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U. S. Nuclear Regulatory Commission
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Mail Stop OP1-17
Washington, DC 20555

SUSQUEHANNA STEAM ELECTRIC STATION NINE-MONTH RESPONSE TO NRC GENERIC LETTER 2008-01 "MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS"
PLA-6439

Docket Nos. 50-387 and 50-388

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

2) PLA-6367, Mr. B. T. McKinney (PPL) to Document Control Desk (USNRC), "Three-Month Response to NRC Generic Letter 2008-01," dated May 27, 2008.

3) NRC Letter from B. K. Vaidya (NRC) to B. T. McKinney (PPL), dated August 12, 2008.

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 (Reference 1) to request that each licensee evaluate the licensing basis, design, testing, and corrective action programs for the Emergency Core Cooling Systems (ECCS), Decay Heat Removal 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 in accordance with 10 CFR 50.54(f) within nine months of the date of the GL to provide the information summarized below:

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

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(b) A description of all corrective actions, including plant, programmatic, procedure, and licensing basis modifications that were determined to be necessary to assure compliance with the quality assurance criteria in Sections III, V, XI, XVI, and XVII of Appendix B to 10 CFR Part 50 and the licensing basis and operating license as those requirements apply to the subject systems; and,

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

In Reference 2, PPL Susquehanna, LLC (PPL) committed to complete its assessments of those inaccessible portions of these systems/functions during the next Refuel Outage on each of the SSES units and provide a supplement to this report with those results within 90 days from startup of the respective unit. In Reference 3, the NRC accepted PPL's course of action for completing the assessments after the initial nine – month response period within 90 days following completion of each of the spring 2009 and spring 2010 refueling outages for SSES Unit 2 and SSES Unit 1, respectively.

PPL has concluded that the subject systems/functions at the Susquehanna Steam Electric Station (SSES) are in compliance with the Technical Specification (TS) definition of Operability and that SSES is currently in compliance with 10 CFR 50. Appendix B, Criterion III, V, XI, XVI and XVII, with respect to the concerns outlined in GL 2008-01 regarding gas accumulation in the accessible portions of these systems/functions.

Attachment 1 to this letter contains the PPL nine-month response to NRC GL 2008-01.

Any questions regarding this GL response should be directed to Mr. Duane L. Filchner at (610) 774-7819.

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

Executed on: 10/4/08

B. T. McKinney

Attachments:
1) NRC Generic Letter 2008-01 Requested Information for a Nine-Month Response
2) Completed Corrective Actions Identified from Evaluation
3) Open Action Items and Remaining Schedule

cc: NRC Region I
Mr. R. Janati, DEP/BRP
Mr. F. W. Jaxheimer, NRC Sr. Resident Inspector
Mr. B. K. Vaidya, NRC Project Manager

Attachment 1 to PLA-6439

NRC Generic Letter 2008-01 Requested Information for a Nine-Month Response

This Attachment contains the Susquehanna Steam Electric Station (SSES) nine-month response to NRC Generic Letter (GL) 2008-01 "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," dated January 11, 2008. In GL 2008-01, the NRC requested "that each addressee evaluate its ECCS, DHR system, and containment spray system licensing basis, design, testing, and corrective actions to ensure that gas accumulation is maintained less than the amount that challenges operability of these systems, and that appropriate action is taken when conditions adverse to quality are identified."

The following information is provided in this response:

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

b) A description of the corrective actions determined necessary to assure compliance with the quality assurance criteria in Sections III, V, XI, XVI, and XVII of Appendix B to 10 CFR Part 50 and the licensing basis and operating license with respect to the subject systems (see Attachments 2 and 3), and

c) A statement regarding which corrective actions have been completed (see Attachment 2), the schedule for the actions not yet complete, and the basis for that schedule (see Attachment 3).

The following systems were determined to be in the scope of GL 2008-01 for SSES Units 1 and 2:

- Emergency Core Cooling Systems (ECCS) - includes High Pressure Coolant Injection (HPCI), Core Spray (CS), and Residual Heat Removal (Low Pressure Coolant Injection (LPCI) mode);
- Decay Heat Removal System – which is RHR, Shutdown Cooling mode;
- Containment Spray System - which is RHR, Containment Spray mode.

PPL has confidence these systems can fulfill their required functions, based upon past and current operating experience, detailed evaluations, and testing performed since plant licensing. However, there are related issues that the nuclear industry is currently considering with respect to the overall performance of these systems (e.g., GSI-193). Resolution of these related issues will continue to be pursued through the BWR Owner's Group (BWROG) and industry leadership organizations and are not being addressed herein.

{Note: In this attachment when "RHR" is used, it refers to the LPCI mode, Shutdown Cooling mode, and Containment Spray mode, unless otherwise noted.}

EVALUATION RESULTS

Licensing Basis Evaluation

1.) Results of the Licensing Basis Review

The SSES licensing basis was reviewed with respect to gas accumulation in the Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems (hereafter referred to as systems). This review included the Technical Specifications (TS), TS Bases, Final Safety Analysis Report (FSAR), the Technical Requirements Manual (TRM) and TRM Bases, responses to NRC generic communications, Regulatory Commitments, and License Conditions. There were no changes to licensing documents that were required to address weaknesses or deficiencies in meeting the regulatory requirements or commitments.

