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October 14, 2008
LIC-08-0106

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

References:
1. Docket No. 50-285
2. NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," dated January 11, 2008 (ML072910759)
3. Letter from J. H. Riley (Nuclear Energy Institute), "Generic Letter (GL) 2008-01, 'Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems,' Evaluation and 9-Month Response Template, Revision 1," (APC 08-13), dated September 24, 2008

Subject: Omaha Public Power District, Fort Calhoun Station (FCS), Response to NRC Generic Letter 2008-01

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 (Reference 2) to request 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 (CS) 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;

(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.

The enclosure to this letter contains the Omaha Public Power District's (OPPD's) nine-month response to NRC GL 2008-01 and follows the template provided by the Nuclear Energy Institute (NEI) in Reference 3.

Results of evaluations, walkdowns, analyses and reviews performed by OPPD and its contractors pursuant to GL 2008-01 show that gas accumulation in safety systems is unlikely to create conditions adverse to safety at FCS. Robust system design and additional countermeasures implemented to address gas accumulation at FCS provide assurance of continued safe operation.

OPPD has concluded that FCS is in conformance with its commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in the OPPD Quality Assurance Program, with the exception of Criteria V, "Instructions, Procedures, and Drawings" and XI, "Test Control." The procedures being developed which are required for compliance were entered into the CAP for tracking and final resolution, as described in Sections B and C of the Enclosure.

The following table lists the regulatory commitments contained in the enclosure in response to GL 2008-01.

Commitment Description	Commitment Date
(1) New surveillance test procedures for managing gas accumulation in safety systems will be instituted.	These new surveillance test procedures will be issued by January 23, 2009.
(2) PBD-32, "Managing Gas Accumulation in Safety Systems," the program basis document to manage gas accumulation in safety systems at FCS, will be developed and issued.	This will be completed by January 23, 2009.

If you should have any questions or need additional information, please contact Mr. Bill Hansher at 402-533-6894.

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

Sincerely,

Jeffrey A. Reinhart
Site Vice President

Enclosure:

c: E. E. Collins, NRC Regional Administrator, Region IV
A. B. Wang, NRC Project Manager
J. D. Hanna, NRC Senior Resident Inspector

Omaha Public Power District's (OPPD's) Nine-Month Response for Fort Calhoun Station, Unit No. 1, to NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems."

SUMMARY

This enclosure provides the Omaha Public Power District's (OPPD's) nine-month response for Fort Calhoun Station Unit No. 1 to NRC Generic Letter (GL) 2008-01 "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal [DHR], and Containment Spray Systems," dated January 11, 2008. In GL 2008-01, the NRC requested that "each addressee evaluate its [emergency core cooling system] ECCS, DHR system, and containment spray system licensing bases, 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),

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 as well as the FCS licensing basis and operating license with respect to the subject systems (see Section B), 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).

Components of the emergency core cooling (ECC), shutdown cooling (SDC) and containment spray (CS) systems at FCS, collectively referred to as safety systems in this response, that were determined to be within the scope of GL 2008-01 include:

- The Low Pressure Safety Injection (LPSI) and High Pressure Safety Injection (HPSI) systems within the Emergency Core Cooling System (ECCS);
- The Shutdown Cooling System (SDC), which is equivalent to DHR; and
- The Containment Spray System (CSS).

A EVALUATION RESULTS

A1 LICENSING BASIS EVALUATION

OPPD reviewed the FCS licensing basis with respect to gas accumulation in the ECC, SDC, and CS systems. This review included the Technical Specifications (TS), TS Bases, Updated Safety Analysis Report (USAR), responses to NRC generic communications, regulatory commitments and Licensing Conditions.

A1.1 Summarize the results of the review of these documents:

The above documents and regulatory commitments were evaluated for compliance with applicable regulatory requirements. A review of the FCS TS did not identify any surveillance requirements for monitoring gas intrusion or accumulation in the ECC, SDC and CS systems. Any gas voids in these systems are identified, monitored and controlled through operating and venting procedures. FCS has not experienced a loss of safety system operability due to local voiding, but has observed, evaluated for acceptability, and corrected instances of local voiding. In addition, the FCS USAR contains no statements pertaining to gas accumulation in safety systems. OPPD will insert descriptive text into applicable sections of the USAR on managing gas accumulation in the safety systems.

Existing operating procedures and new surveillance test (ST) procedures will enhance OPPD's ability to ensure that potential gas voids in the subject safety systems suction and discharge piping are properly managed. These operating and ST procedures are discussed in the Testing Section A3.

A1.2 Summarize the changes to licensing basis documents (Corrective Actions)

Review of the FCS licensing basis documents did not identify any specific corrective actions required to manage gas voids in safety systems. However, as an enhancement, OPPD plans to add descriptive information to applicable sections of the USAR on managing gas accumulation in safety systems. This USAR change will be coordinated with the Program Basis Document (PBD) which will provide details on managing the gas accumulation in the safety systems.

A1.3 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 of the evaluations of a large number of licensees to address the various plant designs. OPPD 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, OPPD plans to evaluate its applicability to FCS, and evaluate adopting the Traveler to either supplement or replace the current TS requirements.

As an enhancement, OPPD will incorporate additional descriptive information in applicable sections of the USAR on managing gas accumulation in safety systems. The completion date for this USAR update is documented in the FCS corrective action program (CAP) under condition report (CR) 2008-2021. A detailed list of pending action items, their completion schedule, and the basis for completion are provided in Section B.

A2 DESIGN EVALUATION

OPPD has reviewed the FCS design basis with respect to gas accumulation in the ECC, SDC, and CS Systems. This review included design basis documents (DBDs), drawings, calculations, engineering evaluations, and vendor technical manuals (VTMs). Details of this review will be documented in the program basis document, PBD-32, "Managing Gas Accumulation in Safety Systems."

A2.1 Discuss the results of the review of the design basis documents. This discussion should include a description of any plant specific calculations or analyses that were performed to confirm the acceptability of gas accumulation in the piping of the affected systems, including any acceptance criteria if applicable. Note: This should describe the "as found" (pre Generic Letter) condition prior to any corrective or enhancement actions.

FCS was licensed for construction prior to May 21, 1971, and, in general, is committed to the 70 draft General Design Criteria (GDC) which were published in the Federal Register (32 FR 10213) on July 11, 1967. The draft GDC are contained in the FCS USAR, Appendix G, *Responses to 70 Criteria*. Specific criteria applicable to the design of the ECCS are documented in FCS USAR, Appendix G and detailed in Section 3 of each system's DBD. A review of USAR, Appendix G did not identify any specific criterion regarding gas intrusion mitigation, gas voiding, acceptable size criterion or water hammer design that was required to be met or applicable to safety systems at FCS.

OPPD's review confirmed that the DBDs address the applicable code requirements, but do not directly identify design criteria to ensure safety system piping configurations remained water solid. However, the DBDs do specify that vent valves are placed at high points and drain valves are located through the safety injection (SI) systems as a non-safety related feature of the systems.

Plant-specific calculations and analyses of the ECCS pump suction piping, HPSI and LPSI discharge headers, SDC system and CS discharge headers were performed to confirm the impact of gas accumulation on the performance of the affected systems. Results of these evaluations are summarized below:

<u>ECCS Pump Suction Piping</u>

An evaluation of gas voiding in the ECC pump suction piping was performed by Fauske & Associates, Inc. (FAI) in June 2008 as part of the effort to address GL 2008-01. The purpose of this evaluation (calculation FC07124, "Evaluation of the Maximum Gas Void Fractions that Could be Delivered to the ECCS Pumps in the Fort Calhoun Design") was to determine if gas void fractions in the suction piping between the Safety Injection and Refueling Water Tank (SIRWT) and the safety system pumps could cause potential damage to these pumps.

The maximum potential gas voids that could be resident in the ECCS and CS suction piping were calculated based on measurements obtained from laser templating of piping performed during the 2008 refueling outage (RFO) at FCS. The analysis concluded that the potential gas voids in the suction path from the SIRWT to the ECCS pumps during the injection phase from the SIRWT are well below the gas void fractions that could challenge pump operability; and the piping section along the recirculation flow path, which could contain a larger gas volume, would have a maximum flow rate that was determined to be too low for the gas voids to be transported to the suction line of the ECCS pumps. (Reference FCS drawing E-23866-210-130, Sheet 3) A plant modification made during the spring 2008 RFO disabled automatic actuation of CS following a loss-of-coolant-accident (LOCA). Therefore, during the injection and recirculation phase, the CS pumps would not be running and the total flow in the suction header would be significantly reduced. The OPPD review also found the ECCS pump VTMs did not address acceptance criteria or provide a specific discussion of void fraction limits for operation with air ingestion.

The 24-inch nominal diameter suction piping between the sump strainers and the recirculation isolation valves has been evaluated regarding the potential for gas voids. Physical inaccessibility prevented laser templating of this piping. The inaccessible portion of the ECCS consists of the containment isolation valves HCV-383-3 and HCV-383-4 encased within a protective enclosure, referred to as a submarine hull, and piping embedded in concrete. A detailed review of the as-built drawings for this portion of piping was performed. The piping geometry is angled upward from the isolation valves toward the containment sump strainers by at least 45° at each suction connection which will allow any entrained air to self-vent through the strainer and into containment (Ref. FCS drawing E-23866-210-130, Sheet 3). Recirculation of fluid from the containment sump will not initiate until the pool depth in containment is sufficient to maintain adequate strainer submergence, thereby keeping the piping segment from the strainers to the isolation valves completely filled. The conclusion is that, while the piping could be empty during normal operation, it would be filled and self-vented prior to RAS following an accident.

