pump discharge and spray header piping from the containment isolation valves to the spray nozzles was determined not to be susceptible to gas intrusion per PWROG calculation methodology FAI/08-78.

  Waterford 3 has experienced gas accumulation specifically related to the Containment Spray system following the removal of Shutdown Cooling from service. ECP03-003 determined gas volume acceptance criteria for the affected piping to be 0.5 ft^3 per train. Contained gas volumes greater than this amount cause the affected train of Containment Spray to be inoperable.

Removal of gas/gas entrained water from the affected piping is accomplished through the use of System Operating Procedure OP-009-001, "Containment Spray," and is required to be performed when Containment Spray has been restored to service from Shutdown Cooling operations in accordance with System Operating Procedure OP-009-005, "Shutdown Cooling". A series of flushes and UT/venting is utilized to remove this gas entrained water from the system.

- RCS Allowable Gas Ingestion

  PWROG evaluation of the impact of non-condensable gasses entering the RCS determined that having 5 ft^3 of non-condensable gas at a pressure of 400 psig in the HPSI discharge piping and 5 ft^3 of non-condensable gas at 100 psig in the LPSI discharge piping will not prevent the ECCS from performing its core cooling function. Operating Procedure OP-009-008, "Safety Injection System," directs post maintenance venting of ECCS systems in accordance with Operations' Surveillance Procedure OP-903-026, "Emergency Core Cooling System Valve Lineup Verification". The post maintenance venting instructions include direction for the venting of system piping both inside and outside the containment building. The procedure directs the operator to "open the following vent valves until steady stream of water issues, then close vent valves." Performance of venting in accordance with procedural direction would be expected to limit the gas volumes in the HPSI/LPSI discharge piping since valves remain open until a steady stream of water issues. Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," also performs verification of the ECCS systems gas volume on a 31 day basis by use of UT/venting. This verification is for piping outside of containment only. Specific gas volume acceptance criteria are provided by the procedure which is more conservative than the limits provided by the PWROG evaluation. Containment entry is not made for verification of gas volume in the sections of piping downstream of the containment penetrations. Previously submitted condition reports show that gas volumes found in the inside containment piping are likely to have been generated due to nitrogen inleakage from the Safety Injection Tanks (SITs). Thorough post maintenance venting, coupled with a low tolerance for SIT leakage, should ensure that the HPSI/LPSI discharge piping gas volumes remain below the limits established by the PWROG evaluation.

3. Summarize the changes, if any, to the design basis documents (corrective actions) and the schedule for completion of the corrective actions.

The following Engineering Changes (EC) will be issued:

EC-1002 - Hydraulic Evaluation of Safety Injection Sump Strainers, scheduled for completion by October 24, 2008.

EC-10775 - Hydraulic Evaluation of Filling the Containment Spray Ring Header, scheduled for completion by June 18, 2009.

An EC to incorporate PWROG industry studies/calculations listed in this response.

4. Discuss the results of the system P&ID and isometric drawing reviews to identify all system vents and high points.

The piping and isometric drawings for the ECCS, CS and SDC systems were reviewed to identify vents, designed piping slopes and high points. Specifically, the following flow paths were reviewed:

- Safety Injection flow paths (High Pressuring injection and Low Pressure injection paths)
  - RWSP to Safety Injection Pump Suction
  - Safety Injection Sump to Safety Injection Pump Suction
  - Safety Injection Pumps to RCS Cold Leg Injection
  - High Pressure Injection pumps to RCS Hot Leg Injection

- Shutdown Cooling Suction flow paths
  - LPSI Pump suction from Hot Legs
  - LPSI Pump discharge to RCS cold legs
  - Shutdown Cooling Heat exchanger cross connects with CS

- Containment Spray flow path
  - RWSP to CS Pump suction
  - Safety Injection Sump to CS pump suction
  - CS Pump discharge to the motor operated containment isolation valves
  - Shutdown Cooling Heat Exchanger cross connects with LPSI

A review of the isometric drawings indicates that only two sections of piping are designed with sloped sections. The common header for the pump suctions is designed with a sloped section, and Containment Spray piping after the outside containment isolation valve is designed with one small sloped section. These sections were confirmed to be sloped during the confirmatory walkdowns.

Each flow path was reviewed line by line to identify system vents and high points. Waterford 3 has also previously developed an elevation drawing for LPSI/SDC

(G1114) and CS (Sketches SK-C-M-531 and SK-C-C-M-532). Each high point of the systems was reviewed to determine if it could be effectively vented with an existing system vent. A review of these drawings demonstrated that system high points for SDC/LPSI and CS contain the necessary vents at high points in the system outside of containment.

Elevation drawings do not exist for HPSI. A review of the isometric drawings verified that high points of this system contain vents as necessary outside of containment with the following exception noted; Hot leg injection lines for HPSI outside of containment do not have vents at the high points when entering containment. Additionally, PWROG Calculation FAI/08-78 states, "There are also configurations where the hot leg injection enters from the bottom, such as Combustion Engineering designs that have the injection piping connected to the Shutdown Cooling piping that enters the bottom of the hot legs. Depending on whether the piping upstream of this connection rises to an elevation higher than the hot leg, the most fundamental assessment may be that the hot leg is the high point and there is no potential for gas accumulation." Waterford 3 fits this design. As documented in the above Section 2, Design Evaluation, hot leg injection has been evaluated and determined to be unaffected by gas accumulation, and has been excluded from further consideration for high point vents.

