Entergy

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Kevin H. Bronson
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October 14, 2008

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
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SUBJECT: Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket 50-293
License No. DPR-35

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

REFERENCE:

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. NRC letter, Re: Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems, Proposed Alternative Course of Action (TAC NO MD7863)", dated September 15, 2008
3. Entergy letter "Three-Month Response Extension Request to NRC Generic Letter 2008-01, Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems", dated April 10, 2008
4. Entergy letter "Three-Month Response to NRC Generic Letter 2008-01, Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems", dated May 7, 2008

LETTER NUMBER: 2.08.055

Dear Sir or Madam:

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 dated January 11, 2008 (Reference 1). This GL requested that each licensee evaluate the licensing basis, design, testing, and Corrective Action Programs for the Emergency Core Cooling Systems (ECCS), Residual Heat Removal (RHR) system, and Containment Spray system, 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.

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

(a) A description of the results of evaluations that were performed pursuant to the requested actions of the GL;

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

Attachment 1 to this letter contains Entergy's Pilgrim Nuclear Power Station (Pilgrim Station) nine-month response to NRC GL 2008-01.

Attachment 2 contains the commitments made in this letter.

Entergy Nuclear Operations, Inc (ENO) is involved in industry activities which may impact the conclusions reached during this evaluation of Pilgrim Station relative to gas accumulation. These activities will be monitored to determine if additional changes to the PNPS licensing and design basis are needed or desired. The actions identified in this response will be refined as PNPS and the nuclear industry identify processes and lessons-learned that can reduce the vulnerability to gas in accumulation in ECC systems.

If you have any questions or require additional information, please contact Mr. Joseph R. Lynch, Licensing Manager, at (508) 830-8403.

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

Executed on October 14th, 2008.

Sincerely,

for Kevin H. Bronson
Site Vice President

RMB/dal

Attachments:
1. PNPS Nine Month Response to NRC Generic Letter 2008-01 – 15 pages
2. Summary of Commitments – 1 page

cc:
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Attachment 1 to ENO Letter 2.08.055

Attachment 1 to Letter 2.08.055

PNPS Nine Month Response to NRC Generic Letter GL2008-01

(16 pages)

This Attachment contains the Entergy Nuclear Operations, Inc (ENO) Pilgrim Nuclear Power Station (Pilgrim Station) 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 (Reference 1). 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."

This response includes the results of ENO's comprehensive evaluation of the subject systems. As committed in Reference 3 and accepted in Reference 4, ENO will complete its evaluation of any inaccessible portions of these systems by startup from the 2009 RFO and will provide a supplement to this response within 90 days following startup but no later than August 10, 2009.

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 Core Standby Cooling Systems (CSCS) were determined to be in the scope of GL 2008-01 for Pilgrim Station:

- High Pressure Coolant Injection (HPCI) System
- Core Spray (CS) System
- Residual Heat Remove (RHR) System
  - Low Pressure Coolant Injection (LPCI) mode
  - Containment Spray Cooling mode
  - Suppression Pool Cooling mode
  - Shutdown Cooling mode

It should be noted that there are related issues that the nuclear industry is currently considering with respect to the overall performance of these systems (e.g., GSI-193). Consistent with discussions in SECY 2008-108, resolution of these related issues will be addressed independent of the Generic Letter and will not be addressed herein.

A. EVALUATION RESULTS

Licensing Basis Evaluation

Entergy, Pilgrim Nuclear Power Station (Pilgrim Station) licensing basis was reviewed with respect to gas accumulation in the Emergency Core Cooling Systems (i.e. HPCI, RHR and CS as well as other decay heat removal and containment spray systems). This review included the Technical Specifications (TS), TS Bases, Updated Final Safety Analysis Report (UFSAR), responses to NRC generic communications, Regulatory Commitments, and License Conditions.

1. *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 using Entergy's Licensing Document search engine.

   A review of the UFSAR did not identify any specific requirements related to gas accumulation in the ECCS systems. However, from the system descriptions it is evident that the ECCS systems are assumed to be water-filled. No specific venting discussion or void acceptance criterion was identified.

   Pilgrim Station TS includes limiting conditions for operation and surveillance requirements that address gas accumulation in ECCS systems. These require the RHR, Core Spray, and HPCI systems to be filled up to the last block valve when they are required to be operable. The surveillance requirement is for monthly venting of RHR and CS at all times, and monthly venting of HPCI when aligned to the suppression pool.

   There is currently no proposed change to the TS Bases. Following the NRC and NEI resolution of the general issue regarding whether statements in TS Bases should more accurately state the necessity to ensure the systems are "sufficiently full of water" versus simply "full of water", the Bases for the TS SR(s) will be re-evaluated.

   No specific regulatory commitments were identified with respect to gas accumulation within the ECCS systems in response to NRC generic communications.

   Each plant licensed before the GDCs were formally adopted, including PNPS, was evaluated on a plant-specific basis, determined to be in compliance with the intent of the later GDCs, and licensed by the Commission. Furthermore, current regulatory processes are sufficient to ensure that plants continue to operate and comply with the intent of the GDCs. Plants with construction permits issued prior to May 21, 1971 did not need exemptions from the GDC.

2. *Changes to licensing basis documents (corrective actions):*

   The licensing basis document review determined that there were no weaknesses or deficiencies in any of the licensing documents listed. No corrective actions are currently required.

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 Technical Specifications Task Force (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 from the evaluation 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 Pilgrim Station, and evaluate adopting the Traveler to either supplement or replace the current TS requirements.

Design Evaluation

Pilgrim Station's design basis was reviewed with respect to gas accumulation in the subject systems. This review included Design Basis Documents (DBDs), Calculations, Engineering Evaluations, and Vendor Technical Manuals.

1. *Results of the review of the design basis documents:*

   Although it is clear that the design calls for the systems to be water filled, Pilgrim Station's review did not identify any specific design requirements relating to acceptable void size for the subject systems. Pilgrim Station historically has not had any systems experience significant gas accumulation in either pump discharge or suction piping.

   Pilgrim Station TS requirements identify monthly periodic venting for RHR, Core Spray, and HPCI.

   Gas can be introduced from suction sources due to formation of air entraining vortices or by not isolating the preferred water source before level is too low. To methodically address such issues at all Entergy plants, Fleet Guide EN-ME-G-001 "Evaluation of Pump Protection from Low Submergence" was prepared to provide a systematic approach for evaluation of the potential for air ingestion in pumps due to low submergence, vortexing, and air ingestion.

   The Condensate Transfer System provides positive pressure as keep-fill to the RHR and Core Spray pumps discharge lines. This is necessary as the suction lines of these pumps are lined up to the Torus. The HPCI suction line is lined up to the Condensate Storage Tanks (CSTs) and the static water head alone provides adequate pressure to maintain these lines full.

   The Containment Spray Cooling mode of RHR provides water to a spray header system inside the drywell. This spray header is open to the drywell environment and is only required to be full up to the Containment Spray isolation valves. Air-filled piping downstream of the first normally-closed motor operated isolation valve would not create a water hammer that could challenge the operability of those systems.

   The HPCI Pumps are normally aligned to receive suction from the CST. After cooling the reactor, the water exits via the postulated break and drain to the Torus. Once the CST is depleted, the HPCI suction source is transferred to the suppression pool, which is the safety related, long-term water source.

   As a result of the complete review of all PNPS ECCS Systems for potential air intrusion from suction source vortexing due to low submergence, corrective actions were initiated in 2006 and updated in 2008 for the HPCI System. There is presently an Operability Determination in place demonstrating that the current procedures and operator guidance are adequate to protect against air ingestion into the HPCI suction when aligned to the CSTs. Long term corrective actions are planned to revise the Technical Specification allowable value for reserve volume and raise the pressure switch setpoint for the HPCI automatic transfer on low CST level.

   The potential for gas intrusion due to inadvertent draining, system realignments and incorrect maintenance and testing procedures is precluded by the implementation of

specific System Fill & Vent Plans that are required by station procedure and are linked to the operations tagout used to isolate equipment for either maintenance or surveillance testing.

There are no locations in the LPCI / RHR, Core Spray, and HPCI Systems where leakage through isolation valves or through check valves can result in gas transport from the intrusion location to other locations in the ECCS.