A deficiency has been noted with respect to the ECCS suction piping. It was discovered that procedures are not in place to ensure the ECCS sump suction header piping between containment sump recirculation isolation valve HCV-383-3, and check valve SI-160, on one header, and containment sump recirculation isolation valve HCV-383-4, and check valve SI-159, on the other header, are sufficiently water filled. (Ref. FCS drawing E-23866-210-130, Sheet 3.) This deficiency was noted upon review of system drawings and design basis alignments for recirculation post-LOCA as part of the GL 2008-01 design basis evaluation. The arrangement in the current configuration, without procedural guidance, could potentially have a voided condition between the containment isolation valve and the respective check valve in each containment sump suction header. It is not part of the current design basis to have these lines filled for normal operations. As a result of this review, operating procedure OI-SI-1, "Safety Injection Normal Operation," will be revised to ensure that the section of piping between valves HCV-383-3 and SI-160, and HCV-383-4 and SI-159, will be filled with water as part of normal operations to maintain an acceptable void volume. To evaluate operability of this potential non-conforming condition, a UT examination was performed on the respective recirculation suction headers. It was found that one header was water filled and the other header had a small void (2" void height in the 24" header). Evaluation concluded that the containment sump recirculation headers were operable based on the flow rates being sufficiently low that the identified gas void would not be transported along with the flow stream during accident conditions. The operability evaluation regarding potential voiding in this segment of piping was documented in the CAP under CR 2008-6112. OPPD has a high level of confidence that potential voiding conditions described above have not occurred in the past, due to performance of hydro testing of the piping at the end of previous refueling outages.

Based on the above evaluations, OPPD concludes that any potential gas voids in the ECCS suction piping would not render the pumps inoperable in an accident situation.

LPSI Discharge Headers

The susceptibility of the LPSI system to potential water hammer due to gas voids has been investigated and corrective actions have been implemented.

OPPD, in response to NRC Information Notice (IN) 97-40, performed an engineering evaluation in 1997 (FC06689) which concluded that the system was susceptible to water hammer.

Several modifications were implemented as a result of these evaluations: (a) vent valves were installed upstream of the LPSI loop isolation valves, (b) specific check valves and loop isolation valves were replaced to reduce the leakage of nitrogen-rich water from the safety injection tanks (SITs), and (c) a procedure was implemented to vent the system at appropriate intervals based on changes in SIT level to limit the gas void volume.

As an enhancement to system reliability, permanent ultrasonic void detection instrumentation was installed on the LPSI discharge piping at system high points to monitor for the presence of gas voids. FCS procedures require the system to be declared inoperable whenever the existence of a void is detected by the void detection instrumentation. In addition, in an effort to reduce the potential for gas intrusion into the LPSI system, a jockey pump was installed on the discharge side of the LPSI pumps. The jockey pump maintains the discharge piping water filled and pressurized.

Based on the above discussion, there is reasonable assurance that the LPSI system will perform its design function during a design basis accident (DBA).

HPSI Discharge Headers

The HPSI system involves eight parallel injection lines, each having an injection valve and a check valve in series (Ref. FCS drawing E-23866-210-130, Sheet 2A). HPSI discharge header high point locations were investigated for void formation during the 2008 FCS RFO. Although some evidence of voiding was identified, it was not conclusively determined the void had formed during plant operation. It is postulated that the void may have resulted from check valve leakage testing performed prior to UT examination during the 2008 RFO. Further, no evidence of a water hammer event has ever been recorded in any HPSI discharge piping during more than three decades of operation.

The operability of the HPSI discharge headers was also investigated in calculation FC07487, "Response to the Fort Calhoun HPSI Piping High Points to Gas-Water Waterhammer," performed by FAI in June 2008. This evaluation focused on the accumulation of non-condensable gases at piping high points that could lead to potential water hammer conditions during startup of a HPSI pump. It was conservatively assumed that the horizontal piping sections at all eight high points were completely voided using the highest pump run-up induced velocity and pressure to establish water hammer conditions. Results showed the calculated force imbalance was minimal compared to the stiffness of the piping. Therefore, the evaluated gas volume in the HPSI discharge piping will not produce damaging water hammer and the HPSI system will operate as designed during accident conditions.

CS Discharge Headers

During normal operations, the CS discharge piping from the containment isolation valves to the spray nozzles is empty. This piping will fill with water upon a containment spray actuation signal (CSAS). The design of the CS system anticipated the loads from water filling the dry portion of the piping during spray actuation.

CS injection is not part of the design basis mitigation of the post-LOCA containment temperature and pressure transient. During the injection phase of a LOCA, this piping, by design, is not filled and the isolation valves remain closed. During the realignment phase of a LOCA, a CS pump may be utilized for cooled suction to the HPSI pump lineup. This piping alignment would be normally filled, and hence it is not voided during long term cooling. The CS system is only actuated following a main steam line break (MSLB) event.

FAI has evaluated the CS discharge piping from the CS pumps to the containment isolation valves to determine the dynamic loads generated by gas voids of various sizes. OPPD is developing an acceptance criterion for gas voiding based on dynamic loads provided by FAI and the piping support design limits. This evaluation will be documented in calculation FC07504.

FAI is also evaluating the CS piping downstream of the containment isolation valves for hydraulic response to spray initiation. Preliminary conclusions indicate that this piping can be excluded from further consideration based on Pressurized Water Reactor Owners Group (PWROG) methodology (PA-SEE-0450). Calculation FC07501, "Waterhammer Exclusion of the FCS CS Piping Downstream of the Containment Isolation Valves," will document this evaluation.

Reduced Inventory Operation Shutdown Cooling Alignment

OPPD has existing operating restrictions during reduced inventory conditions for both normal operation and post DBA. This is accomplished by monitoring the Reactor Coolant System (RCS) coolant level as part of the precautions when initiating SDC (cooled suction alignment), thereby ensuring that the level remains above the center line of the hot leg (1006.5') and providing adequate net positive suction head (NPSH) for SDC operations, as documented in operating instruction OI-SC-1, "Shutdown Cooling Initiation."

Restrictions on operation of SDC are also implemented when the RCS level is below elevation 1010' (reduced inventory condition) to ensure that no more than two LPSI loop injection valves are open. This action is to minimize SDC pump runout and reduce the likelihood of vortexing in the event that the SDC heat exchanger LPSI bypass flow control valve, FCV-326, fails open. Additional restrictions are implemented in operating instruction OI-SC-1 regarding off-site power sources and electrical distribution trains. These limitations and protocols govern initiation of the SDC system; thereby reducing the likelihood of vortexing should the RCS level be reduced. Therefore, this condition has been previously addressed and appropriate actions are stipulated in existing procedures to minimize the likelihood of a SDC vortexing event.

A2.2 Discuss new applicable gas volume acceptance criteria for each piping segment in each system where gas can accumulate where no acceptance criteria previously existed and summarize the Corrective Actions, and schedule for completion of any Corrective Actions.

a) ECCS Pump Suction Piping

FCS-specific gas volume acceptance criteria for ECCS suction piping are being developed in response to GL 2008-01. These criteria are based on plant-specific evaluations of the suction piping configurations performed by Westinghouse and limit ingestion by the associated pumps to 2% air void fraction at the pump inlet. This is consistent with the PWROG program PA-SEE-0450, evaluating industry information on pump performance with gas voids. Limiting air ingestion at the pump inlet to 2% air void fraction ensures that any performance degradation experienced during the short time frame of air ingestion would be negligible. The evaluations consider the impact on required NPSH compared to the available NPSH during the air ingestion.

The plant-specific acceptance criterion for the pump suction piping will be documented in calculation FC07500, "Allowable Gas Void Accumulation in the Fort Calhoun ECCS Pump Suction Piping."

b) Pump Discharge Piping up to Containment Isolation Valves

FCS-specific evaluations are being performed to develop gas volume acceptance criteria for the SI discharge piping upstream of the normally closed isolation valves. Gas accumulation in this section of piping may result in pressure pulsations after a pump start. The subsequent pressure pulsation may cause relief valves in the subject systems to lift or result in unacceptable pipe loads (i.e., axial forces that are greater than the design rating of the axial restraint(s)). This effort was initiated prior to the issuance of GL 2008-01 and the evaluations utilize a methodology subsequently developed by a PWROG program to evaluate pump discharge piping gas accumulation.

The method uses plant-specific information for piping restraints and relief valve set points in the subject systems to determine the acceptable gas volume accumulation such that relief valve lifting in the subject systems does not occur and pipe loading is within acceptable limits (i.e., axial forces that are less than the design rating of the axial restraint(s)).

OPPD will complete implementation of this methodology and establish the applicable limits for gas accumulation in the discharge piping in the following calculation files:

- FC07503, "Allowable Gas Void Accumulation for the Fort Calhoun High Pressure Safety Injection Discharge Piping"
- FC07504, "Allowable Gas Void Accumulation for the Fort Calhoun Containment Spray Discharge Piping"

The corresponding acceptance criteria for the LPSI discharge piping were developed prior to the release of GL 2008-01, as described in the previous section and as documented in calculation FC06941. Ultrasonic void detection instruments, located on the high points of the LPSI discharge piping, monitor for the presence of gas void of a critical size and provide an alarm on the plant computer when a gas void is detected.

