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SOUTHERN COMPANY
Energy to Serve Your World℠

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50-366 50-364 50-425

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

Edwin I. Hatch Nuclear Plant
Joseph M. Farley Nuclear Plant
Vogtle Electric Generating Plant
Nine-Month Response to NRC Generic Letter 2008-01

Ladies and Gentlemen:

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems" to request that each licensee evaluate the licensing basis, design, testing, and corrective action programs for the Emergency Core Cooling Systems, Decay Heat Removal Systems, and Containment Spray Systems, to ensure that gas accumulation is maintained less than the amount that challenges operability of these systems, and that appropriate action is taken when conditions adverse to quality are identified.

The NRC requested, in GL 2008-01, for each licensee to submit a written response in accordance with 10 CFR 50.54(f) within nine months of the date of the generic letter to provide the following information:

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

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

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

In summary, the Southern Nuclear Operating Company (SNC) has concluded that the subject systems at Edwin I. Hatch Nuclear Plant, Joseph M. Farley Nuclear Plant, and Vogtle Electric Generating Plant are in compliance with the TS definition of Operability, in other words, capable of performing their intended safety function and that these plants are currently in compliance with 10 CFR 50 Appendix B, Criterion III, V, XI, XVI, and XVII, with respect to the concerns outlined in GL 2008-01 regarding gas accumulation in the portions of these systems. As noted in the three-month response to GL 2008-01, SNC will complete its assessments of those portions of these systems not walkdowned prior to this nine-month response, during the next refueling outage for each plant unit and provide a supplement to this report with those results within ninety days from startup of the outage for each plant unit.

Additionally, the NRC requested that if a licensee cannot meet the requested response date, the licensee "...shall provide a response within 3 months of the date of this GL..." The three-month response was submitted to the NRC by SNC letter, dated May 30, 2008. The NRC responded by letter dated September 3, 2008 and requested a supplemental response to revise the proposed course of action. The additional NRC requested information is addressed in this nine-month response.

Enclosures 1, 2, and 3 to this letter contain the Southern Nuclear Operating Company's nine-month response to the information requested in NRC GL 2008-01.

Enclosure 4 to this letter contains new commitments.

Mr. M. J. Ajluni states he is Nuclear Licensing Manager of Southern Nuclear Operating Company, is authorized to execute this oath on behalf of Southern Nuclear Operating Company and to the best of his knowledge and belief, the facts set forth in this letter are true.

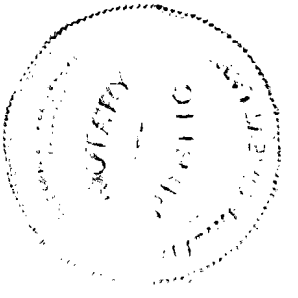
If you have any questions, please advise.

Respectfully submitted,

SOUTHERN NUCLEAR OPERATING COMPANY

Mark J Ajluni

M. J. Ajluni
Manager, Nuclear Licensing



Sworn to and subscribed before me this 10th *day of* October, *2008.*

Patricia N. Raymond
Notary Public

My commission expires: 7-12-2012

MJA/JLS/phr

Enclosures: 1. Hatch Nuclear Plant Nine-Month Response to NRC Generic Letter 2008-01
2. Farley Nuclear Plant Nine-Month Response to NRC Generic Letter 2008-01
3. Vogtle Electric Generating Plant Nuclear Plant Nine-Month Response to NRC Generic Letter 2008-01
4. NRC Generic Letter 2008-01 Nine-Month Response Commitment Table

cc: Southern Nuclear Operating Company
Mr. J. T. Gasser, Executive Vice President
Mr. J. R. Johnson, Vice President – Farley
Mr. D. R. Madison, Vice President – Hatch
Mr. T. E. Tynan, Vice President – Vogtle
Mr. D. H. Jones, Vice President – Engineering
RType: CFA04.054; CHA02.004; CVC7000; LC#14824

U. S. Nuclear Regulatory Commission
Mr. L. A. Reyes, Regional Administrator
Mr. K. D. Feintuch, NRR Project Manager – Farley
Mr. R. E. Martin, NRR Project Manager – Hatch and Vogtle
Mr. E. L. Crowe, Senior Resident Inspector – Farley
Mr. J. A. Hickey, Senior Resident Inspector – Hatch
Mr. G. J. McCoy, Senior Resident Inspector – Vogtle

Alabama Department of Public Health
Dr. D. E. Williamson, State Health Officer

State of Georgia
Mr. N. Holcomb, Commissioner – Department of Natural Resources

Edwin I. Hatch Nuclear Plant
Joseph M. Farley Nuclear Plant
Vogtle Electric Generating Plant
Nine-Month Response to NRC Generic Letter 2008-01

Enclosure 1

Hatch Nuclear Plant Nine-Month Response to
NRC Generic Letter 2008-01

Enclosure 1

Hatch Nuclear Plant Nine-Month Response to NRC Generic Letter 2008-01

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

The following information is provided in this response:

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

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

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

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

- Emergency Core Cooling System (ECCS)
  - High Pressure Coolant Injection (HPCI) System
  - Low Pressure Coolant Injection (LPCI) System
    (Note: LPCI is an operating mode of the RHR System)
  - Core Spray (CS) System
- Residual Heat Removal (RHR) System
  (Note: Containment Spray is an operating mode of the RHR system)
- Reactor Core Isolation Cooling (RCIC) System
  (Note: Although not explicitly listed as an ECCS system, RCIC was also considered).

A. EVALUATION RESULTS

Licensing Basis Evaluation

Southern Nuclear Operating Company (SNC) has reviewed the HNP licensing basis with respect to gas accumulation in the ECCS, RHR and RCIC Systems. This included a review of the Technical Specifications (TS), TS Bases, Updated Final Safety Analysis Report (UFSAR), the Technical Requirements Manual (TRM) and TRM Bases, Regulatory Commitments, and License Conditions.

1. Licensing Basis Review Summary

   A description of the HNP TS and UFSAR sections found to contain relevant information or requirements associated with gas accumulation in the applicable system(s) follows:

   a. HNP Unit 1 and Unit 2 TS 3.5.1, "ECCS - Operating," SR 3.5.1.1, states: "Verify, for each ECCS injection/spray subsystem, the piping is filled with water from the pump discharge valve to the injection valve." The Frequency of this SR is 31 days. The Bases for SR 3.5.1.1 states:

      "The flow path piping has the potential to develop voids and pockets of entrained air. Maintaining the pump discharge lines of the HPCI System, CS System, and LPCI subsystems full of water ensures that the ECCS will perform properly, injecting its full capacity into the RCS upon demand. This will also prevent a water hammer following an ECCS initiation signal. One acceptable method of ensuring that the lines are full is to vent at the high points. In addition, when HPCI is aligned to the suppression pool (instead of the CST), one acceptable method is to monitor pump suction pressure. The 31 day Frequency is based on the gradual nature of void buildup in the ECCS piping, the procedural controls governing system operation, and operating experience."

      Note that the LPCI mode of the HNP RHR system functions as part of the ECCS, providing low pressure injection into the core. Therefore, the requirements described above are applicable to the LPCI mode of the HNP RHR system.

      HNP procedures provide for performing high point venting at a 31 day frequency.

   b. TS 3.5.1, "ECCS - Operating," Bases contains a discussion of the "keep fill system" used for the LPCI and CS systems in the background section of the Bases. The Bases states:

      "To ensure rapid delivery of water to the RPV and to minimize water hammer effects, all ECCS pump discharge lines are filled with water. The LPCI and CS System discharge lines are kept full of water using a "keep

fill" system (jockey pump system). The HPCI System is normally aligned to the CST. The height of water in the CST is sufficient to maintain the piping full of water up to the first isolation valve. The relative height of the feedwater line connection for HPCI is such that the water in the feedwater lines keeps the remaining portion of the HPCI discharge line full of water. Therefore, HPCI does not require a "keep fill" system."

c. HNP Unit 1 and Unit 2 TS 3.5.2, "ECCS - Shutdown," SR 3.5.2.3, states:

"Verify, for each required ECCS injection/spray subsystem, the piping is filled with water from the pump discharge valve to the injection valve." The Frequency of this SR is 31 days. The bases for this SR refers to the Bases for SR 3.5.1.1 (see Section a. above).

d. HNP Unit 1 and Unit 2 TS 3.5.3, "RCIC System," SR 3.5.3.1 states:

"Verify the RCIC System piping is filled with water from the pump discharge valve to the injection valve."

The Frequency of this SR is 31 days. The Bases for this SR states:

"The flow path piping has the potential to develop voids and pockets of entrained air. Maintaining the pump discharge line of the RCIC System full of water ensures that the system will perform properly, injecting its full capacity into the Reactor Coolant System upon demand. This will also prevent a water hammer following an initiation signal. One acceptable method of ensuring the line is full when aligned to the CST is to vent at the high points and, when aligned to the suppression pool, by monitoring pump suction pressure. The 31 day Frequency is based on the gradual nature of void buildup in the RCIC piping, the procedural controls governing system operation, and operating experience."

e. HNP Unit 1 and Unit 2 TS 3.5.3, "RCIC System," Bases contains an applicable discussion in the background section of the Bases. The Bases states:

"To ensure rapid delivery of water to the RPV and to minimize water hammer effects, the RCIC System discharge piping is kept full of water. The RCIC System is normally aligned to the CST. The height of water in the CST is sufficient to maintain the piping full of water up to the first isolation valve. The relative height of the feedwater line connection for RCIC is such that the water in the feedwater lines keeps the remaining portion of the RCIC discharge line full of water. Therefore, RCIC does not require a "keep fill" system."

f. HNP Unit 2 UFSAR Section 5.5.6, "RCIC System" contains a discussion of this system with information relevant to how the system is maintained full of water. Section 5.5.6.4, "Safety Evaluation" states in part:

> "The RCIC system is normally lined up with the pump taking suction on the CST. All valves between the storage tank and the first isolation valve on the pump discharge line are open. This allows communication between the CST and the discharge line, through the RCIC pump. The minimum water level in the CST is at el 137 ft, the RCIC pump suction connection to the tank is at el 130 ft 6 in., and the elevation of the first isolation valve in the discharge line is 123 ft 0 in. No portion of the RCIC pump suction or discharge lines is higher in elevation than the suction connection on the storage tank. Therefore, the 14-ft el difference between the water level in the storage tank and the first isolation valve ensures that the discharge line remains completely filled with water up to the isolation valve.
>
> The discharge line connects to the bottom of the feedwater line at el 140 ft 0 in. Therefore, the remainder of the discharge line is maintained full by feedwater flow."

g. HNP Unit 2 UFSAR Section 6.3, "ECCS" contains a detailed discussion of the system used to keep the discharge lines of the LPCI and CS systems filled with water. Section 6.3.2.2.5, "ECCS Discharge Line Fill System (Jockey Pump System)" states in part:

> "The Technical Specifications require periodic testing to confirm the RHR and CS discharge lines are maintained full when the systems are required to be operable. If the discharge piping is found to be partially empty at the time of testing, the subsystem is inoperable per Technical Specifications.
>
> Prior to performance of RHR or CS system surveillance involving start up of the pumps, system fill and vent are required by the surveillance procedure by referencing the applicable normal operating procedure. However, Technical Specifications require verification of filled discharge piping."

Licensing Basis Review Conclusions:

The review of the applicable licensing basis documents confirmed that for the HNP ECCS, RHR System, and RCIC System, the licensing basis supports limiting the quantity of gas in these systems such that the capability of these systems to perform their required safety functions is not adversely affected.

In addition to the licensing basis documents discussed above, the internal responses to applicable industry operating experience (as referenced in GL 2008-01) with gas accumulation issues were reviewed. This internal HNP OE response review has confirmed that the HNP responses (such as, resultant procedure reviews and revisions, additional training, and design evaluations performed) were consistent with a licensing basis that supports limiting the

quantity of gas in the ECCS, RHR, and CS Systems such that the capability of these systems to perform their required safety functions is not adversely affected.

No suction side surveillance requirements (SRs) for the ECCS pumps currently exist. Based on an evaluation of HNP operating experience as well as current design considerations for potential gas intrusion mechanisms, SNC has concluded that there are currently no significant factors that would warrant the need to establish a suction side surveillance. SNC considers the only viable cause for gas intrusion on the suction side of the ECCS to be improper post maintenance fill and vent by plant staff. This gas intrusion mechanism does not have a periodicity such that an additional suction side surveillance would provide significant benefit to ensuring system operability is maintained. However, SNC will consider operating experience from the BWR fleet to determine if other mechanisms have been discovered that would suggest the need for a periodic surveillance on the suction side of these systems. It is expected that this issue will be addressed on a generic basis through the Technical Specifications Task Force (TSTF) Traveler process after licensees at other BWR plants have completed their evaluations in response to this generic letter. Specific conditions related to HNP ECCS suction piping are further discussed in the design evaluation section.

2. Summary of Changes to Licensing Basis Documents

A revision to the TS could be incorporated to clarify that some gas is allowed in the piping as long as the specified safety function of each system can be performed. However, considering the industry effort to develop the appropriate TS and Bases changes via the TS Task Force (TSTF) process and the adequacy of the current HNP licensing documents reviewed, no changes are currently planned for the existing licensing basis documents. Upon completion of the TSTF process including NRC approval, SNC will evaluate further licensing basis document changes consistent with the industry and NRC approved TSTF changes.

3. Licensing Evaluation Items Not Complete

TS improvements are being addressed generically 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. SNC 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, SNC will evaluate its applicability to HNP and evaluate adopting the Traveler to either supplement or replace the current TS requirements.

A Corrective Action for procedure development/revision has been initiated to include requirements for periodic monitoring and trending of ECCS piping and CS System piping to ensure this piping is maintained sufficiently full of water such that the ECCS

and CS Systems remain capable of performing their intended safety functions. This action will be complete by November 21, 2008.

Design Evaluation

The HNP design basis was reviewed with respect to gas accumulation in the ECCS, RHR, and RCIC Systems. This review included Design Basis Documents, Calculations, Engineering Evaluations, and Vendor Technical Manuals.