ECCS lines inside of containment do not contain high point vents. Cold Leg Injection lines inside containment are typically maintained at SIT pressures of 650 psig, and the nitrogen is maintained in solution. Leakage from the RCS back into these lines is monitored via pressure instrumentation and level instruments on the SITs. Gas would accumulate in the high point of the injection lines, which are the SITs.

5. Identify new vent valve locations, modifications to existing vent valves, or utilization of existing vent valves based on the drawing review, and summarize the Corrective Actions, and schedule for completion of the Corrective Actions.

No new vents are required to be installed at Waterford 3 as a result of drawing reviews (P&IDs, piping isometrics, system elevation drawings, etc.).

In the past, Waterford 3 implemented the following plant modifications based on the results of previous plant walkdowns pertaining to gas intrusion/accumulation concerns:

- Auto vents have been installed on LPSI A at Penetration 39 (SI-1402A) and past SI-138A (SI-133A). The auto vents were installed as a result of leakage from Safety Injection Tank 2B past SI-142A, the inside containment check valve, and SI-138A, the 2B Injection Line Flow Control Valve.

- Vent valves were installed on LPSI A(B) at Penetrations 36 (SI-1412B), 37 (SI-1402B), 38 (SI-1412A) and 39 (SI-1402A). These

valves, which are located outside Containment, provide a mechanism for monitoring and venting gas accumulation downstream of the inboard Containment Isolation valves for each of the penetrations.

- Vent valves were installed on the shutdown cooling suction line, below the outside containment isolation valve SI-407A(B), which are installed in vertical runs of piping. Air accumulation below the valves can be removed without stroking SI-407A(B). The installation includes a second valve to allow for filling of the line as necessary with a pressurized water source since this location may be below RWSP level during refueling outages. Vent valves were also installed above each of the SI-407A(B) isolation valves to allow for proper venting of the lines between SI-407A(B) and the inside containment isolation valve SI-405 A(B).

- A modification was implemented per ER-W3-2004-0575-000 to add a fill line to the Safety Injection Sump suction piping system to provide a flowpath to fill the piping segment between valves SI-602A(B) and SI-604A(B) with RWSP water. Also, a magnetic float level indicator was installed to enable water level to be monitored on a periodic basis.

- Vent valves were installed on each of the injection lines for HPSI at the containment penetrations to allow for adequate venting of the system.

- Vent valves were also installed in Containment Spray A(B) injection lines. The 'A' and 'B' injection piping required three vents on each train. Vent valves CS-1191, CS-1211 and CS-122A were installed to monitor and vent gas accumulation in the 'A' train, and CS-113B, CS-116B, and CS-122B were installed to monitor and vent gas accumulation in the 'B' train.

6. **Discuss the results (including the scope and acceptance criteria used) of the system confirmation walkdowns that have been completed for the portions of the systems that require venting to ensure that they are sufficiently full of water.**

Waterford 3 performed confirmatory walkdowns of piping outside containment for the ECCS, CS and SDC lines with the exceptions noted below:

- Piping that was equal to or greater than 20 feet in the overhead, and

- Piping that was in cluttered locations that were not accessible (piping around the lines did not allow for clear access to the lines).

The walkdowns were performed using engineering procedure PE-001-020, "Walkdown Process Associated with Managing Gas Accumulation," with measurements of the piping height relative to the floor taken at a maximum of ten feet intervals. Locations to measure the piping elevation were chosen to be near to supports, valves, tees, vents and elbow locations. Lengths between supports were also measured to check for slumps in the piping.

The collected data was reviewed to determine if the piping contained inadvertent slopes or high points in the horizontal runs. Small deviations in the elevation measurements of up to 5/8 inches (0.625 inches) were considered to be acceptable based upon the minimal amount of gas that would collect in this small elevation deviation over ten foot sections of pipe. The confirmatory walkdowns identified that the existing piping was installed with the allowed piping installation tolerance and was essentially horizontal. Seventeen (17) highpoints in the horizontal runs of piping have been identified in the systems. The points which require additional evaluation have been entered into the corrective action program under CR-WF3-2008-04569.

As identified in the Waterford 3 Three-Month response to NRC GL 2008-01 (Reference 2), Waterford 3 will perform any necessary confirmatory walkdowns or evaluations of inaccessible piping in the containment during the next refueling outage, currently scheduled to begin in Fall 2009.

Gas accumulation within the Containment Spray system downstream of the containment isolation valves and RCS Hot Leg injection piping downstream of its isolation valves have been evaluated per the methodology provided in the above Section 2, Design Evaluation, and concluded that these piping sections are therefore excluded from the plant walkdown scope for both inside and outside containment.

Piping inside containment that has not had a confirmatory walkdown includes the cold leg injection lines for HPSI and LPSI and are considered operable. Cold leg injection piping inside the containment does not contain high point vents. Cold leg injection lines inside containment are typically maintained at SIT pressure of 650 psig, and the nitrogen is maintained in solution. Leakage from the RCS back into these lines is monitored via pressure instrumentation and level instruments on the Safety Injection Tanks. Gas coming out of solution from the RCS leakage would accumulate in the high point of the injection lines, which is the SIT.