Surveillance test procedures, as described in the Testing Evaluation section of this response, will provide assurance that any gas accumulated in the SI discharge piping is limited to that permitted by the acceptance criteria.

c) Pump Discharge Piping Downstream of Containment Isolation Valves

Piping downstream of the normally closed containment isolation valves is being evaluated to determine the piping response in the presence of accumulated gas. This region of piping is being evaluated separately because of the possible beneficial characteristics of the valve stroke open action, relative to the pump ramp-up time. The downstream piping includes the CS piping downstream of the normally-closed isolation valve and the HPSI and LPSI cold leg injection piping downstream of the isolation valve. (Ref. FCS drawing E-23866-210-130, Sheet 2A.) These isolation valves are closed during power operation and opened upon receipt of a safety injection actuation signal (SIAS) or a containment spray actuation signal (CSAS). Also, the hot leg injection piping downstream of the normally-closed isolation valve is opened following switchover to injection for both the HPSI and LPSI alignments.

1. The FCS design basis does not currently include a plant specific water hammer analysis of the CSS downstream of the isolation valve. A calculation is being developed that will utilize the PWROG methodology. The PWROG methodology for CS evaluates the piping response as the CS header is filled and compares the potential force imbalances with the weight of the piping. The net force resulting from the pressurization of the CS header during the filling transient is a small fraction of the dead weight of the filled piping, and therefore the filling transient is well within the margin of the pipe hangers. Calculation FC07501, "Waterhammer Exclusion of the Fort Calhoun Containment Spray Piping Downstream of the Containment Isolation Valves," is being developed and will form the basis for exclusion of CS piping downstream of the normally closed containment isolation valves.

2. A Combustion Engineering-Nuclear Steam Supply System (CE-NSSS) specific methodology has been developed to assess the potential for a significant water hammer event to occur in the piping downstream of the normally closed cold leg HPSI and LPSI header isolation valves. The methodology establishes that if the upstream valve has an opening time slower than the pump ramp-up time and the downstream path to the RCS is only restricted by check valve(s), then no significant water hammer would occur.

   A plant-specific calculation covering the cold leg injection discharge piping water hammer issue is being developed and will be documented in FC07502, "Waterhammer Exclusion of the Fort Calhoun Cold Leg Header Piping."

3. The PWROG has developed a methodology (PA-SEE-0450) to assess when a significant water hammer could occur during switchover to hot leg injection. The methodology concluded that if the upstream valve has an opening time of approximately ten seconds and the downstream path to the RCS is only restricted by check valve(s), then no significant water hammer would occur. A plant-specific calculation covering the hot leg injection water hammer issue is being developed and will be documented in FC07505, "Waterhammer Exclusion of the Fort Calhoun Hot Leg Injection."

d) RCS Allowable Gas Ingestion

The PWROG qualitatively evaluated the impact of non-condensable gases entering the RCS on the ability on the post-accident core cooling functions of the RCS. This evaluation assumed that five cubic feet of non-condensable gas at 400 psig was present in the HPSI discharge piping concurrent with five cubic feet of non-condensable gas at 100 psig in the LPSI discharge piping. The qualitative evaluation concluded that these quantities of gas will not prevent the ECCS from performing its core cooling function; therefore, these considerations are not limiting with respect to gas accumulation acceptance criteria.

Surveillance test procedures will include acceptance criteria to ensure that gas accumulation in the LPSI and HPSI system piping meets the PWROG criteria for injected gas into the RCS. This item will be documented in the CAP.

Corrective actions and their schedule for implementation are discussed in Sections B and C of this response.

A2.3 Summarize the changes, if any, to the design basis documents (Corrective Actions) and the schedule for completion of the Corrective Actions.

As part of the design basis document review at FCS, it was determined that six calculations for evaluating void accumulation in the ECCS piping at FCS would be developed. The following list of calculations will become part of the FCS design basis upon their completion, in support of the new STs, and will be added as references in the FCS DBDs and PBD-32:

1. FC07500, "Allowable Gas Void Accumulation in the Fort Calhoun ECCS Pump Suction Piping."
2. FC07501, "Waterhammer Exclusion of the Fort Calhoun Containment Spray Piping Downstream of the Containment Isolation Valves."
3. FC07502, "Waterhammer Exclusion of the Fort Calhoun Cold Leg Header Piping."
4. FC07503, "Allowable Gas Void Accumulation for the Fort Calhoun High Pressure Safety Injection Discharge Piping."
5. FC07504, "Allowable Gas Void Accumulation for the Fort Calhoun Containment Spray Discharge Piping."
6. FC07505, "Waterhammer Exclusion of the Fort Calhoun Hot Leg Injection."

The completion of these calculations will be documented in the CAP.

As an enhancement, the DBDs for the ECCS will be updated to reference the PBD-32 regarding gas intrusion from a design aspect. The DBDs for the HPSI, LPSI, CS and SDC systems will be modified to reference the new design calculations. Updates of the DBDs are scheduled for completion by January 23, 2009.

New one-line piping plan and profile drawings were developed as a result of the 2008 RFO piping walkdown. OPPD plans to add these new one-line piping plan and profile drawings to the controlled drawing database.

Review of the detailed piping plan and profile drawings identified several new piping locations that warrant additional evaluation from a design impact. The evaluation will utilize finalized acceptance criteria to determine if design changes are required. The following locations will be evaluated: 1) two high points on the LPSI discharge header, 2) three HPSI discharge header locations, and 3) three locations on the CS header. This evaluation will be documented in the CAP.

A2.4 Discuss the results of the system P&ID and isometric drawing reviews to identify all system vents and high points.

Review of the FCS system piping and instrument drawings (P&IDs) and isometric drawings was performed for the ECC, SDC and CS systems.

The drawing review evaluated whether vent valves were installed on high point locations and that the horizontal pipe sections and installed components would allow gas to migrate to piping sections where vents were installed.

OPPD has developed composite one-line elevation diagrams of the selected systems using the P&IDs and isometrics drawings. The one-line composite elevation drawings provide a visual representation of the relative elevation differences between system piping and installed components. Review of the one-line drawings identified several locations that had the potential for gas accumulation due to their high point locations or their interface with adjacent gas entrained systems (i.e., SITs). These identified locations are specified in Section A2.5 of this design review.

The one-line drawings were later updated to reflect more accurate as-built information obtained from the piping plan and profile drawings which were developed from the 2008 RFO laser templating project. These piping plan and profile drawings were developed in response to GL 2008-01.

A2.5 Identify new vent valve locations, modifications to existing vent valves, or utilization of existing vent valves that were previously considered to be in inaccessible areas, based on the drawing review, and summarize the Corrective Actions, and schedule for completion of the Corrective Actions.

Review of FCS drawings identified several locations warranting installation of vent valves. These valves were installed at high points on the CS and HPSI systems during the 2008 RFO. The identification and location of these vent valves is summarized below.

Containment Spray System Vent Valves		
Valve ID	**Valve Location**	**Drawing No.**
SI-447	12" horizontal line, directly upstream of HCV-344	E-23866-210-130, Sh. 1
SI-448	12" horizontal line, directly upstream of HCV-345	E-23866-210-130, Sh. 1
SI-449	12" common header for 'A' and 'B' Trains in Room 13	E-23866-210-130, Sh. 1

High Pressure Safety Injection System Vent Valves		
Valve ID	**Valve Location**	**Drawing No.**
SI-450	2" horizontal line, directly upstream of HCV-318	E-23866-210-130, Sh. 2A
SI-451	2" horizontal line, directly downstream of HCV-317	E-23866-210-130, Sh. 2A
SI-452	2" horizontal line, directly upstream of HCV-321	E-23866-210-130, Sh. 2A
SI-453	2" horizontal line, directly downstream of HCV-320	E-23866-210-130, Sh. 2A
SI-454	2" horizontal line, directly upstream of HCV-315	E-23866-210-130, Sh. 2A
SI-455	2" horizontal line, directly downstream of HCV-314	E-23866-210-130, Sh. 2A
SI-456	2" horizontal line, directly upstream of HCV-312	E-23866-210-130, Sh. 2A
SI-457	2" horizontal line, directly downstream of HCV-311	E-23866-210-130, Sh. 2A

The review of FCS isometric drawings and P&IDs is considered complete. Vent valves added as a result of this drawing review, as listed above, have been added to the appropriate P&IDs and isometric drawings.

A2.6 Discuss the results (including the scope and acceptance criteria used) of the system confirmation walkdowns that have been completed for the portions of the systems that require venting to ensure that they are sufficiently full of water.

Piping walkdowns were performed in response to GL 2008-01 to determine if existing vent valves were properly installed at the high points of the horizontal piping runs and to confirm that no loop seals existed. The walkdown also confirmed whether piping was properly sloped to installed vent valves and to identify potential gas accumulation locations. Details of the walkdown will be documented in PBD-32. The following is a brief summary of the scope, method and the findings of this effort.