2.) Changes to Licensing Basis Documents

As described above, no licensing basis document changes are warranted.

3.) Items not completed for the Nine-Month Response

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 of the evaluations of a large number of licensees to address the various plant designs. PPL 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, PPL will evaluate its applicability to the SSES, and evaluate adopting the Traveler to either supplement or replace the current TS requirements.

Design Evaluation

The SSES design basis was reviewed with respect to gas accumulation in the Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems. This review included Design Basis Documents, Calculations, Engineering Evaluations, and Vendor Technical Manuals.

1.) Design Documentation Review

The systems utilize a keep fill system from condensate transfer to maintain the discharge lines between the pump discharge check valves and the isolation valves on the discharge lines downstream of the check valves in a filled condition. The keep fill pressures are maintained at approximately 120 psig, depending on location in the system. The intent of the keep fill system is to prevent component damage due to water hammer and delay in the delivery of flow to the reactor when a system pump starts during automatic system initiation. The keep fill subsystem uses connections with the condensate storage and transfer system to supply the water required for maintaining the discharge piping filled. A small, but continuous, inflow of keepfill water into the discharge lines makes up for leakage across the pump discharge check valves. The estimated make-up for the pump discharge lines is less than 1 gpm. To ensure that the discharge lines are always filled, indication is provided in the control room as to whether the condensate transfer pumps are operating. An alarm will indicate low condensate transfer pump discharge pressure, which can be verified on a pressure indicator in the control room. The off-normal procedure for loss of Condensate Transfer provides actions to ensure system operability following loss of Condensate Transfer. With the injection lines properly filled, vented, and pressurized, maintaining an adequate pump discharge header pressure assures that the injection lines remain filled with water.

A passive keep fill system is also provided as a back up to the condensate transfer system. This system provides backup keep fill for the discharge piping via a passive head tank. This tank has at least 2,000 gallons of water as the source of keepfill water to the pump discharge lines for the systems. Water is supplied by gravity from this tank to the pump discharge lines through the keepfill piping. This source of water is isolated from all other condensate transfer loads by a check valve to assure the full capacity of this tank is available for the pump discharge lines. This tank is designed to assure that there is an adequate supply of water to keep the pump discharge lines full of water for more than eight hours after the loss of the non - safety related condensate transfer system. By keeping the pump discharge lines full of water, these systems are protected from the damaging effects of water hammer throughout the period of time when these systems perform their functions.

Design calculations were reviewed with respect to gas intrusion. SSES has an RHR system calculation, which establishes an acceptable gas volume at the system high point. The calculation recognizes that this system has the potential for gas accumulation in the suppression pool (SP) return header with the system in standby condition. When the suppression pool return header isolation valve is opened to initiate suppression pool cooling, any non-condensable gas that may have accumulated in the SP return header could migrate to the upper most portions of the

RHR piping. The analysis shows that a gas volume of up to 1.8 cubic feet at a keepfill pressure of approximately 120 psig is acceptable at the system high point.

{Note: Procedures require monitoring the time to vent at this high point location.}

An action has been generated to perform similar analyses for the Core Spray and the HPCI systems pump discharge piping. These actions will be completed in support of the final Unit 2 response to this Generic Letter, following the upcoming Unit 2 RIO.

2.) <u>New Gas Volume Acceptance Criteria</u>

Though SSES has determined the subject systems meet the Technical Specification definition for operability based on surveillance testing and operating experience, SSES will enhance the test acceptance criteria to provide added assurance of system operability as described below.

a.) <u>Suction Piping</u>:

Based on past operating experience and a pump suction void fraction study provided by the BWROG, no gas intrusion acceptance criteria are required for the suction piping. The pumps are located at the low point in the system and are not subject to air ingestion. If a void were found in the suction piping, it would not cause a continuous gas void to flow through the pump. If flow velocities were high enough, the void could eventually reach the pump suction, however, this would occur over a long period of time. At minimum flow conditions, flow velocities would not be high enough for any gas to reach the pump inlets. As evaluated in a BWROG report, an average void fraction of up to 10% can be tolerated by the pumps and systems for a period of up to 5 seconds. For SSES, this equates to an acceptable gas volume of approximately 10 cubic feet for RHR, 7 cubic feet for Core Spray and 5.5 cubic feet for the HPCI system at atmospheric conditions. Based on the suction piping configuration at SSES, these pumps are not expected to be subject to any gas volumes near the limits established by the BWROG during system operation.

The RHR and CS systems are routinely tested with their pump suctions aligned to the suppression pool. The pump / system flow rates during these periodic tests are sufficient for dynamic venting of their suction piping and portions of their discharge piping. During periodic testing of the RHR and CS systems, there have been no flow anomalies observed, as would be expected if these pumps were to become air bound due to air trapped in the suction lines. These systems have not experienced any problems due to gas being transported to the pump suction. Based on the above discussion, these systems are fully capable of performing their design basis functions with the present suction piping configuration.