Sections of piping that were not walked down outside containment, as noted above, are considered operable. The inaccessible sections of piping outside containment are either monitored periodically for gas accumulation by Operations' Surveillance Procedure OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," or contain auto venting capability. Other small sections of piping that were inaccessible are not the highest point in the system, and these locations are less likely to have gas accumulation based upon the location in the system. Sections of piping that are inaccessible that are part

of the Containment Spray system are filled and vented following restoration from shutdown cooling as described in Section 8 below, and are not likely to accumulate gas during normal operations.

In addition, no mechanism for gas accumulation exists at most of these high points and locations noted above. Where mechanisms exist (i.e. leaking check valves as identified by lowering Safety Injection Tank Level), increased monitoring has been identified and implemented. There has been no operational evidence of gas accumulation in these systems. Specifically, during system operation no pressure pulses occur, pump parameters are normal, no relief valves are lifting, no abnormal noise has been noted, and In-service Testing results are satisfactory. Therefore, the systems are considered operable.

7. **Identify new vent valve locations, modifications to existing vent valves, or utilization of existing vent valves that resulted from the confirmatory walkdowns, and summarize the corrective actions, and the schedule for completion of the corrective actions, i.e., the walkdowns that have been completed, and the walkdowns not yet complete (refer to Reference 4 Three-Month Response to NRC Generic Letter 2008-01).**

No additional plant modifications outside containment have been identified as a result of the outside containment walkdowns performed to address GL 2008-01 concerns. The locations of high points identified during the plant walkdowns will be evaluated per the corrective action process (reference CR-WF3-2008-4569), and any additional vents will be included in the final response to this GL following the next refueling outage scheduled to begin Fall 2009.

As identified in the Waterford 3 Three-Month response to NRC GL 2008-01, Waterford 3 will perform any necessary confirmatory walkdowns or evaluations of inaccessible piping in the containment during the next Refueling Outage currently scheduled to begin in Fall 2009. Waterford 3 will complete any plant modifications required as a result of the pending walkdowns by the following refueling outage.

8. **Discuss the results of the fill and vent activities and procedure reviews for each system. (Note that routine periodic surveillance testing is addressed in the "Testing Evaluation" section of this template).**

Waterford 3 procedures which contain filling and venting activities have been evaluated as follows:

Operating Procedure OP-009-001, "Containment Spray," contains procedural direction for initial fill and vent of the Containment Spray System. This procedure is utilized after Containment Spray has been restored to service from Shutdown Cooling operations in accordance with System Operating Procedure OP-009-005, "Shutdown Cooling". This procedure is also utilized if gas accumulation is discovered in the section of Containment Spray piping bounded by Shutdown Cooling Heat Exchanger A(B) Outlet Stop Check, CS-117A(B) and Shutdown

Cooling Heat Exchanger A(B) Outlet Isolation to RWSP, CS-118A(B) and Containment Spray Header isolation, CS-125A(B).

Manual venting is utilized on initial fill, verifying the system is full by water emitting from the vent valves. Venting of instrumentation is assured within this procedure by performance of in-service checks as documented in Attachment 11.3, "Containment Spray System Instrumentation In-Service Checks". This same section is used following maintenance activities, which drain the Containment Spray System.

Procedural guidance is included for periodic surveillance of gas accumulation detection utilizing either ultrasonic testing (UT) or manual venting. Guidance is provided to address operability based on detected gas accumulation size when using ultrasonic testing. This same procedure section is used to monitor the system for gas accumulation following restoration of Shutdown Cooling System operations. The system is monitored for gas accumulation to ensure operability when raising modes following plant outages.

System Operating Procedure OP-009-005, "Shutdown Cooling," contains procedural direction to ensure the flushing of piping and periodic monitoring for gas accumulation following restoration of Shutdown Cooling System operations. Note that the majority of the Shutdown Cooling System consists of LPSI and CS system piping. Flushing, designed to replace Shutdown Cooling System water with RWSP water, is conducted in LPSI System piping and in SIT fill and drain piping to ensure water left in this piping is not gas saturated. A periodicity is established for gas accumulation monitoring which ensures that any gas accumulations formed are found and vented before system operability is affected.

Venting of instrumentation within this procedure is not required because Shutdown Cooling is comprised of the LPSI and Containment Spray systems, which were previously free of gas accumulation while in LPSI system operation and Containment Spray system operation prior to shifting to Shutdown Cooling system operation.

Operating Procedure OP-009-008, "Safety Injection System," contains procedural direction for initial fill and vent of the Safety Injection System. Manual venting is utilized on initial fill, verifying the system full by water emitting from the vent valves. Venting of instrumentation is assured within this procedure by performance of in-service checks as documented in Attachment 11.4, "Containment Spray System Instrumentation In-Service Checks". This same section is used following maintenance activities which drain the Safety Injection System.

Procedural guidance is also provided within System Operating Procedure OP-009-005, "Shutdown Cooling," to fill and vent suction piping downstream of Safety Injection Sump Suction Valves SI-602A(B). This section is used post maintenance and prior to changing plant mode.