The scope of the walkdowns included the accessible portion of the ECCS suction header piping from the SIRWT to the containment sump strainers, individual suction lines to the ECCS and CS pumps, and discharge piping from the pumps to their respective loop isolation valves. These walkdowns were performed during the 2008 RFO and included the piping in the auxiliary and containment buildings. The only portion of the safety systems not included in the walkdown scope were the containment isolation valves located in the submarine hulls, the piping embedded in concrete from the submarine hulls to the containment sump, and the SIRWT suction piping embedded in concrete.

The ECC, SDC, and CS systems are mostly uninsulated; therefore, only a small amount of insulation was required to be removed to support the piping walkdowns.

Several methods were evaluated to determine the piping levelness, slope and relative component location of the designated piping systems. The method selected was three-dimensional (3D) laser templating. Laser templating is considered to provide the greatest accuracy with a relatively short amount of time required in the radiation area, thus providing a dose savings.

Laser templating involves taking a 3D image of the space or compartment being measured using a laser scanner. The laser scanner is calibrated to have an accuracy of greater than one-quarter inch. Data collected from the templating process was then used to create a 3D model showing the pipes, valves and other structures. The model was then used to create a 2-dimensional (2D) drawing showing the piping configuration, valves, and structures with pertinent elevations and piping slopes. The completed plan and profile drawings provide a detailed, accurate visual illustration of the piping and component elevation and slope.

Laser templating of the subject piping began in April 2008 and was completed during the 2008 RFO. Detailed piping plan and profile drawings, developed from the laser templating, were completed in August 2008.

A summary of the results of the system walkdown and piping plan and profile drawing review is provided below.

<u>ECCS and CS Suction Headers</u>

A total of five vent valves (SI-161, SI-162, SI-370, SI-371 and SI-382) are installed on the ECCS and CS suction headers. These valves were installed as part of the original plant construction.

Review of the piping plan and profile drawings revealed minor negative pipe slope (i.e., slope away from the vent valves and vertical risers) and installed components, such as check valves, that may block the migration of gas to an installed vent valve. Assuming the suction headers are completely vented at the vent locations (i.e., a solid stream of water is emitted from each vent), there would still be sections of trapped gas that cannot be expelled by normal venting methods. The localized void fraction of potential accumulated gas was less then 3.9% in the 'A' suction header and 3.6% in the 'B' suction header.

An operability analysis was performed by FAI to determine the impact of the potentially trapped gas in the ECCS suction headers on pump performance. This evaluation is documented in calculation FC07124 and CR 2008-5381. Based on the conclusions of the evaluation, no operability concerns were identified and no new vent valves were proposed on the ECCS suction headers.

LPSI Discharge Header

Four vent valves (SI-397, SI-398, SI-399, and SI-400) are installed on the LPSI discharge header. These valves were installed in response to investigation related to NRC IN 97-40 which addressed gas intrusion due to back-leakage from the SITs into adjoining low pressure systems. These vent valve locations were selected based on the high probability of gas being introduced into the system at that point due to their interface with the SI tanks' discharge header and the fact that they are located at the high point of the LPSI system.

Review of the detailed piping plan and profile drawings identified two high point locations that warrant consideration for vent valves. Further information on potential new vent valves is contained in Section A2.7.

HPSI Discharge Header

Based on review of the piping plan and profile drawings, vent valves were installed upstream and downstream of the HPSI loop injection valves during the 2008 RFO since this location has the highest probability of gas accumulation. These loop injection valves establish the interface with the SIT discharge header and are located at the high point of the HPSI system.

Review of the detailed piping plan and profile drawings identified three localized high point locations that warrant consideration for vent valves, as discussed below in Section A2.7.

CS Discharge Header

Based on review of the piping plan and profile drawings, vent valves were installed upstream of the CS header isolation valves (HCV-344 and HCV-345) and in Room 13 (Lower Mechanical Penetration Area) at the high point of a loop seal in the system during the 2008 RFO. The isolation valves upstream of the containment isolation valve are at the high point of the system, at an elevation approximately four feet higher than the normal SIRWT level and, therefore, at a slight vacuum. The vent valve in Room 13 (Lower Mechanical Penetration Area) is located on a piping section that forms a loop seal. Downstream piping is open to containment atmosphere through the open spray nozzles. Over time, any leakage through the containment isolation valves combined with back-leakage through the CS pump discharge check valves will permit air to be introduced into the piping at these locations. (Ref. FCS drawing E-23866-210-130, Sh. 1)

Review of the detailed plan and profile drawings found several locations where negative pipe slope could result in gas accumulation. Void volume calculations performed for the locations identified found they were below the interim acceptance criteria and would not impact system operability. (Ref. calculation FC07504, "Allowable Gas Void Accumulation for the Fort Calhoun Containment Spray Discharge Piping.") The one location (Room 14, SDC Heat Exchanger Area) with the higher potential trapped gas volume will be evaluated for future installation of a vent valve.

The CS flow elements FE-342 and FE-343 are located on a horizontal section of piping at a lower elevation than vent valves SI-447 and SI-448, located near valves HCV-344 and HCV-345. However, the flow element has an orifice that is smaller than the piping internal diameter and therefore, presents a potential blockage to gas migration to the higher point vents located upstream of valves HCV-344 and HCV-345. (Reference FCS drawing E-23866-210-130, Sheet 1.) Three locations will be evaluated for vent valves as discussed in Section A2.7.

Shutdown Cooling

The SDC system uses a combination of LPSI and CS piping and components on the pump discharge side and a dedicated section of piping from an RCS hot leg to the LPSI pumps on the suction side. (Ref. drawings E-23866-210-130, Sh. 1 and 3)

The majority of the SDC discharge piping was reviewed as part of the individual LPSI and CS systems evaluations. The review of those unique portions of piping and the associated cross-connect section is discussed in the following paragraphs.

Review of the piping plan and profile drawings found the following:

1. The suction piping that is located in containment between isolation valve HCV-348 and the containment penetration has an upward bow. Based on piping plan and profile drawings, this section of piping could potentially trap gas if the SDC suction line is not properly refilled following maintenance. This condition is discussed under Testing Evaluation, Item A3.3.

2. SDC isolation valve HCV-335 is an isolation valve between the LPSI and CS systems. (Ref. drawing E-23866-210-130, Sh. 1). Piping from each system forms a portion of the SDC flow path. During power operation, HCV-335 is closed and the piping on the LPSI side forms a loop seal. Since this segment of piping does not have a vent valve and is not capable of being dynamically flushed, installation of a vent valve at the high point upstream of HCV-335 is being considered. This particular location is part of the LPSI system and will be tracked under that system, as discussed in A2.7 below.

A2.7 Identify new vent valve locations, modifications to existing vent valves, or utilization of existing vent valves that were previously considered to be in inaccessible areas, that resulted from the confirmatory walkdowns, and summarize the Corrective Actions, and the schedule for completion of the Corrective Actions, i.e., the walkdowns that have been completed, and the walkdowns not yet complete...

As noted previously, laser templating of the subject piping was completed during the 2008 RFO. Detailed piping plan and profile drawings, developed from the laser templating, were completed in August 2008. This information will be used in conjunction with formalized void size acceptance criterion to determine the need for additional vent valve locations and/or surveillance test monitoring points.

OPPD is using the following approach in determining the need for new vent valves:

1. Establish potential void locations and void volumes based on piping configuration (i.e., negative piping slope, components blocking migration of gas to high points, etc.). This has been completed by the development of the piping plan and profile drawings and void volume calculations.

2. Identify vulnerability to void accumulation based on interface with gas bearing systems.

3. Determine void size acceptance criteria for each system.

4. Determine if the system can be dynamically vented.

5. Consider operating history of the systems and if there has been any evidence of past water hammer.

6. Determine acceptability of void remaining in system.

These actions are scheduled for completion by January 23, 2009. OPPD plans to install vent valves as needed based on safety significance and work planning schedule. These actions are considered enhancements and are tracked by the CAP.

ECCS and CS Suction Headers

No new vent valves are proposed on the ECCS and CS suction headers.

LPSI Discharge Headers

Review of the detailed piping plan and profile drawings identified the following two LPSI discharge header locations that warrant consideration for vent valves:

1. The cross-tie piping between the LPSI and CS systems, which is part of the flow path for the SDC system. The isolation boundary between these two systems is isolation valve HCV-335. During power operation, HCV-335 is closed and the piping on the LPSI side forms a loop seal which has no vent valve and cannot be dynamically flushed.

2. The LPSI header line from Room 22 (East SI Pump Room) into Room 23 (Spent Regenerant Tank Room) has significant length of piping with a negative slope and therefore has the potential for appreciable gas accumulation.

These two LPSI discharge header locations will be evaluated for future vent valves installation and design impact. System operability is not impacted since these piping segments are part of the SDC flow path and are dynamically flushed when SDC is in service. Additionally, the jockey pump's function is to maintain the LPSI discharge header pressurized and water filled. This evaluation will be documented in the CAP.

HPSI Discharge Headers

Review of the detailed piping plan and profile drawings identified the following three HPSI discharge header locations that warrant consideration for vent valves:

1. The common suction line to HPSI pumps SI-2A and SI-2C. Any gas in this section of piping would simply accumulate as it would be blocked by check valve SI-113 from migrating back to the ECCS suction header where vent valves are located.

2. The cross tie high point at HCV-2988 is a potential void accumulation location as it would be difficult to fill approximately 7 feet of piping between the SI piping header and isolation valve HCV-2988.