1. Design Review

   The HNP design basis was reviewed with respect to gas accumulation in the subject systems. Various design basis documents were reviewed including calculations, process and instrumentation diagrams (P&IDs), and isometric drawings.

   HNP employs keep fill systems (Jockey Pump System) to automatically maintain the RHR and CS systems in a filled and vented configuration. The design of the subject systems does not include specific voided piping as part of the design, except for the Drywell and Torus Spray modes of RHR System piping downstream of the outboard containment isolation valves to the spray rings inside the drywell and torus air space.

   Design features and water level set points are controlled by design and operating procedures to prevent vortex effects that can potentially ingest gas into the system during design basis events.

   The following types of calculations were reviewed relative to gas intrusion:

   a) CST level setpoint and vortex submergence calculations

   b) ECCS suction strainer calculations

   c) Pump NPSH calculations

2. Gas Volume Acceptance Criteria

   a) Pump Suction Piping

      The interim allowable gas accumulation in the pump suction piping is based on limiting the gas entrainment to the pump after a pump start. A Joint Owners Group program established interim pump gas ingestion limits to be employed by the member utilities. The interim criteria address pump mechanical integrity only and are as follows:

	Single-Stage	***Multi-Stage***	***Multi-Stage***
		Stiff Shaft	Flexible Shaft
Steady-State	2%	2%	2%
Transient*	5% for 20 sec.	20% for 20 sec.	10% for 5 sec.
$Q_{B.E.P.}$ Range	70%-120%	70%-140%	70%-120%
Pump Type (transient data)	WDF	CA	RLIJ, JHF
* The transient criteria are based on pump test data and vendor supplied information.			

The limits contained in the table illustrate that the 2% pump suction acceptance criteria contained in NUREG/CR-2792 can be exceeded for the models of pumps identified in the table, however the 2% pump suction acceptance criteria contained in NUREG/CR-2792 is applicable to all models of pumps.

HNP Pump Suction Void Acceptance Criteria

A plant specific calculation was performed for HNP to determine the acceptable gas volumes at potential gas accumulation locations in the HPCI pump suction piping such that the Joint Owners Group program pump suction interim criteria were met. The gas transport analysis correlated the pump inlet void fraction to the volume of trapped gas in the suction side gas accumulation locations.

Potential gas accumulation locations in the HPCI pump suction piping were determined to be the following:

- Check valves
- Vent valves
- Loop seals

The one-line diagrams generated from the P&IDs and isometric drawings were utilized to identify the potential gas accumulation locations in the suction piping of the subject systems as discussed above.

The following HPCI suction paths were evaluated:

- Injection with suction from the CST
- Injection with suction from the torus

Analyses similar to that discussed above for the HPCI System will also be performed to determine the pump suction acceptance criteria from each potential water source for the following HNP systems: RCIC, RHR, and CS. HNP procedures will be revised to provide assurance that gas in the affected systems suction piping is limited to within the acceptance criteria determined by the HNP specific analyses

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

A Joint Owner's Group program evaluated pump discharge piping gas accumulation. Gas accumulation in the piping downstream of the pump to the first closed isolation valve or the RCS pressure boundary isolation valves will result in amplified pressure pulsations after a pump start. The subsequent pressure pulsation may cause relief valves in the subject systems to lift, or result in unacceptable pipe loads, in other words, axial forces that are greater than the design rating of the axial restraint(s). The Joint Owner's Group program establishes a method to determine the limit for discharge line gas accumulation to be utilized by the member utilities.

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

SNC will implement this methodology for HNP via detailed system specific calculations. HNP procedures will be revised to provide assurance that gas in the affected systems discharge piping is limited to within the acceptance criteria determined by the HNP specific application of the Joint Owner's Group program method.

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

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

d) Effects of RCS Gas Ingestion

A conservative "worst case" scenario evaluation provided a limiting LOCA PCT heatup rate of 12 °F/s was determined for the entire U.S. BWR fleet. Using this heatup rate, 48 °F of PCT impact is assessed with a maximum of 4-second delay in the ECCS actuation. An assessment justified that gas voids passing through the core do not pose an additional safety concern mainly because of the unlikely path for air to get into the core and high void conditions in the core present during a LOCA.

Assessments on the LOFW and ATWS events concluded that a delay of 5 seconds in ECCS flow would affect the analysis results insignificantly and have no impact on meeting the acceptance criteria. The evaluation of station blackout

events indicated that a delay of 10 seconds would not impact the ability of the water makeup system to maintain the vessel water level above the top of active fuel. Similarly, it was concluded that a delay of 10 seconds would have an insignificant impact on meeting the acceptance criteria in Appendix R fire safe shutdown analysis.

e) Gas Accumulation in Valve Bonnets

The potential for air trapped in valve bonnets was evaluated for the HPCI System suction piping. Air trapped in valve bonnets that could get in the HPCI suction piping was accounted for in the pump suction void acceptance criteria for HNP. The affect of air trapped in valve bonnets in the suction piping of the other systems will be accounted for in the pump suction void acceptance criteria established for the other systems. This will be completed with the development of the pump suction void acceptance criteria for HNP.

Air trapped in valve bonnets that could get in the discharge piping of the subject systems will be accounted for in the pump discharge void acceptance criteria established for HNP. This will be completed with the development of the pump discharge void acceptance criteria

3. Changes to Basis Design Documents

See Item 11 in the design section for a complete list of all Corrective Actions.

4. One-line Drawings, Gas Intrusion Locations and Mechanisms

The one-line drawings were developed to reflect in-scope system piping, the elevation of the piping, the diameter of the piping, and where identified, the horizontal length of the piping.

The one-line drawings include in-scope valves, identify the type of valve, the normal position of the valve, and the valve ID.

The one-line drawings identify orifices, reducers, tanks, pumps, heat exchangers, vent valves, and test connection valves, if they are located in the piping where a local high point exists.

The P&ID and isometric drawings that were used to prepare the one-line drawings are identified on the one-line drawings.

The one-line drawings were reviewed to identify where gas can accumulate in the system, which includes isolated branch lines, valve bodies, heat exchangers, or improperly sloped piping.

Potential gas accumulation locations were identified from the one-line drawings developed from the P&IDs and isometric drawings. The following criteria were used to identify gas accumulation locations:

- Inverted loop seals formed by piping runs;
- Piping which will not self-vent due to the presence of a normally closed check valve or isolation valve;
- Piping which cannot be adequately vented because the vent location would require the fill water to flow counter-current against the gas to be vented, and
- Piping which cannot be vented due to the presence of an orifice.

A review of industry and SNC operating experience was performed to determine possible gas intrusion mechanisms. The following gas accumulation mechanisms were reviewed:

- Air can be introduced during routine maintenance and may not be removed if the subsequent fill and vent is inadequate.
- The ECCS, CS, and RHR systems are initially filled with an air saturated water source. Air can be stripped out of solution due to various mechanisms such as agitation, pressure reduction, or temperature increase.
- Steam or non-condensable gasses can be introduced due to leakage from the RCS into the ECCS.

5. Evaluation of New Vent Valve Locations

   Based on the identification of the locations where gas can accumulate, and the gas intrusion mechanisms identified above, it was determined that currently no new vent valves should be installed in Unit 1 and that new vent valves should be installed at two [2] locations in Unit 2, and other locations in both units will be evaluated further to determine whether new vent valves should be added, or if these locations should be monitored.

6. System Piping Walkdowns

   Walkdowns, some of which utilized laser metrology, were completed on subject system piping for Units 1 and 2 that is located outside of the drywell, located outside the steam chase, located outside of the drywell access, not buried, and that did not require scaffolding to be erected for access. Additionally, piping in locked high radiation areas was excluded.

   The objective of the laser metrology is to obtain the relative slope, location, orientation, and deviation from horizontal of the subject system piping. The following will be determined from analysis of the laser metrology data:

   - Verification that the piping is sloped in the proper direction.
   - Verification that horizontal (nominal) runs of piping do not contain local highpoints.
   - Identify additional high points (all areas vulnerable to gas accumulation).

The objective of the visual walkdowns was to:

- Verify that the vent valves are in the proper location along horizontal (nominal) runs of the piping.
- Verify that vent valves are in the proper location along circumference of the piping.
- Identify test connections on top of the piping and vent valves that were not identified on the P&IDs which could be used to vent accumulated gas.

The Units 1 and 2 subject system piping that is located outside of containment, not buried, and that did not require scaffolding to be erected for access, was visually walked down.

7. Confirmatory Walkdowns of System Piping

   Additional locations where gas can accumulate may be identified during the HNP Unit 2 Spring 2009 refueling outage and the Unit 1 Spring 2010 refueling outage. Corrective actions to address these additional locations, if any, will be completed during those refueling outages.

8. Operating Procedure Reviews

   The following plant system operating procedures, which include steps for system fill and vent, were reviewed to address the gas accumulation issues discussed in GL 2008-01.

   a. CS System
   b. HPCI System
   c. RCIC System
   d. RHR LPCI Subsystem

   The procedure reviews resulted in comments to improve and enhance the affected procedures with respect to controlling gas accumulation.

9. Procedure Revisions

   A Corrective Action for potential procedure revisions will be initiated to evaluate the comments resulting from the operating procedure review. The corrective action will require the review results to be further evaluated to determine the scope of the necessary procedure revisions.

   HNP procedures will be revised to provide assurance that gas in the ECCS, RHR, and RCIC suction piping is limited to within the acceptance criteria determined by the HNP specific analyses.

10. Gas Intrusion Mechanisms

    See Item 4 above.

11. Corrective Actions and Schedule for Completion

    a. Corrective Action has been initiated to revise HNP procedures to provide assurance that gas in the affected systems suction piping is limited to within the acceptance criteria determined by the HNP specific analyses. Additionally, HPCI System post maintenance fill and vent procedures used to provide assurance that gas in the HPCI System suction piping is limited to within the acceptance criteria (including the impact of gas trapped in valve bonnets) will be revised based on the HNP specific analyses.

    b. A Corrective Action has been initiated to perform analyses, similar to the analysis performed for the HPCI System, to determine the pump suction acceptance criteria for the following HNP systems: RCIC, LPCI mode of RHR System operation, and CS System. HNP post maintenance fill and vent procedures will be revised to provide assurance that gas in the affected systems suction piping is limited to within the acceptance criteria (including the impact of gas trapped in valve bonnets) determined by the HNP specific analyses.

    c. A Corrective Action has been initiated to implement the Joint Owners Group methodology for evaluating pump discharge piping susceptible to pressure pulsation after pump start and to develop HNP specific acceptance criteria for discharge piping gas voids. HNP procedures will be revised to provide assurance that gas in the affected systems discharge piping is limited to within the acceptance criteria determined by the HNP specific application of the Joint Owner's Group program method. Air trapped in valve bonnets that could get in the discharge piping of the subject systems will be accounted for in the pump discharge void acceptance criteria established for HNP.

    d. Based on the identification of the locations where gas can accumulate, and the gas intrusion mechanisms identified above, it was determined that currently no new vent valves should be installed in Unit 1 and that new vent valves should be installed at two [2] locations in Unit 2, and other locations in both units will be evaluated further to determine whether new vent valves should be added, or if these locations should be monitored.

    e. The evaluation of the other locations to determine if vent valves need to be installed or if these locations should be monitored.

    f. The Unit 2 inaccessible piping will be walked down during the Spring 2009 refueling outage.

    g. The walkdown results for the Unit 2 Spring 2009 outage will be evaluated and necessary modifications will be completed by the end of the refueling outage.

    h. The Unit 1 inaccessible piping will be walked down during the Spring 2010 refueling outage.

i. The walkdown results for the Unit 1 Spring 2010 outage will be evaluated and necessary modifications will be completed by the end of the refueling outage.

j. A Corrective Action for potential procedure revisions was initiated to evaluate the comments resulting from the operating procedure review. The Corrective Action will require reviewing the comments to determine the scope of the necessary procedure revisions.

Testing Evaluation

1. Surveillance Procedure Review

   The 31-day periodic keep fill and or venting procedure requirements to verify that the discharge piping is filled with water and the periodic pump operability requirements for the following systems were reviewed to address the gas accumulation issues discussed in GL 2008-01.

   a. CS System
   b. HPCI System
   c. RCIC System
   d. RHR System

   The procedure reviews resulted in comments, where deemed appropriate, to improve and enhance the affected procedures with respect to controlling gas accumulation.

2. Procedure Revisions

   A Corrective Action for potential procedure revisions will be initiated to evaluate the comments resulting from the surveillance procedure review. The corrective action will require the review results to be further evaluated to determine the scope of the necessary procedure revisions.

3. Control of Gas Accumulation in the RHR System (Decay Heat Removal Mode of Operation)

   Residual Heat Removal System venting is performed in accordance with the applicable procedures. The applicable procedures provide for fill and vent of the Suppression Pool suction lines and RHR pump casings when a solid stream of water is observed.

   The applicable procedures provide for fill and vent of the RHR Injection lines utilizing the appropriate Jockey pumps. When a solid stream of water is observed, the RHR Injection line venting is terminated by closing the RHR Injection inboard and outboard high point vents.

The CS and RHR system keepfill Surveillance test is used to monitor that the RHR system, including the verification that the shutdown cooling mode lines, are maintained full of water. The jockey pump system maintains the RHR system filled prior to re-aligning the system for the shutdown cooling mode of operation and the keep fill level switch provides alarm indication if gas collects at the high point to initiate the alarm. The RHR System operating procedures include steps for flushing and venting the shutdown cooling line just prior to opening the suction cooling isolation valves when placing RHR in the shutdown cooling mode of operation. RHR pump flow rate is carefully monitored during shutdown cooling operation including avoiding sustained operation in certain flow rate regions.

The existing procedures for manual operation of the RHR system in the decay heat removal mode of operation provide sufficient assurance the system is filled and vented properly.

