ENERGY NORTHWEST

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October 8, 2008
GO2-08-141

10 CFR 50.54(f)

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

Subject: **COLUMBIA GENERATING STATION, DOCKET NO. 50-397
NINE-MONTH RESPONSE TO NRC GENERIC LETTER 2008-01, "MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS"**

References:
1. NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," dated January 11, 2008
2. Energy Northwest Letter, "Three-Month Response to NRC Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems,"" dated April 10, 2008
3. NRC Letter from W. H. Ruland (NRC) to J. H. Riley (NEI), no subject, dated July 8, 2008
4. NRC Letter from C.F. Lyon (NRC) to J.V. Parrish (Energy Northwest), "Columbia Generating Station – Re: Generic Letter 2008-01 "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," Proposed Alternative Course of Action," dated August 21, 2008

Dear Sir or Madam:

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 (Reference 1) to request that each licensee evaluate the licensing basis, design, testing, and corrective action programs for the Emergency Core Cooling Systems (ECCS), Residual Heat Removal (RHR) system, and Containment Spray system, to ensure that gas accumulation is maintained less than the amount that challenges operability of these systems, and that appropriate action is taken when conditions adverse to quality are identified.

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

> "(a) A description of the results of evaluations that were performed pursuant to the requested actions;
>
> (b) A description of all corrective actions, including plant, programmatic, procedure, and licensing basis modifications that were determined to be necessary to assure compliance with the quality assurance criteria in Sections III, V, XI, XVI, and XVII of Appendix B to 10 CFR Part 50 and the licensing basis and operating license as those requirements apply to the subject systems; and,
>
> (c) A statement regarding which corrective actions were completed, the schedule for completing the remaining corrective actions, and the basis for that schedule."

In summary, Energy Northwest has concluded that the subject systems/functions at Columbia Generating Station (Columbia) are operable. In addition, Energy Northwest has concluded that Columbia is in conformance with its commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in Columbia's Operational Quality Assurance Program Description with exception of the identified deviations that have not yet been corrected and are entered into Columbia's Corrective Action Program for tracking and final resolution, as described in Section C of this Attachment.

As directed in Reference 4 and as committed to in Reference 2, Energy Northwest will complete its assessments of those currently inaccessible portions of these systems/functions during the next refueling outage and provide a supplement to this report with those results within 90 days following startup from that outage.

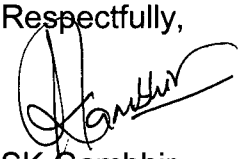
Energy Northwest makes the following additional commitment:

> Within 60 days after NRC approval of a generic Technical Specifications Task Force (TSTF) Traveler relating to gas accumulation, Energy Northwest will evaluate its applicability to Columbia and evaluate adopting the Traveler to either supplement or replace the current TS requirements.

The attachment to this letter contains the Energy Northwest nine-month response to NRC GL 2008-01. If you have any questions, please contact Mr. M.C. Humphreys, Licensing Supervisor at (509) 377-4025.

I declare under penalty of perjury that the foregoing is true and correct. Executed on the date of this letter.

Respectfully,



SK Gambhir
Vice President, Technical Services

Attachments 1. GL 2008-01 Requested Information for a Nine-Month Response
2. List of Regulatory Commitments

cc: EE Collins, Jr. – NRC RIV
CF Lyon – NRC NRR
NRC Senior Resident Inspector/988C
WA Horin – Winston & Strawn
RN Sherman – BPA/1399

GL 2008-01 REQUESTED INFORMATION FOR A NINE-MONTH RESPONSE

This Attachment contains Columbia Generating Station (Columbia) 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:

- Emergency Core Cooling System (ECCS)
  - High Pressure Core Spray (HPCS) System – 1 train
  - Low Pressure Core Spray (LPCS) System – 1 train
  - Low Pressure Coolant Injection (LPCI) System – 3 trains
    (Note: LPCI is an operating mode of the Residual Heat Removal system)
- Residual Heat Removal (RHR) System
  - Residual Heat Removal System - 3 trains
- Containment Spray System
  - Drywell/Wetwell Spray System - 2 trains
    (Note: Containment Spray is an operating mode of the RHR system)