The HPCI system is periodically tested with its pump suction aligned to the condensate storage tank (CST). The system flow rate during these periodic tests is near the maximum flow rate expected under accident conditions, and is therefore consistent with the suction conditions that would be experienced during a system initiation under accident conditions. The HPCI system has not experienced any flow anomalies or any problems due to gas being transported to the pump suction during system testing. It should be noted that during plant walkdowns of the HPCI system, a dead leg was identified in the HPCI suction piping (common to both HPCI and Core Spray) near the CST. This dead leg is viewed as a potential gas trap and will require further evaluation. This condition has been entered into the SSES Corrective Action program for further investigation.

The HPCI pump can also take suction from the suppression pool. In general, this piping remains full after it has been filled and vented, since the normal suppression pool water level is sufficiently above the suction piping. Note that a potential gas trap has been identified on the upstream side of the HPCI pump suction suppression pool supply valves (HV-1(2)155F042), since these valves are not opened during filling/venting of the HPCI suction piping. There is potential for some gas accumulation between the HPCI suction strainers and these HPCI pump suction valves. The pipe from the suction strainers up to and including HV-1(2)52F042 is below the suppression pool water level, does not include any local high points, and is not drained for system maintenance. Any gas accumulation in this pipe would be the result of dissolved gas coming out of solution in the pipe. As such, the volume of gas accumulated in this pipe, if any, is insignificant and does not bring HPCI operability into question. Actions have been generated to confirm there is no significant gas accumulation in this piping by opening the existing vent valve with the HPCI pump suction valve open.

Based on the above discussions and the proposed corrective actions, it is concluded that no air intrusion monitoring criteria is required for the suction piping.

b.) <u>Discharge Piping:</u>

Since the acceptance criteria were established, significant gas accumulation has not been found at the high point vents in the pump discharge piping of the RHR system during technical specification surveillance testing. RHR system high point venting has been trended for several years. For the RHR system, a vent time acceptance criteria has been established based on past system operating experience and trend data. An allowable gas volume acceptance criterion has already been developed for the RHR system which demonstrates that the system can tolerate significant air accumulation in upper portions of the RHR discharge piping (containment spray header) without adversely impacting system operation. An action has been generated to better correlate the gas volume acceptance criteria determined by analysis to allowable vent times.

For the HPCI and Core Spray systems, interim actions have been implemented to begin trending gas accumulation at system high points. Since trending has been established, no significant air accumulation has been found. Actions have been generated to establish the gas volume acceptance criteria for the Core Spray and HPCI systems, similar to the RHR system. Meeting the vent time acceptance criteria ensures the system will respond in accordance with the system design basis.

Operating experience demonstrates that there is no immediate concern with gas intrusion in the ECCS system discharge piping. In 2003, the HPCI system experienced an injection to the reactor vessel and there was no report of a water hammer during the event. A review of the HPCI startup data during this event shows that system discharge pressures do not increase significantly above the dead head of the pump on a system initiation, indicating that there is no significant air trapped in this system, which could initiate a significant water hammer event. No water hammer events have been recorded in the Core Spray and RHR systems due to air intrusion; however, actions have been generated to instrument and monitor RHR and Core Spray startup data to confirm the discharge pressures remain at or near pump dead head pressures on a system initiation and to confirm these systems would function as designed during a system initiation under accident conditions. Current operating experience indicates that the ECCS discharge piping design is adequate and no immediate actions are required. Actions have been generated to establish acceptance criteria for gas intrusion for all the systems and to effectively trend gas accumulation in these systems on a monthly basis to confirm these systems will continue to perform their intended design basis functions.

c.) Downstream ECCS Piping:

An analysis of system piping downstream of the injection valves has been completed by the BWROG and a determination made that the existence of air voids in this piping will have no adverse consequences related to accident conditions. The BWROG concluded that even if small voids did exist, the pressure transient would not be greater than the normal injection pressure. HPCI was not included in the scope of this analysis. Walkdowns will be performed during the next refueling outages on Units 2 and 1 in 2009 and 2010 respectively, to confirm acceptability of the HPCI system piping layout downstream of the HPCI injection valves.

d.) Effects of Reactor Coolant System (RCS) Gas Ingestion:

Injection delay times resulting from air or gas at system high points will not adversely impact the results of any SSES accident analyses.

The BWROG evaluated the potential effects of gas intrusion on ECCS analyses, investigated the impact of gas intrusion resulting in a delay in injection, and evaluated the impact of gas voids passing through the core. The analysis establishes a limiting LOCA peak clad temperature heat up rate of 12° F/sec and concludes that with a maximum of a 4-second delay in the ECCS injection, a worst case 48° F peak clad temperature (PCT) impact would result. As long as the change in licensing basis PCT does not exceed 50° F, the change is considered insignificant per 10 CFR 50.46(a)(3)(i), therefore, a maximum delay time for ECCS injection of up to 4 seconds was considered acceptable. The clad heat up rates at SSES are lower than the 12° F/sec rate used in this owners group report, therefore, these results are bounding for SSES.

The BWROG also evaluated the impact of delayed injection times on the loss of feedwater event (LOFW), Anticipated Transient Without SCRAM (ATWS) events, Station Blackout (SBO), and Appendix R safe shutdown events and concludes that delay times of up to 4 seconds would not significantly impact the results of these analyses. At SSES, injection delay times as a result of air accumulation at system high points are not expected to exceed this 4-second limit.

The BWROG analysis concludes that gas voids passing through the core do not cause an additional safety concern since it is unlikely that the air would find a path into the core and high void conditions are already present in the core during a LOCA.