4. Potential Gas Intrusion as a result of Inadvertent Draining

   Confirmatory monitoring employed at the conclusion of refueling outages will ensure that proper filling and venting practices were utilized.

5. Gas Void Detection and Documenting

   Current HNP procedures do not require the volume of gas vented to be measured or documented. The current HNP procedures do not contain acceptance criteria for accumulated gas volumes. However, consistent with the Corrective Actions identified in the Design Section, HNP surveillance procedures will be revised to include gas volume acceptance criteria. In addition action will be taken to revise the surveillance procedures to require that a Condition Report be initiated to evaluate the source and impact of accumulated gas volumes that exceed the limits specified in the revised procedures.

Corrective Action Evaluation

1. Gas Accumulation and the Corrective Action Program

   SNC's Corrective Action Program will be used to document gas intrusion/accumulation issues as potential nonconforming conditions. As part of SNC's Corrective Action Program, Corrective Actions related to plant equipment are evaluated for potential impact on operability and reportability. Therefore, SNC's review concluded that issues involving gas intrusion/accumulation will be addressed by the Corrective Action Program to provide further assurance that accumulated gas found in the affected systems is evaluated to determine the source of the gas and the impact on the affected system.

   A review of the internal responses to applicable industry OE (as referenced in GL 2008-01) was performed with respect to gas accumulation issues. This internal OE response review confirmed that the HNP Corrective Action Program was used

effectively to address the issues resulting from the review of an OE (such as the procedure reviews and revisions, additional training, and design reviews performed).

2. Corrective Actions and Schedule for Completion

   The proposed corrective action for surveillance procedure revisions (discussed in Item 5 in the Testing Evaluation section) includes the addition of procedural requirements to initiate a Condition Report based on exceeding the specified gas void size. Item 5 in the Testing Section contains a discussion of the applicable Corrective Action.

B. DESCRIPTION AND SCHEDULE OF CORRECTIVE ACTIONS

1. Corrective Actions Completed

   a. Generic guidance document for fill and vent has been completed.

2. Corrective Actions to be Completed, Schedule, and Basis for that Schedule:

   The basis for the following corrective actions is:

   The completion of the remaining walkdowns will require outage conditions for completion. The current schedule for additional walkdowns is acceptable due to the low risk of gas intrusion issues. This acceptability is based on updated surveillance procedures, recent operating history, adequacy of the current design basis, the results of completed walkdowns, and the completion of licensing basis evaluations that indicate the licensing basis supports limiting the quantity of gas in these systems such that the capability of these systems to perform their required safety functions is not adversely affected.

   The completion of the remaining evaluations and procedure reviews require additional time to ensure a quality product, due to manpower requirements and the large scope of work remaining. The current schedule for completing all evaluations and procedure reviews is acceptable based on the issuance of generic guidance for venting and filling, and previous procedure reviews associated with previously identified gas intrusion issues, and compensatory measures such as additional pre-job briefings that are conducted for activities that have been associated with gas accumulation issues.

   The corrective actions to be completed and schedules are:

   a. A Corrective Action for procedure development/revision has been initiated to include requirements for periodic monitoring and trending of ECCS, RHR, and RCIC piping. This action will be complete by November 21, 2008.

   b. Corrective Action has been initiated to revise HNP procedures to provide assurance that gas in the affected systems suction piping is limited to within the acceptance criteria determined by the HNP specific analyses. Additionally, HPCI System post maintenance fill and vent procedures used to provide assurance that gas in the HPCI System suction piping is limited to within the acceptance criteria (including the impact of gas trapped in valve bonnets) will be revised based on the HNP specific analyses.

      Procedural guidance will be provided by November 21, 2008.

   c. A Corrective Action has been initiated to perform analyses, similar to the analysis performed for the HPCI System, to determine the pump suction acceptance criteria for the following HNP systems: RCIC, LPCI mode of RHR

System operation, and CS System. HNP post maintenance fill and vent procedures will be revised to provide assurance that gas in the affected systems suction piping is limited to within the acceptance criteria (including the impact of gas trapped in valve bonnets) determined by the HNP specific analyses.

The affected procedures will be revised within one hundred and twenty (120) days following receipt of the analyses results. Final corrective action will be discussed in our follow-up letter.

d. A Corrective Action has been initiated to implement the Joint Owners Group methodology for evaluating pump discharge piping susceptible to pressure pulsation after pump start and to develop HNP specific acceptance criteria for discharge piping gas voids. HNP procedures will be revised to provide assurance that gas in the affected systems discharge piping is limited to within the acceptance criteria determined by the HNP specific application of the Joint Owner's Group program method. Air trapped in valve bonnets that could get in the discharge piping of the subject systems will be accounted for in the pump discharge void acceptance criteria established for HNP.

   The affected procedures will be revised within one hundred and twenty (120) days following receipt of the above results. Final corrective action will be discussed in our follow-up letter.

e. Based on the identification of the locations where gas can accumulate, and the gas intrusion mechanisms identified above, it was determined that currently no new vent valves should be installed in Unit 1 and that new vent valves should be installed at two [2] locations in Unit 2, and other locations in both units will be evaluated further to determine whether new vent valves should be added, or if these locations should be monitored.

   The new Unit 2 vent valves will be installed by the end of the Spring 2009 refueling outage.

f. The evaluation of the other locations to determine if vent valves need to be installed or if these locations should be monitored, will be completed by 120 days after the receipt of the engineering evaluation. Final corrective action will be discussed in our follow-up letter.

g. The Unit 2 inaccessible piping will be walked down during the Spring 2009 refueling outage.

h. The walkdown results for the Unit 2 Spring 2009 outage will be evaluated and necessary modifications will be completed by the end of the refueling outage.

i. The Unit 1 inaccessible piping will be walked down during the Spring 2010 refueling outage.

j. The walkdown results for the Unit 1 Spring 2010 outage will be evaluated and necessary modifications will be completed by the end of the refueling outage.

k. A Corrective Action for potential procedure revisions was initiated to evaluate the comments resulting from the operating procedure review. The Corrective Action will require reviewing the comments to determine the scope of the necessary procedure revisions.

   This Corrective Action will be complete by June 30, 2009.

C. SUMMARY AND CONCLUSIONS

The licensing basis, design, testing, and corrective action evaluations, and the corrective actions resulting from these evaluations performed in response to GL 2008-01 provide reasonable assurance that the HNP ECCS, RCIC, and RHR Systems will continue to perform their required safety functions.

Edwin I. Hatch Nuclear Plant
Joseph M. Farley Nuclear Plant
Vogtle Electric Generating Plant
Nine-Month Response to NRC Generic Letter 2008-01

Enclosure 2

Farley Nuclear Plant Nine-Month Response to
NRC Generic Letter 2008-01

Enclosure 2

Farley Nuclear Plant Nine-Month Response to NRC Generic Letter 2008-01

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

The following information is provided in this response:

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

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

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

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

- Emergency Core Cooling System (ECCS)
  - High Pressure Injection (Charging Pumps[1])
  - Low Pressure Injection[2]
- Containment Spray (CS) System
- Residual Heat Removal (RHR) System[2]

(1) The Charging Pumps are also part of the Chemical and Volume Control System (CVCS).

(2) The RHR pumps function as the low pressure injection pumps in the ECCS.

A. EVALUATION RESULTS

Licensing Basis Evaluation

Southern Nuclear Company (SNC) has reviewed the FNP licensing basis with respect to gas accumulation in the ECCS, RHR, and CS Systems. This review included the Technical Specifications (TS), TS Bases, Updated Final Safety Analysis Report (UFSAR), the Technical Requirements Manual (TRM) and TRM Bases, Regulatory Commitments, and License Conditions.

1. Licensing Basis Review Summary:

   The FNP UFSAR and TS are common to both FNP Unit 1 and Unit 2. A description of the TS and UFSAR sections found to contain relevant information or requirements associated with gas accumulation in the applicable system(s) follows:

   a. TS 3.5.2, "ECCS Operating" and TS 3.5.3, "ECCS Shutdown" address the operability requirements for the ECCS (including the RHR System) in Modes 1 through 4. The Bases for these TS require "...an OPERABLE flow path capable of taking suction from the RWST upon an SI signal and transferring suction to the containment sump." The Bases go on to state the following:

      > "During an event requiring ECCS actuation, a flow path is required to provide an abundant supply of water from the RWST to the RCS via the ECCS pumps and their respective supply headers to each of the three cold leg injection nozzles."

      The TS contain specific requirements for flow path valve alignment and valve actuation, as well as pump performance.

   b. TS 3.6.6, "Containment Spray and Cooling Systems" contain the requirements for the CS system in Modes 1 through 4. The Bases for these TS require "...an OPERABLE flow path capable of taking suction from the RWST upon an ESF actuation signal and manually transferring suction to the containment sump."

      TS 3.6.6 contain specific requirements for flow path valve alignment and valve actuation, as well as pump performance.

   c. UFSAR Section 6.3, "Emergency Core Cooling," and UFSAR Section 6.2.2, "Containment Heat Removal Systems" discuss the ECCS and CS System. The UFSAR describes the operation and design features of the systems that provide the required safety functions.

   Licensing Basis Review Conclusions:

   The review of the applicable licensing basis documents confirm that the FNP ECCS, RHR, and CS System licensing basis supports limiting the quantity of gas

in these systems such that the capability of these systems to perform their required safety functions is not adversely affected.

Although no specific requirements are identified in the TS or Bases with regard to the accumulation of gas in the system piping, it is inherent in the requirement for an operable flow path and the capability to deliver the required flow upon demand that the number and size of gas voids in the system piping be limited such that the capability of the ECCS and CS components to perform their required safety function is not adversely affected. In addition, the CS System is normally in a standby mode similar to the ECCS. However, the CS System is not connected to the RCS or the CVCS system such that hydrogen or nitrogen gas intrusion could occur (as in the ECCS) and cause gas voids to form over time. Therefore, there is a lower probability of gas voids developing in the CS system than in the ECCS system after the initial fill and vent is accomplished. In addition, considering the elevation difference between the RWST and the CS System pump suction and that the CS System pumps have casing vents which assure the discharge piping is filled up to the first closed isolation valve, adequate assurance that the CS System is sufficiently full is provided by the fill and vent procedures which assure the CS System is capable of performing its required safety function.

Similarly, the descriptions of each system's capability, design, and function in the UFSAR imply that the number and size of gas voids in the system piping be limited such that the capability of the ECCS and CS components to perform their safety function as described in the UFSAR is not adversely affected.

In addition to the licensing basis documents discussed above, the FNP internal responses to applicable industry operating experience (OE) (as referenced in GL 2008-01) with gas accumulation issues were reviewed. This FNP internal OE response review has confirmed that the responses (such as, the resultant procedure reviews and revisions, additional training, and design evaluations performed) were consistent with a licensing basis that supports limiting the quantity of gas in the ECCS, RHR, and CS Systems such that the capability of these systems to perform their required safety functions is not adversely affected.

The CVCS startup and operation procedures provide for "Fill and Vent of the Charging System from RWST" including static venting for suction and discharge followed by a brief charging pump run and subsequent vent of individual charging pumps using the respective discharge drain valves. The CVCS procedures also provide direction for returning the various charging pumps to service after maintenance and allow for a brief charging pump run and subsequent vent of individual charging pumps using the respective discharge drain valves. The CVCS procedure is also used for charging pump suction venting and directs use of a "vent rig" and quantification of the amount of gas vented and calls for a Condition Report and an operability evaluation of the affected charging pump, if any amount of gas is vented. If gas is vented, the procedure directs a delay and then a re-performance of venting until gas free water issues from the vent. The CVCS procedure contains a precaution that includes an amount of gas that has

been determined acceptable for maintaining the respective charging pumps operable.

The RHR procedures provide appendices that are used for the various venting evolutions for the RHR system. Appendix 1 and 2 address venting the RHR and RWST to 'A' Train and 'B' Train of charging pump suction, respectively. The amount of gas vented is quantified. Appendix 3 & 4 address the fill and vent of A (B) Train RHR after drain down of the system for maintenance. Specific steps address a brief RHR pump run followed by additional venting. The procedure also addresses the filling of the RHR containment sump suction line.

The CS System procedures provide for gravity filling of the system piping from the RWST. The suction piping from the containment sump is also filled and visually verified full.

2. Summary Of Changes To Licensing Basis Documents

Although the FNP TS do not contain specific requirements for periodically verifying the ECCS and CS System piping is sufficiently filled with water, there is an industry effort to develop the appropriate TS and Bases changes via the TS Task Force (TSTF) process. The TSTF process will result in an industry and NRC approved standard set of requirements relative to the issue of gas accumulation. Upon completion of the TSTF process, including NRC approval, SNC will evaluate further licensing basis document changes consistent with the industry and NRC approved TSTF changes.

However, in order to provide additional assurance that the ECCS and CS System piping are maintained sufficiently filled with water, SNC will initiate procedure revisions that will assure periodic monitoring of the ECCS and CS system piping is performed and that the piping is verified to be sufficiently full such that the ECCS and CS Systems remain capable of performing their intended safety functions.

3. Licensing Evaluation Items Not Complete

   a. TS improvements are being addressed by the TSTF to provide an approved TSTF traveler for making changes to individual licensee's TS related to the potential for unacceptable gas accumulation. The development of the TSTF traveler relies on the results of the evaluations of a large number of licensees to address the various plant designs. SNC 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. SNC will evaluate the resolution of TS issues with respect to the changes contained in the TSTF traveler, and submit a license amendment request based on this evaluation following NRC approval of the Consolidated Line Item Improvement Process (CLIIP) Notice of Availability of the TSTF traveler. The Bases changes associated with the Technical Specification changes will also be made.

b. A Corrective Action for procedure development/revision has been initiated to include requirements for periodic monitoring of ECCS piping and CS System piping to ensure this piping is maintained sufficiently full of water such that the ECCS and CS Systems remain capable of performing their intended safety functions.

Design Evaluation

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

1. Design Review

   The FNP design basis was reviewed with respect to gas accumulation in the subject systems. Various design basis documents were reviewed including calculations, process and instrumentation diagrams (P&IDs), and isometric drawings.