The mission times of each ECCS system are specified in a Topical Design Basis Document (TDBD). The long-term duration specified for the operability of ECCS equipment is 30 days following a LOCA. The HPCI pump would transfer ECCS duties to RHR and CS once the RPV was depressurized.

2. *New applicable gas volume acceptance criteria for each piping segment in each system where gas can accumulate where no acceptance criteria previously existed, summary of the corrective actions, and schedule for completion of any corrective actions.*

   a) *Pump Suction Piping:*

      Gas volume acceptance criteria for ECCS pump suction voiding was determined to be a bounding initial startup transient 10% void fraction for up to 5 seconds, based on industry-developed guidance. This conservative criterion has been applied in support of system operability. These values, used in conjunction with other factors such as NPSH, suction submergence, and transients for which the system is credited, provide a basis for system operability.

   b) *Pump discharge piping which is susceptible to pressure pulsation after a pump start:*

      Gas volume acceptance criteria for ECCS pump discharge voiding is based on an evaluation of water hammer effects on piping and supports. Void size is limited by the maximum volume of gas that adversely affects ECCS performance, based on industry-developed guidance.

      Gas accumulation in the piping downstream of the pump to the first closed isolation valve or the RCS pressure boundary isolation valves would result in amplified pressure pulsations during a pump start. The subsequent pressure transient may exceed the setpoints of thermal relief valves in the subject systems, or result in unacceptable pipe loads (i.e., axial forces that are greater than the design rating of the axial restraints, or bending loads at elbows, nozzles, or anchor points). An evaluation method was established to determine the applicable limits for discharge piping gas accumulation in the affected systems. These limits are then used as the basis for acceptance criteria that can be applied to each system. The criteria was compared to the potential air accumulation that may be present due to the as-built line slopes determined from the system walkdowns (regardless of whether system operating practices would flush all gases from these potential void areas).

      The water hammer calculation methodology was based on the classical Joukowsky equation that relates peak pressure to the pump flow velocity and fluid momentum. The peak water hammer force acting on the piping is a function of the maximum rate of rise of the void pressure during the compression of the air volume upon the pump start. The resulting piping stresses and support loads are then dependent on the structural configuration and dynamic response of the piping and supports that are directly affected by the pressure transient amplitude and rise time.

      The evaluation used plant specific information for piping configuration, restraints and anchor points in the subject systems to determine the acceptable gas volume

accumulation such that the pipe loading is within acceptable limits (i.e., axial and bending forces are less than the design capacities of the piping, axial restraints, nozzles, and anchor points). The results are described in item (6) below.

The maximum air volume considered was defined by an industry-based evaluation of the gas intrusion impact on ECCS performance , i.e., air intrusion in the ECCS lines can temporarily reduce and delay the coolant injection as described in item (d) below. In addition, the evaluation determined that there is typically a much smaller acceptable gas volume accumulation such that relief valve setpoints are not exceeded in the RHR and CS systems.

Entergy has implemented this methodology for Pilgrim Station and established the applicable limits for gas accumulation in the discharge piping of the affected systems. The evaluation of the maximum allowable void sizes based on the ECCS function shows that, with that largest volume of air, all pipe stresses and pipe support loading remain within normal design allowables or operability limit values. These void volumes are well above the potential air voids due to local high points or any expected amount of air accumulation. The maximum allowable void sizes based on the ECCS function are considered to be the operability limit for these systems. Potential air voids due to local high points based on as-built piping slope deviations from horizontal, which are well below these maximum allowable void volumes, were evaluated as described in item (6) below.

Pilgrim Station procedures provide maximum assurance that gas accumulation is prevented. This is accomplished by rigorous filling and venting practices and a "zero tolerance" for as-found gas accumulation during routine venting. The acceptance criteria below are not used to establish any allowable amount of air during routine venting. These void volumes are intended to be used only for operability determinations if air voids are detected.

The following acceptance criteria are applicable:

		Maximum Void Size (ft^3)		
System		**Suction[1]**	**Discharge[2]**	**Relief Valve[3]**
HPCI		4.26	36.46	n/a
RHR	12" Torus Return	4.81	41.17	7.49
	18" LPCI Main		82.35	16.50
	10" Cont. Spray		19.00	3.54
Core Spray		3.61	30.88	8.14

1. Based on initial startup transient 10% void fraction for up to 5 seconds on the pump suction side.
2. Based on maximum gas volume defined by an evaluation of the gas intrusion impact on ECCS performance (accounts for suction void size also at the maximum value shown).
3. Based on gas volume accumulation such that relief valve setpoints are not exceeded in the RHR and CS systems.

It is known that the simplified evaluation methodology for water hammer peak pressure is conservative in several respects. This methodology assumes that the air void volume is consolidated in one location; at the high point end of a single piping run, and the water is assumed to be incompressible. In actual cases where the air voids are distributed in several locations (e.g., local high points due to pipe slopes), the resulting water hammer would be significantly reduced.

This is particularly relevant to the LPCI/RHR System, which is the largest ECCS System and has the largest potential for the presence of localized air voids due to minor as-built pipe slopes in horizontal lines. The potential total air volume, when measurement uncertainties are included, is less than the void volume that can result in a peak transient pressure that exceeds the relief valve setpoint. Peak pressures predicted by the simplified evaluation method would also not be expected because these postulated voids are distributed throughout the system, which has multiple branches and loop cross-tie piping that diminish the effect of the pump start transient. It is also noted that there are only small thermal relief valves in the discharge piping that are for thermal expansion conditions and are not needed for overpressure protection from water hammer pressure transients. In addition, this postulated pressure transient would occur during the RHR Pump starts performed for routine In-Service Testing (IST) and this has not been observed.

LPCI and Core Spray System responses following a loss of the Keep-Fill System have been considered to address gas void formation and system restoration. For Loss-of-Offsite-Power (LOOP) scenarios with the LPCI and Core Spray Systems in their normal standby valve lineups, which are initially full and water-solid, these systems will remain in the full condition. There are no sources of air intrusion into these systems, and high elevation column-separation is only a concern for long-term system leakage effects while in the standby configuration.

c) *Pump discharge piping which is not susceptible to water hammer or pressure pulsation following a pump start:*

The RHR Containment Spray piping downstream of the isolation valves that are normally-closed during power operation is not susceptible to water hammer, as this is open-ended piping that is designed to be empty during normal operation. This mode of RHR operation is manually initiated by opening the isolation valves to fill the riser and spray headers when needed to reduce Drywell and/or Torus temperature and pressure after core cooling has been established.

d) *Effects of RCS Gas Ingestion:*

The acceptance criteria for pump discharge side voiding is based on an evaluation of water hammer effects on piping and supports for air voids up to the limiting maximum void size that adversely affects ECCS performance. A conservative "worst case" scenario evaluation providing a limiting LOCA Peak Clad Temperature (PCT) heatup rate of 12°F/sec has been determined for the entire U.S. BWR fleet. Using this heatup rate, 48°F of PCT impact is assessed with a maximum of 4 seconds delay in the ECCS actuation.

An assessment concluded 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 of the Loss of Feedwater (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. *Changes, if any, to the design basis documents (corrective actions) and the schedule for completion of the corrective actions:*

   The design basis document review determined that there were no weaknesses or deficiencies in any of the licensing documents listed. No corrective actions are currently required.

4. *Results of the system P&ID and isometric drawing reviews to identify all system vents and high points:*

   A complete system isometric scale drawing was developed by compiling all of the fabrication isometric drawings for each system. Vent locations were also shown on these drawings to determine any unventable locations. There is a high point vent on each system discharge that is accessible by Operations for filling and venting during shutdown conditions. For the RHR and CS systems, these vents are also accessible for the routine (monthly) keep-fill venting. Pump drawings were also reviewed. There is a high point vent on each system pump that is accessible to completely fill and vent the pump casings.

   Potentially unventable local high points were evaluated in all areas where gas can accumulate in the system. This included isolated branch lines, heat exchangers, and areas located upstream of closed isolation valves. This evaluation identified system high points where air could accumulate in the RHR, CS, and HPCI systems. Each potential location was evaluated for acceptability or subjected to ultrasonic testing (UT) to assess the condition, as described in item (6) below.