3.) Changes to Design Basis Documents

No changes to SSES design basis documentation are required as a result of the activities associated with this GL 2008-01 response.

4.) Results of System P&ID and Isometric Drawing Reviews

Isometric drawings were reviewed to identify system high point vents and to identify areas considered potential gas traps, where the potential for gas intrusion or gas accumulation may exist. High point vents were reviewed to validate adequacy of established high point vent locations. A potential gas trap was identified in the HPCI system. The high point vent was found to be located below the system injection valve. This piping will be walked down and checked for gas voids using ultrasonic testing during the upcoming unit outages, since the piping is located in a high radiation area. The system is considered fully operable based on past operating experience. The HPCI system experienced an injection to the reactor vessel in 2003 and there was no report of a water hammer during the event. In addition, system operating data confirmed the system piping did not experience significant pressure spikes during this system initiation. Significant pressure spikes in the discharge line would be expected during a significant water hammer event.

Potential gas trap locations were identified which included system dead legs at branch lines to system relief valves and abandoned piping, horizontal piping with flow orifices or flow elements that are installed with a vent on one side of the components. These locations are discussed in Section 6 below.

The Isometric drawings were also compared against system fill/vent procedures to evaluate adequacy of system fill/venting. These reviews identified that vent sequencing of local high points at high system elevations before venting local high points at lower system elevations was not always identified in the procedures. In addition, there were instances where local system high point vents were not identified in the system vent/fill procedures. Also, the fill and vent procedures typically only require check of the system high point vent during monthly surveillances, rather than all local high point vents. These discrepancies have been entered into the SSES Corrective Action program for resolution.

5.) New Vent Valve Locations / Modifications to Existing Vent Valves – Design Review

There are no new vent valves or modifications to existing vent valves required as a result of the design basis or drawing reviews.

6.) Results of System Confirmation Walkdowns

System walk downs of accessible piping outside containment in the RHR, HPCI, and Core Spray systems were performed to confirm the accuracy of the system as-built piping isometrics. The piping layouts were compared to the as-built piping isometrics for accuracy. Walk downs were also used to ensure system high point vents were at the locations specified on the isometric drawings and to identify areas that are considered potential gas traps, such as a local high point where no vent is provided. The system walk downs demonstrated that the as-built piping isometrics are accurate, with only non-impacting or minor discrepancies found. These discrepancies have been identified in the SSES Corrective Action program.

In general, all the piping in accessible areas outside containment has been walked down. In some cases, interferences with other plant equipment or piping located in high radiation areas outside containment prevented walkdowns from being completed. These exceptions represent a small portion of system piping and are documented in the SSES Corrective Action program, including operability determinations. The piping that is located in high radiation areas or requires significant insulation removal will be walked down during the upcoming Unit 2 and Unit 1 refueling outages in 2009 and 2010.

Piping downstream of the injection valves will not be walked down. As stated above, this piping was evaluated and it was concluded that this piping cannot create a water hammer which could challenge the operability of these systems when required to mitigate any postulated events. The HPCI system piping downstream of the injection valve to the feedwater header will be walked down during upcoming refueling outages to confirm adequacy of pipe layout.

Areas identified as potential gas traps from the walkdowns and from design review of isometric drawings were documented in the SSES Corrective Action program. The majority of potential gas traps identified were at system dead legs.

Dead legs at system relief valves are not considered to contribute significantly to the presence of gas in the systems discharge piping since these lines (typically one-inch diameter) would contain an insignificant amount of air at the 120 psig keepfill pressures. Dead legs on the discharge line would tend to remain as dead legs after the system is placed in service. Following a pump start, any air trapped in the line would further compress due to an increase in line pressure caused by the pump start. This would not contribute to any air that may have accumulated at the system high point and therefore would not significantly contribute to the severity of water hammer loads as a result of gas accumulating at system high point.

Gas pockets (if any are formed) in horizontal suction and discharge piping are believed to be minimal in size and thus non-impacting. Piping identified during the walkdowns, as horizontal on the piping isometrics was visually determined to be horizontal. However, there were some exceptions. Some lines will require a more detailed inspection to confirm proper slope and to confirm vent location is adequate. These lines include the horizontal piping at the core spray pipe injection line elevation and the horizontal piping at the LPCI injection pipe elevation. More detailed pipe inspections will be performed at these locations during the upcoming outages to confirm the location of the high point vents.

For those lines considered horizontal based on visual inspections, it is recognized there could be some minor slope variations, not detectable to the naked eye. The amount of air that could be trapped in these lines would be expected to be minimal, since any trapped air would either remain in these locations or pass through the system once the system is started. After maintenance is completed on these systems, the system is filled and vented and then operated to confirm operability of the system. During these operability runs, system flows are sufficient to sweep away any gas voids at horizontal pipe locations (Froude numbers are greater than 0.54). In addition, since operating history shows that there have been no water hammer events associated with these systems, any air that may be trapped in these horizontal pipe locations has not been found to adversely impact operation of these ECCS systems.

Walkdowns of the suction piping revealed one location that could contain a gas trap. This location is at a dead leg in the suction line (common to HPCI and Core Spray) off the Condensate Storage tank. This issue was entered into the SSES Corrective Action program.