   Containment sump strainer performance, including NPSH, vortexing, and flashing under accident conditions has been evaluated and was provided to the NRC under separate correspondence in response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors."

   Design features and RWST water level set points are controlled by design and operating procedures to prevent vortex effects that can potentially ingest gas into the system during design basis events. Additional limitations in maximum flow rates also help prevent vortex effects during shutdown cooling operations at reduced RCS inventory.

   The following types of calculations were reviewed relative to gas intrusion:

   a. RWST level setpoint calculations

   b. Containment Sump level calculations

   c. RCS mid-loop level calculations

   d. Pump NPSH calculations

   In addition, a calculation was performed to verify the CVCS Volume Control Tank (VCT) level setpoints provide an adequate allowance to preclude air entraining vortices during ECCS switchover from the VCT to the RWST.

2. Gas Volume Acceptance Criteria

   a) Pump Suction Piping

      The interim allowable gas accumulation in the pump suction piping is based on limiting the gas entrainment to the pump after a pump start. A PWROG program established interim pump gas ingestion limits to be employed by the member utilities. The interim criteria address pump mechanical integrity only and are as follows:

	Single-Stage	*Multi-Stage*	*Multi-Stage*
		Stiff Shaft	Flexible Shaft
Steady-State	2%	2%	2%
Transient*	5% for 20 sec.	20% for 20 sec.	10% for 5 sec.
$Q_{B.E.P.}$ Range	70%-120%	70%-140%	70%-120%
Pump Type (transient data)	WDF	CA	RLIJ, JHF
* The transient criteria are based on pump test data and vendor supplied information.			

The limits contained in the table illustrate that the 2% pump suction acceptance criteria contained in NUREG/CR-2792 can be exceeded for the models of pumps identified in the table, however the 2% pump suction acceptance criteria contained in NUREG/CR-2792 is applicable to all models of pumps.

FNP procedures will be revised to provide assurance that the volume of gas in the pump suction piping for the ECCS, RHR, and CS System is limited such that pump gas ingestion is within the above PWROG program established interim criteria.

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

A joint Owner's Group program evaluated pump discharge piping gas accumulation. Gas accumulation in the piping downstream of the pump to the first closed isolation valve or the RCS pressure boundary isolation valves will result in amplified pressure pulsations after a pump start. The subsequent pressure pulsation may cause relief valves in the subject systems to lift, or result in unacceptable pipe loads, in other words, axial forces that are greater than the design rating of the axial restraint(s). The joint Owner's Group program establishes a method to determine the limit for discharge line gas accumulation to be utilized by the member utilities.

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

SNC will implement this methodology for FNP via a detailed system specific calculation. FNP procedures will be revised to provide assurance that gas in the affected systems discharge piping is limited to within the acceptance criteria determined by the FNP specific application of the joint Owner's Group program method.

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

The PWROG has developed methodologies that can be used to evaluate the piping response in the presence of accumulated gas for: 1) the Containment Spray piping downstream of the isolation valve that is normally closed during power operation as the riser and spray header are filled, and 2) the hot leg injection piping downstream of the isolation valve that is normally closed during power operation and opened following switchover to this injection location.

1. The PWROG methodology for Containment Spray evaluates the piping response as the Containment Spray header is filled and compares the potential force imbalances with the weight of the piping. The net force resulting from the pressurization of the Containment Spray header during the filling transient is a small fraction of the dead weight of the filled piping, and therefore the filling transient is within the margin of the pipe hanger design.

   The FNP Containment Spray System discharge header piping will be evaluated using the PWROG methodology described above. Using this methodology it will be determined if the force imbalances on the Containment Spray System discharge header piping are within the margin of the pipe hanger design.

2. A PWROG methodology has been developed to assess when a significant gas-water waterhammer could occur during switchover to hot leg injection. The methodology concludes that: If the upstream valve has an opening time of approximately 10 seconds and the downstream path to the Reactor Coolant System (RCS) is only restricted by check valve(s), no significant waterhammer, would occur, in other words, none of the relief valves in the subject systems would lift and none of the piping restraints would be damaged.

   Since some of the FNP ECCS flow paths for switchover to hot leg injection have flow restrictions (orifices and throttle valves) in the hot leg injection flow path, the PWROG methodology will not be used. As such, a detailed plant specific evaluation will be performed to assess the influence of the flow restriction(s). The FNP specific evaluation will determine allowable void sizes that will prevent significant waterhammer, in other words, none of the relief valves in the subject systems would lift and none of the piping restraints would be damaged as a result of the flow restrictions in the flow path.

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 5 cubic feet of non-condensable gas at 400 psia was present in the HHSI discharge piping concurrent with 5 cubic feet of non-condensable gas at 100 psia in the LHSI discharge piping. The qualitative evaluation concluded that the quantities of gas that will not prevent the ECCS from performing its core cooling function.

The FNP procedures will be revised to provide assurance that the gas accumulation in any sections of the FNP LPSI injection system cold leg and hot leg piping is verified to be less than 5 cubic feet of non-condensable gas at 100 psia at any location. FNP procedures will also be revised to provide assurance that the gas accumulation in any sections of the FNP HHSI cold and hot leg injection is verified to be less than 5 cubic feet of non-condensable gas at 400 psia at any location.

Based on the industry generic interim acceptance criteria (in 2.a above), SNC developed the FNP specific pump suction criteria:

Pump Suction Void Acceptance Criteria at FNP:

A plant specific calculation was performed for FNP to determine the acceptable gas volumes at potential gas accumulation locations in the ECCS and CSS pump suction piping such that the PWROG program pump suction interim criteria were met.

The gas transport analysis correlated the pump inlet void fraction to the volume of trapped gas in the suction side gas accumulation locations.

Potential gas accumulation locations in the ECCS and CSS pump suction piping were determined to be the following:

- Check valves
- Loop seals
- Orifice plates

The one-line drawings generated from the P&IDs and isometric drawings were utilized to identify the potential gas accumulation locations in the suction piping of the subject systems as discussed above.

The following ECCS and CSS suction paths were evaluated:

Charging Pump (HHSI)

- Safety injection with suction from the refueling water storage tank (RWST)
- Recirculation with suction from the residual heat removal (RHR) pump (cross-tie to RHR)

RHR Pump (LHSI)

- Safety injection with suction from the RWST

- Normal cooldown with suction from reactor coolant system (RCS) hot legs
- Recirculation with suction from the sump

Containment Spray Pump

- Spray with suction from the RWST
- Recirculation spray with suction from the sump

Gas Accumulation in Valve Bonnets

The potential for air trapped in valve bonnets was evaluated. Air trapped in valve bonnets that could get in the piping of the subject systems was accounted for in the pump suction void acceptance criteria for FNP. Air trapped in valve bonnets that could get in the piping of the subject systems will be accounted for in the pump discharge void acceptance criteria for FNP.

3. Changes to Design Basis Documents

   See last item in the design section for a complete list of all Corrective Actions.

4. One Line Drawings, Gas Intrusion Locations and Mechanisms

   One-line drawings were developed to reflect in-scope system piping, the elevation of the piping, the diameter of the piping, and where identified, the horizontal length of the piping.

   The one-line drawings include in-scope valves, identification of the type of valve, the normal position of the valve, and the valve ID.

   The one-line drawings identified orifices, reducers, tanks, pumps, heat exchangers, vent valves, and test connection valves, if they were located in the piping where a local high point exists.

   The P&ID and isometric drawings that were used to prepare the one-line drawings are identified on the one-line drawings.

   The one-line drawings were reviewed to identify areas where gas can accumulate in the system. These areas include isolated branch lines, heat exchangers, or improperly sloped piping.

   Potential gas accumulation locations were identified from the one-line drawings developed from the P&IDs and isometric drawings. The following criteria were used to identify gas accumulation locations:

   - Inverted loop seals formed by piping runs;

- Piping which will not self-vent due to presence of a normally closed check valve or isolation valve; and
- Piping which cannot be vented due to presence of an orifice.

A review of industry and SNC operating experience was performed to determine possible gas intrusion mechanisms. The following gas accumulation mechanisms were reviewed:

- Air can be introduced during routine maintenance and may not be removed if the subsequent fill and vent is inadequate.
- The ECCS, CS, and RHR systems are initially filled with an air saturated water source. Air can be stripped out of solution due to various mechanisms such as agitation, pressure reduction, or temperature increase.
- Hydrogen introduced in the VCT will come out of solution in the charging pump miniflow lines and RCP seal leak-off due to large pressure drops across miniflow orifices and RCP seals and could be transported to the charging pump suction lines.
- Steam or non-condensable gasses can be introduced due to leakage from the RCS into the ECCS.
- Hydrogen will come out of solution in charging pump suction lines due to VCT pressure changes.
- Gas may collect in the RHR heat exchanger U-tubes and can be flushed into the pump suction header during periodic pump surveillance testing.

5. Evaluations of New Vent Valve Locations

   Based on the identification of the locations where gas can accumulate, and the gas intrusion mechanisms identified above, it was determined that vent valves should be installed in one location on Unit 1 and three locations on Unit 2, and other locations will be evaluated to determine if vent valves should be added and/or if these locations should be monitored.

6. System Piping Walkdowns

   Walkdowns utilizing laser metrology were completed on subject system piping for Units 1 and 2 that is located outside of containment, not insulated, not buried, and that did not require scaffolding to be erected for access.

   The Unit 2 un-insulated subject system piping that is inside containment will be walked down during the Fall 2008 refueling outage. The Unit 2 subject system piping that is located outside of containment will also be walked down, where insulation can be removed, during the Fall 2008 refueling outage.

   The Unit 1 un-insulated subject system piping that is inside containment will be walked down during the Spring 2009 refueling outage. The Unit 1 subject system piping that is located outside of containment will also be walked down, where insulation can be removed, during the Spring 2009 refueling outage.

The objective of the laser metrology is to obtain the relative slope, location, orientation, and deviation from horizontal of the subject system piping. The following will be determined from analysis of the laser metrology data:

- Verification that the piping is sloped in the proper direction
- Verification that horizontal (nominal) runs of piping do not contain local highpoints
- Identify additional high points (all areas vulnerable to gas accumulation).

The objective of the visual walkdowns is to:

- Verify that the vent valves are in the proper location along horizontal (nominal) runs of the piping.
- Verify that vent valves are in the proper location along circumference of the piping
- Identify test connections and vent valves which could be used to vent gas accumulated in the subject system piping that were not identified on the P&IDs, and the one-line piping layout drawings that were prepared from the P&IDs and isometric drawings

The Units 1 and 2 subject system piping that is located outside of containment, not buried, and that did not require scaffolding to be erected to access it was visually walked down.

The Unit 2 subject system piping that is inside containment will be visually walked down during the Fall 2008 refueling outage.

The Unit 1 subject system piping that is inside containment will be visually walked down during the Spring 2009 refueling outage.

7. Confirmatory Walkdowns of System Piping

   Additional locations where gas can accumulate may be identified during the FNP Unit 1 Spring 2009 refueling outage and the Unit 2 Fall 2008 refueling outage. Corrective actions to address these additional locations, if any, will be completed during those refueling outages.

8. Fill and Vent and Operating Procedure Reviews

   The operating procedures, which include steps for system fill and vent, were reviewed to address the gas accumulation issues discussed in GL 2008-01.

   The following operating procedures were reviewed

   a. CVCS operating procedures
   b. RCS reduced inventory operating procedures
   c. RHR operating procedures
   d. CS System operating procedures

The operating procedure reviews resulted in comments to improve and enhance the affected procedures with respect to controlling gas accumulation.

9. Procedure Revisions

   A Corrective Action for potential procedure revisions was initiated to evaluate the comments resulting from the operating procedure review. The Corrective Action will require reviewing the comments to determine the scope of the necessary procedure revisions.

10. Gas Intrusion Mechanisms

    See Item 4 above.

11. Ongoing Industry Programs

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

    - Gas Transport in Pump Suction Piping

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

    - Pump Acceptance Criteria

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

12. Corrective Actions and Schedule for Completion

    A Corrective Action was initiated to revise FNP procedures to provide assurance that the volume of gas in the pump suction piping for the ECCS, RHR, and CS System is limited such that pump gas ingestion is within the above PWROG program established interim criteria (Item 2.a above).

    A Corrective Action was initiated to implement the joint Owner's Group program methodology for FNP and establish the applicable limits for gas accumulation in the discharge piping of the affected systems.

A Corrective Action was initiated to revise the applicable FNP procedures to provide assurance that gas in the affected systems discharge piping is limited to within the acceptance criteria determined by the FNP specific application of the joint Owner's Group program method.

A Corrective Action was initiated to evaluate the FNP Containment Spray System discharge header piping using the PWROG methodology discussed in Item 2.c.1 above. Using this methodology it will be determined if the force imbalances on the Containment Spray System discharge header piping are within the margin of the pipe hanger design.

A Corrective Action was initiated to perform a detailed plant specific evaluation to assess the influence of the orifices in the ECCS flow path for switchover to Hot Leg recirculation. The FNP specific evaluation will determine allowable void sizes that will prevent significant waterhammer, in other words, none of the relief valves in the subject systems would lift and none of the piping restraints would be damaged as a result of the flow restrictions in the flow path.

A Corrective Action was initiated to revise FNP procedures to provide assurance that the gas accumulation in any sections of the FNP LPSI injection system cold leg and hot leg piping is verified to be less than 5 cubic feet of non-condensable gas at 100 psia at any location.

A Corrective Action was initiated to revise FNP procedures to provide assurance that the gas accumulation in any sections of the FNP HHSI cold leg injection piping is verified to be less than 5 cubic feet of non-condensable gas at 400 psia at any location.

A Corrective Action was initiated to install new vent valves.

A Corrective Action was initiated to evaluate the other critical locations identified to determine if vent valves need to be installed and/or these locations should be monitored.

A Corrective Action was initiated to evaluate the comments resulting from the operating procedure review. The Corrective Action requires the review results to be further evaluated to determine the scope of the necessary procedure revisions, and revise the procedures as necessary.