3. The cross-tie for the alternate hot leg injection merits further evaluation. There is a potential high point approximately 18 feet long that could be difficult to fill.

These three HPSI discharge header locations will be evaluated for future vent valve installation and design impact. System operability is judged not to be impacted since there has been no indication of gas voiding as evidenced by the absence of any water hammer when a HPSI pump is periodically run to fill the SITs. These evaluations will be documented in the CAP.

<u>CS Discharge Headers</u>

Review of the detailed piping grade drawings identified the following three CS discharge header locations that warrant consideration for vent valves:

1. The horizontal piping upstream of flow element FE-342. The CS flow element is located on a horizontal section of piping at a lower elevation than downstream vent valve SI-447. Given that the flow element has an orifice size that is smaller than the piping internal diameter and therefore, presents a potential blockage to gas migration to the higher point vents.

2. The horizontal piping upstream of flow element FE-343. The CS flow element is located on a horizontal section of piping at a lower elevation than downstream vent valve SI-448. Given that the flow element has an orifice size that is smaller than the piping internal diameter and therefore, presents a potential blockage to gas migration to the higher point vents.

3. The 12-inch piping in Room 14 (SDC Heat Exchanger Area). Negative piping slope has the potential to prevent the migration of gas to downstream vent SI-449.

These three CS discharge locations will be evaluated for future vent valves installation and design impact. In the interim, system operability is not judged to be impacted since the potential trapped gas volumes are below interim acceptance criteria. These evaluations will be documented in the CAP.

<u>Shutdown Cooling</u>

Review of the detailed piping plan and profile drawings identified the following SDC locations that warrant consideration for a vent valve:

1. A review of the SDC system plan and profile drawings found that negative pipe slope and geometry in the suction piping could potentially trap gas in the piping along the top of the long horizontal run of pipe between HCV-348 and the containment penetration. The potential is greatest if this section of piping is drained for maintenance during an outage and then gravity filled during restoration. Normal SDC flow velocity through the pipe of 1500 gpm (one LPSI pump running) will not transport potentially trapped gas to the pump suction. The high point location along this section of pipe is inside the bioshield and is not considered accessible for static venting prior to initiation of SDC. The current configuration of this discharge section of piping is not an operability concern since it would be dynamically flushed during normal SDC operation. Entrapped gas in the section of piping between SDC isolation valves HCV-347 and HCV-348 (beyond that in the arch at the top of the pipe discussed above) will vent to the RCS when HCV-348 is opened (Ref. drawings E-23866-210-130, Sheets 2A and 3). Historically, there has been no indication of LPSI pump performance problems when SDC is placed in service.

2. The SDC discharge piping contains cross-tie piping between the LPSI and CS system. The isolation boundary between the two systems is isolation valve HCV-335. This piping is part of the flow path for the SDC system. During power operation, HCV-335 is closed and the piping on the LPSI side forms a loop seal which has no vent or cannot be dynamically vented. This location may warrant installation of a vent valve at the high point of this piping segment to allow venting of gas that may accumulate from RCS degassing following an outage.

These two SDC locations will be evaluated for design impact. These evaluations will be documented in the CAP.

The corrective actions and the schedule for completing such actions for the items described in this section are documented in Section B.

A2.8 Discuss the results of the fill and vent activities and procedure reviews for each system. (Note that routine periodic surveillance testing is addressed in the "Testing Evaluation" section of this template).

A review of the processes and procedures used for filling and venting the ECC, CS and SDC systems piping was performed as discussed below.

Operations Procedures Review

Review of the following fill and vent procedures was performed:

- OP-1, Master Checklist for Plant Startup
- OP-2A, Plant Startup
- OI-SI-1, Safety Injection - Normal Operation
- OI-CS-1, Containment Spray - Normal Operation
- OI-SC-1, Shutdown Cooling Initiation

Fill and vent activities are controlled by an approved operating procedure. The results of this review and action items that were identified are summarized in Testing Evaluation Section A3.4. The review identified the need for an additional surveillance procedure to periodically monitor the accumulation of gas voids; this procedure is described in Testing Evaluation Section A3.2.

Verification that Procedures Exist to Vent All Locations

A review of the FCS operating procedures for the following systems and activities was performed to ensure that protocols exist to properly vent all necessary piping locations:

- ECCS combined suction,
- HPSI discharge,
- CS discharge,
- SDC piping,
- Restoration of ECCS following maintenance, and
- LPSI discharge.

These reviews are summarized in Testing Evaluation Section A3.4. Issues that need to be addressed are identified in Testing Evaluation Section A3.6.

Verification that Venting Procedures have Effective Steps, Adequate Venting Durations and Acceptance Criteria for Completion of Venting

Operating procedure OI-SI-1, "Safety Injection – Normal Operation," was reviewed to confirm proper venting of the SI, LPSI, HPSI, CS and SDC systems. The focus of this review was on the following attachments:

- Attachment 17, "Venting the Safety Injection System" - Sequencing of steps is appropriate. Venting duration and acceptance criteria are combined into a statement that venting is to continue until a continuous stream of water is emitted. An enhancement to add vent valve SI-382 to the procedure for venting the "B" Safety Injection Header was identified.

- Attachment 18A, "Venting the LPSI Header with LPSI Jockey Pump," and Attachment 18B, "Venting the LPSI Header with LPSI Pumps" - Sequencing of steps is appropriate. Venting duration and acceptance criteria are combined into a statement that venting is to continue until a continuous solid stream of water is observed. LPSI void detection instrumentation (YS-351, YS-352, YS-353 and YS-354) is permanently installed to monitor the LPSI header for voids.

- Attachment 19, "Venting the HPSI Headers with the HPSI Pumps" - Sequencing of steps is appropriate. There is no venting duration or acceptance criterion for completion of venting. This applies to all four HSPI loops covered in the attachment – loops 1A, 1B, 2A and 2B. As an enhancement, acceptance criteria should be added for completion of venting.

- Changes to OI-SI-1 for outlining filling of the section of piping between the containment penetration isolation valve and the respective check valve shall be implemented. A sequence of steps shall be provided for the fill and venting of the section of piping between containment penetration isolation valve and the respective downstream check valve.

Operating Instruction OI-CS-1, "Containment Spray - Normal Operation," was reviewed. The sequencing of steps is appropriate. Venting duration and acceptance criteria are combined into a statement that venting is to continue until a clear flow of liquid is observed.

SDC system flow is confirmed sufficient for cooling the reactor core before the last reactor coolant pump is shut down. During the SDC initiating process, the SDC flow control valve FCV-326 is initially throttled to 20% open before a pump is started. This action has been established to prevent water hammer in the SDC system upon system start up.

Verification that Venting of Instrument Lines, Including Backfilling of Level and Flow Transmitters is Included in System Venting Procedures

Procedures that address fill and vent of flow transmitters in the ECC and CS piping systems were reviewed for appropriate venting instructions. These procedures were found to contain appropriate venting instructions for the following transmitters: FT-313, FT- 316, FT-319, FT-322, FT-326, FT-328, FT-330, FT-332, FT-334, FT-342, and FT-343.

The STs and calibration procedures (IC-CP-01-313, IC-CP-01-0316, IC-CP-01-0319, IC-CP-01-0322, IC-CP-01-0326, IC-CP-01-0328, IC-CP-01-0330, IC-CP-01-0332, IC-CP-01-0334, IC-CP-01-0342 and IC-CP-01-0343) for the applicable instrumentation were reviewed to ensure they have appropriate procedure steps for filling and venting of instrument lines as part of the restoration process. Each procedure included a step in the restoration section to vent the transmitter prior to returning the instrument to service.

Effectiveness of Dynamic Venting Methods for All Locations where Dynamic Venting is used (Adequate Flow Rates/Fluid Velocities): Revise Procedures as Necessary to ensure that Dynamic Venting is adequately implemented:

The SDC flow rate is adequate to dynamically vent the discharge piping. Further, SDC is required to be in service and operating properly prior to securing the alternate heat removal loop (reactor coolant pump and steam generator). Operating experience with the SDC system over plant life has shown that gas binding or water hammer have not occurred.

Discuss if Vacuum Fill Operations are used for Piping Sections which are Difficult to Fill and Vent following Maintenance

FCS does not use vacuum fill operations on any of the subject systems addressed by NRC Generic Letter 2008-01.

The RCS is vacuum refilled following refueling and maintenance outages that breach the RCS pressure boundary. The RCS is interconnected to the subject systems, thus the vacuum refill process expedites filling the RCS and helps remove air or gas accumulated in the system and its interconnected piping.

Evaluate the use of Vacuum Fill Operations for Piping Sections which are Difficult to Fill and Vent Following Maintenance. Implementation of Vacuum Fill may require Plant Modifications, Changes to Procedures.

No immediate need for additional vacuum fill operations has been identified. As an enhancement to system maintenance and operation, OPPD plans to evaluate the merits of vacuum fill for these evolutions. An action item will be initiated in the CAP to track this evaluation.

Ensure that Fill and Vent Procedures Provide Instruction to Modify Restoration Guidance to Address Changes in Maintenance Work Scope or to Reflect Different Boundaries from those Assumed in the Procedure.