As discussed previously, system operating history during quarterly HPCI and Reactor Core Isolation Cooling system flow surveillances has not identified any performance issues with the pumps. Therefore, the suction piping design is adequate to support the ability of the system to perform its function.

7.) New Vent Valve Locations / Modifications to Existing Vent Valves-System Walkdowns

At this time, the need for additional vent valves or modifications to existing vent valves is not required as a result of the system walkdowns and evaluations completed to date.

8.) Results of Fill and Vent Activities / Operating Procedure Reviews

Actions documenting open items resulting from the review of the fill and vent and operating procedures are listed in Attachment 3.

9.) Identify Operating Procedure Revisions or New Procedures

The following changes have been identified for the affected SSES operating procedures. These changes have been entered in the SSES Corrective Action program.

a. Currently, gas accumulation in the RHR system is monitored by timing gas released from system high point vent valves. An acceptable vent time has been established based on past operating experience. The allowable gas volume has been established by calculation. These vent times have been trended for several years and indicate that air intrusion in this system is minimal. An action to include the local high point vents in the RHR surveillance procedures will be added to verify there is no air/gas at these vents. The monthly surveillance procedures for the RHR system currently only check the system high point vent to confirm discharge piping is filled with water. This action is required to confirm local system high points are filled with water.

b. Similar to the RHR system, procedure changes have been initiated to check for air at the HPCI and Core Spray system high points on a monthly basis. Initial data shows there is minimal air found in these systems. The intent of these checks is to ensure that the volume of air or gas at these high points remain below analyzed values (to be established), to confirm system operability.

c. The Core Spray System Drain Procedures review identified additional vent locations to be utilized and included in the Core Spray System Drain Procedures. These actions are included in Attachment 3. The Core Spray System Drain Procedures are used to both drain the system and vent the system upon refilling. All other drain procedures were found to be adequate, with no additional changes required.

d. There were vent sequencing concerns identified in existing system operating procedures which will be resolved. (See Attachment 3). The fill/vent sections of the system operating procedures are no longer used, since all systems have prescribed drain procedures for on-line and outage time periods to facilitate structure for proper fill and vent sequence to preclude gas intrusion and minimize any potential trapped air in the systems. Operations department assigns teams during system and plant outages to facilitate and coordinate system draining and filling evolutions. A complete fill and vent of the system from lower elevations to higher elevations is completed following system maintenance for on-line and outage activities that require system draining. System fill and vents are completed anytime the system is placed in service, after the system has been secured and following restoration to the desired system configuration.

e. Training/communications will be conducted to increase sensitivity/awareness of having an adequate restoration plan in place following maintenance activities. The training will be conducted in accordance with operations non-routine training and communications procedure.

f. A test procedure will be developed and implemented to establish a method for quantifying vented air volume and comparing this volume to acceptance criteria. A known volume of air will be correlated to the measured vent time. The test results will be used to confirm gas volumes at system high points meet acceptance criteria.

10.) Potential Gas Intrusion Mechanisms

Potential gas intrusion mechanisms include dissolved gas coming out of solution, in-leakage through vent valves when the local system pressure is less than atmospheric, inadvertent draining due to incorrect maintenance or testing procedures, inadequate post maintenance fill and vent activities, and conditions where local temperatures are at or above saturation temperature.

An additional potential source of gas intrusion was previously evaluated for the RHR system. When the RHR system is in standby, gas from the suppression chamber could be drawn into the RHR suppression pool return line via the suppression chamber spray header isolation valve (F027) and become trapped in the piping between the suppression pool return shut-off valve (F028) and the suppression pool return valve (F024). When the F028 valve is opened, entrapped gas could migrate to the upper regions of the RHR discharge piping – to the drywell spray header isolation valve (F016). Accumulation of gas in this area has been evaluated for the RHR system. Calculation results show that piping loads from water hammer associated with gas intrusion are acceptable, even with a large intrusion of gas into the suppression pool return line. The system has been monitored for gas intrusion at this location and it was concluded that there is no indication of significant intrusion of gas in the RHR return line, down stream of the F028 valve. The RHR system is routinely monitored for gas accumulation near the drywell spray header isolation valve.

With regard to suction piping, the potential for gas intrusion in the pump suction piping is minimized because the pumps are located at the low point in the system. The potential for gas intrusion in the pump discharge piping is reduced by the presence of a keep fill system, which maintains the discharge piping filled at approximately 120 psig.

11.) Items not completed for the Nine-Month Response

Attachment 3 contains a listing of items that are not yet completed.

Testing Evaluation

1.) Results of Periodic Venting or Gas Accumulation Surveillance Procedure Review

The results of the review of SSES procedures are discussed in **Design Evaluation** Sections 4 and 9.

2.) Identify Surveillance Procedure Revisions or New Procedures

Attachment 3 identifies procedures that require either revision or development,

3.) Procedures for the manual operation of the [RHR] system in its decay heat removal mode of operation.

Shutdown Cooling is a manual-only mode of RHR system operation used for routine shutdown cooling (SDC). The SDC suction piping is separate (i.e. not the same) from the suction for LPCI. There are no alarms or instruments for the suction piping for shutdown cooling. The SDC procedure includes detailed steps for venting the suction piping to ensure it is full prior to use. No gas-related problems have been encountered with the SDC suction line.