5. *New vent valve locations, modifications to existing vent valves, or utilization of existing vent valves based on the drawing review.*

   Evaluation and ultrasonic testing (UT) of the locations identified in the drawing review indicated that there were no adverse conditions. As a result of this review, no new vent locations are required to maintain the systems full of water during normal operation. All systems will maintain "full condition" once they have been properly filled and vented. Potential new vent locations were only identified in areas that would facilitate filling and venting when performing maintenance, as described in item (6) below.

6. *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.*

   Pilgrim Station performed confirmatory walkdowns of piping outside containment for the subject system lines in order to verify that the fabrication isometric drawings and P&IDs match the as-built system configuration. Elements addressed during this walkdown also included component location, vent locations, including the location on the pipe, and piping slope.

   The field walkdowns validated the configuration of the plant that is represented on the piping isometric drawings and P&IDs. This included vent and drain locations, as well as

system components. Original piping fabrication isometrics at PNPS did not indicate any intentional sloping for horizontal water lines such that all horizontal water-carrying piping was designed to be horizontal within the normal fabrication tolerances. No unusual conditions outside of expected installation tolerance deviations were identified.

The susceptible portions of each system were evaluated to determine if additional corrective action was required. As a result, ultrasonic testing (UT) was performed on the following sections of pipe that were determined to be vulnerable:

- The discharge piping of HPCI has a normally-closed isolation valve in a vertical run of pipe. The system high point vent is downstream and the system is only ventable during plant shutdown. UT exams upstream of the isolation valve identified that the pipe was water solid. Procedural improvements have been initiated to ensure the system is filled and vented properly during refueling outages as evaluated in the "Corrective Actions Evaluation" and Sections 'B' and 'C' of this Attachment.
- The suppression pool suction for the HPCI pump has two normally-closed isolation valves and an upward sloped line with local high points that are prevented from completely venting through the pump in the normal CST suction lineup. UT exams upstream of both isolation valves identified that the pipe had a small pocket of air. The corrective action process at Pilgrim Station determined the system to be operable based on the acceptance criteria in item (2). This is a potential new vent location that would facilitate filling and venting during normal operation or when performing maintenance.
- The Loop 'A' Core Spray discharge line has an inverted "U" section that does not have a local vent. The piping was subjected to a UT inspection and the pipe was found to be water solid. Procedural improvements have been initiated to ensure the system is filled and vented properly during refueling outages as evaluated in the "Corrective Actions Evaluation" and Sections 'B' and 'C' of this Attachment. This is a potential new vent location that would facilitate filling and venting during normal operation or when performing maintenance.

The following locations were evaluated as acceptable:

- The Core Spray pump suction piping in each loop has a normally-isolated branch line that is an alternate suction path to the Condensate Storage Tank (CST). These lines are used at high flow during refueling for reactor basin flood-up and will remain full. There is no safety function mode of CS that requires this suction path to be used, as the CS pumps are normally lined up to the Torus.
- The RHR pump suction piping in each loop has a normally-isolated branch line that is the Shutdown Cooling (SDC) suction path to the Reactor Recirculation System. This suction path is used during normal reactor shutdowns with manual lineup and initiation and will remain full. There is no safety function mode of RHR that requires this suction path to be used, as the RHR pumps are normally lined up to the Torus.

Potential air voids due to local high points based on as-built piping slope deviations from horizontal were evaluated based on acceptance criteria developed by the water hammer calculation methodology described earlier. From this evaluation, it is concluded that any water hammer during a pump start in the ECCS Systems that occurs due to the potential air in the system would result in pipe stress and pipe support loading that is within normal design allowable values.

Small portions of each system were inaccessible for completing all walkdown activities. The walkdowns that were completed validated that the piping design information was correct and accurate, with no deviations found outside of normal installation tolerances. Based on this field work, together with the analysis performed demonstrating the available tolerance to air voids, it is concluded that there will be no significant adverse effects from any of the inaccessible areas.

7. *Locations of new vent valves, modifications to existing vent valves, or utilization of existing vent valves that resulted from the confirmatory walkdowns, summary of the corrective actions, schedule for completion of these corrective actions, i.e., the walkdowns that have been completed, and the walkdowns not yet complete.*

   No new vent valve locations were identified as a requirement to completely fill and vent the LPCI / RHR, Core Spray, and HPCI Systems as result of the system review.

8. *Results of the fill and vent activities and procedure reviews for each system:*

   For each subject system, the process used for filling and venting the system was reviewed. This included all applicable procedures. Existing procedures were reviewed to identify any required revisions, as well as identifying the need for the creation of new procedures to address venting. Identified procedure enhancements have been entered into Pilgrim Station's Corrective Action Program for tracking and final resolution, as described in Sections 'B' and 'C' of this Attachment.

9. *Procedure revisions, or new procedures resulting from the fill and vent activities, procedure reviews that need to be developed, and summary of the corrective actions, and schedule for completion of the corrective actions.*

   Procedure revisions will be made to ensure that future fill and vent activities, including those performed during shutdown conditions, are performed in the best possible manner and with all suitable precautions well understood. Enhancements to PNPS procedures will ensure clarity when discussing venting operations and associated acceptance criteria, including the establishment of an explicit "zero tolerance" for air found during periodic venting. These changes are being tracked by the Corrective Action Process and will be completed by the start of Pilgrim Station's 2009 RFO.

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

    The design basis review determined that there were no weaknesses or deficiencies in any of the subject systems. No corrective actions were required.

11. *Ongoing Industry Programs:*

    Ongoing industry programs are planned that may impact the conclusions reached during the Design Evaluation of Pilgrim Station relative to gas accumulation. The activities will be monitored to determine if additional changes to the Pilgrim Station design may be required or desired to provide additional margin.

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

    No corrective actions are required to ensure operability. Enhancements to Pilgrim Station procedures will be completed by the start of Pilgrim Station's 2009 RFO. These

enhancements are not required and are only provided to ensure adequate information is given to operations. The details of these enhancements are located in Sections 'B' and 'C' of this Attachment.

Testing Evaluation

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

For each system, LPCI / RHR, Core Spray, and HPCI, the process used for filling and venting the system was reviewed. This included all applicable procedures. Pilgrim Station procedures adequately vent the systems of air at system high points, conforming to TS requirements.

PNPS uses a generic fill, vent, and drain procedure to provide the overall requirements for venting in all systems. The System Fill, Vent, and Drain Instructions provide generic instructions and include the template for a "System Fill & Vent Plan", which is incorporated with the applicable system tagout. In addition, the individual system operating procedures provide the normal startup and operational venting instructions for each system. For LPCI / RHR and Core Spray, there is also the "LPCI System and Core Spray System Keep-Fill Checks", which fulfill the monthly requirements of the Technical Specifications keep-fill checks (Technical Specifications Sections 3.5.H and 4.5.H) by venting the high points on the discharge piping of these systems and observing solid water flow.

Existing venting procedures and practices utilize effective sequencing of steps, adequate venting durations, and acceptance criteria for the completion of venting. Additionally, a second Senior Reactor Operator (SRO) must review and sign any System Fill & Vent Plan. The purpose of this review is to verify that the plan is adequate for the task and that valve manipulations are properly recorded. It is required that whenever LPCI, Core Spray or HPCI are required to be operable, the discharge piping from the pump discharge of these systems to the last block valve have to be filled, in accordance with Tech Spec 3.5.H. During the monthly keep-fill checks, the LPCI and Core Spray discharge piping is vented from the high point and water flow observed. If air is present during venting or water flow is not observed, then the Shift Manager (SM) is notified immediately and action is initiated to determine the cause and correct the problem, including the initiation of Corrective Action Documentation.

Filling & venting of the HPCI System is currently performed routinely during refueling outages as part of the procedure for Local Leak Rate Testing (LLRT) of Primary Containment isolation valves. A System Fill & Vent Plan is completed and attached to the applicable tagout for the valve surveillance. Periodic venting of the HPCI system during normal operation is not required or performed when the system is lined up to the CST. The elevation of the CST provides adequate head to keep the system piping full. As a result of this review, it was determined that specific fill & vent instructions should be included in the normal system operating procedure for this purpose and Pilgrim Station will enhance the applicable procedures to ensure venting is completed before startup operations.