Modifications to restoration guidance for maintenance work scope changes are addressed by Standing Order M-101, "Maintenance Work Control." Required work scope changes to a maintenance task are documented on Form FC-1173A, "Work Task Document – Supplement Page." Post maintenance and operability testing requirements are evaluated and required changes are documented on Form FC-1173A. Filling and venting of a piping system, if required by the scope of maintenance work, is integral to satisfactory post maintenance and operability testing of the system or component. Form FC-1173A must be approved by several individuals including the system engineer and the test engineer. The Shift Manager verifies successful testing of a system before it is returned to service.

A2.9 Identify procedure revisions, or new procedures resulting from the fill and vent activities and procedure reviews that need to be developed, and summarize the Corrective Actions, and schedule for completion of the Corrective Actions. (Note that routine periodic surveillance testing is addressed in the "Testing Evaluation" section of this template.)

The current procedures were reviewed for fill and vent activities. These reviews are documented in Design Evaluation Section A2.8. The resulting action items from these reviews are documented in the CAP under CR 2008-2021.

No new operating procedures are required. However, FCS is developing new ST procedures which will incorporate acceptance criteria for gas accumulation in the subject safety systems. These procedures are described in Testing Evaluation Sections A3.2 and A3.5 and their completion is being tracked in the CAP as delineated in Sections B and C.

A2.10 Discuss potential gas intrusion mechanisms into each system for each piping segment that is vulnerable to gas intrusion.

Potential Gas Intrusion Mechanisms Evaluated for FCS

a) Leakage from accumulators or other high pressure sources that can result in gases coming out of solution.

In the past it has been identified that leakage from the SITs into the LPSI system has resulted in gas voiding. Due to these previous gas voiding issues, modifications have been installed to mitigate the impact of this gas intrusion source, as discussed in Section A2.1. In brief, a jockey pump (SI-18) has been installed to assist in control of gas intrusion. Void monitors were installed to monitor locations with known gas voiding. Vent valves have also been installed for mitigation of potential gas intrusion.

OPPD has replaced three LPSI loop isolation valves (HCV-327, HCV-331 and HCV-333) and three LPSI loop check valves (SI-194, SI-197 and SI-203) during recent RFOs in an effort to eliminate leakage from the SITs into the LPSI discharge header.

b) Leakage from the RCS can result in the formation of steam pockets or hydrogen coming out of solution.

Back-leakage from a high pressure RCS source to a low pressure interface could occur at the loop check valves to the RCS (SI-208, SI-212, SI-216 and SI-220). This configuration is unique to FCS since any back-leakage from the RCS through these check valves will be routed through leakage coolers that are installed on each injection line. Thus, any leakage across the valves is cooled and kept under pressure and then returned to the reactor coolant drain tank (RCDT). Leakage past check valves that has occurred at FCS has been sampled by Chemistry personnel and determined to be approximately 99% nitrogen. It is not anticipated that hydrogen would come out of solution as hydrogen gas source is limited and regulated by pressure in the VCT.

c) Dissolved gas can come out of solution due to a pressure reduction such as through control valves, orifices and ECCS sump screens, or because of elevation changes or venting.

The potential for dissolved gas to come out of solution due to pressure reduction from various mechanisms was evaluated. It was concluded that orifices would not be a potential source of gas voiding based on system configurations.

Newly installed sump strainers were evaluated for potential voiding. It was concluded that the potential for voiding is minimized by containment overpressure and pool water temperature. A conservative sump pool water level was used in the voiding calculations. The ECCS suction side high points were concluded to not be a point of significant gas intrusion as discussed under the Design Evaluation Section A2.1.

d) Inadvertent draining, system realignments, and incorrect maintenance and testing procedures can result in gas intrusion.

Potential gas intrusion due to system realignments, testing procedures, and maintenance are addressed in Section A3, Testing Evaluation. Any potential for gas intrusion will be addressed by procedure changes as noted in Section A3.

e) Air in-leakage can occur through system pathways which allow drain-back to the system.

Review confirmed that isolation valves exist in system pathways. Therefore, drain-back to the ECCS is not a potential source of gas intrusion.

f) Failure of level instruments to indicate the correct level for tanks used as a pump suction source can result in gas intrusion.

OPPD has evaluated the ECCS level instrument systems and concluded that, due to redundancy, configuration and type of level instrumentation utilized, failures associated with such instrumentation will not be a source of gas intrusion.

g) Leakage through isolation valves or through check valves can result in gas transport from the intrusion location to other locations in the ECCS.

At FCS, back-leakage from the RCS to the ECCS system is only susceptible at the loop check valves. Such leakage, should it occur, will be routed through leakage coolers installed on each injection line. Pressure control valves on each injection line along with accumulators will relieve any back-leakage.

h) Leakage through vent valves can occur when the local system pressure is less than the nominal atmospheric vent pressure.

Detailed review of the composite plan and profile drawing for each system (HPSI, LPSI, and CS) identified that a vacuum of 4 to 5 psid could potentially exist at the injection isolation valve locations due to the relative elevations of the normal SIRWT water level and the valve locations. The static conditions at these locations have the potential for a void formation. Corrective actions have been taken to address gas voiding due to back-leakage through existing vent valves or through valve packing in-leakage. To assure that these locations remain water solid, including the recent vent valve installations, these header valve locations will be evaluated for inclusion in the ST procedure and will be assessed as part of the performance based inspection frequency.

i) Temperatures at or above saturation temperature can occur due to heat conduction through piping connected to the RCS or due to leakage of RCS fluid through isolation valves.

FCS procedures address pressure lock conditions that could result in thermal stratification and steam bubble formation. Susceptible piping locations are monitored by thermocouples to ensure that a pressure lock condition does not result in thermal stratification or heatup that could lead to a water hammer situation.

j) Gas can be introduced from suction sources due to formation of air entraining vortices or by not isolating suction source before it is completely drained.

Review confirmed that gas intrusion into the ECCS is not expected as a result of drain down of the SIRWT prior to recirculation actuation or due to vortexing when ECCS suction is drawn from the containment sump.

New style, horizontally-stacked disk strainers were installed in the containment sump in the fall of 2006 in response to NRC Generic Safety Issue (GSI) 191. Evaluations confirmed the new strainers reduce the fluid approach velocity under worst case flow rates and remain fully submerged for all accident scenarios. Vortexing and air ingestion were addressed in the hydraulic sizing report for the new containment sump strainers. Testing of the new strainers under conditions of minimal submergence demonstrated that vortexing was prevented and that air ingestion did not occur until the water level was lowered below the top of the strainers. It was concluded that a large margin to vortex formation and air ingestion exists during ECCS operation under accident conditions.

FAI calculation FAI/07-125 and scale testing (calculation FC07258) provide reasonable assurance that sufficient water remains in the SIRWT at the point when recirculation actuation occurs to prevent vortexing. Therefore, ECCS pump performance required to mitigate DBA scenarios is assured.

OPPD has implemented operating restrictions during reduced inventory (SDC) conditions to ensure that the fluid level remains above the center line of the hot leg. These restrictions will prevent the potential for a vortex to form at the SDC system suction nozzle connection to the hot leg during such operations.

k) Review air-operated valve designs for potential air leakage into the system.

An evaluation of air operated valve (AOV) designs installed in the ECC, SI, SDC and CS systems concluded that they create little potential for air leakage into these systems. The AOVs at FCS are part of the AOV Plant Design Basis Program and are subject to testing and performance evaluations.

l) Identify other plant specific methods of gas intrusion.

No other plant specific methods for gas intrusion were identified as a result of the design evaluations.

A2.11 Ongoing Industry Programs

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

- Gas Transport in Pump Suction Piping

  The PWROG has sponsored testing of gas transport in 6-inch and 8-inch suction piping. WCAP-16631-NP, Revision 0, "Testing and Evaluation of Gas Transport to the Suction of ECCS Pumps," documents the results of this program. A supplemental PWROG program, currently in progress and scheduled for completion in 2009, will extend testing to gas transport in 4-inch and 12-inch low temperature systems and 4-inch high temperature systems, and will integrate the results of the 4-inch, 6-inch, 8-inch and 12-inch testing.

- Pump Acceptance Criteria

  Long-term industry actions were identified that will provide additional tools to address GL 2008-01 with respect to pump gas void ingestion tolerance limits. The program results will be reviewed for applicability to FCS. This action will be documented in the CAP.

A2.12 Provide a detailed list of items that have not been completed, a schedule for their completion, and the basis for that schedule.

The Design Evaluation is still in progress at FCS including the preparation of calculations, development of acceptance criteria, composition of surveillance test procedures, and enhancement of the operating procedures.

The design calculations listed in Section A2.3 are scheduled for completion by December 30, 2008. The design calculations establish the necessary acceptance criteria for input into the STs. Based on the design calculations, the STs will be composed and issued by January 23, 2009. Issuance of these STs is considered a regulatory commitment.

As an enhancement, the DBDs for the safety systems will be updated to reflect reference to PBD-32 in regards to gas intrusion from a design aspect. The new calculations documented to support design evaluations will also be referenced in the DBDs during this update. These DBD updates will be completed by January 23, 2009.

Following the completion of the development of the acceptance criteria for the ST procedures, additional vent valves may be added in the safety systems. Decisions for installation of vent valves will be made in accordance with the safety significance of the potential void per the FCS work planning schedule. These actions are considered enhancements and are tracked by the CAP.