Operations' Surveillance Procedure OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," performs periodic surveillance testing (UT) and venting of high point vents for all portions of the ECCS, in compliance with Technical Specification 4.5.2.b.2, which requires "Verifying the ECCS piping is full of water" at least once per 31 days. This verification is performed per Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," which originally began performing periodic UT and manual venting in 1997 to address gas accumulation concerns.

Guidance is provided to address operability based on detected gas accumulation size when using ultrasonic testing. This same procedure section is used to monitor the system for gas accumulation following restoration of Shutdown Cooling System operations. The system is monitored for gas accumulation to ensure operability when changing modes following plant outages.

Operations' Surveillance Procedure OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," is also utilized to monitor for gas accumulation at increased frequency when necessitated by excessive lowering of Safety Injection Tank levels. This is controlled by Entergy Nuclear Management Manual EN-OP-111, "Operational Decision-Making Issue (ODMI) Process," which utilizes existing plant procedures to perform actions required. A periodicity is established for gas accumulation monitoring which ensures that any gas accumulations formed are found, quantified, and vented before system operability is affected.

Additional discussion specifically addressing the piping locations tested (UT) and vented by Operations' Surveillance Procedure OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," is provided in the "Testing Evaluation" section of this response.

9. **Identify procedure revisions, or new procedures resulting from the fill and vent activities and procedure reviews that need to be developed, and summarize the corrective actions, and schedule for completion of the corrective actions. (Note that routine periodic surveillance testing is addressed in the "Testing Evaluation" section of this template).**

   There are no procedure revisions necessary or new procedures required for performing adequate fill and vent activities on LPSI /HPSI, Shutdown Cooling or Containment Spray Systems.

10. **Discuss potential gas intrusion mechanisms into each system for each piping segment that is vulnerable to gas intrusion.**

    - Low Pressure Safety Injection (LPSI)/Shutdown Cooling (SDC)

      The LPSI 'A' and 'B' cold leg injection piping has potential for gas intrusion as system leakage at pressure isolation points is fed by water from the SITs. This may occur at the containment penetrations where if this nitrogen entrained water from the SITs leak by one or both of the containment isolation valves, the nitrogen comes out of solution due to pressure changes

and creates gas accumulation in the piping high points. Monthly surveillances per Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," inspect these sections of piping.

Gas accumulation could form in the LPSI 'A' and 'B' pump suction piping below valves SI-407 A(B) used during Shutdown Cooling operations. Gas accumulation in this section of piping can occur when RWSP level is below the level of the isolation valves SI-407 A(B). The lower level in RWSP does not occur during normal power operations, but can occur during shutdown conditions, following maintenance on the system or draining of the RWSP to the reactor cavity to support fuel assembly movement. Gas accumulation can also form in this section of piping following the stroking of the Shutdown Cooling Warm-up Line valve SI-135 A(B). Gas accumulation may form in this area when header pressure is above 35 psig and leakage from a SIT is present. Monthly surveillances per Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," inspect these sections of piping.

The horizontal LPSI A(B) pump hot leg suction piping for SDC suction has potential for gas accumulation as the level in the pipe equalizes with the level of the RWSP, again creating a vacuum which is relieved by in-leakage from valves located between SI-407A(B) and SI-405A(B), until possibly entirely draining the piping between SI-407A(B) and SI-405A(B). This concern is not present during SDC operation. Analysis per Condition Report CR-WF3-2008-4161 will re-evaluate the total gas accumulation acceptable limits in this section of piping. This Condition Report was initiated after relief valve SI-406B lifted due to a possible pressure spike resulting when upstream air operated valve (AOV) SI-405B experienced an initial rapid opening of the valve, apparently due to the valve disc initially being stuck in the valve seat.

LPSI trains are cross connected with the Containment Spray systems for the use of the Shutdown Cooling Heat Exchanger. Following Shutdown Cooling operations, the LPSI and CS systems are flushed and vented as described in Section 8 of this response, as per System Operating Procedure OP-009-005, "Shutdown Cooling". Under normal conditions these cross connect valves are closed and stroked periodically for surveillance. Gas accumulation between the systems would be a concern only when drivers are present in one of the systems, such as an elevated pressure in the LPSI header. Additional monitoring is prescribed, when necessary, through the corrective action process.

SDC purification is connected to the LPSI system during normal SDC operations when the plant is shutdown. During power operations, this system is isolated with two manual valves from LPSI on the discharge and suction side. Following SDC operations during normal plant shutdowns, the LPSI system is flushed and vented as described in Section 8 of this response.

- Containment Spray (CS)

Once inside containment, the CS riser contains a check valve at elevation 130 feet. Downstream of this check valve the system is open to the containment atmosphere. Leakage past valves in the system, including the inside containment check valve, could cause the header to drain and gas accumulation to form. The header is monitored per Surveillance Procedure OP-903-001, "Technical Specification Surveillance Logs," and is maintained above the 182 foot elevation, which is sufficiently above the inside containment check valve to prevent gas accumulation in the piping. A solenoid valve is installed bypassing the containment isolation check valve to allow for monitoring of the fluid height.