Testing Evaluation

1. Surveillance Procedure Review

   The periodic surveillance procedures for flow path operability and pump testing were reviewed to address the gas accumulation issues discussed in GL 2008-01.

   The FNP TS do not contain specific requirements for periodic verification that the ECCS or CS System is sufficiently filled with water. Therefore, FNP does not currently have periodic surveillance procedures to verify the ECCS and CS System piping is filled with water. Based on this review, comments for further enhancement of the procedures were identified. In addition, the need for additional procedures to periodically verify that the ECCS and CS System piping are sufficiently filled with water was identified.

   A Corrective Action for potential procedure revisions was initiated to evaluate the comments resulting from the surveillance procedure review. The Corrective Action require the review results to be further evaluated to determine the scope of the necessary procedure revisions.

2. Procedure Revisions

   In addition, to the procedure enhancements and comments that will be evaluated further to determine the necessary procedure revisions discussed in Item 1 above, the review comments are discussed below.

   - Procedure development or revisions will be initiated to implement the periodic monitoring of the ECCS System and CS System piping to verify the piping is maintained sufficiently filled with water such that the systems remain capable of performing their intended safety functions.
   - Surveillance procedure revisions will be evaluated to incorporate the following changes as applicable:

     a. Incorporation of gas void size acceptance criteria and the requirement to initiate a Condition Report when the applicable acceptance criteria is exceeded.
     b. Method(s) to quantify the gas voids,
     c. A method to trend the size of the gas void, and
     d. A method to identify the type of gas found.

3. Control of Gas Accumulation in the RHR System (Decay Heat Mode of Operation

   During normal plant operation the RHR System is pressurized from the RWST static pressure. When aligned for the decay heat removal mode of operation the RHR pump is stopped and the RWST to RHR pump suction is closed. The RHR pump suctions from hot leg loop 1 are opened. RHR discharge to RCS Cold Legs 1 & 2 is verified to be open. The RHR heat exchanger outlet valve and RHR heat exchanger bypass valves are verified to be closed. The RHR pump miniflow valve is verified to

be open. The RHR pump is started and RHR letdown is reduced to the desired value. The RHR heat exchanger bypass valve is throttled open until the RHR pump mini-flow valve closes. The RHR heat exchanger discharge valve is slowly opened while slowly closing the RHR heat exchanger bypass valve as required to maintain RCS flow $\geq$ 3000 gpm and to commence RCS cooldown.

RHR pump parameters that are recommended and available for monitoring include pump suction pressure, pump discharge pressure, pump amps, pump vibration, pump, system and heat exchanger temperatures, RHR flow and RCS level.

The RHR procedures provide appendices that are used for various venting evolutions for the RHR system. The procedure uses high point venting to vent RHR and RWST to 'A' Train and 'B' Train of charging pump suction, respectively. The quantity of gas vented during the procedure is quantified. The procedure directs repetition of vent steps as necessary to obtain gas free water. The procedure contains cautions that direct termination of venting and notification of the Shift Supervisor if excessive gas is vented.

The procedure also provides for fill and vent of A (B) Train RHR after drain down of the system for maintenance. The procedure contains steps to provide a brief RHR pump run followed by additional high point venting.

The procedures for manual operation of the RHR system in the decay heat removal mode of operation provide sufficient assurance the system is initially filled and vented properly and placed slowly in operation with the appropriate caution and sufficient indications available to assure the proper operation of the system for decay heat removal.

4. Potential Gas Intrusion as a Result of Inadvertent Draining

   Confirmatory monitoring employed at the conclusion of refueling outages will ensure that proper filling and venting practices were utilized.

5. Gas Void Detection and Documenting

   The CVCS startup and operating procedures contain instructions that are used for charging pump suction venting and require the amount of gas vented be quantified. A Condition Report and an operability evaluation of the affected charging pump is required if any amount of gas is vented. A precaution includes an amount of gas that has been determined acceptable for maintaining the respective charging pumps operable. If gas is vented, then the procedure directs a 15 minute wait and re-performance of venting until gas free water issues from the vent.

   A precaution in the CVCS startup and operating procedure provides limitations related to VCT pressure reductions and gas accumulation in idle charging pump suctions. VCT pressure reduction limits are provided, venting is directed if pressure reduction limits have been exceeded and documentation of exceeding pressure reduction limits in a Condition Report is also addressed.

The RHR procedures provide instructions for venting the RHR and RWST to 'A' Train and 'B' Train of charging pump suction, respectively. The amount of gas vented is quantified. A precaution in the procedure requires the Shift Supervisor be notified if the quantity of gas exceeds the specified limit in the precaution. The RHR procedure also contains instructions for fill and vent of the A (B) train RHR after drain down of the system for maintenance. The instructions provided in this section of the procedure" direct repeat as necessary of high point vent steps to vent all air from system and further directs a brief run of RHR pump and repeat of venting, as necessary.

6. Corrective Actions and Schedule for Completion

A Corrective Action for potential procedure revisions (discussed in Item 1 above) was initiated to evaluate the comments resulting from the surveillance procedure review. The Corrective Action require the review results to be further evaluated to determine the scope of the necessary procedure revisions.

In addition to the recommended procedure enhancements and comments that will be evaluated further to determine the necessary procedure revisions, the following Corrective Action was initiated to address the review comments discussed in Item 2 above:

> A Corrective Action for procedure development/revision has been initiated to include requirements for periodic monitoring and trending of ECCS piping and CS System piping to ensure this piping is maintained sufficiently full of water such that the ECCS and CS Systems remain capable of performing their intended safety functions. This action will be complete by November 21, 2008.

Corrective Action Evaluation

1. Gas Accumulation and the Corrective Action Program

   SNC's Corrective Action Program is used to document gas intrusion/accumulation issues as potential nonconforming conditions. Procedures for the ECCS, and RHR System require either a Corrective Action Report to be initiated or that the Unit Shift Supervisor notified, if the specified amount of accumulated gas is found. As part of SNC's Corrective Action Program, Corrective Actions related to plant equipment are evaluated for potential impact on operability and reportability. It has been concluded that issues involving gas intrusion/accumulation are properly prioritized and evaluated under the Corrective Action Program.

   In addition, the FNP internal responses to applicable industry OE (as referenced in GL 2008-01) with gas accumulation issues were reviewed. This FNP internal OE response review confirmed that the FNP Corrective Action Program has been used effectively to address issues resulting from the review of an OE (for example, procedure reviews and revisions, additional training, and design evaluations performed).

2. Corrective Actions and Schedule for Completion

   The proposed Corrective Actions for surveillance procedure revisions and development include the addition of more consistent procedural requirements to initiate Condition Reports based on exceeding certain specified gas void sizes. The surveillance procedure review section contains a discussion of these Corrective Actions. The schedule for completion is discussed in Section B "Description of Necessary Corrective Actions."

B. DESCRIPTION AND SCHEDULE OF CORRECTIVE ACTIONS

1. Corrective Actions Completed

   a. Generic guidance document for fill and vent has been completed.

2. Corrective Actions to be Completed, Schedule, and Basis for that Schedule

   The basis for the following corrective actions is:

   The completion of the remaining walkdowns will require outage conditions for completion. The current schedule for additional walkdowns is acceptable due to the low risk of gas intrusion issues. This acceptability is based on updated surveillance procedures, recent operating history, adequacy of the current design basis, the results of completed walkdowns, and the completion of licensing basis evaluations that indicate the licensing basis supports limiting the quantity of gas in these systems such that the capability of these systems to perform their required safety functions is not adversely affected.

   The completion of the remaining evaluations and procedure reviews require additional time to ensure a quality product, due to manpower requirements and the large scope of work remaining. The current schedule for completing all evaluations and procedure reviews is acceptable based on the issuance of generic guidance for venting and filling, and previous procedure reviews associated with previously identified gas intrusion issues, and compensatory measures such as additional pre-job briefings that are conducted for activities that have been associated with gas accumulation issues.

   The corrective actions to be completed and schedules are:

   a. A Corrective Action for procedure development/revision has been initiated to include requirements for periodic monitoring and trending of ECCS piping and CS System piping to ensure this piping is maintained sufficiently full of water such that the ECCS and CS Systems remain capable of performing their intended safety functions. This action will be complete by November 21, 2008.

   b. FNP procedures will be revised to provide assurance that the volume of gas in the pump suction piping for the ECCS, RHR, and CS System is limited such that pump gas ingestion is within the PWROG program established interim criteria. Procedural guidance will be provided by November 21, 2008.

   c. SNC will implement the PWROG methodology for evaluation of pump discharge piping gas accumulation and establish the applicable limits for gas accumulation in the discharge piping of the affected systems. Air trapped in valve bonnets that could get in the piping of the subject systems will be accounted for in the pump discharge void acceptance criteria for FNP. FNP procedures will be revised to provide assurance that gas in the affected

systems discharge piping is limited to within the acceptance criteria. SNC expects to receive the results of the application of this methodology by December 2008. SNC will determine if any follow up corrective actions are needed within 90 days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

d. The FNP Containment Spray System discharge header piping will be evaluated using the PWROG methodology. Using this methodology it will be determined if the force imbalances on the Containment Spray System discharge header piping are within the margin of the pipe hanger design. SNC expects to receive the results of the application of this methodology by December 2008. SNC will determine if any follow up corrective actions are needed within 90 days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

e. Since the FNP ECCS flow path for switchover to hot leg injection has flow restrictions (orifices and throttle valves) in the hot leg injection flow path, the PWROG methodology cannot be used. As such, a detailed plant specific evaluation will be performed to assess the influence of the flow restriction(s). The FNP specific evaluation will determine allowable void sizes that will prevent significant waterhammer, in other words, none of the relief valves in the subject systems would lift and none of the piping restraints would be damaged as a result of the flow restrictions in the flow path. This evaluation will be completed by December 2008. SNC will determine if any follow-up corrective actions are needed within 90 days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

f. The FNP procedures will be revised, as necessary, to provide assurance that the gas accumulation in any sections of the FNP LPSI injection system cold leg and hot leg piping is verified to be less than 5 cubic feet of non-condensable gas at 100 psia at any location. FNP procedures will also be revised to provide assurance that the gas accumulation in any sections of the FNP HHSI cold and hot leg injection is verified to be less than 5 cubic feet of non-condensable gas at 400 psia at any location. These procedure revisions will be completed by November 21, 2008.

g. For Unit 2, three new vent valves will be installed by the end of the Fall 2008 Unit 2 refueling outage. For Unit 1, one new vent valve will be installed by the end of the Spring 2009 Unit 1 refueling outage. SNC will complete the evaluation of the other locations to determine if vent valves need to be installed and/or if these locations should be monitored. SNC expects to receive the results of an evaluation using the PWROG methodology by December 2008. SNC will determine if any follow up corrective actions are needed within 90 days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

h. The Unit 2 un-insulated subject system piping that is inside containment will be walked down during the Fall 2008 refueling outage. The Unit 2 subject

system piping that is located outside of containment will also be walked down, where practical, during the Fall 2008 refueling outage.

The Unit 1 un-insulated subject system piping that is inside containment will be walked down during the Spring 2009 refueling outage. The Unit 1 subject system piping that is located outside of containment will also be walked down, where practical, during the Spring 2009 refueling outage.

i. A Corrective Action for potential procedure revisions was initiated to evaluate the comments resulting from the operating procedure review. The Corrective Action will require reviewing the comments to determine the scope of the necessary procedure revisions. This Corrective Action will be complete by June 30, 2009.

C. SUMMARY AND CONCLUSIONS

The licensing basis, design, testing, and corrective action evaluations, and the corrective actions resulting from these evaluations performed in response to GL 2008-01 provide reasonable assurance that the FNP ECCS, CS, and RHR Systems will continue to perform their required safety functions.

Edwin I. Hatch Nuclear Plant
Joseph M. Farley Nuclear Plant
Vogtle Electric Generating Plant
Nine-Month Response to NRC Generic Letter 2008-01

Enclosure 3

Vogtle Electric Generating Plant Nine-Month Response to NRC Generic Letter 2008-01

Enclosure 3

Vogtle Electric Generating Plant Nine-Month Response to NRC Generic Letter 2008-01

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

The following information is provided in this response:

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

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

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

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

- Emergency Core Cooling System (ECCS)
  - High Pressure Injection (Charging Pumps[1])
  - Safety Injection (SI) System
  - Low Pressure Injection[2]
- Containment Spray (CS) System
- Residual Heat Removal (RHR) System[2]

(1) The Charging Pumps are also part of the Chemical and Volume Control System (CVCS).

(2) The RHR pumps function as the low pressure injection pumps in the ECCS.

A. EVALUATION RESULTS

Licensing Basis Evaluation

Southern Nuclear Company (SNC) has reviewed the VEGP licensing basis with respect to gas accumulation in the ECCS, RHR, and CS Systems. This review included the Technical Specifications (TS), TS Bases, Updated Final Safety Analysis Report (UFSAR), the Technical Requirements Manual (TRM) and TRM Bases, NRC Commitments, and License Conditions.

1. Licensing Basis Review Summary

   A description of the TS and UFSAR sections that contain relevant information or requirements associated with gas accumulation in the applicable system(s) follows:

   a. TS 3.5.2, "ECCS - Operating," Surveillance Requirement (SR) 3.5.2.3, "Verify ECCS piping is full of water." The Frequency of this SR is 31 days and its applicability is Modes 1, 2, and 3. The Bases for SR 3.5.2.3 states:

      > "With the exception of the operating centrifugal charging pump, the ECCS pumps are normally in a standby, nonoperating mode. As such, flow path piping has the potential to develop voids and pockets of entrained gases. Maintaining the piping from the ECCS pumps to the RCS full of water ensures that the system will perform properly, injecting its full capacity into the RCS upon demand. This will also prevent water hammer, pump cavitation, and pumping of noncondensible gas (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an SI signal or during shutdown cooling. The 31-day Frequency takes into consideration the gradual nature of gas accumulation in the ECCS piping and the procedural controls governing system operation."