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

A. EVALUATION RESULTS

A.1 LICENSING BASIS EVALUATION

Regulatory requirements and how they are addressed at Columbia Generating Station (Columbia) were reviewed with respect to gas accumulation in the Emergency Core Cooling, Residual Heat Removal, and Containment Spray Systems. This evaluation included a review of the Technical Specifications (TS), TS Bases, Final Safety Analysis Report (FSAR), the Licensee Controlled Specifications (LCS) and LCS Bases, responses to NRC Generic Communications, Regulatory Commitments, and License Conditions. The following is a description of the results of the licensing basis evaluation.

A.1.1 Summary of Reviews for the Licensing Basis Evaluation

a. General Design Criteria Review

The requirements of 10 CFR 50 Appendix A, General Design Criteria for Nuclear Power Plants, are addressed in Section 3.1 of Columbia's FSAR. These details were initially reviewed and approved by the NRC as documented in NUREG-0892.

b. Quality Assurance Criteria Review

The requirements of 10 CFR 50 Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Reprocessing Plants are addressed in Columbia's Operational Quality Assurance Program Description (OQAPD). Columbia's OQAPD was initially reviewed and approved by the NRC as documented in NUREG-0892. In addition, Section 5.4.1.a of Columbia TS describes Columbia's requirement to have established, implemented, and maintained written procedures that cover applicable procedures recommended in Regulatory Guide 1.33, Revision 2.

c. Technical Specifications Review

The requirements of 10 CFR 50.36 are addressed in Sections 3.5, 3.6, and 3.9 of Columbia TS which establish Limiting Conditions for Operation (LCO) and Surveillance Requirements (SR) for the ECCS, RHR system, and Containment Spray system. Columbia is a Boiling Water Reactor (BWR) 5 plant with a Mark II containment design. Based on NRC review and approval in 1997, Columbia's Technical Specifications were converted to Improved Technical Specifications and are consistent, relative to these systems, with the Standard Technical Specifications (STS) found in NUREG-1434 for BWR-6 plants. The following is a summary of how the requirements of 10 CFR 50.36 are addressed in Columbia TS for the specified systems:

1) With regard to ECCS, LCOs 3.5.1 and 3.5.2 establish operability requirement for ECCS injection/spray subsystems. With regard to maintaining these systems filled with water, SR 3.5.1.1 and 3.5.2.3 establish surveillance requirements to periodically (once per 31 days) verify that the piping from the pump discharge valve to the injection valve for each of the required ECCS injection/spray subsystems is filled with water.

   No suction side SRs for the ECCS pumps currently exist. Based on an evaluation of Columbia operating experience as well as current design considerations for potential gas intrusion mechanisms, Energy Northwest has concluded that there are currently no significant factors that would warrant the need to establish a suction side surveillance. Energy Northwest 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 to it such that an additional suction side surveillance would provide significant benefit to ensuring system operability is maintained.

   However, Energy Northwest will consider evaluation results from the BWR fleet in response to the GL 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 GL. Specific conditions related to Columbia ECCS suction piping are further discussed in the design evaluation section of this attachment.

2) With regard to RHR, in addition to the requirements of LCOs 3.5.1 and 3.5.2 placed on RHR pumps (i.e., LPCI mode), LCOs 3.9.8 and 3.9.9 establish operability requirements of RHR for shutdown cooling while in Mode 5 (i.e., Refueling) and 3.6.2.3 establishes operability requirements for RHR in suppression pool cooling mode while in Modes 1, 2, and 3.