The RHR shutdown cooling discharge piping from the RHR pump is the same as the LPCI flowpath, which is discussed in the Design Evaluation Section of this response. The alarms and instrumentation for the discharge piping is discussed in Item 1 under Design Evaluation.

4.) Results of Procedure Reviews.

Procedure reviews identified several Operating procedure changes for the station. The RHR, Core Spray, and HPCI operating procedures have not been updated to the current standards for filling and venting systems, drain procedures are currently utilized at the station and have been for several years. The Operations department assigns teams during system and plant outages to facilitate and coordinate system draining and filling evolutions. All ECCS systems have prescribed drain procedures for on-line and outage time periods to facilitate structure into proper fill and vent sequence and are adjusted as needed to facilitate planned maintenance activities to preclude gas intrusion and minimize any potential trapped air in the ECCS systems. Corrective actions have been identified to correct the sequence within the operating procedures.

5.) Gas voids documentation, disposition and trending

Gas voids are detected by trending vent times in the monthly discharge line filled and alignment check surveillances. For the RHR system, this has been in place since trending acceptance criteria were established in May 2005. The threshold was established by trending the RHR high point vent times to determine the amount of gas typically present in the system. With monthly venting of four (4) RHR divisions over 16 months, the resulting large number of data points was representative of a wide variety of individual operators. This data indicated that a threshold of approximately 30 seconds would be sufficient to detect substantial changes in gas accumulation while avoiding the excessive burden of analyzing the vent time more frequently than necessary.

The RHR vent times since May 2005 have averaged 2.9 seconds, ranging from 0 to 31 seconds, with 7 of 161 total data points above 10 seconds. The 31-second value was obtained during a forced outage in June 2005, and the elevated vent time was not repeated in subsequent surveillances. Since there was no other data to indicate significant air intrusion (i.e. no recent system draining, no discharge header pressure drop, no transient on pump start), this was attributed to variation in operation of the vent valve.

For Core Spray and HPCI, SSES began trending high point vent time data in 2008. Any trapped gas present in the system in locations that cannot be vented (i.e. pressure relief valve inlets, gas traps, etc.) has not impacted the system based on acceptable system performance as previously described. The trending effort has focused on detection of significant change of the amount of gas typically present at the system high point.

6.) Detailed list of items that have not been completed, a schedule for their completion, and the basis for that schedule.

A listing of items that have not been completed is contained in Attachment 3.

Corrective Action Evaluation

1.) Results of Reviews

The SSES Corrective Action program is used to document gas intrusion/accumulation issues as potential nonconforming conditions. Existing procedures for the RHR require a Condition Report to be initiated if the accumulated gas volume acceptance criteria specified in the procedures are exceeded. As part of the SSES Corrective Action Program, Condition Reports related to plant equipment are evaluated for potential impact on operability and reportability. Therefore, PPL's review concluded that issues involving gas intrusion/accumulation are properly prioritized and evaluated under the Corrective Action Program. Once acceptance criteria has been established for the HPCI and Core Spray systems, procedures will be revised to require initiation of a condition report if the accumulated gas volume acceptance criteria is exceeded. These systems are currently monitored for gas intrusion at system high points and currently, no significant gas accumulation has been found in these systems.

2.) Items not completed

A listing of items that have not been completed is contained in Attachment 3.

Conclusion

Based upon the above, PPL has concluded that SSES Units 1 and 2 are in conformance with the commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in the SSES Quality Assurance Program.

Identified discrepancies that have not yet been resolved are entered into the SSES Corrective Action Program for tracking and final resolution as described in Attachment 3.

PPL has evaluated the accessible portions of the systems that perform the functions described in this GL and has concluded that these systems are Operable, as defined in the SSES TS, and are in conformance to our commitments to the applicable General Design Criteria (GDC), as stated in the SSES FSAR.

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

As committed in Reference 2, PPL will submit its evaluation of the inaccessible portions of these systems within 90 days following completion of each of the spring 2009 and spring 2010 refueling outages for SSES Unit 2 and SSES Unit 1.

Attachment 2 to PLA-6439

Completed Corrective Actions Identified from Evaluation

Completed Actions

ACTION TRACKING DOCUMENT	DESCRIPTION
CRA 987202	Complete walk down of accessible areas of the systems to confirm the as built configuration of these systems is in accordance with the plant design drawings. Identify and document any discrepancies and potential gas traps as a result of these walkdowns.
CRA 1069735	Evaluate/Disposition potential air traps identified during Unit 1 non-outage walkdowns of RHR, Core Spray and HPCI systems.
CRA 1069734	Evaluate/Disposition potential air traps identified during Unit 2 non-outage walkdowns of RHR, Core Spray and HPCI systems.
CRA 1069733	Evaluate inaccessible areas found during Unit 1 non-outage walkdown of RHR, Core Spray and HPCI systems.
CRA 1069732	Evaluate inaccessible areas found during Unit 2 non-outage walkdown of RHR, Core Spray and HPCI systems
CRA 971643	Review fill/vent procedures for RHR, core spray and HPCI system and identify recommended procedure changes to improve fill/vent practices.
AR/CPG 1028314 and AR/CPG 1028315	Revised procedures to monitor and trend RHR, Core Spray and HPCI systems for air intrusion at system high points on a monthly basis.