      In Mode 4, SR 3.5.2.3 is invoked by TS 3.5.3, "ECCS – Shutdown," SR 3.5.3.1. Therefore, SR 3.5.3.1 provides assurance the ECCS will perform properly, injecting the required capacity into the RCS upon demand in Modes 1 through 4.

      Note that the VEGP RHR system functions as part of the ECCS, starting automatically on an SI signal and providing low head injection into the core as well as supplying the suction flow to the centrifugal charging pumps and SI pumps during recirculation mode of operation. Therefore, the requirements described above are applicable to the RHR system.

   b. TS 3.6.6, "Containment Spray and Cooling Systems" contain the requirements for the CS system in Modes 1 through 4. The Bases for these TS require "...an OPERABLE flow path capable of taking suction from the RWST upon an ESF actuation signal and manually transferring suction to the containment sump."

Although TS 3.6.6 does not contain specific requirements for limiting gas accumulation, it does contain requirements for flow path valve alignment and valve actuation, as well as pump performance. Inherent in maintaining the required operable flow path is the requirement that the gas voids in the flow path be limited such that the system remains operable.

c. UFSAR Section 5.4.7, "Residual Heat Removal System." This section of the UFSAR includes a discussion of the RHR system that addresses the shutdown cooling mode of system operation (i.e., Modes 5 and 6) during reduced RCS inventory conditions.

   Specifically, UFSAR Section 5.4.7.2.3.7, "Mid-loop and Drain Down Operations" refers to the fact that "care must be taken to avoid air entrainment into the RHR pump suction" during mid-loop operation.

   UFSAR Section 5.4.7.2.3.7 describes the instrumentation and alarms available to help assure the necessary RCS level is maintained when the RHR is relied on for cooling during shutdown plant conditions with a reduced RCS inventory. The RCS level monitoring instrumentation and RHR pump motor current unstable alarm available in the control room and the operating staff's heightened awareness of RHR system vulnerability to air entrainment during reduced RCS inventory conditions provide additional assurance the RHR system will remain capable of performing its required shutdown cooling function in plant operating Modes 5 and 6.

d. UFSAR Section 6.3, "Emergency Core Cooling System."

   Section 6.3.2.2.9, "Refueling Water Storage Tank" contains a discussion of the RWST. This section includes a statement regarding the tank outlet which is designed to prevent vortex propagation to the pump suction lines. In addition, the UFSAR describes the available water volume below the minimum submergence level but above the bottom of the RWST provided for vortex prevention and not included in the allowances available for ECCS and Containment Spray switchover to recirculation mode of operation.

   The discussion in Section 6.3.2.2.9 of the UFSAR describes the RWST design features that prevent the entrainment of air in the ECCS suction piping when the RWST level is reduced prior to switchover to the ECCS recirculation mode of operation. Adequate RWST level is maintained to assure the ECCS pumps have sufficient net positive suction head to remain operable during accident conditions prior to the switchover to recirculation mode of operation.

   Section 6.3.2.5 "System Reliability" contains a discussion of ECCS filling and venting. The UFSAR states:

> "Proper initial fill and venting of the ECCS ensures that water hammer does not occur in ECCS lines. In addition, the head of water provided by the RWST further ensures the lines remain full and water hammer concerns do not develop. High point vents in the ECCS lines are provided to ensure means for proper venting of lines and pumps. Fill and venting procedures for the ECCS ensure removal of air from the system to prevent the possibility of a water hammer if injection flow is initiated. The RWST location/configuration ensures that the Technical Specification limit for the RWST low water level is above the ECCS high point required to maintain water solid ECCS lines.
>
> Further, the existence of high point vents and the positive head of water provides means by which the operator can confirm water solid ECCS lines."

This Section of the UFSAR clearly states the expectation for plant procedures that address filling and venting of the ECCS. In addition, this section describes the required RWST low water level limit being above the ECCS piping high point which helps to assure the ECCS pump suction piping is maintained under a positive pressure and aids in ensuring the system is properly vented.

Licensing Basis Review Conclusions

The review of the applicable licensing basis documents confirmed that the VEGP ECCS, RHR, and CS System licensing basis supports limiting the quantity of gas in these systems such that the capability of these systems to perform their required safety functions is not adversely affected.

In addition to the licensing basis documents discussed above, the VEGP internal responses to applicable industry operating experience (OE) (as referenced in GL 2008-01) with gas accumulation issues were reviewed. This VEGP internal OE response review has confirmed that the responses (i.e., the resultant procedure reviews and revisions, additional training, development of system diagrams showing relative elevation differences, and design evaluations performed etc.,) were consistent with the licensing basis that supports limiting the quantity of gas in the ECCS, RHR, and CS Systems such that the capability of these systems to perform their required safety functions is not adversely affected.

TS 3.5.2, "ECCS - Operating," SR 3.5.2.3, states "Verify ECCS piping is full of water." Although the Bases for this SR address the piping from the ECCS pumps to the RCS, the LCO section of the bases specifically addresses an "OPERABLE flow path capable of taking suction from the RWST upon an SI signal and automatically transferring suction to the containment sump." Inherent in maintaining an operable flow path is the requirement to limit gas voids in the suction piping such that the system remains capable of performing its intended safety function as described in the Bases.

TS 3.6.6, "Containment Spray and Cooling Systems" contain the requirements for the CS system. Similar to the ECCS Bases discussed above, the CS System Bases require "...an OPERABLE flow path capable of taking suction from the RWST upon an ESF actuation signal and manually transferring suction to the containment sump." Inherent in maintaining an operable flow path is the requirement to limit gas voids in the suction piping such that the system remains capable of performing its intended safety function as described in the Bases. The CS System is normally in a standby, non-operating mode similar to the ECCS. However, the CS System is not connected to the RCS or the CVCS system such that hydrogen or nitrogen gas intrusion could occur (as could potentially occur in the ECCS) and cause gas voids to form over time. Therefore, there is a lower probability of gas voids developing in the CS system than in the ECCS system, after the initial fill and vent is accomplished. In addition, considering the elevation difference between the RWST and the CS System pump suction and that the CS System pumps have casing vents as well as discharge piping vents located well above the CS pumps, adequate assurance of CS System fill is provided by the fill and vent procedures to assure the CS System is capable of performing its required safety function.

The following is a summary of the existing VEGP procedures addressing fill and vent, as well as periodic verifications. VEGP has a 31-day venting surveillance for the ECCS consistent with the current TS requirements. The applicability of the venting surveillance is Modes 1-4. These surveillances vent at a number of distinct venting points primarily on the discharge side of ECCS related systems. These surveillance procedures include the RHR, Safety Injection, and Charging Systems. VEGP also has procedures in place that provide for normal venting of these systems, prior to system startup and after maintenance activities.

The ECCS fill and vent procedures involve initial static venting followed by dynamic venting during system startup.

The CVCS fill and vent procedures direct venting during system startup and following maintenance on a charging pump and associated piping.

The CS System fill and vent procedures provide for gravity fill of the piping from RWST. Vents include respective pump casing and containment sump supply test vents. In addition, the procedures use a CS System Discharge piping vent that is located at an elevation significantly higher than the CS System pumps to verify the system is full. Steps are included in the procedure to direct that the respective Containment Spray pumps be operated for 5 minutes and the venting process repeated, prior to declaring the respective pump (pumps) operable. Steps are also included in the procedure to direct that the venting steps be repeated until no air is found. The CS System suction line from the containment sump is also filled and visually verified to be full.

RHR system procedures address the filling and venting of each RHR train. These procedures contain sections that direct the performance of dynamic venting after the performance of static venting for the respective trains of RHR. Steps are included in the procedures to direct stopping the respective RHR pumps and then re-performing venting.

SI System procedures provide for static venting followed by dynamic venting for various situations, including post maintenance. Dynamic venting is directed after static venting by: "To verify all air is vented from the SI Pump Suction Lines, start and operate the SI Pumps on mini-flow as applicable."

2. Summary of Changes to Licensing Basis Documents

A revision to the TS could be incorporated to clarify that some gas is allowed in the piping as long as the specified safety function of each system can be performed. However, considering the industry effort to develop the appropriate TS and Bases changes via the Technical Specification Task Force (TSTF) process and the adequacy of the current VEGP licensing documents reviewed, no changes are currently planned for the existing licensing basis documents. Upon completion of the TSTF process including NRC approval, SNC will evaluate further licensing basis document changes consistent with the industry and NRC approved TSTF changes.

However, in order to provide additional assurance that the ECCS and CS System piping remain sufficiently filled with water, procedure revisions will be initiated to ensure that more complete periodic monitoring of the ECCS piping is performed. In addition, to assure the CS System remains sufficiently full of water procedure revisions will be developed to periodically monitor the CS System suction piping.

3. Licensing Evaluation Items Not Complete

   a. TS improvements are being addressed by the TSTF to provide an approved TSTF traveler for making changes to individual licensee's TS related to the potential for unacceptable gas accumulation. The development of the TSTF traveler relies on the results of the evaluations of a large number of licensees to address the various plant designs. SNC 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. SNC will evaluate the resolution of TS issues with respect to the changes contained in the TSTF traveler, and, as applicable, submit a license amendment request based on this evaluation following NRC approval of the Consolidated Line Item Improvement Process (CLIIP) Notice of Availability of the TSTF traveler. The Bases changes associated with the TS changes will also be made.

   b. A corrective action for procedure development/revision has been initiated and includes the procedure additions discussed in item 2 above (i.e., improved periodic monitoring of ECCS piping and the initiation of periodic monitoring of the CS System piping). SNC plans to confirm adequacy of filling and venting

practices utilized during the Vogtle Unit 2 Fall 2008 refueling outage to be followed by enhanced monitoring and trending for both Vogtle units by November 21, 2008.

Design Evaluation

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

1. Design Review

   The VEGP design basis was reviewed with respect to gas accumulation in the subject systems. Various design basis documents were reviewed including calculations, process and instrumentation diagrams (P&IDs), and isometric drawings.

   Containment sump strainer performance, including NPSH, vortexing, and flashing under accident conditions has been evaluated and was provided to the NRC under separate correspondence in response to Generic Letter 2004-02, "Potential Impact of Debris Blockage on Emergency Recirculation During Design Basis Accidents at Pressurized-Water Reactors."

   Design features and RWST water level set points are controlled by design and operating procedures to prevent vortex effects that can potentially ingest gas into the system during design basis events. Additional limitations in maximum flow rates also help prevent vortex effects during shutdown cooling operations at reduced RCS inventory.

   The following types of calculations were reviewed relative to gas intrusion:

   a. RWST level setpoint calculations

   b. Containment Sump level calculations

   c. RCS mid-loop level calculations

   d. Pump NPSH calculations

   In addition, a calculation was performed to verify that the CVCS Volume Control Tank (VCT) level setpoints provide an adequate allowance to preclude air entraining vortices during ECCS switchover from the VCT to the RWST.

   The calculation review process identified the following issue:

   The RWST has a vortex suppression device. However, no specific calculation using an accepted criterion was located for submergence with the vortex suppression device. Therefore a calculation will be generated to identify an accepted criterion for submergence with the vortex suppression device. This calculation will be completed by January 15, 2009.

2. Gas Volume Acceptance Criteria

   a) Pump Suction Piping

   The interim allowable gas accumulation in the pump suction piping is based on limiting the gas entrainment to the pump after a pump start. A PWROG program established interim pump gas ingestion limits to be employed by the member utilities. The interim criteria address pump mechanical integrity only and are as follows:

	Single-Stage	***Multi-Stage***	***Multi-Stage***
		Stiff Shaft	Flexible Shaft
Steady-State	2%	2%	2%
Transient*	5% for 20 sec.	20% for 20 sec.	10% for 5 sec.
$Q_{B.E.P.}$ Range	70%-120%	70%-140%	70%-120%
Pump Type (transient data)	WDF	CA	RLIJ, JHF
* The transient criteria are based on pump test data and vendor supplied information.			

   The limits contained in the table illustrate that the 2% pump suction acceptance criteria contained in NUREG/CR-2792 can be exceeded for the models of pumps identified in the table, however the 2% pump suction acceptance criteria contained in NUREG/CR-2792 is applicable to all models of pumps.

   VEGP procedures will be revised to provide assurance that the volume of gas in the pump suction piping for the ECCS, RHR, and CS System is limited such that pump gas ingestion is within the above PWROG program established interim criteria.

   b. Pump discharge piping which is susceptible to pressure pulsation after a pump start.

   A joint Owner's Group program evaluated pump discharge piping gas accumulation. Gas accumulation in the piping downstream of the pump to the first closed isolation valve or the RCS pressure boundary isolation valves will result in amplified pressure pulsations after a pump start. The subsequent pressure pulsation may cause relief valves in the subject systems to lift, or result in unacceptable pipe loads, i.e., axial forces that are greater than the design rating of the axial restraint(s). The joint Owner's Group program establishes a method to determine the limit for discharge line gas accumulation to be utilized by the member utilities.

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

SNC will implement this methodology for VEGP via detailed system specific calculations. VEGP procedures will be revised to provide assurance that gas in the affected systems discharge piping is limited to within the acceptance criteria determined by the VEGP specific application of the joint Owner's Group program method. SNC expects to receive the results of the application of this methodology by December 2008.

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

The PWROG has developed methodologies that can be used to evaluate the piping response in the presence of accumulated gas for: 1) The Containment Spray piping downstream of the isolation valve that is normally closed during power operation as the riser and spray header are filled, and 2) The hot leg injection piping downstream of the isolation valve that is normally closed during power operation and opened following switchover to this injection location.

1. The PWROG methodology for Containment Spray evaluates the piping response as the Containment Spray header is filled and compares the potential force imbalances with the weight of the piping. The net force resulting from the pressurization of the Containment Spray header during the filling transient is a small fraction of the dead weight of the filled piping, and therefore the filling transient is well within the margin of the pipe hanger design.