The schedule for resolution of the open items is based on the availability of resources, completion of acceptance criteria and subsequent surveillance test development, incorporation of new or revised procedures, and radiological considerations for access to plant systems and equipment.

A3 TESTING EVALUATION

A3.1 Discuss the results of the periodic venting or gas accumulation surveillance procedure review.

Surveillance testing requirements in the TS do not require periodic venting or monitoring for gas intrusion or accumulation in the ECC, SDC and CS systems. Gas voids in these systems are identified, monitored, and controlled through FCS operating and venting procedures.

Detailed reviews were conducted of operating procedures and instructions for fill and vent of the ECC, SDC, and CS systems with a focus on gas accumulation, effectiveness of step sequencing, venting duration, and acceptance criteria for completion of the venting. These reviews are documented in Design Evaluation Section A2.8.

OPPD employs startup procedures OP-1 and OP-2A for system fill and venting requirements prior to going to full power operations. These startup procedures direct the use of operational procedures for filling and venting of the ECC systems. Venting guidance is provided in procedure OI-SI-1 for LPSI and HPSI systems and in operating instruction OI-CS-1 for the CS system.

OPPD is developing new surveillance procedures as a result of this review to include periodic UT inspections of the safety system piping to determine if voids exist at predetermined locations and the void size(s). The ST procedures will include acceptance criteria to ensure that safety systems remain operable in the presence of gas voids.

A3.2 Identify procedure revisions, or new procedures resulting from the periodic venting or gas accumulation surveillance procedure review that need to be developed.

OPPD does not have existing ST procedures for gas intrusion as discussed in Testing Evaluation Section A3.1. Gas accumulation is managed through the existing fill and vent procedures, design changes by providing appropriate means to vent the ECC systems, and monitoring the voids as discussed in the Design Evaluation Section. OPPD will create new ST procedures to include periodic UT examination of the piping to monitor for gas voids.

These ST procedures will be conducted on a periodic basis to monitor that each ECCS piping system is sufficiently full. Acceptance criteria of void volume for each specified high point location will be determined resulting from the initial implementation of UT inspection and other evaluation reports.

The ST procedures will require entry into the CAP when the quantity of gas present or vented is exceeding acceptance criteria during surveillances. The ST procedures will include an option for sampling analysis of gas voids if the source of the gas is unknown or questionable. The frequency to conduct the STs will be based on system performance and adjusted accordingly. This will provide the flexibility to change ST frequency based on results. This corrective action will be phased in as acceptance criteria for each sub-system are developed.

The ST procedures will be revised after the release of original revision to redefine accessibility of piping based on actual expected radiation exposure and scaffolding requirements. Therefore, verification locations and periodicity will be specified accordingly.

A3.3 Discuss how procedures adequately address the manual operation of the SDC system in its decay heat removal mode of operation. Include how the procedures assure that the SDC system is sufficiently full of water to perform its decay heat removal safety function (high point venting or UT) and how pump operation is monitored by plant personnel (including a description of the available instrumentation and alarms).

Operating Instruction OI-SC-1, "Shutdown Cooling Initiation," was reviewed. This review found that the sequence of steps to fill the SDC suction line between containment isolation valves HCV-347 and HCV-348 is ineffective. The procedure has the outboard isolation valve opened (HCV-347) to fill the piping between the containment isolation valves. Filling of this section of piping is not possible without also opening HCV-348. Further evaluation is required to determine if HCV-348 should be opened rather than HCV-347 to flood the line between the valves with RCS water. A review of the plan and profile drawings for this section of piping shows that, due to pipe slope and geometry, gas could be trapped in the top of the horizontal run of pipe between HCV-348 and the containment penetration if this piping segment is drained and then gravity filled from the RCS. However, SDC system operability is not impacted by this condition since the flow velocity of one LPSI pump is insufficient to transport the gas to the pump suction. Entrapped gas in the section of piping between valves HCV-347 and HCV-348 beyond that in the arch at the top of the pipe discussed above will vent to the RCS and accumulate in the pressurizer gas space when HCV-348 is opened. Review of and subsequent changes to OI-SC-1 have been entered into the CAP under CR 2008-2021 as noted in Section B.

SDC pump operation is monitored using numerous alarms and indications.

Indications of LPSI pump performance are:

- Local discharge pressure gauge for each pump
- Pump discharge pressure indication PI-325 in the control room
- Discharge header flow indication on FI-326 in the control room
- Individual pump ammeters located above the handswitch in the control room
- Pump status lights that indicate if the pump breaker is closed, open or mispositioned

Alarms associated with LPSI pump performance are:

- The LPSI pump bearing cooler no flow alarm will actuate if component cooling water flow to the bearings drops below 5 gpm.

- A SDC high-low flow alarm is enabled when SDC isolation valve HCV-348 is opened and alarms if flow drops below 1200 gpm or exceeds 2000 gpm.

- A LPSI pump OFF NORMAL alarms actuates if any of the following conditions exist:

    a. Pump breaker is racked down
    b. Control switch is in PULL OUT
    c. DC control power is lost (e.g., fuses are blown)
    d. 69-permissive switch is not in AFTER CLOSE
    e. RAS override switch is in OVERRIDE

A3.4 Summarize the results of the procedure reviews performed to determine that gas intrusion does not occur as a result of inadvertent draining due to valve manipulations specified in the procedures, system realignments, or incorrect maintenance procedures.

The following procedures were reviewed to examine the gas intrusion potential in the safety systems due to plant operational activities:

- OP-1, Master Checklist for Plant Startup
- OP-2A, Plant Startup
- OI-SI-1, Safety Injection – Normal Operation
- OI-CS-1, Containment Spray – Normal Operation

The results of the above listed procedure reviews and recommended actions are as follows:

1. There are no steps in OP-1 or OP-2A for direct venting of the ECCS suction header during plant startup from Mode 4/5. A procedure change to OP-1 Attachment 1, "Checklist for Plant Startup from Mode 4/5 to Mode 1," has been initiated to ensure both ECCS suction headers are vented in accordance with OI-SI-1 Attachment 17 prior to the plant exceeding 210°F.

2. No changes are required to procedures for HPSI discharge piping.

3. OI-SI-1, Attachment 17 uses two vent valves (SI-370 and SI-371) to vent the ECCS suction headers. Additional review of the ECCS suction header drawings indicated that SI-382, the LCV-383-1 outlet line vent valve, is at a slightly higher elevation than SI-371. This valve will be added to OI-SI-1, Attachment 17.

4. OI-SI-1, Attachment 19, "Venting the HPSI headers with the HPSI pumps," was reviewed and no changes are required to procedures for HPSI discharge piping venting.

5. Each of the four LPSI discharge headers is vented in accordance with OI-SI-1 Attachments 18A or 18B as part of plant startup. No changes are required to procedures for LPSI discharge piping venting.

6. Each of the two CS discharge headers is vented in accordance with OI-CS-1 Attachment 2 and Attachment 3 as part of plant startup. No changes are required to procedures for CS discharge piping venting.

7. Restoration of ECCS following maintenance: Review of OI-SI-1 identified that restoration of LPSI pump to service has steps that vent the pump casing but do not provide direction on venting the suction or discharge piping. No similar guidance exists for removing or restoring a HPSI or CS pump for maintenance. OPPD plans to revise OI-SI-1 to provide this guidance.

8. Changes will be made to OI-SI-1 to provide guidance on substantially filling the section of piping between HCV-383-3 and SI-160, and HCV-383-4 and SI-159.

A3.5 Describe how gas voids are documented (including the detection method such as venting and measuring or UT and void sizing and post venting checks), dispositioned (including method(s) used such as static or dynamic venting), and trended, if found in any of the subject systems.

Explain here or in the "Corrective Actions Evaluation" section the threshold (acceptance criteria) for entry into the Corrective Action Program (CAP) and how the CAP addresses disposition and trending. For gas voids less than the CAP threshold, if applicable, describe how these gas voids are documented and trended as a means to detect system changes that may be indicative of degradation leading to future gas voiding.

Ultrasonic void detection instrumentation (YS-351, YS-352, YS-353 and YS-354) is permanently installed to monitor the LPSI header for voids. The instrumentation is configured to alarm if a predetermined void size accumulates at the high point locations. Gas voids at these locations are documented in the CAP via condition reports (CRs). The header is continuously monitored for the formation of voids using the installed instrumentation. Voids have not been detected at these locations since the LPSI jockey pump was installed.

Surveillance tests are being developed as part of the response to this GL to monitor other locations in the subject systems using manual ultrasonic detection methods. Voids detected as part of the surveillance program will be recorded and trended per PBD-32. Voids greater than the ST acceptance criteria will be vented and documented in the CAP. The frequency of monitoring will be adjusted as needed, based on trending results.

A3.6 Provide a detailed list of items that have not been completed, a schedule for their completion, and the basis for that schedule

The following items were identified as needing additional action and are documented in the CAP under CR 2008-2021.

1. OPPD will create new ST procedures to include periodic UT examination of the piping to monitor for gas voids. The periodic UT inspections shall include the section of ECCS recirculation piping that is located between HCV-383-3 and SI-160 and HCV-383-4 and SI-159. The ST procedures will be issued by January 23, 2009; this is a regulatory commitment.

2. There are no vent valves unique to the SDC suction piping or directions to vent SDC discharge piping in accordance with approved procedures. OPPD will perform additional analysis for susceptibility of gas voiding for the SDC piping if required.