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

   Based on the review of testing requirements and system design, Pilgrim Station will develop procedural enhancements to capture the results of venting operation review. This will include, as required, entry into the Corrective Actions Process if any air is present during venting operations and notification of the Shift Manager.

3. *Procedures relating to the manual operation of the RHR System in its decay heat removal mode of operation.*

   The Shutdown Cooling (SDC) mode of operation of the RHR System is used to remove core decay heat and sensible heat from the reactor primary system in order to permit cool down and to maintain the reactor in a cold condition for refueling and servicing. The SDC mode of RHR is a non-safety-related function and is capable of reducing reactor water temperature to 125°F approximately 20 hours after reactor shutdown. The transition of the LPCI / RHR System from its standby LPCI valve lineup into the SDC mode is performed manually in accordance with procedures that provide detailed guidance to Operations personnel. Depending on whether the loop water chemistry is satisfactory, a system loop flush is performed using water from the Condensate Transfer System through 4" flushing supply lines. Any initial entry into SDC requires that a detailed venting process be performed. The filling and venting is performed using the Keep-Fill System water supply with the 2" bypass flow path open for additional capacity, rather than the normal keep-fill supply 1" globe valve. These highly developed procedures preclude any water hammer transient upon startup of the RHR pump.

4. *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:*

   The potential for gas intrusion due to inadvertent draining, system realignments, and incorrect maintenance and testing procedures is precluded by the implementation of specific System Fill & Vent Plans in accordance with Pilgrim Station procedures, which are controlled via the station tagout process.

5. *Method of documenting and trending gas voids if found in any of the subject systems:*

   During the monthly keep-fill checks, the LPCI and Core Spray discharge piping is vented from the high point and water flow observed. If air is present during venting or water flow is not observed, the Shift Manager (SM) is notified immediately and action is initiated to determine the cause and correct the problem, including the initiation of Corrective Action Documentation.

6. *List of items that have not been completed, a schedule for their completion, and the basis for that schedule:*

   All corrective actions based on the above Testing Evaluation review are procedural enhancements and are not required to ensure operability. These corrective actions have been entered into the CAP and will be completed before Pilgrim Station's RFO-17 in 2009. The details of these enhancements are located in Sections 'B' and 'C' of this report.

Corrective Actions Evaluation

1. *Results of the reviews regarding how gas accumulation has been addressed:*

   As a result of the reviews associated with GL2008-01, Pilgrim Station is making procedural enhancements to facilitate operations. These are changes that are not required to ensure operability and will only help with verification that all systems are water solid.

   The following procedural enhancements will be introduced to ensure full systems:

   - Dynamically venting the RHR crosstie to flush potential air voids due to slope.
   - Dynamically venting the Core Spray Loop "A" inverted "U".
   - Specific instructions for filling and venting the HPCI system.

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

   All corrective actions based on these reviews are enhancements and are not required to ensure operability. These corrective actions have been entered into the CAP and will be completed before Pilgrim Stations RFO in 2009. The details of these enhancements are located in Sections 'B' and 'C' of this report.

Conclusion

Based upon the above, Entergy has concluded that Pilgrim Station is in conformance with its commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in the Entergy's Quality Assurance Program. Identified procedure enhancements have been entered into Pilgrim Station's Corrective Action Program for tracking and final resolution, as described in Sections B and C of this Attachment.

Based on the evaluations completed and documented herein, Entergy concludes that the evaluated systems are in compliance with the current licensing basis and design basis and applicable regulatory requirements and are operable. Suitable design, operational, and testing control measures are in place for maintaining this compliance.

B. DESCRIPTION OF NECESSARY CORRECTIVE ACTIONS

The following corrective actions were determined to be enhancements that will ensure continued compliance with the applicable regulations and requirements:

1. Improving RHR procedures to ensure that dynamic venting of the RHR crosstie is performed every two years after all evolutions that may introduce air into the system are completed. This will flush all potential air voids due to local high points from as-built slope variations.

2. Improving the Core Spray operating procedure to ensure that the inverted "U" in the Loop 'A' discharge of the system is dynamically filled during applicable shutdown conditions. Procedural enhancements will also be made to ensure this line is kept full once it has been vented.

3. Improving the HPCI procedure to include specific instructions for filling & venting system that may be referenced when performing maintenance and/or Local Leak Rate Testing.

4. Ensure procedures identify that there is no acceptable quantity of air that may be present or vented during monthly surveillances, other than amount from clearing the vent piping or attachments, and that corrective action shall be initiated whenever air is detected by immediately notifying the SM and initiating a Condition Report as-needed.

5. Develop administrative controls for capturing the results of venting operations, evaluating operability, and trending the results.

6. Entergy will evaluate, and submit as appropriate to the NRC, proposed changes (enhancements) to the Pilgrim Station Technical Specifications based upon the final, approved version of Technical Specification Task Force (TSTF) Traveler for unacceptable gas accumulation in ECCS, adjusted, as needed, to account for plant-specific design and licensing basis, within 90 days following NRC publication of the Notice of Approval of the TSTF Traveler in the Federal Register.

C. CORRECTIVE ACTION SCHEDULE

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

   Corrective actions identified as a result of the evaluations associated with GL 2008-01 have not been completed. All corrective actions are enhancements to the system that have been initiated in the Corrective Action Program.

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

   All corrective actions based on these reviews are enhancements and are not required to ensure operability. These corrective actions have been entered into the CAP and will be completed before Pilgrim Station's RFO in 2009. This is considered appropriate because these enhancements address operations during an outage, or startup from an outage. Field UTs of the systems' vulnerabilities identified that the systems are full of water. These vulnerabilities can only be present after maintenance activities during plant shutdown and cannot manifest themselves before the next outage.

   The programmatic tracking and trending administrative controls will be developed by July 2009. This provides time for Entergy to work as a Fleet to ensure that there is a consistent approach to monitoring gas accumulation in the subject systems.

   Pilgrim Station's schedule for TS improvements will be based on the industry effort to develop and obtain NRC approval of a TSTF.

D. CONCLUSIONS

Entergy has evaluated those Pilgrim Station systems that perform the functions described in this GL and has concluded that these systems are operable, as defined in Pilgrim Station TS and are in conformance to our commitments to the applicable General Design Criteria (GDC), as stated in the Pilgrim Station UFSAR. It is also concluded that there will be no significant adverse effects from any of the small portions of each system that were inaccessible for completing all walkdown activities.

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 Reference 1.0, Pilgrim Station will complete its evaluation of the inaccessible portions of these systems by startup from the 2009 RFO and will provide a supplement to this response within 90 days thereafter.

E. REFERENCES

1.0 NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal and Containment Spray Systems," NVY 08-008, dated January 11, 2008

2.0 Letter, PNPS to USNRC, "Pilgrim Station Three Month Response to Generic Letter 2008-001," BVY 08-020, dated April 20, 2008

3.0 Letter, USNRC to PNPS, "Pilgrim Nuclear Power 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 (TAC NO. MD7863)

4.0 Pilgrim Station Engineering Report PNP-ME-08-00002 Rev 0 "Summary of Activities Associated with the Resolution of GL 2008-01"

Attachment 2 to ENO Letter 2.08.055

Pilgrim Nuclear Power Station

Pilgrim Station Regulatory Commitment List

(1 page)

Attachment 2 to Letter 2.08.055
Summary of 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.