   The VEGP Containment Spray System discharge header piping will be evaluated using the PWROG methodology described above. Using this methodology it will be determined if the force imbalances on the Containment Spray System discharge header piping are within the margin of the pipe hanger design. This evaluation will be completed by December 2008.

2. A PWROG methodology has been developed to assess when a significant gas-water waterhammer could occur during switchover to hot leg injection. The methodology concludes that: If the upstream valve has an opening time of approximately 10 seconds and the downstream path to the Reactor Coolant System (RCS) is only restricted by check valve(s), no significant waterhammer, would occur, i.e., none of the relief valves in the subject systems would lift, and none of the piping restraints would be damaged.

   Since some of the VEGP ECCS flow paths for switchover to hot leg injection have orifices in the hot leg injection flow path, the PWROG methodology will

not be used. As such, a detailed plant specific evaluation will be performed to assess the influence of the flow restriction(s). The VEGP specific evaluation will determine allowable void sizes that will prevent significant waterhammer i.e., none of the relief valves in the subject systems would lift, and none of the piping restraints would be damaged as a result of the flow restrictions in the flow path.

d. RCS Allowable Gas Ingestion

The PWROG qualitatively evaluated the impact of non-condensable gases entering the RCS on the post-accident core cooling functions of the RCS. This evaluation assumed that 5 cubic feet of non-condensable gas at 400 psia was present in the combined high head safety injection (HHSI) and intermediate head safety injection (IHSI) discharge piping concurrent with 5 cubic feet of non-condensable gas at 100 psia in the low head safety injection (LHSI) discharge piping. The qualitative evaluation concluded that these quantities of gas will not prevent the ECCS from performing its core cooling function.

The VEGP procedures will be revised to provide assurance that the total gas accumulation in VEGP LHSI injection system cold leg and hot leg piping is verified to be less than 5 cubic feet of non-condensable gas at 100 psia. VEGP procedures will also be revised to provide assurance that the total gas accumulation in VEGP HHSI cold leg injection and IHSI system cold leg and hot leg piping is verified to be less than 5 cubic feet of non-condensable gas at 400 psia. These procedure revisions will be completed by November 21, 2008.

Based on the industry generic interim acceptance criteria (in 2.a above), SNC developed the VEGP specific pump suction criteria:

Pump Suction Void Acceptance Criteria at VEGP

A plant specific calculation was performed for VEGP to determine the acceptable gas volumes at potential gas accumulation locations in the ECCS and CSS pump suction piping such that the PWROG program pump suction interim criteria was met.

The gas transport analysis correlated the pump inlet void fraction to the volume of trapped gas in the suction side gas accumulation locations.

Potential gas accumulation locations in the ECCS and CSS pump suction piping were determined to be the following:

- Check valves
- Loop seals
- Orifice plates

The one-line drawings generated from the P&IDs and isometric drawings were utilized to identify the potential gas accumulation locations in the suction piping of the subject systems as discussed above.

The following ECCS and CSS suction paths were evaluated:

Charging Pump (HHSI)

- Safety injection with suction from the refueling water storage tank (RWST)
- Recirculation with suction from the residual heat removal (RHR) pump (cross-tie to RHR)

Intermediate Head SI (IHSI)

- Safety injection with suction from the refueling water storage tank (RWST)
- Recirculation with suction from the residual heat removal (RHR) pump (cross-tie to RHR)

RHR Pump (LHSI)

- Safety injection with suction from the RWST
- Normal cooldown with suction from reactor coolant system (RCS) hot legs
- Recirculation with suction from the sump

Containment Spray Pump

- Spray with suction from the RWST
- Recirculation spray with suction from the sump

Gas Accumulation in Valve Bonnets

The potential for air trapped in valve bonnets was evaluated. Air trapped in valve bonnets that could get in the piping of the subject systems was accounted for in the pump suction void acceptance criteria for VEGP.

Air trapped in valve bonnets that could get in the piping of the subject systems will be accounted for in the pump discharge void acceptance criteria for VEGP. This will be completed with the development of the pump discharge void acceptance criteria and will be completed within ninety days following receipt of the December 2008 evaluation report. Final corrective action will be discussed in our follow-up letter.

3. Changes to Design Basis Documents

   See the last item in the design section for a complete list of all corrective actions.

4. One Line Drawings, Gas Intrusion Locations and Mechanisms

   The one-line drawings were developed to reflect in-scope of the system piping, the elevation of the piping, the diameter of the piping, and where identified, the horizontal length of the piping.

   The one-line drawings include in-scope valves, the type of valve, the normal position of the valve, and the valve ID.

   The one-line drawings identify any orifices, reducers, tanks, pumps, heat exchangers, vent valves, and test connection valves, if they are located in the piping where a local high point exists.

   The P&ID and isometric drawings that were used to prepare the one-line drawings are identified on the one-line drawings.

   The one-line drawings were reviewed to identify where gas can accumulate in the system, which includes isolated branch lines, heat exchangers, or improperly sloped piping.

   Potential gas accumulation locations were identified from the one-line drawings developed from the P&IDs and isometric drawings. The following criteria were used to identify gas accumulation locations:

   - Inverted loop seals formed by piping runs;
   - Piping which will not self-vent due to presence of a normally closed check valve or isolation valve; and
   - Piping which cannot be vented due to presence of an orifice.

   A review of industry and SNC operating experience was performed to determine possible gas intrusion mechanisms. The following gas accumulation mechanisms were reviewed:

   - Air can be introduced during routine maintenance and may not be removed if the subsequent fill and vent is inadequate.
   - The ECCS, CS, and RHR systems are initially filled with an air saturated water source. Air can be stripped out of solution due to various mechanisms such as agitation, pressure reduction, or temperature increase.
   - Hydrogen introduced in the VCT will come out of solution in the charging pump miniflow lines and RCP seal leak-off due to large pressure drops across miniflow orifices and RCP seals and could be transported to the charging pump suction lines.

- The SI accumulator water is saturated with nitrogen at a pressure of approximately 650 psia. Nitrogen may come out of solution due to leakage from the safety injection accumulators into the ECCS through normally closed check valves in ECCS lines and normally closed isolation valves in the test system.
- Steam or non-condensable gasses can be introduced due to leakage from the RCS into the ECCS.
- Hydrogen will come out of solution in charging pump suction lines due to VCT pressure changes.
- Gas may collect in the RHR heat exchanger U-tubes and can be flushed into the pump suction header during periodic pump surveillance testing.

5. Evaluation of New Vent Valve Locations

   Based on the identification of the locations where gas can accumulate, and the gas intrusion mechanisms identified above, it was determined that one vent valve location was recommended for Unit 1 and one location was recommended for Unit 2. Other locations will continue to be evaluated to determine whether vent valves should be added, or these locations should be monitored. For Unit 1 and 2, the new location is the common suction line for the normal charging system and the HHSI. In addition to new vent locations, a number of existing vent locations were added to venting procedures, specifically seven locations for Unit 1 HHSI, two locations for Unit 1 IHSI cold leg, one location for Unit 1 IHSI hot leg, three locations for Unit 1 LHSI cold leg, two locations for Unit 1 LHSI hot leg, eight locations for Unit 2 HHSI, two locations for Unit 2 IHSI cold leg, one location for Unit 2 IHSI hot leg, three locations for Unit 2 LHSI cold leg, and two locations for Unit 2 LHSI hot leg.

   The new vent valve location for Vogtle Unit 2 was installed during the Fall 2008 refueling outage. Vogtle Unit 1 vent valve location will be installed during the Fall 2009 Unit 1 refueling outage. The evaluation of the other locations to determine if vent valves should be installed or these locations should be monitored and will be completed within ninety days following receipt of the December 2008 evaluation report. Final corrective action will be discussed in our follow-up letter.

6. System Piping Walkdowns

   Walkdowns utilizing laser metrology were completed on subject system piping for Units 1 and 2 that is located outside of containment, not insulated, not buried, not located in confined spaces and that did not require scaffolding to be erected to access it. Additionally, walkdowns which were planned to be conducted during the Fall 2008 Unit 2 refueling outage have been completed.

   The Unit 2 un-insulated subject system piping that is inside containment was also walked down utilizing laser metrology. The Unit 2 subject system piping that is located in confined spaces outside of containment was also walked down, utilizing laser metrology.

The Unit 1 un-insulated subject system piping that is inside containment and in confined spaces, will be walked down during the Fall 2009 refueling outage.

The objective of the laser metrology is to obtain the relative slope, location, orientation, and deviation from horizontal of the subject system piping. The following will be determined from analysis of the laser metrology data:

- Verification that the piping is sloped in the proper direction.
- Verification that horizontal (nominal) runs of piping do not contain local highpoints.
- Identify additional high points (all areas vulnerable to gas accumulation).

The objective of the visual walkdowns is to:

- Verify that the vent valves are in the proper location along horizontal (nominal) runs of the piping.
- Verify that vent valves are in the proper location along circumference of the piping.
- Identify test connections on top of piping that could be used for venting and vent valves that were not identified on the P&IDs, and the one-line drawings that were prepared using P&IDs and isometric drawings.

The Units 1 and 2 subject system piping that is located outside of containment, not buried, not located in confined spaces and that did not require scaffolding to be erected for access, was visually walked down.

The Unit 2 subject system piping that is inside containment was also visually walked down.

The Unit 1 subject system piping that is inside containment will be visually walked down during the Fall 2009 refueling outage.

7. Confirmatory Walkdowns of System Piping

   Additional locations where gas can accumulate may be identified during the Vogtle Unit 1 Fall 2009 refueling outage and the Unit 2 Spring 2010 refueling outage. Corrective actions to address these additional locations, if any, will be completed during those refueling outages.

8. Fill and Vent and Operating Procedure Reviews

   The applicable fill and vent procedures used at VEGP were reviewed to address the gas accumulation issues discussed in GL 2008-01.

   The fill and vent procedure reviews resulted in comments, where deemed appropriate to improve and enhance the affected procedures with respect to controlling gas accumulation.

The following operating procedures were also reviewed to address the gas accumulation issues discussed in GL 2008-01.

a. RHR operating procedures
b. CVCS operating procedures
c. RCS reduced inventory operating procedures
d. Safety Injection operating procedures

The operating procedure reviews resulted in comments where deemed appropriate to improve and enhance the affected procedures with respect to controlling gas accumulation.

9. Procedure Revisions

A Corrective Action for potential procedure revisions will be initiated to evaluate the comments resulting from the fill and vent and operating procedure review. The corrective action will require the review results to be further evaluated to determine the scope of the necessary procedure revisions. Interim guidance has been issued until procedural changes can be addressed through the corrective action program.

10. Gas Intrusion Mechanisms

See Item 4 above.

11. Ongoing Industry Programs

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

- Gas Transport in Pump Suction Piping

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

- Pump Acceptance Criteria

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

12. Corrective Actions and Schedule for Completion

    a. SNC plans to implement corrective action for procedure development/revision (i.e., improved periodic monitoring of ECCS piping and the initiation of periodic monitoring of the CS System piping, refer to testing evaluation section). In addition, SNC plans to confirm adequacy of filling and venting practices utilized during the Vogtle Unit 2 Fall 2008 refueling outage to be followed by enhanced monitoring and trending for both Vogtle units. This will be completed by November 21, 2008.

    b. Generate a calculation to identify an accepted criterion for submergence with the vortex suppression device. This will be completed by January 15, 2009.

    c. Implement procedure guidance to provide assurance that the volume of gas in the pump suction piping for the ECCS, RHR, and CS System is limited such that pump gas ingestion is within the above PWROG program established interim criteria. This will be completed by November 21, 2008.

    d. Containment Spray System discharge header piping will be evaluated using the PWROG methodology. Using this methodology it will be determined if the force imbalances on the Containment Spray System discharge header piping are within the margin of the pipe hanger design. SNC expects to receive the results of the application of this methodology by December 2008. SNC will determine if any follow up corrective action are needed within 90 days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

    e. Complete evaluation to determine allowable void sizes that will prevent significant waterhammer, i.e., none of the relief valves in the subject systems would lift, and none of the piping restraints would be damaged as a result of the flow restrictions in the flow path. SNC expects to receive the evaluation results by December 2008. SNC will determine if any follow up corrective action are needed within ninety days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

    f. The VEGP procedures will be revised to provide assurance that the total gas accumulation in VEGP LHSI injection system cold leg and hot leg piping is verified to be less than 5 cubic feet of non-condensable gas at 100 psia. VEGP procedures will also be revised to provide assurance that the total gas accumulation VEGP HHSI cold leg injection and IHSI injection system cold leg and hot leg piping is verified to be less than 5 cubic feet of non-condensable gas at 400 psia. This will be completed by November 21, 2008.

    g. Develop pump discharge void acceptance criteria to account for air trapped in valve bonnets that could get in the system piping. SNC expects to receive the evaluation results by December 2008. SNC will determine if any follow up corrective action are needed within ninety days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

h. A vent valve will be installed in the common suction line for the normal charging system and the HHSI during the Fall 2009 Vogtle Unit 1 refueling outage. This will be completed by Fall 2009 Vogtle Unit 1 refueling outage. Complete evaluation of the other locations using developed discharge piping acceptance criteria and monitoring and trending results to determine if vent valves need to be installed or these locations should be monitored. SNC expects to receive the evaluation results by December 2008. SNC will determine if any follow up corrective action are needed within ninety days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter. Address additional locations where gas can accumulate if identified during the Vogtle Unit 1 Fall 2009 refueling outage and the Unit 2 Spring 2010 refueling outage. This will be completed by Vogtle Unit 1 Fall 2009 refueling outage and Unit 2 Spring 2010 refueling outage.

i. The Unit 1 un-insulated subject system piping that is inside containment and in confined spaces, where practical, will be walked down utilizing laser metrology during the Fall 2009 refueling outage. This will be completed by Vogtle Unit 1 Fall 2009 refueling outage.

j. Review comments for the operating procedure review to deterrmine the scope of the necessary procedure revisions. This will be completed by June 30, 2009.