3. A procedure change to OP-1 Attachment 1, "Checklist for Plant Startup from Mode 4/5 to Mode 1," has been initiated to ensure both ECCS suction headers are vented in accordance with OI-SI-1 Attachment 17 prior to the plant exceeding 210°F.

4. SI-382, the LCV-383-1 outlet line vent valve, is at a slightly higher elevation than SI-371. This valve will be added to OI-SI-1, Attachment 17.

5. Review of OI-SI-1 identified that restoration of LPSI pump to service has steps that vent the pump casing but do not provide direction on venting the suction or discharge piping. No similar guidance exists for removing or restoring a HPSI or CS pump for maintenance.

6. A procedure change to OI-SI-1 will be implemented to provide guidance on substantially filling the section of piping between HCV-383-3 and SI-160, and HCV-383-4 and SI-159, respectively.

OPPD plans to revise the above operating procedures by January 23, 2009.

A4 CORRECTIVE ACTIONS EVALUATION

A4.1 Summarize the results of the reviews regarding how gas accumulation has been addressed at FCS.

OPPD has completed an evaluation of gas accumulation in the ECC, SDC and CS systems. The evaluations were conducted through review of the licensing basis, performing design evaluations, evaluating testing requirements and documenting needed corrective actions. The results of the evaluations and details of the identified issues are summarized above.

A CR pursuant to CAP procedure SO-R-2, "Condition Reporting and Corrective Action," would be used to document gas intrusion or accumulation as a potentially nonconforming condition. Condition reports are based on the CAP and comply with Criterion XVI of 10 CFR 50, Appendix B. As part of the CAP, CRs related to plant equipment are evaluated for potential impact on operability and reportability. CRs involving gas intrusion or accumulation are prioritized and evaluated through the CAP.

OPPD has generated CR 2008-2021 to identify action items related to GL 2008-01 that are being addressed with an established schedule, and those that have been closed. OPPD concludes that issues involving gas accumulations are properly identified, documented, prioritized and are being addressed. OPPD has addressed gas voids issues through analyses and installation of vent valves on an on-going basis since the 1980s.

As discussed in Section A3 of this response, no surveillance procedures exist that quantify the amount of gas present in the safety systems or require entry into the CAP for gas quantities that exceed the acceptance criteria. The following action has been identified in Section A3 and is repeated here for completeness:

- Surveillance test procedures are being developed to include acceptance criteria for the amount of gas allowed and entry into the CAP for amounts that exceed the acceptance criteria.

A4.2 Provide a detailed list of items that have not been completed, a schedule for their completion, and the basis for that schedule.

The Corrective Actions Evaluation has been completed.

Conclusion:

Based upon the above, OPPD has concluded that FCS is in conformance with its commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in the OPPD Quality Assurance Program, with the exception of Criterion V, "Instructions, Procedures, and Drawings" and Criterion XI, "Test Control." The procedures being developed which are required for compliance were entered into the CAP for tracking and final resolution, as described in Sections B and C of this Enclosure.

B DESCRIPTION OF NECESSARY CORRECTIVE ACTIONS

OPPD is addressing all action items that are identified in the previous section. The items which are considered necessary corrective actions to assure compliance with the applicable regulations will be addressed per the established schedule.

A detailed list of items that are pending completion is provided below. This list identifies the open items that were generated as a result of the evaluations performed pursuant to GL 2008-01 and provides a schedule for their resolution. This schedule is governed by completion of calculations involving gas voids and by approval of new surveillance test procedures. The schedule for performance of the new STs will be based on the availability of the systems and constraints imposed by plant operation. These corrective actions have been entered into the CAP under CR 2008-2021.

A list of the identified issues that need to be addressed which are regulatory commitments being made in response to GL 2008-01 is provided below:

1. New surveillance test procedures for managing gas accumulation in safety systems will be instituted. These new surveillance test procedures will be issued by January 23, 2009.

2. PBD-32, "Managing Gas Accumulation in Safety Systems," the program basis document to manage gas accumulation in safety systems, will be developed and issued by January 23, 2009.

There are many activities that warrant completion as a result of the reviews performed in response to GL 2008-01. Many of these actions are inherent to the overall program management via completion of the PBD, and subsequently successfully managing gas accumulation (e.g., performance of six calculations to develop acceptance criteria as input into the STs, etc.) The following list provides planned enhancements or corrective actions in support of the response to GL 2008-01, which are not considered regulatory commitments, and is captured in the CAP under CR 2008-2021:

1. Descriptive text will be incorporated into applicable sections of the USAR on managing gas accumulation in safety systems. The USAR changes will be completed by January 23, 2009.

2. Develop gas volume acceptance criteria for ECCS pump suction piping. This evaluation will be documented in calculation FC07500 by December 30, 2008.

3. Develop water hammer exclusion criteria for CS piping downstream of the containment isolation valves. This evaluation will be documented in calculation FC07501 by December 30, 2008.

4. Develop gas volume acceptance criteria for water hammer exclusion cold leg header piping downstream of the containment isolation valves. This evaluation will be documented in calculation FC07502 by December 30, 2008.

5. Develop gas volume acceptance criteria for HPSI discharge piping. This evaluation will be documented in calculation FC07503 by December 30, 2008.

6. Develop gas volume acceptance criteria for CS discharge piping. This evaluation will be documented in calculation FC07504 by December 30, 2008.

7. Develop gas volume acceptance criteria for water hammer exclusion hot leg injection. This evaluation will be documented in calculation FC07505 by December 30, 2008.

8. Training requirements as outlined in response to GL 2008-01 will be completed by March 30, 2009.

9. Provide guidance in operating instruction OI-SI-1 to fill the ECCS recirculation piping located between valves HCV-383-3 and SI-160 and HCV-383-4 and SI-159 by January 23, 2009.

10. Evaluate the ECCS discharge header locations that warrant consideration for installation of new vent valves. Pending completion of void volume acceptance criteria, a determination of the final vent valve locations will be made by January 23, 2009.

11. As an enhancement, the system design basis documents SDBD-SI-HP-132(HPSI), SDBD-SI-LP-133(LPSI), SDBD-SI-CS-131(CSS), and SDBD-SDC-130 (SDC) will be updated to reconcile GL 2008-01 response and action items by January 23, 2009.

12. As discussed in Section A2.8, the ECCS venting procedures, OI-SI-1 and OI-CS-1, will be revised to incorporate necessary venting duration and acceptance criteria by January 23, 2009.

13. Evaluate the SDC system for: (a) Potential trap of gas in the piping along the top of the long horizontal run of pipe between HCV-348 and the containment penetration; (b) SDC discharge piping cross-tie piping between the LPSI and CS system where the isolation boundary between the two systems is isolation valve HCV-335; and (c) Changes to operating procedure OI-SC-1 associated with this review. This item will be completed by January 23, 2009.

14. OPPD plans to evaluate the merits of vacuum fill for these evolutions. This item will be completed by June 23, 2009.

15. A procedure change to OP-1 Attachment 1, "Checklist for Plant Startup from Mode 4/5 to Mode 1," has been initiated to ensure both ECCS suction headers are vented in accordance with OI-SI-1 Attachment 17 prior to the plant exceeding 210°F. This item will be completed by January 23, 2009.

16. SI-382, the LCV-383-1 outlet line vent valve, is at a slightly higher elevation than SI-371. This valve will be added to OI-SI-1, Attachment 17. This item will be completed by January 23, 2009.

17. Review of OI-SI-1 identified that restoration of LPSI pump to service has steps that vent the pump casing but do not provide direction on venting the suction or discharge piping. No similar guidance exists for removing or restoring a HPSI or CS pump for maintenance. Procedural enhancements will be completed by January 23, 2009.

18. Long-term industry actions were identified that will provide additional tools to address GL 2008-01 with respect to pump gas void ingestion tolerance limits. The program results will be reviewed for applicability to FCS and should be completed by June 1, 2010.

19. Surveillance test procedures will include acceptance criteria to ensure that gas accumulation in the LPSI and HPSI system piping meets the PWROG criteria for injected gas into the RCS. This will be completed by January 23, 2009.

C CORRECTIVE ACTION SCHEDULE

C1 Summarize the corrective actions that have been completed as a result of the evaluations discussed above.

The following corrective actions have been completed:

1. Completed safety system walkdowns during the 2008 RFO.
2. Developed piping plan and profile drawings, to be used in conjunction with formalized void size acceptance criterion for determining the need for additional vent valve locations and/or surveillance test monitoring points, during the 2008 RFO.

C2 Summarize the corrective actions to be completed including the scope, schedule, and a basis for that schedule.

The corrective actions to be completed including scope and schedule are addressed in Section B. The schedule for resolution of the corrective actions is based on the availability of resources, completion of acceptance criteria and subsequent surveillance test development, incorporation of new or revised procedures, and radiological considerations for access to plant systems and equipment.

CONCLUSION

OPPD has evaluated the accessible portions of those systems that perform the functions described in this GL and has concluded that these systems are operable, as defined in the TS and are in conformance to our commitments to the applicable draft GDC, as stated in the USAR.

The open actions cited above (with the exception of the regulatory commitments identified in Section B) are considered to be enhancements to the existing programs/processes/procedures for assuring continued operability of these subject safety systems.