List of Regulatory Commitments			
COMMITMENT	**TYPE (Check one)**		**SCHEDULED COMPLETION DATE (If Required)**
	ONE-TIME ACTION	**CONTINUING COMPLIANCE**	
Develop administrative controls for capturing the results of venting operations, evaluating operability and trending the results.		X	July 2009
Evaluate the applicability to Pilgrim Station the final, approved version of the Technical Specification Task force (TSTF) Traveler for unacceptable gas accumulations in ECCS systems.	X		Within 90 days following NRC publications of the Notice of Approval of the TSTF Traveler in the Federal Register

Entergy

Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
600 Rocky Hill Road
Plymouth, MA 02360

Kevin H. Bronson
Site Vice President

October 14, 2008

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
11555 Rockville Pike
Rockville, MD 20852

SUBJECT: Entergy Nuclear Operations, Inc.
Pilgrim Nuclear Power Station
Docket 50-293
License No. DPR-35

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

REFERENCE:

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. NRC letter, Re: Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems, Proposed Alternative Course of Action (TAC NO MD7863)", dated September 15, 2008
3. Entergy letter "Three-Month Response Extension Request to NRC Generic Letter 2008-01, Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems", dated April 10, 2008
4. Entergy letter "Three-Month Response to NRC Generic Letter 2008-01, Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems", dated May 7, 2008

LETTER NUMBER: 2.08.055

Dear Sir or Madam:

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 dated January 11, 2008 (Reference 1). This GL requested that each licensee evaluate the licensing basis, design, testing, and Corrective Action Programs for the Emergency Core Cooling Systems (ECCS), Residual Heat Removal (RHR) system, and Containment Spray system, 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.

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

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

Attachment 1 to this letter contains Entergy's Pilgrim Nuclear Power Station (Pilgrim Station) nine-month response to NRC GL 2008-01.

Attachment 2 contains the commitments made in this letter.

Entergy Nuclear Operations, Inc (ENO) is involved in industry activities which may impact the conclusions reached during this evaluation of Pilgrim Station relative to gas accumulation. These activities will be monitored to determine if additional changes to the PNPS licensing and design basis are needed or desired. The actions identified in this response will be refined as PNPS and the nuclear industry identify processes and lessons-learned that can reduce the vulnerability to gas in accumulation in ECC systems.

If you have any questions or require additional information, please contact Mr. Joseph R. Lynch, Licensing Manager, at (508) 830-8403.

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

Executed on October 14th, 2008.

Sincerely,

for Kevin H. Bronson
Site Vice President

RMB/dal

Attachments: 1. PNPS Nine Month Response to NRC Generic Letter 2008-01 – 15 pages
2. Summary of Commitments – 1 page

cc: Mr. James S. Kim, Project Manager
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Pilgrim Nuclear Power Station

Attachment 1 to ENO Letter 2.08.055

Attachment 1 to Letter 2.08.055

PNPS Nine Month Response to NRC Generic Letter GL2008-01

(16 pages)

This Attachment contains the Entergy Nuclear Operations, Inc (ENO) Pilgrim Nuclear Power Station (Pilgrim Station) 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 (Reference 1). 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."

This response includes the results of ENO's comprehensive evaluation of the subject systems. As committed in Reference 3 and accepted in Reference 4, ENO will complete its evaluation of any inaccessible portions of these systems by startup from the 2009 RFO and will provide a supplement to this response within 90 days following startup but no later than August 10, 2009.

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 Core Standby Cooling Systems (CSCS) were determined to be in the scope of GL 2008-01 for Pilgrim Station:

- High Pressure Coolant Injection (HPCI) System
- Core Spray (CS) System
- Residual Heat Remove (RHR) System
  - Low Pressure Coolant Injection (LPCI) mode
  - Containment Spray Cooling mode
  - Suppression Pool Cooling mode
  - Shutdown Cooling mode

It should be noted that there are related issues that the nuclear industry is currently considering with respect to the overall performance of these systems (e.g., GSI-193). Consistent with discussions in SECY 2008-108, resolution of these related issues will be addressed independent of the Generic Letter and will not be addressed herein.

A. EVALUATION RESULTS

Licensing Basis Evaluation

Entergy, Pilgrim Nuclear Power Station (Pilgrim Station) licensing basis was reviewed with respect to gas accumulation in the Emergency Core Cooling Systems (i.e. HPCI, RHR and CS as well as other decay heat removal and containment spray systems). This review included the Technical Specifications (TS), TS Bases, Updated Final Safety Analysis Report (UFSAR), responses to NRC generic communications, Regulatory Commitments, and License Conditions.

1. *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 using Entergy's Licensing Document search engine.

   A review of the UFSAR did not identify any specific requirements related to gas accumulation in the ECCS systems. However, from the system descriptions it is evident that the ECCS systems are assumed to be water-filled. No specific venting discussion or void acceptance criterion was identified.

   Pilgrim Station TS includes limiting conditions for operation and surveillance requirements that address gas accumulation in ECCS systems. These require the RHR, Core Spray, and HPCI systems to be filled up to the last block valve when they are required to be operable. The surveillance requirement is for monthly venting of RHR and CS at all times, and monthly venting of HPCI when aligned to the suppression pool.

   There is currently no proposed change to the TS Bases. Following the NRC and NEI resolution of the general issue regarding whether statements in TS Bases should more accurately state the necessity to ensure the systems are "sufficiently full of water" versus simply "full of water", the Bases for the TS SR(s) will be re-evaluated.

   No specific regulatory commitments were identified with respect to gas accumulation within the ECCS systems in response to NRC generic communications.

   Each plant licensed before the GDCs were formally adopted, including PNPS, was evaluated on a plant-specific basis, determined to be in compliance with the intent of the later GDCs, and licensed by the Commission. Furthermore, current regulatory processes are sufficient to ensure that plants continue to operate and comply with the intent of the GDCs. Plants with construction permits issued prior to May 21, 1971 did not need exemptions from the GDC.

2. *Changes to licensing basis documents (corrective actions):*

   The licensing basis document review determined that there were no weaknesses or deficiencies in any of the licensing documents listed. No corrective actions are currently required.

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 Technical Specifications Task Force (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 from the evaluation 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 Pilgrim Station, and evaluate adopting the Traveler to either supplement or replace the current TS requirements.

Design Evaluation

Pilgrim Station's design basis was reviewed with respect to gas accumulation in the subject systems. This review included Design Basis Documents (DBDs), Calculations, Engineering Evaluations, and Vendor Technical Manuals.

1. *Results of the review of the design basis documents:*

   Although it is clear that the design calls for the systems to be water filled, Pilgrim Station's review did not identify any specific design requirements relating to acceptable void size for the subject systems. Pilgrim Station historically has not had any systems experience significant gas accumulation in either pump discharge or suction piping.

   Pilgrim Station TS requirements identify monthly periodic venting for RHR, Core Spray, and HPCI.

   Gas can be introduced from suction sources due to formation of air entraining vortices or by not isolating the preferred water source before level is too low. To methodically address such issues at all Entergy plants, Fleet Guide EN-ME-G-001 "Evaluation of Pump Protection from Low Submergence" was prepared to provide a systematic approach for evaluation of the potential for air ingestion in pumps due to low submergence, vortexing, and air ingestion.

   The Condensate Transfer System provides positive pressure as keep-fill to the RHR and Core Spray pumps discharge lines. This is necessary as the suction lines of these pumps are lined up to the Torus. The HPCI suction line is lined up to the Condensate Storage Tanks (CSTs) and the static water head alone provides adequate pressure to maintain these lines full.

   The Containment Spray Cooling mode of RHR provides water to a spray header system inside the drywell. This spray header is open to the drywell environment and is only required to be full up to the Containment Spray isolation valves. Air-filled piping downstream of the first normally-closed motor operated isolation valve would not create a water hammer that could challenge the operability of those systems.

   The HPCI Pumps are normally aligned to receive suction from the CST. After cooling the reactor, the water exits via the postulated break and drain to the Torus. Once the CST is depleted, the HPCI suction source is transferred to the suppression pool, which is the safety related, long-term water source.

   As a result of the complete review of all PNPS ECCS Systems for potential air intrusion from suction source vortexing due to low submergence, corrective actions were initiated in 2006 and updated in 2008 for the HPCI System. There is presently an Operability Determination in place demonstrating that the current procedures and operator guidance are adequate to protect against air ingestion into the HPCI suction when aligned to the CSTs. *Long term corrective actions are planned to revise the Technical Specification* allowable value for reserve volume and raise the pressure switch setpoint for the HPCI automatic transfer on low CST level.

   The potential for gas intrusion due to inadvertent draining, system realignments and incorrect maintenance and testing procedures is precluded by the implementation of

specific System Fill & Vent Plans that are required by station procedure and are linked to the operations tagout used to isolate equipment for either maintenance or surveillance testing.