Attachment 3 to PLA-6439

Open Action Items
And
Remaining Schedule

ACTION TRACKING DOCUMENT	COMPLETION DATE	DESCRIPTION	BASIS FOR SCHEDULE
CRA 1033824	Prior to startup following the Unit 1 16th RIO in Spring 2010	Complete Unit 1 system walkdown of inaccessible areas during upcoming refueling outage	Outage required to complete walkdowns
CRA 1033823	Prior to startup following the Unit 2 14th RIO in Spring 2009	Complete Unit 2 system walkdown of inaccessible areas during upcoming refueling outage	Outage required to complete walkdowns
CRA 1033834	Within 90 days following startup from the Unit 2 Spring 2009 Refueling Outage.	Complete evaluations of the GL 2008-01 subject systems using results of the walkdowns of Unit 2 inaccessible piping sections and submit a supplemental response to the NRC documenting completion of the Unit 2 walkdowns and any impact upon the GL 2008-01 9 month response as a result of the completed evaluations.	Provides sufficient time to complete the evaluation after the RIO activities have been completed.
CRA 1033835	Within 90 days following startup from the Unit 1 Spring 2010 Refueling Outage.	Complete evaluations of the GL 2008-01 subject systems using results of the walkdowns of Unit 1 inaccessible piping sections and submit a supplemental response to the NRC documenting completion of the Unit 1 walkdowns and any impact upon the GL 2008-01 9 month response as a result of the completed evaluations.	Provides sufficient time to complete the evaluation after the RIO activities have been completed.
CRA 1046402	Within 90 days following startup from the Unit 1 Spring 2010 Refueling Outage.	Evaluate air trap on Unit 1 HPCI/RCIC suction line following detailed inspections (CR 1046092)	Provides sufficient time to complete the evaluation after the RIO activities have been completed.

ACTION TRACKING DOCUMENT	COMPLETION DATE	DESCRIPTION	BASIS FOR SCHEDULE
CRA 1046403	Within 90 days following startup from the Unit 2 Spring 2009 Refueling Outage.	Evaluate air trap on Unit 2 HPCI/RCIC suction line following detailed inspections (CR 1046100)	Provides sufficient time to complete the evaluation after the RIO activities have been completed.
AR/WO-1079156	Prior to startup following the Unit 1 16th RIO in Spring 2010	Evaluate Unit 1 RHR LPCI injection line between F015 and F017 valves. Check slope of line, check vent location and check for air trapped in line.	Outage needed to complete activity.
AR/WO-1037479	Prior to startup following the Unit 2 14th RIO in Spring 2009	Evaluate Unit 2 RHR LPCI injection line between F015 and F017 valves. Check slope of line, check vent location and check for air trapped in line.	Outage needed to complete activity.
AR/EWR-1079149	Prior to startup following the Unit 1 16th RIO in Spring 2010	Evaluate vent locations above Unit 1 RHR heat exchangers.	Outage needed to complete activity.
AR/EWR-1079149	Prior to startup following the Unit 2 14th RIO in Spring 2009	Evaluate vent locations above Unit 2 RHR heat exchangers.	Outage needed to complete activity.
AR/EWR-1079167	Prior to startup following the Unit 1 16th RIO in Spring 2010	Evaluate effectiveness of isolation of Unit 1 Instrument Air line from RHR heat exchangers.	Outage needed to complete activity.
AR/EWR-1079167	Prior to startup following the Unit 2 14th RIO in Spring 2009	Evaluate effectiveness of isolation of Unit 2 Instrument Air line from RHR heat exchangers.	Outage needed to complete activity.

ACTION TRACKING DOCUMENT	COMPLETION DATE	DESCRIPTION	BASIS FOR SCHEDULE
CRA 987203	08/31/2009	Perform water hammer analyses and develop acceptance criteria for gas intrusion for Unit 1 and 2 ECCS systems	Provides sufficient time to complete detailed water hammer evaluations for ECCS systems.
AR/CPG 1080316	11/30/2009	Implement procedure changes to incorporate acceptance criteria for gas intrusion developed in CRA 987203.	Provides sufficient time to complete procedure implementation after development of acceptance criteria.
CRA 971639	05/29/2009	Implement recommended procedure changes as a result of fill/vent procedure reviews related to Generic Letter 2008-01	Provides sufficient time to complete procedure changes after outage activities.
TP-249-086	90 days following the Unit 2 14th RIO in Spring 2009	Obtain test data, re-evaluate and revise procedures (if necessary) for RHR and core spray systems to demonstrate that there are no significant pressure spikes on a pump initiation.	Provides sufficient time to revise and implement procedure changes.
AR/CPG 1065516	02/25/2009	Revise the monthly surveillance for the RHR system to check for air intrusion at local system high point vents as well as the system high point vent and trend results	Provides sufficient time to revise and implement procedure changes.
TP-249-087	90 days following the Unit 2 14th RIO in Spring 2009	Implement test procedure (TP) to relate quantity of gas at system high points to vent times. Need to measure air at system high point and equate volume of air to a measured vent time. Revise vent procedures as appropriate	Provides sufficient time to generate, implement TP, and revise vent procedures.