- High Pressure Safety Injection (HPSI)

  HPSI 'A' and 'B' cold leg and hot leg injection piping has the potential for gas intrusion as system leakage at pressure isolation points is fed by water from the SITs. If this nitrogen entrained water from the SITs leak by the containment isolation valves, the nitrogen comes out of solution due to pressure changes and creates gas accumulation in the piping high points. Monthly surveillances per Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," inspect these sections of piping.

  HPSI 'A' and 'B' are cross connected to the Chemical Volume and Control System (CVCS) and are isolated with a manual valve. The cross connect is with the discharge of the charging pumps. On the 'A' line for HPSI, the connection is to the 'A' header. Monitoring of the header pressure will detect leakage from the charging system. On the 'B' line, the cross connection is to the Hot Leg injection line, between the motor operated valves SI-502B and SI-506B. Leakage past these valves is monitored by pressure instrumentation to detect leakage and possible gas accumulation.

  Hot leg injection lines for HPSI 'A' and 'B' are connected to the RCS. Leakage past the isolation check valves may accumulate gas from RCS depressurization. Pressure instruments in this section of piping provide indication of leakage past these valves. Analysis completed on the hot legs has excluded these from further consideration for gas accumulation per Section 2 of this response.

- Common Suction Headers (for HPSI and CS)

  Although RWSP inventory and head tends to maintain the Safety Injection Sump return piping filled, this return piping 2SI24-2A(B) is susceptible to gas accumulation through evaporation from the sump on the Containment side if the isolation valve is leaking past the seat. A "keep fill" system has been installed, reference ER-W3-2004-0575-000, to provide a mechanism for level verification of Safety Injection Sump suction piping 2SI24-2A(B), as well as providing a flow path for filling the piping between valves SI-602A(B) and SI-604A(B). In addition, the system is verified full at least once every 31 days by Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification".

11. Ongoing Industry Programs

Ongoing industry programs are planned in the following areas which may impact the conclusions reached during the design evaluation of Waterford 3 relative to gas accumulation. These activities will be monitored to determine if additional changes to the Waterford 3 design may be required or desired to provide additional margin.

- Gas Transport in Pump Suction Piping

  The PWROG has initiated testing to provide additional knowledge relative to gas transport in large diameter piping. One program performed testing of gas transport in 6-inch and 8-inch piping. Another program will perform additional testing of gas transport in 4-inch and 12-inch low temperature systems and 4-inch high temperature systems. This program will also integrate the results of the 4-inch, 6-inch, 8-inch and 12-inch testing.

- Pump Acceptance Criteria

  Long-term industry tasks were identified that will provide additional tools to address GL-2008-01 with respect to pump gas accumulation ingestion tolerance limits.

12. Provide a detailed list of items that have not been completed, a schedule for their completion, and the basis for that schedule.

- As identified in the Waterford 3 Three-Month response to NRC GL 2008-001, Waterford 3 will perform any necessary confirmatory walkdowns and evaluations of inaccessible piping in the containment within 90 days following startup from the next refueling outage. ECCS lines inside of containment do not contain high point vents. Cold leg injection lines inside containment are typically maintained at SIT pressures of 650 psig, and the nitrogen is maintained in solution. Leakage from the RCS back into these lines is monitored via pressure instrumentation and level instruments on the SITs. Gas would accumulate in the high point of the injection lines, which are the SITs. The Containment Spray header piping (from the Containment Isolation valves CS-125 A(B) to the spray nozzles) was evaluated to be not susceptible to gas intrusion per PWROG Calculation FAI/08-78.

- Waterford 3 will evaluate piping locations identified in the post NRC GL 2008-001 plant/system walkdown as possible high points where gas accumulation could occur, reference CR-WF3-2008-4569. This action will be completed by May 14, 2009. No evidence of gas voiding has been identified in these systems, and it is anticipated there will not be any gas voids. This is based on the following:

- There is no mechanism for the creation of gas pockets at these high points.
- There is no operational evidence of gas accumulation. Specifically, during system operation no pressure pulses occur, pump amperage remains normal, no relief valves lift, and there is no abnormal noise.
- In-service Testing results are satisfactory.
- The geometrical dimensions of the high points are within piping construction tolerances.

- As identified in the Waterford 3 Three-Month response to NRC GL 2004-002, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accident at Pressurized-Water Reactor," Waterford 3 will analyze vortexing and NPSH of the LPSI, HPSI and CS systems, reference Engineering Change EC-1002. This action will be completed by October 24, 2008. Engineering Calculation ECM07-001 previously analyzed LPSI, HPSI and CS piping for gas accumulation and has concluded that there is sufficient margin to maintain operability. There is no reason to believe that there are any deficiencies with NPSH or any vortexing issues for LPSI, HPSI, SDC or CS.
- Waterford 3 will issue Engineering Change EC-10775, which performs plant-specific evaluation of the Containment Spray ring header piping in accordance with PWROG guidance provided in Calculation FAI/08-78, reference LO-LAR-2008-0042 CA-030. This action will be completed by June 18, 2009.