There are no locations in the LPCI / RHR, Core Spray, and HPCI Systems where leakage through isolation valves or through check valves can result in gas transport from the intrusion location to other locations in the ECCS.

The mission times of each ECCS system are specified in a Topical Design Basis Document (TDBD). The long-term duration specified for the operability of ECCS equipment is 30 days following a LOCA. The HPCI pump would transfer ECCS duties to RHR and CS once the RPV was depressurized.

2. *New applicable gas volume acceptance criteria for each piping segment in each system where gas can accumulate where no acceptance criteria previously existed, summary of the corrective actions, and schedule for completion of any corrective actions.*

   a) *Pump Suction Piping:*

      Gas volume acceptance criteria for ECCS pump suction voiding was determined to be a bounding initial startup transient 10% void fraction for up to 5 seconds, based on industry-developed guidance. This conservative criterion has been applied in support of system operability. These values, used in conjunction with other factors such as NPSH, suction submergence, and transients for which the system is credited, provide a basis for system operability.

   b) *Pump discharge piping which is susceptible to pressure pulsation after a pump start:*

      Gas volume acceptance criteria for ECCS pump discharge voiding is based on an evaluation of water hammer effects on piping and supports. Void size is limited by the maximum volume of gas that adversely affects ECCS performance, based on industry-developed guidance.

      Gas accumulation in the piping downstream of the pump to the first closed isolation valve or the RCS pressure boundary isolation valves would result in amplified pressure pulsations during a pump start. The subsequent pressure transient may exceed the setpoints of thermal relief valves in the subject systems, or result in unacceptable pipe loads (i.e., axial forces that are greater than the design rating of the axial restraints, or bending loads at elbows, nozzles, or anchor points). An evaluation method was established to determine the applicable limits for discharge piping gas accumulation in the affected systems. These limits are then used as the basis for acceptance criteria that can be applied to each system. The criteria was compared to the potential air accumulation that may be present due to the as-built line slopes determined from the system walkdowns (regardless of whether system operating practices would flush all gases from these potential void areas).

      The water hammer calculation methodology was based on the classical Joukowsky equation that relates peak pressure to the pump flow velocity and fluid momentum. The peak water hammer force acting on the piping is a function of the maximum rate of rise of the void pressure during the compression of the air volume upon the pump start. The resulting piping stresses and support loads are then dependent on the structural configuration and dynamic response of the piping and supports that are directly affected by the pressure transient amplitude and rise time.

      The evaluation used plant specific information for piping configuration, restraints and anchor points in the subject systems to determine the acceptable gas volume

accumulation such that the pipe loading is within acceptable limits (i.e., axial and bending forces are less than the design capacities of the piping, axial restraints, nozzles, and anchor points). The results are described in item (6) below.

The maximum air volume considered was defined by an industry-based evaluation of the gas intrusion impact on ECCS performance , i.e., air intrusion in the ECCS lines can temporarily reduce and delay the coolant injection as described in item (d) below. In addition, the evaluation determined that there is typically a much smaller acceptable gas volume accumulation such that relief valve setpoints are not exceeded in the RHR and CS systems.

Entergy has implemented this methodology for Pilgrim Station and established the applicable limits for gas accumulation in the discharge piping of the affected systems. The evaluation of the maximum allowable void sizes based on the ECCS function shows that, with that largest volume of air, all pipe stresses and pipe support loading remain within normal design allowables or operability limit values. These void volumes are well above the potential air voids due to local high points or any expected amount of air accumulation. The maximum allowable void sizes based on the ECCS function are considered to be the operability limit for these systems. Potential air voids due to local high points based on as-built piping slope deviations from horizontal, which are well below these maximum allowable void volumes, were evaluated as described in item (6) below.

Pilgrim Station procedures provide maximum assurance that gas accumulation is prevented. This is accomplished by rigorous filling and venting practices and a "zero tolerance" for as-found gas accumulation during routine venting. The acceptance criteria below are not used to establish any allowable amount of air during routine venting. These void volumes are intended to be used only for operability determinations if air voids are detected.

The following acceptance criteria are applicable:

		Maximum Void Size (ft^3)		
System		**Suction[1]**	**Discharge[2]**	**Relief Valve[3]**
HPCI		4.26	36.46	n/a
RHR	12" Torus Return	4.81	41.17	7.49
	18" LPCI Main		82.35	16.50
	10" Cont. Spray		19.00	3.54
Core Spray		3.61	30.88	8.14

1. Based on initial startup transient 10% void fraction for up to 5 seconds on the pump suction side.
2. Based on maximum gas volume defined by an evaluation of the gas intrusion impact on ECCS performance (accounts for suction void size also at the maximum value shown).
3. Based on gas volume accumulation such that relief valve setpoints are not exceeded in the RHR and CS systems.

It is known that the simplified evaluation methodology for water hammer peak pressure is conservative in several respects. This methodology assumes that the air void volume is consolidated in one location; at the high point end of a single piping run, and the water is assumed to be incompressible. In actual cases where the air voids are distributed in several locations (e.g., local high points due to pipe slopes), the resulting water hammer would be significantly reduced.

This is particularly relevant to the LPCI/RHR System, which is the largest ECCS System and has the largest potential for the presence of localized air voids due to minor as-built pipe slopes in horizontal lines. The potential total air volume, when measurement uncertainties are included, is less than the void volume that can result in a peak transient pressure that exceeds the relief valve setpoint. Peak pressures predicted by the simplified evaluation method would also not be expected because these postulated voids are distributed throughout the system, which has multiple branches and loop cross-tie piping that diminish the effect of the pump start transient. It is also noted that there are only small thermal relief valves in the discharge piping that are for thermal expansion conditions and are not needed for overpressure protection from water hammer pressure transients. In addition, this postulated pressure transient would occur during the RHR Pump starts performed for routine In-Service Testing (IST) and this has not been observed.

LPCI and Core Spray System responses following a loss of the Keep-Fill System have been considered to address gas void formation and system restoration. For Loss-of-Offsite-Power (LOOP) scenarios with the LPCI and Core Spray Systems in their normal standby valve lineups, which are initially full and water-solid, these systems will remain in the full condition. There are no sources of air intrusion into these systems, and high elevation column-separation is only a concern for long-term system leakage effects while in the standby configuration.

c) *Pump discharge piping which is not susceptible to water hammer or pressure pulsation following a pump start:*

The RHR Containment Spray piping downstream of the isolation valves that are normally-closed during power operation is not susceptible to water hammer, as this is open-ended piping that is designed to be empty during normal operation. This mode of RHR operation is manually initiated by opening the isolation valves to fill the riser and spray headers when needed to reduce Drywell and/or Torus temperature and pressure after core cooling has been established.

d) *Effects of RCS Gas Ingestion:*

The acceptance criteria for pump discharge side voiding is based on an evaluation of water hammer effects on piping and supports for air voids up to the limiting maximum void size that adversely affects ECCS performance. A conservative "worst case" scenario evaluation providing a limiting LOCA Peak Clad Temperature (PCT) heatup rate of 12°F/sec has been determined for the entire U.S. BWR fleet. Using this heatup rate, 48°F of PCT impact is assessed with a maximum of 4 seconds delay in the ECCS actuation.

An assessment concluded 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 of the Loss of Feedwater (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. *Changes, if any, to the design basis documents (corrective actions) and the schedule for completion of the corrective actions:*

   The design basis document review determined that there were no weaknesses or deficiencies in any of the licensing documents listed. No corrective actions are currently required.

4. *Results of the system P&ID and isometric drawing reviews to identify all system vents and high points:*

   A complete system isometric scale drawing was developed by compiling all of the fabrication isometric drawings for each system. Vent locations were also shown on these drawings to determine any unventable locations. There is a high point vent on each system discharge that is accessible by Operations for filling and venting during shutdown conditions. For the RHR and CS systems, these vents are also accessible for the routine (monthly) keep-fill venting. Pump drawings were also reviewed. There is a high point vent on each system pump that is accessible to completely fill and vent the pump casings.