Testing Evaluation

1. Surveillance Procedure Review

   The periodic venting and pump operation surveillance procedures used at VEGP were reviewed to address the gas accumulation issues discussed in GL 2008-01.

   VEGP utilizes a 31 day venting surveillance for the ECCS. The review of the VEGP periodic venting and pump surveillance procedures resulted in comments, where deemed appropriate. The periodic venting surveillance procedures were recently revised to add a number of additional vent points. At least 15 vent valve pairs (inboard and outboard) were added to the procedure for each Unit. However, additional comments and recommendations for further enhancement of these procedures were made during the reviews.

   A Corrective Action for potential procedure revisions will be initiated to evaluate the comments resulting from the surveillance procedure review. The corrective action will require the review results to be further evaluated to determine the scope of the necessary procedure revisions.

2. Procedure Revisions

In addition to the procedure enhancements and comments that will be evaluated further to determine the necessary procedure revisions discussed in Item 1 above, the following review findings are discussed below.

- Procedure revisions to the existing 31-day ECCS venting surveillances will be initiated to provide additional assurance that the ECCS suction piping is maintained sufficiently filled with water.

- Procedure revisions or new procedure development will be initiated to provide additional assurance that the CS System suction piping and the CS System pumps up to the first closed discharge line isolation valve are maintained sufficiently full of water.

- Surveillance procedure revisions will be evaluated to incorporate the following changes as applicable:

    a. Incorporation of gas void size acceptance criteria and the requirement to initiate a Condition Report when the applicable acceptance criteria is exceeded,

    b. Method(s) to quantify the gas voids,

    c. A method to trend the size of the gas void, and

    d. A method to identify the type of gas found.

3. Control of Gas Accumulation in the RHR System (Decay Heat Mode of Operation)

During normal plant operation, the RHR System is pressurized from the RWST static pressure. When aligned for the decay heat removal mode of operation, the RHR discharge to RCS the appropriate Cold Legs is verified to be open. The RHR pump is then placed in pull-to-lock and the RWST to RHR pump suction is closed. The RHR pump suctions from the Hot Leg loop are opened. The RHR heat exchanger outlet and RHR heat exchanger bypass valves are verified to be closed. The RHR pump miniflow valve is verified to be open. The RHR pump is started and RHR Letdown is established. Warm up is accomplished by throttling open the RHR heat exchanger bypass until RHR pump mini-flow valve closes. Monitoring of the RHR heat exchanger inlet temperature is accomplished using a plant computer point, until the temperature stabilizes. When RHR warm up is completed, full flow to the RCS is initiated by throttling open the RHR heat exchanger bypass to the desired flow rate (nominally 3000 gpm).

As described above, adequate measures are taken to assure the RHR system is sufficiently filled with water prior to being placed in service for decay heat removal.

For initial high point venting of the RHR system, the procedures direct performance of dynamic venting after performance of static venting for the respective trains of

RHR. The procedure directs stopping the respective RHR pump after the pump has been operated for a period of time and then re-performing venting.

Procedures also provide for high point venting after maintenance. The procedure directs running the RHR pump and re-venting after the initial static venting performance. Additionally, there is a 31-day (high point) venting surveillance in place. The applicability of this surveillance procedure is Modes 1-4. This surveillance vents at a number of distinct venting points primarily on the discharge side of ECCS related systems. These surveillance procedures include the RHR, Safety Injection, and Charging Systems.

The RHR Procedures contain several precautions and cautions related to operation of the RHR system. A precaution states: "Thoroughly fill and vent all applicable RHR components prior to returning them to service after maintenance. This minimizes system performance degradation and water hammer due to gas entrainment." Another precaution states: "If only an RHR pump and its associated piping, or only a portion of system piping has been drained for maintenance, Sections 6.7 and 6.8 should be performed as applicable to ensure the system is filled and vented." A precaution is included to address mid-loop operation and states: "Whenever the RCS is at 188 feet (one foot above mid nozzle) the RHR flow should be limited to the lower end of a range from 3000 to 3500 gpm. (>3200 gpm indicated flow ensures >3000 gpm actual flow for all temperatures). This minimizes the potential loss of RHR Pump suction due to gas entrainment from vortex formation." Cautions are included in the procedure that state: "If the RCS is under vacuum, a minimum flow rate of about 1200 gpm for 3 minutes is needed to refill the voided section of RHR discharge piping. 1500 gpm should NOT be exceeded during the refill period. Flow rates are to be adjusted very SLOWLY any time flow is being increased to address potential water hammer concerns." Additional cautions are included to address the potential for water hammer. These additional cautions specify that: "Starting an RHR Pump at RCS water level below 216 foot elevation and with 1 HV 8809B closed will cause water hammer in the discharge piping."

The existing procedures for manual operation of the RHR system in the decay heat removal mode of operation provide sufficient assurance the system is initially filled and vented properly and operated with the appropriate caution during reduced inventory conditions.

4. Potential Gas Intrusion as a Result of Inadvertent Draining

   Confirmatory monitoring employed at the conclusion of refueling outages will ensure that proper filling and venting practices were utilized.

5. Gas Void Detection and Documenting

   The VEGP ECCS 31-day venting surveillance procedure contains steps to determine the size of the void. The procedure also specifies that the venting of an abnormally large amount of gas may constitute a TS violation and that the Shift Supervisor be

notified immediately and a Condition Report be initiated immediately for long term corrective action and reportability evaluations.

6. Corrective Actions and Schedule for Completion

   A corrective action for procedure revisions will be initiated to evaluate the recommended procedure comments discussed above.

   This corrective action will be completed by the conclusion of the Vogtle Unit 2 Fall refueling outage.

Corrective Action Evaluation

1. Gas Accumulation and the Corrective Action Program

   SNC's Corrective Action Program is used to document abnormally large gas intrusion/accumulation issues as potential nonconforming conditions. The ECCS flowpath verification procedure, which is used to perform the monthly venting of the ECCS piping requires a Condition Report to be initiated, and the Unit Shift Supervisor notified, if an abnormally large amount of gas is found. As part of SNC's Corrective Action Program, Corrective Actions related to plant equipment are evaluated for potential impact on operability and reportability. It has been concluded that issues involving gas intrusion/accumulation are properly prioritized and evaluated under the Corrective Action Program.

   In addition, VEGP responses to applicable industry OE (as referenced in GL 2008-01) with gas accumulation issues were reviewed. This internal VEGP OE response review confirmed that the VEGP Corrective Action Program has been used effectively in the past to address issues resulting from the review of an OE (i.e., the additional procedure reviews and revisions, additional training, development of system diagrams showing relative elevation differences, and design evaluations performed etc.,).

2. Corrective Actions and Schedule for Completion

   The proposed corrective actions for surveillance procedure revisions include the addition of more consistent procedural requirements to initiate Condition Reports based on exceeding certain specified gas void sizes. The surveillance procedure review section contains a discussion of these Corrective Actions and the associated completion date.

B. DESCRIPTION AND SCHEDULE OF CORRECTIVE ACTION

1. Corrective Actions Completed

   a. One new vent valve has been installed for Unit 2 in the common suction line for the normal charging system and the HHSI.

   b. Generic guidance document for fill and vent has been completed.

2. Corrective Actions to be Completed, Schedule, and Basis for that Schedule

   The basis for the following corrective actions is:

   The completion of the remaining walkdowns will require outage conditions for completion. The current schedule for additional walkdowns is acceptable due to the low risk of gas intrusion issues. This acceptability is based on updated surveillance procedures, recent operating history, adequacy of the current design basis, the results of completed walkdowns, and the completion of licensing basis evaluations that indicate the licensing basis supports limiting the quantity of gas in these systems such that the capability of these systems to perform their required safety functions is not adversely affected.

   The completion of the remaining evaluations and procedure reviews require additional time to ensure a quality product, due to manpower requirements and the large scope of work remaining. The current schedule for completing all evaluations and procedure reviews is acceptable based on the issuance of generic guidance for venting and filling, and previous procedure reviews associated with previously identified gas intrusion issues, and compensatory measures such as additional pre-job briefings that are conducted for activities that have been associated with gas accumulation issues.

The corrective actions to be completed and schedules are:

   a. SNC plans to implement corrective action for procedure development/revision (i.e., improved periodic monitoring of ECCS piping and the initiation of periodic monitoring of the CS System piping, refer to testing evaluation section). In addition, SNC plans to confirm adequacy of filling and venting practices utilized during the Vogtle Unit 2 Fall 2008 refueling outage to be followed by enhanced monitoring and trending for both Vogtle units. This will be completed by November 21, 2008.

   b. Generate a calculation to identify an accepted criterion for submergence with the vortex suppression device. This will be completed by January 15, 2009.

   c. Implement procedure guidance to provide assurance that the volume of gas in the pump suction piping for the ECCS, RHR, and CS System is limited such that

pump gas ingestion is within the above PWROG program established interim criteria. This will be completed by November 21, 2008.

d. Containment Spray System discharge header piping will be evaluated using the PWROG methodology. Using this methodology it will be determined if the force imbalances on the Containment Spray System discharge header piping are within the margin of the pipe hanger design. SNC expects to receive the results of the application of this methodology by December 2008. SNC will determine if any follow up corrective actions are needed within ninety days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

e. Complete evaluation to determine allowable void sizes that will prevent significant waterhammer, i.e., none of the relief valves in the subject systems would lift, and none of the piping restraints would be damaged as a result of the flow restrictions in the flow path. SNC expects to receive the evaluation results by December 2008. SNC will determine if any follow up corrective actions are needed within ninety days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

f. The VEGP procedures will be revised to provide assurance that the total gas accumulation in VEGP LHSI injection system cold leg and hot leg piping is verified to be less than 5 cubic feet of non-condensable gas at 100 psia. VEGP procedures will also be revised to provide assurance that the total gas accumulation VEGP HHSI cold leg injection and IHSI injection system cold leg and hot leg piping is verified to be less than 5 cubic feet of non-condensable gas at 400 psia. This will be completed by November 21, 2008.

g. Develop pump discharge void acceptance criteria to account for air trapped in valve bonnets that could get in the system piping. SNC expects to receive the evaluation results by December 2008. SNC will determine if any follow up corrective actions are needed within ninety days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter.

h. A vent valve will be installed in the common suction line for the normal charging system and the HHSI during the Fall 2009 Vogtle Unit 1 refueling outage. This will be completed by Fall 2009 Vogtle Unit 1 refueling outage. Complete evaluation of the other locations using developed discharge piping acceptance criteria and monitoring and trending results to determine if vent valves need to be installed or these locations should be monitored. SNC expects to receive the evaluation results by December 2008. SNC will determine if any follow up corrective actions are needed within ninety days following receipt of the evaluation. Final corrective action will be discussed in our follow-up letter. Address additional locations where gas can accumulate if identified during the Vogtle Unit 1 Fall 2009 refueling outage and the Unit 2 Spring 2010 refueling outage. This will be completed by Vogtle Unit 1 Fall 2009 refueling outage and Unit 2 Spring 2010 refueling outage.

i. The Unit 1 un-insulated subject system piping that is inside containment and in confined spaces, where practical, will be walked down utilizing laser metrology during the Fall 2009 refueling outage. This will be completed by Vogtle Unit 1 Fall 2009 refueling outage.

j. Review comments for the operating procedure review to determine the scope of the necessary procedure revisions. This will be completed by June 30, 2009.

C. SUMMARY AND CONCLUSIONS

The licensing basis, design, testing, and corrective action evaluations, and the corrective actions resulting from these evaluations performed in response to GL 2008-01 provide reasonable assurance that the VEGP ECCS, CS, and RHR Systems will continue to perform their required safety functions.

Edwin I. Hatch Nuclear Plant
Joseph M. Farley Nuclear Plant
Vogtle Electric Generating Plant
Nine-Month Response to NRC Generic Letter 2008-01

Enclosure 4

NRC Generic Letter 2008-01 Nine-Month Response Commitment Table

Enclosure 4

Commitment Table

Commitment	Type		Scheduled Completion Date (If Required)
	One-Time Action	Continuing Compliance	
All currently identified GL 2008-01 related corrective actions for Farley Unit 1 will be completed by no later than the end of the Unit 1 1R22 refueling outage.	X		04/26/09
All currently identified GL 2008-01 related corrective actions for Farley Unit 2 will be completed by 04/26/09	X		04/26/09
All currently identified GL 2008-01 related corrective actions for Hatch Unit 1 will be completed by no later than the end of the Unit 1 1R24 refueling outage.	X		03/17/10
All currently identified GL 2008-01 related corrective actions for Hatch Unit 2 will be completed by no later than the end of the Unit 2 2R20 refueling outage.	X		03/18/09
All currently identified GL 2008-01 related corrective actions for Vogtle Unit 1 will be completed by no later than the end of the Unit 1 1R15 refueling outage.	X		10/15/09
All currently identified GL 2008-01 related corrective actions for Vogtle Unit 2 will be completed by no later than the end of the Unit 2 1R22 refueling outage.	X		04/26/09
A follow-up updated submittal to the nine-month response will be provided to the NRC, for Farley Unit 1, no later than ninety days following the end of the next scheduled refueling outage.	X		07/26/09
A follow-up updated submittal to the nine-month response will be provided to the NRC, for Farley Unit 2, no later than ninety days following the end of the next scheduled refueling outage.	X		02/14/09
A follow-up updated submittal to the nine-month response will be provided to the NRC, for Hatch Unit 1, no later than ninety days following the end of the next scheduled refueling outage.	X		06/17/10

Enclosure 4

Commitment Table

A follow-up updated submittal to the nine-month response will be provided to the NRC, for Hatch Unit 2, no later than ninety days following the end of the next scheduled refueling outage.	X		06/18/09
A follow-up updated submittal to the nine-month response will be provided to the NRC, for Vogtle Unit 1, no later than ninety days following the end of the next scheduled refueling outage.	X		01/15/10
A follow-up updated submittal to the nine-month response will be provided to the NRC, for Vogtle Unit 2, no later than ninety days following the end of the current 2R13 refueling outage.	X		01/18/09