Testing Evaluation

1. **Discuss the results of the periodic venting or gas accumulation surveillance procedure review.**

   Periodic ultrasonic testing (UT) or manual venting is performed at Waterford 3 in compliance with Technical Specification 4.5.2.b.2, which requires verifying the ECCS piping is full of water at least once per 31 days. This verification is performed per Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," which originally began performing periodic UT and manual venting in 1997 to address gas accumulation concerns. UT and manual venting is performed at the high points in the LPSI and HPSI systems.

   The high points identified in the procedure include the cold leg injection lines at the containment penetrations for LPSI and HPSI between the flow control valve and the inside containment check valves, HPSI Discharge headers at the high point, LPSI pump discharge headers at the high point, Shutdown Cooling Suction piping downstream of the outside containment isolation valve (valve in a vertical run), LPSI SDC warm-up line piping, and HPSI and CS Suction from the Safety Injection Sump.

2. **Identify procedure revisions or new procedures resulting from the periodic venting or gas accumulation surveillance procedure review that need to be developed.**

   Waterford 3 currently has a procedure in place for periodic surveillance testing (UT) and manual venting of Safety Injection piping at least once every 31 days. This procedure satisfactorily tests (UT) and satisfactorily performs venting of gas accumulation, therefore no procedural revision is required. Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," has been reviewed and does not need revision to adequately address the gas accumulation issue.

3. **Discuss how procedures adequately address the manual operation of the SDC system in its decay heat removal mode of operation. Include how the procedures assure that the SDC system is sufficiently full of water to perform its decay heat removal safety function (high point venting or UT) and how pump operation is monitored by plant personnel (including a description of the available instrumentation and alarms).**

   Shutdown Cooling is accomplished using the LPSI pumps and is performed in accordance with System Operating Procedure OP-009-005, "Shutdown Cooling". The procedure directs venting prior to a train being placed in service. Specific venting points are contained in the procedure to ensure the system is free of gas accumulation. The procedure does allow venting not to be performed in the case where the system has not been in operation for greater than four days, with Shift Manager/Control Room Supervisor discretion.

Pump operation is monitored by plant personnel in the control room using ammeter indication, the Reactor Coolant Shutdown Level Indicating/Measurement System and a Shutdown Cooling Trouble annunciator. Operators understand that fluctuating ammeter indication is a symptom of pump cavitation. The Reactor Coolant Shutdown Level Indicating/Measurement System will provide an alarm in the control room when water level drops below a predetermined level, preventing the possibility of pump operation with air entrainment due to suction vortexing. The Shutdown Cooling Trouble annunciator assists the operators by providing visual and audible indication of Core Exit Thermocouple temperature increasing above, or pump flow decreasing below values set by the operator.

Additional monitoring is assured by field operators performing pre/post start checks of the pump being started. Field operators understand the symptoms of pump cavitation and the importance of notifying the operator in the control room when cavitation or abnormal start symptoms exist.

4. **Summarize the results of the procedure reviews performed to determine that gas intrusion does not occur as a result of inadvertent draining due to valve manipulations specified in the procedures, system realignments, or incorrect maintenance procedures.**

Review of site procedures related to ECCS, Shutdown Cooling and Containment Spray systems dealing with system operation, maintenance and testing were reviewed. It was determined that procedure performance should not result in gas intrusion due to inadvertent draining. Procedures reviewed as part of this evaluation contain venting instructions that do not require the venting to be completed in a specific order.

5. **Describe how gas accumulation is documented (including the detection method such as venting and measuring or UT and gas accumulation sizing and post venting checks), dispositioned (including method(s) used such as static or dynamic venting), and trended, if found in any of the subject systems.**

Entergy's Corrective Action Program is used to document gas intrusion/accumulation issues as potential nonconforming conditions. Existing procedures for LPSI, HPSI and CS require a Condition Report to be initiated and the Operations' Shift Supervisor notified, if the accumulated gas volume acceptance criteria specified in the procedures are exceeded. While procedures may contain acceptance criteria for contained gas volumes, condition reports are initiated for any gas accumulation noted, regardless of whether or not they exceed that criteria.

The most likely detection method for contained gas volumes is UT, or manual venting accomplished in accordance with the applicable operating/surveillance procedure. If detected volumes were discovered using UT, then they will be sized using the UT results. Once discovered, manual venting is performed by

operating vent valves until a solid, air free stream of water is expended. The required condition report is initiated which drives investigation as to where the gas volume was generated from and how to prevent recurrence. Discovered contained gas volumes are trended by Systems Engineering.

6. **Provide a detailed list of items that have not been completed, a schedule for their completion, and the basis for that schedule.**

No actions are required for Waterford 3 compliance in this section.

Corrective Actions Evaluation

1. **Summarize the results of the reviews regarding how gas accumulation has been addressed at your site.**

Entergy's Corrective Action Program is used to document gas intrusion/accumulation issues as potential nonconforming conditions. Existing procedures for LPSI, HPSI and CS require a condition report (CR) to be initiated, and the Operations Shift Manager to be notified, if the accumulated gas volume acceptance criteria specified in the procedures are exceeded. As part of Entergy's Corrective Action Program, CRs related to plant equipment are evaluated for potential impact on operability and reportability. Therefore, Entergy's review concluded that issues involving gas intrusion/accumulation are properly prioritized and evaluated under the Corrective Action Program.