   Potentially unventable local high points were evaluated in all areas where gas can accumulate in the system. This included isolated branch lines, heat exchangers, and areas located upstream of closed isolation valves. This evaluation identified system high points where air could accumulate in the RHR, CS, and HPCI systems. Each potential location was evaluated for acceptability or subjected to ultrasonic testing (UT) to assess the condition, as described in item (6) below.

5. *New vent valve locations, modifications to existing vent valves, or utilization of existing vent valves based on the drawing review.*

   Evaluation and ultrasonic testing (UT) of the locations identified in the drawing review indicated that there were no adverse conditions. As a result of this review, no new vent locations are required to maintain the systems full of water during normal operation. All systems will maintain "full condition" once they have been properly filled and vented. Potential new vent locations were only identified in areas that would facilitate filling and venting when performing maintenance, as described in item (6) below.

6. *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.*

   Pilgrim Station performed confirmatory walkdowns of piping outside containment for the subject system lines in order to verify that the fabrication isometric drawings and P&IDs match the as-built system configuration. Elements addressed during this walkdown also included component location, vent locations, including the location on the pipe, and piping slope.

   The field walkdowns validated the configuration of the plant that is represented on the piping isometric drawings and P&IDs. This included vent and drain locations, as well as

system components. Original piping fabrication isometrics at PNPS did not indicate any intentional sloping for horizontal water lines such that all horizontal water-carrying piping was designed to be horizontal within the normal fabrication tolerances. No unusual conditions outside of expected installation tolerance deviations were identified.

The susceptible portions of each system were evaluated to determine if additional corrective action was required. As a result, ultrasonic testing (UT) was performed on the following sections of pipe that were determined to be vulnerable:

- The discharge piping of HPCI has a normally-closed isolation valve in a vertical run of pipe. The system high point vent is downstream and the system is only ventable during plant shutdown. UT exams upstream of the isolation valve identified that the pipe was water solid. Procedural improvements have been initiated to ensure the system is filled and vented properly during refueling outages as evaluated in the "Corrective Actions Evaluation" and Sections 'B' and 'C' of this Attachment.
- The suppression pool suction for the HPCI pump has two normally-closed isolation valves and an upward sloped line with local high points that are prevented from completely venting through the pump in the normal CST suction lineup. UT exams upstream of both isolation valves identified that the pipe had a small pocket of air. The corrective action process at Pilgrim Station determined the system to be operable based on the acceptance criteria in item (2). This is a potential new vent location that would facilitate filling and venting during normal operation or when performing maintenance.
- The Loop 'A' Core Spray discharge line has an inverted "U" section that does not have a local vent. The piping was subjected to a UT inspection and the pipe was found to be water solid. Procedural improvements have been initiated to ensure the system is filled and vented properly during refueling outages as evaluated in the "Corrective Actions Evaluation" and Sections 'B' and 'C' of this Attachment. This is a potential new vent location that would facilitate filling and venting during normal operation or when performing maintenance.

The following locations were evaluated as acceptable:

- The Core Spray pump suction piping in each loop has a normally-isolated branch line that is an alternate suction path to the Condensate Storage Tank (CST). These lines are used at high flow during refueling for reactor basin flood-up and will remain full. There is no safety function mode of CS that requires this suction path to be used, as the CS pumps are normally lined up to the Torus.
- The RHR pump suction piping in each loop has a normally-isolated branch line that is the Shutdown Cooling (SDC) suction path to the Reactor Recirculation System. This suction path is used during normal reactor shutdowns with manual lineup and initiation and will remain full. There is no safety function mode of RHR that requires this suction path to be used, as the RHR pumps are normally lined up to the Torus.

Potential air voids due to local high points based on as-built piping slope deviations from horizontal were evaluated based on acceptance criteria developed by the water hammer calculation methodology described earlier. From this evaluation, it is concluded that any water hammer during a pump start in the ECCS Systems that occurs due to the potential air in the system would result in pipe stress and pipe support loading that is within normal design allowable values.

Small portions of each system were inaccessible for completing all walkdown activities. The walkdowns that were completed validated that the piping design information was correct and accurate, with no deviations found outside of normal installation tolerances. Based on this field work, together with the analysis performed demonstrating the available tolerance to air voids, it is concluded that there will be no significant adverse effects from any of the inaccessible areas.

7. *Locations of new vent valves, modifications to existing vent valves, or utilization of existing vent valves that resulted from the confirmatory walkdowns, summary of the corrective actions, schedule for completion of these corrective actions, i.e., the walkdowns that have been completed, and the walkdowns not yet complete.*

   No new vent valve locations were identified as a requirement to completely fill and vent the LPCI / RHR, Core Spray, and HPCI Systems as result of the system review.

8. *Results of the fill and vent activities and procedure reviews for each system:*

   For each subject system, the process used for filling and venting the system was reviewed. This included all applicable procedures. Existing procedures were reviewed to identify any required revisions, as well as identifying the need for the creation of new procedures to address venting. Identified procedure enhancements have been entered into Pilgrim Station's Corrective Action Program for tracking and final resolution, as described in Sections 'B' and 'C' of this Attachment.

9. *Procedure revisions, or new procedures resulting from the fill and vent activities, procedure reviews that need to be developed, and summary of the corrective actions, and schedule for completion of the corrective actions.*

   Procedure revisions will be made to ensure that future fill and vent activities, including those performed during shutdown conditions, are performed in the best possible manner and with all suitable precautions well understood. Enhancements to PNPS procedures will ensure clarity when discussing venting operations and associated acceptance criteria, including the establishment of an explicit "zero tolerance" for air found during periodic venting. These changes are being tracked by the Corrective Action Process and will be completed by the start of Pilgrim Station's 2009 RFO.

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

    The design basis review determined that there were no weaknesses or deficiencies in any of the subject systems. No corrective actions were required.

11. *Ongoing Industry Programs:*

    Ongoing industry programs are planned that may impact the conclusions reached during the Design Evaluation of Pilgrim Station relative to gas accumulation. The activities will be monitored to determine if additional changes to the Pilgrim Station design may be required or desired to provide additional margin.

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

    No corrective actions are required to ensure operability. Enhancements to Pilgrim Station procedures will be completed by the start of Pilgrim Station's 2009 RFO. These

enhancements are not required and are only provided to ensure adequate information is given to operations. The details of these enhancements are located in Sections 'B' and 'C' of this Attachment.

Testing Evaluation

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

For each system, LPCI / RHR, Core Spray, and HPCI, the process used for filling and venting the system was reviewed. This included all applicable procedures. Pilgrim Station procedures adequately vent the systems of air at system high points, conforming to TS requirements.

PNPS uses a generic fill, vent, and drain procedure to provide the overall requirements for venting in all systems. The System Fill, Vent, and Drain Instructions provide generic instructions and include the template for a "System Fill & Vent Plan", which is incorporated with the applicable system tagout. In addition, the individual system operating procedures provide the normal startup and operational venting instructions for each system. For LPCI / RHR and Core Spray, there is also the "LPCI System and Core Spray System Keep-Fill Checks", which fulfill the monthly requirements of the Technical Specifications keep-fill checks (Technical Specifications Sections 3.5.H and 4.5.H) by venting the high points on the discharge piping of these systems and observing solid water flow.

Existing venting procedures and practices utilize effective sequencing of steps, adequate venting durations, and acceptance criteria for the completion of venting. Additionally, a second Senior Reactor Operator (SRO) must review and sign any System Fill & Vent Plan. The purpose of this review is to verify that the plan is adequate for the task and that valve manipulations are properly recorded. It is required that whenever LPCI, Core Spray or HPCI are required to be operable, the discharge piping from the pump discharge of these systems to the last block valve have to be filled, in accordance with Tech Spec 3.5.H. During the monthly keep-fill checks, the LPCI and Core Spray discharge piping is vented from the high point and water flow observed. If air is present during venting or water flow is not observed, then the Shift Manager (SM) is notified immediately and action is initiated to determine the cause and correct the problem, including the initiation of Corrective Action Documentation.