ACTION TRACKING DOCUMENT	COMPLETION DATE	DESCRIPTION	BASIS FOR SCHEDULE
AR/EWR-1079344	90 days following the Unit 2 14th RIO in Spring 2009	Develop and implement procedure to obtain startup trace for Unit 1 and Unit 2 Core Spray pumps	Provides sufficient time to revise and implement procedure changes.
AR/EWR 1079350	90 days following the Unit 2 14th RIO in Spring 2009	Develop acceptance criteria for Unit 1 and Unit 2 Core Spray vent verification surveillance	Provides sufficient time to complete the evaluation after RIO activities have been completed.
AR/EWR-1079351	90 days following the Unit 2 14th RIO in Spring 2009	Develop acceptance criteria for Unit 2 HPCI vent verification surveillance	Provides sufficient time to complete the evaluation after RIO activities have been completed.
AR/EWR-1079352	90 days following the Unit 2 14th RIO in Spring 2009	Develop acceptance criteria for Unit 1 HPCI vent verification surveillance	Provides sufficient time to complete the evaluation after RIO activities have been completed.
AR/WO-1079362	Prior to startup following the Unit 2 14th RIO in Spring 2009	Perform UT of 2A Core Spray injection line to quantify gas volume	Outage may be required to complete due to the potential to inop both Core Spray loops.
AR/WO-1079365	Prior to startup following the Unit 2 14th RIO in Spring 2009	Perform UT of 2B Core Spray injection line to quantify gas volume	Outage may be required to complete due to the potential to inop both Core Spray loops.
AR/WO-1079368	Prior to startup following the Unit 1 16th RIO in Spring 2010	Perform UT of 1A Core Spray injection line to quantify gas volume	Outage may be required to complete due to the potential to inop both Core Spray loops.

ACTION TRACKING DOCUMENT	COMPLETION DATE	DESCRIPTION	BASIS FOR SCHEDULE
AR/WO-1079370	Prior to startup following the Unit 1 16th RIO in Spring 2010	Perform UT of 1B Core Spray injection line to quantify gas volume	Outage may be required to complete due to the potential to inop both Core Spray loops.
AR/WO-1079390	Prior to startup following the Unit 2 14th RIO in Spring 2009	Perform UT of Unit 2 HPCI injection line to quantify gas volume	Outage needed to complete activity.
AR/WO-1079394	Prior to startup following the Unit 1 16th RIO in Spring 2010	Perform UT of Unit 1 HPCI injection line to quantify gas volume	Outage needed to complete activity.
AR 1079703, AR 1079715	05/29/2009	Unit 1 Core Spray System Drain Procedure Corrective Actions.	Provides sufficient time to complete procedure changes after outage activities.
AR 1079758, AR 1079761	05/29/2009	Unit 2 Core Spray System Drain Procedure Corrective Actions.	Provides sufficient time to complete procedure changes after outage activities.
AR-1079755	05/29/2009	Unit 1 Core Spray System Operating Procedure Changes	Provides sufficient time to complete procedure changes after outage activities.
AR 1079757	05/29/2009	Unit 2 Core Spray System Operating Procedure Changes	Provides sufficient time to complete procedure changes after outage activities.
AR 1079770	05/29/2009	Unit 1 RHR System Operating Procedure Changes	Provides sufficient time to complete procedure changes after outage activities.

ACTION TRACKING DOCUMENT	COMPLETION DATE	DESCRIPTION	BASIS FOR SCHEDULE
AR 1079771	05/29/2009	Unit 2 RHR System Operating Procedure Changes	Provides sufficient time to complete procedure changes after outage activities.
AR 1079773	05/29/2009	Unit 1 HPCI System Operating Procedure Changes	Provides sufficient time to complete procedure changes after outage activities.
AR 1079785	05/29/2009	Unit 2 HPCI System Operating Procedure Changes	Provides sufficient time to complete procedure changes after outage activities.
AR 1079776	05/29/2009	Unit 1 HPCI system Surveillance Procedure Changes	Provides sufficient time to complete procedure changes after outage activities.
AR 1079780	05/29/2009	Unit 2 HPCI system Surveillance Procedure Changes	Provides sufficient time to complete procedure changes after outage activities.
AR 1080959	90 days following the Unit 2 14th RIO in Spring 2009	Confirm gas accumulation between HV-155F042 and HPCI suppression pool suction strainer is minimal	System is operable because pipe is submerged in suppression pool and is not drained for system maintenance. Confirmatory venting to be performed prior to U2RIO 90-day response.

ACTION TRACKING DOCUMENT	COMPLETION DATE	DESCRIPTION	BASIS FOR SCHEDULE
AR 1080970	90 days following the Unit 2 14th RIO in Spring 2009	Confirm gas accumulation between HV-255F042 and HPCI suppression pool suction strainer is minimal	System is operable because pipe is submerged in suppression pool and is not drained for system maintenance. Confirmatory venting to be performed prior to U2RIO 90-day response.
AR 1081207	11/07/2008	Operations training/communications will be conducted to increase sensitivity/awareness of having an adequate restoration plan in place following maintenance activities. The training will be conducted in accordance with operations non-routine training and communications procedure.	Sufficient time to develop the communications package and present it.