The Corrective Action Process has moved the gas accumulation issue at Waterford 3 through the problem discovery stage, through the acceptance criteria determination stage, into the plant physical change stage, and into the plant/system management stage of the gas accumulation issue. CRs initiated since 1993 depict the following evolution:

During the middle to late 1990's, there were periodic transients as documented in Condition Reports. A Root Cause was performed which determined that the probable cause of the gas accumulation issue was Safety Injection Tank leakage past check valves, and post Shutdown Cooling operation resulting in nitrogen migration into LPSI. Recommendations included periodic UT and manual venting, accomplished using Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification". Additionally, revisions were made to System Operating Procedure OP-009-001, "Containment Spray," requiring static instead of dynamic venting.

The middle to late 1990's also saw the Engineering determination of allowable gas accumulation sizes, installation of additional vent valves, and the revision of venting procedures. CR-WF3-1996-1943 provided for the installation of new vent valves at HPSI/LPSI containment penetration high points. The added valves, SI-1402A(B), SI-1412A(B), SI-2352, SI-2362, SI-2392, and SI-2402, improved system reliability by providing the ability to periodically vent gas volumes at the penetrations. The condition report also drove rework and repair of inside

containment check valves in the HPSI/LPSI systems, SI-142A, SI-241, SI-243 and SI-244, limiting nitrogen back-leakage from the Safety Injection Tanks into the systems. Other condition reports written during this period addressed suction vortex issues and RWSP minimum level requirements.

In the early 2000's, the primary focus has been to manage system gas accumulation by ensuring that periodic testing (UT) and venting is performed frequently enough to ensure that as-found gas accumulation sizes remain within allowable limits to ensure system operability. Low threshold limits for Condition Report initiation has resulted in thorough documentation of as-found gas accumulation.

In addition to "managing" gas accumulation sizes since 2000, other enhancements were also pursued during this period. Automatic venting valves were installed into the plant (ER-W3-2002-0352), and a "keep fill" system was installed, reference ER-W3-2004-0575-000, to provide a mechanism for water level verification (magnetic float level indicator) of SI Sump suction piping 2SI24-2A(B), as well as providing a flow path between valves SI-602A(B) and SI-604A(B) for filling the piping with RWSP water. Also, Operations' Surveillance OP-903-026, "Emergency Core Cooling System Valve Lineup Verification," was revised to verify the system is full at least once every 31 days.

Also, during this period, calculations were enhanced and revised to include limits not only for operability, but also for "operable but degraded," reference CR-WF3-2002-818, ER-W3-2002-0468, Calculation ECP02-004, CR-WF3-2004-2251, and ER-W2-2003-0112-000. Operating procedures were enhanced for improved elimination of gas accumulation, including post Shutdown Cooling venting and sweeping procedure changes.

In conclusion, all high point vents were previously identified from P&IDs and piping isometrics at Waterford 3 prior to Generic Letter 2008-01. Physical changes to the plant were implemented to vent gas accumulation, and plant operating procedures were revised in an effort to purge systems of nitrogen enriched water and to monitor gas accumulation as it occurs. Not only were new high point vents previously added, but system auto vents were also added to piping locations experiencing gas accumulation to automatically vent gas accumulation as they occur.

2. **Provide a detailed list of items that have not been completed, a schedule for their completion, and the basis for that schedule.**

No actions are required for Waterford 3 compliance.

Conclusion

Based upon the above, Entergy has concluded that Waterford 3 is in conformance with its commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in the Entergy Quality Assurance Program Manual (QAPM). Waterford 3 is successfully testing and managing gas accumulation in the ECCS injection systems (LPSI, HPSI, and Containment Spray) at a frequency which ensures that as-found gas accumulation remains within prescribed allowable limits such that HPSI/LPSI, Shutdown Cooling and CS Systems remain operable.

B. DESCRIPTION OF NECESSARY CORRECTIVE ACTIONS

The following corrective actions were determined to be necessary to assure compliance with the applicable regulations:

- As identified in the Waterford 3 Three-Month response to NRC GL 2008-001, Waterford 3 will perform any necessary confirmatory walkdowns or evaluations of inaccessible piping in the containment during the next Refueling Outage currently scheduled to begin in Fall 2009. Entergy will complete its evaluation of the inaccessible portions of these systems and provide a supplement to this response within 90 days following startup from the next Waterford 3 refueling outage scheduled for Fall 2009.

- Entergy will evaluate piping locations identified in the post NRC GL 2008-001 plant/system walkdown as possible high points where gas accumulation could occur, reference CR-WF3-2008-4569. This action will be completed by May 14, 2009.

- As identified in the Waterford 3 Three-Month response to NRC GL 2004-002, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accident at Pressurized-Water Reactor," Entergy will analyze vortexing and NPSH of the LPSI, HPSI and CS systems, reference Engineering Change EC-1002. This action will be completed by October 24, 2008.

- Entergy will issue Engineering Change EC-10775, which performs plant-specific evaluation of the Containment Spray ring header piping in accordance with PWROG guidance provided in Calculation FAI/08-78, reference LO-LAR-2008-0042 CA-030. This action will be completed by June 18, 2009.