Filling & venting of the HPCI System is currently performed routinely during refueling outages as part of the procedure for Local Leak Rate Testing (LLRT) of Primary Containment isolation valves. A System Fill & Vent Plan is completed and attached to the applicable tagout for the valve surveillance. Periodic venting of the HPCI system during normal operation is not required or performed when the system is lined up to the CST. The elevation of the CST provides adequate head to keep the system piping full. As a result of this review, it was determined that specific fill & vent instructions should be included in the normal system operating procedure for this purpose and Pilgrim Station will enhance the applicable procedures to ensure venting is completed before startup operations.

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

   Based on the review of testing requirements and system design, Pilgrim Station will develop procedural enhancements to capture the results of venting operation review. This will include, as required, entry into the Corrective Actions Process if any air is present during venting operations and notification of the Shift Manager.

3. *Procedures relating to the manual operation of the RHR System in its decay heat removal mode of operation.*

   The Shutdown Cooling (SDC) mode of operation of the RHR System is used to remove core decay heat and sensible heat from the reactor primary system in order to permit cool down and to maintain the reactor in a cold condition for refueling and servicing. The SDC mode of RHR is a non-safety-related function and is capable of reducing reactor water temperature to 125°F approximately 20 hours after reactor shutdown. The transition of the LPCI / RHR System from its standby LPCI valve lineup into the SDC mode is performed manually in accordance with procedures that provide detailed guidance to Operations personnel. Depending on whether the loop water chemistry is satisfactory, a system loop flush is performed using water from the Condensate Transfer System through 4" flushing supply lines. Any initial entry into SDC requires that a detailed venting process be performed. The filling and venting is performed using the Keep-Fill System water supply with the 2" bypass flow path open for additional capacity, rather than the normal keep-fill supply 1" globe valve. These highly developed procedures preclude any water hammer transient upon startup of the RHR pump.

4. *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:*

   The potential for gas intrusion due to inadvertent draining, system realignments, and incorrect maintenance and testing procedures is precluded by the implementation of specific System Fill & Vent Plans in accordance with Pilgrim Station procedures, which are controlled via the station tagout process.

5. *Method of documenting and trending gas voids if found in any of the subject systems:*

   During the monthly keep-fill checks, the LPCI and Core Spray discharge piping is vented from the high point and water flow observed. If air is present during venting or water flow is not observed, the Shift Manager (SM) is notified immediately and action is initiated to determine the cause and correct the problem, including the initiation of Corrective Action Documentation.

6. *List of items that have not been completed, a schedule for their completion, and the basis for that schedule:*

   All corrective actions based on the above Testing Evaluation review are procedural enhancements and are not required to ensure operability. These corrective actions have been entered into the CAP and will be completed before Pilgrim Station's RFO-17 in 2009. The details of these enhancements are located in Sections 'B' and 'C' of this report.

Corrective Actions Evaluation

1. *Results of the reviews regarding how gas accumulation has been addressed:*

   As a result of the reviews associated with GL2008-01, Pilgrim Station is making procedural enhancements to facilitate operations. These are changes that are not required to ensure operability and will only help with verification that all systems are water solid.

   The following procedural enhancements will be introduced to ensure full systems:

   - Dynamically venting the RHR crosstie to flush potential air voids due to slope.
   - Dynamically venting the Core Spray Loop "A" inverted "U".
   - Specific instructions for filling and venting the HPCI system.

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

   All corrective actions based on these reviews are enhancements and are not required to ensure operability. These corrective actions have been entered into the CAP and will be completed before Pilgrim Stations RFO in 2009. The details of these enhancements are located in Sections 'B' and 'C' of this report.

Conclusion

Based upon the above, Entergy has concluded that Pilgrim Station is in conformance with its commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in the Entergy's Quality Assurance Program. Identified procedure enhancements have been entered into Pilgrim Station's Corrective Action Program for tracking and final resolution, as described in Sections B and C of this Attachment.

Based on the evaluations completed and documented herein, Entergy concludes that the evaluated systems are in compliance with the current licensing basis and design basis and applicable regulatory requirements and are operable. Suitable design, operational, and testing control measures are in place for maintaining this compliance.

B. DESCRIPTION OF NECESSARY CORRECTIVE ACTIONS

The following corrective actions were determined to be enhancements that will ensure continued compliance with the applicable regulations and requirements:

1. Improving RHR procedures to ensure that dynamic venting of the RHR crosstie is performed every two years after all evolutions that may introduce air into the system are completed. This will flush all potential air voids due to local high points from as-built slope variations.

2. Improving the Core Spray operating procedure to ensure that the inverted "U" in the Loop 'A' discharge of the system is dynamically filled during applicable shutdown conditions. Procedural enhancements will also be made to ensure this line is kept full once it has been vented.

3. Improving the HPCI procedure to include specific instructions for filling & venting system that may be referenced when performing maintenance and/or Local Leak Rate Testing.

4. Ensure procedures identify that there is no acceptable quantity of air that may be present or vented during monthly surveillances, other than amount from clearing the vent piping or attachments, and that corrective action shall be initiated whenever air is detected by immediately notifying the SM and initiating a Condition Report as-needed.

5. Develop administrative controls for capturing the results of venting operations, evaluating operability, and trending the results.

6. Entergy will evaluate, and submit as appropriate to the NRC, proposed changes (enhancements) to the Pilgrim Station Technical Specifications based upon the final, approved version of Technical Specification Task Force (TSTF) Traveler for unacceptable gas accumulation in ECCS, adjusted, as needed, to account for plant-specific design and licensing basis, within 90 days following NRC publication of the Notice of Approval of the TSTF Traveler in the Federal Register.

C. CORRECTIVE ACTION SCHEDULE

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

   Corrective actions identified as a result of the evaluations associated with GL 2008-01 have not been completed. All corrective actions are enhancements to the system that have been initiated in the Corrective Action Program.

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

   All corrective actions based on these reviews are enhancements and are not required to ensure operability. These corrective actions have been entered into the CAP and will be completed before Pilgrim Station's RFO in 2009. This is considered appropriate because these enhancements address operations during an outage, or startup from an outage. Field UTs of the systems' vulnerabilities identified that the systems are full of water. These vulnerabilities can only be present after maintenance activities during plant shutdown and cannot manifest themselves before the next outage.

   The programmatic tracking and trending administrative controls will be developed by July 2009. This provides time for Entergy to work as a Fleet to ensure that there is a consistent approach to monitoring gas accumulation in the subject systems.

   Pilgrim Station's schedule for TS improvements will be based on the industry effort to develop and obtain NRC approval of a TSTF.

D. CONCLUSIONS

Entergy has evaluated those Pilgrim Station systems that perform the functions described in this GL and has concluded that these systems are operable, as defined in Pilgrim Station TS and are in conformance to our commitments to the applicable General Design Criteria (GDC), as stated in the Pilgrim Station UFSAR. It is also concluded that there will be no significant adverse effects from any of the small portions of each system that were inaccessible for completing all walkdown activities.

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 Reference 1.0, Pilgrim Station will complete its evaluation of the inaccessible portions of these systems by startup from the 2009 RFO and will provide a supplement to this response within 90 days thereafter.

E. REFERENCES

1.0 NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal and Containment Spray Systems," NVY 08-008, dated January 11, 2008

2.0 Letter, PNPS to USNRC, "Pilgrim Station Three Month Response to Generic Letter 2008-001," BVY 08-020, dated April 20, 2008

3.0 Letter, USNRC to PNPS, "Pilgrim Nuclear Power 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 (TAC NO. MD7863)

4.0 Pilgrim Station Engineering Report PNP-ME-08-00002 Rev 0 "Summary of Activities Associated with the Resolution of GL 2008-01"

Attachment 2 to ENO Letter 2.08.055

Pilgrim Nuclear Power Station

Pilgrim Station Regulatory Commitment List

(1 page)

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.

List of Regulatory Commitments			
COMMITMENT	**TYPE (Check one)**		**SCHEDULED COMPLETION DATE (If Required)**
	ONE-TIME ACTION	**CONTINUING COMPLIANCE**	
Develop administrative controls for capturing the results of venting operations, evaluating operability and trending the results.		X	July 2009
Evaluate the applicability to Pilgrim Station the final, approved version of the Technical Specification Task force (TSTF) Traveler for unacceptable gas accumulations in ECCS systems.	X		Within 90 days following NRC publications of the Notice of Approval of the TSTF Traveler in the Federal Register