C. CORRECTIVE ACTION SCHEDULE

The following summarizes the status of those corrective actions which were determined to be necessary to assure compliance with the applicable regulations:

1. Summarize the corrective actions that have been completed as a result of the evaluations discussed above.

There have been no required corrective actions as a result of the evaluations discussed above.

2. Summarize the corrective actions to be completed including the scope, schedule, and a basis for that schedule.

As identified in the Waterford 3 Three-Month response to NRC GL 2008-001, Entergy will perform any necessary confirmatory walkdowns or evaluations of inaccessible piping in the containment during the next Refueling Outage currently scheduled to begin in October 2009. Entergy will complete evaluation of the inaccessible portions of these systems and provide a supplement to this response within 90 days following startup from the next Waterford 3 refueling outage. ECCS lines inside of containment do not contain high point vents. Cold Leg Injection lines inside containment are typically maintained at Safety Injection Tank pressures of 650 psig, and the nitrogen is maintained in solution. Leakage from the RCS back into these lines is monitored via pressure instrumentation and level instruments on the Safety Injection Tanks. Gas would accumulate in the high point of the injection lines, which are the Safety Injection Tanks. The Containment Spray header piping (from the Containment Isolation valves CS-125 A(B) to the spray nozzles) was evaluated to be not susceptible to gas intrusion per PWROG Calculation FAI/08-78.

Entergy will evaluate piping locations identified in the post NRC GL 2008-001 plant/system walkdown as possible high points where gas accumulation could occur, reference CR-WF3-2008-4569. This action will be completed by May 14, 2009. No evidence of gas voiding has been identified in these systems, and it is anticipated there will not be any gas voids. This is based on the following:

- There is no mechanism for the creation of gas pockets at these high points.
- There is no operational evidence of gas accumulation. Specifically during system operation no pressure pulses occur, pump amps are normal, no relief valves are lifting, and there is no abnormal noise.

- In-service Testing results are satisfactory.
- The geometrical dimensions of the high points are within piping construction tolerances.

As identified in Waterford 3's Three-Month response to NRC GL 2004-002, "Potential Impact of Debris Blockage on Emergency Recirculation during Design Basis Accident at Pressurized-Water Reactor," Entergy will analyze vortexing and NPSH of the LPSI, HPSI and CS systems, reference Engineering Change EC-1002. This action will be completed by October 24, 2008. Engineering Calculation ECM07-001 has previously analyzed LPSI, HPSI and CS piping for gas accumulation and has concluded that there is sufficient margin to maintain operability. There is no reason to believe that there are any deficiencies with NPSH or any vortexing issues for LPSI, HPSI, SDC or CS.

Entergy will issue Engineering Change EC-10775, which performs plant-specific evaluation of the Containment Spray ring header piping in accordance with PWROG guidance provided in Calculation FAI/08-78, reference LO-LAR-2008-0042 CA-030. This action will be completed by June 18, 2009.

CONCLUSION

Entergy has evaluated the accessible portions of those Waterford 3 systems that perform the functions described in this GL and has concluded that these systems are Operable, as defined in the Waterford 3 Technical Specification and are in conformance to our commitments to the applicable General Design Criteria (GDC), as stated in the Waterford 3 UFSAR.

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

As committed in Attachment 2, Entergy will complete its evaluation of the inaccessible portions of these systems by startup from the next Refuel Outage at Waterford 3 and will provide a supplement to this response within 90 days thereafter.

Entergy has concluded that Waterford 3 is in conformance with its commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in the Entergy Quality Assurance Program Manual (QAPM). Waterford 3 is successfully testing and managing gas accumulation in the ECCS injection systems (LPSI, HPSI, and Containment Spray) at a frequency which ensures that as-found gas accumulation remains within prescribed allowable limits such that HPSI/LPSI, Shutdown Cooling and CS remain operable.

Attachment 2

W3F1-2008-0068

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 (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
1. Entergy will complete its evaluation of the inaccessible portions of these systems and provide a supplement to this response within 90 days following startup from the next Waterford 3 refueling outage.	x		90 days following startup from the next Waterford 3 refueling outage scheduled for Fall 2009
2. Entergy's continued support of the industry and NEI Gas Accumulation Management Team activities also includes participation in on-going industry research. Entergy will evaluate subsequent NEI recommendations resulting from that research for applicability to Waterford 3 and will evaluate those recommendations for implementation.		x	
3. Entergy is continuing to support the industry and NEI Gas Accumulation Management Team activities regarding the resolution of generic TS changes via the Technical Specification Task Force (TSTF) traveler process and other on-going industry efforts. After NRC approval of the traveler, Entergy will evaluate its applicability to Waterford 3, and evaluate adopting the traveler to either supplement or replace the current TS requirements.	x		Upon NRC approval of the TSTF

COMMITMENT	TYPE (Check One)		SCHEDULED COMPLETION DATE (If Required)
	ONE-TIME ACTION	CONTINUING COMPLIANCE	
4. Entergy will evaluate piping locations identified in the post NRC GL 2008-001 plant/system walkdown as possible high points where gas accumulation could occur.	x		May 14, 2009
5. Entergy will issue Engineering Change EC-10775, which evaluates plant-specific evaluation of the Containment Spray ring header piping in accordance with PWROG guidance provided in Calculation FAI/08-78.	x		June 18, 2009