3) Lastly, with regard to Containment Spray systems, in addition to the requirements of LCOs 3.5.1 and 3.5.2 placed on RHR pumps (i.e., LPCI mode), LCO 3.6.1.5 establishes operability requirements for drywell spray subsystems while in Modes 1, 2, and 3.

d. Licensee Controlled Specifications Review

As an added measure for ensuring the operability of the ECCS injection/spray subsystems, Columbia's LCS provides further requirements to ensure adequate leak tightness is maintained in the ECCS discharge piping to preclude void formation upon the loss of power to the keep fill pumps. Section 1.5.2 of the LCS establishes minimum ECCS discharge piping pressure retention times to support

continued operability of these systems in Modes 1, 2, and 3. LCS surveillance requirement SR 1.5.2.1 requires that pressure retention capability be tested once per 12 months to verify that system integrity is maintained within limits established in the LCS.

e. Energy Northwest Commitment Review

There are no other regulatory commitments relative to the concerns of GL 2008-01 beyond that described in the current Columbia Licensing Basis documents.

A.1.2 Summary of Corrective Actions from the License Basis Evaluation

There were no corrective actions identified as a result of the evaluation of Columbia's licensing basis.

A.1.3 Summary of Items to be Completed for the License Basis Evaluation

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. Energy Northwest 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, Energy Northwest will evaluate its applicability to Columbia and evaluate adopting the Traveler to either supplement or replace the current TS requirements.

A.1.4 Conclusion of the License Basis Evaluation

Based on the licensing basis evaluation, Energy Northwest has determined that Columbia's Licensing Basis adequately addresses the requirements of 10 CFR 50, Appendix A General Design Criteria, 10 CFR 50, Appendix B Quality Assurance Criteria, and 10 CFR 50.36, Technical Specifications.

A.2 DESIGN EVALUATION

Columbia's design was reviewed with respect to gas accumulation in the Emergency Core Cooling, Residual Heat Removal, and Containment Spray Systems. This included a review of design basis documents, calculations, design drawings, fill and vent procedures, engineering evaluations, and vendor technical manuals. As part of this review, potential gas intrusion mechanisms were identified and evaluated. In addition, confirmatory plant walkdowns on

accessible portions of system piping were conducted to assess as-built piping configurations and potential areas for gas accumulation. Lastly, ultrasonic testing (UT) was performed on a number of suspected areas to evaluate for the presence of gas. The following is a description of the results of the design evaluation at Columbia.

A.2.1 Summary of Reviews for the Design Evaluation

a. Calculation Reviews

With respect to the systems identified in the GL, it was determined through a review of site specific analyses and calculations that calculations did not exist to support acceptance criteria for how much gas could be allowed and not impact system operability in all portions of ECCS, RHR and Containment Spray systems.

Energy Northwest has since established acceptance criteria to support operability in all these systems based on BWROG and PWROG joint industry activities to evaluate and quantify acceptable amounts of gas in these systems. This includes the following considerations:

1) Pump Suction Piping

   Gas volume acceptance criteria for ECCS pumps has been determined to be a bounding 1% void fraction for continuous voiding and 10% void fraction for up to 5 seconds. These conservative criteria will be applied in support of system operability until further data supports a change. These values used in conjunction with other factors such as net positive suction head required ($NPSH_R$), duration of gas flow, and transients for which the system is credited provide a basis for assessing system operability should gas be discovered.

2) Pump Discharge Piping Which is Susceptible to Pressure Pulsation after a Pump Start

   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 established 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.

3) Downstream ECCS Piping Analysis

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. For the specific case of the injection piping downstream of the isolation valve the voids will compress until the void pressure equals the pressure of the reservoir the line is injected into and the fluid acceleration will be downstream towards the vessel or larger injection path (such as recirculation piping). Since the downstream area increases in volume, there will be no reflected pressure wave and the pressure pulse will be negligible. Even if voids did exist in the discharge piping downstream of the isolation valve for the ECCS systems, the pressure transient would not be greater than an actual injection in an accident.

4) Effects of RCS Gas Ingestion

A conservative "worst case" scenario evaluation provided a limiting Loss of Coolant Accident (LOCA) Peak Cladding Temperature (PCT) heat-up rate of 12 °F/s for the entire U.S. BWR fleet. Using this heat-up rate, 48 °F of PCT impact is assessed with a maximum of 4-second delay in ECCS flow. 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 the high void conditions already present in the core during LOCA.

Assessments on the Loss of Feed Water (LOFW) and Anticipated Transients Without Scram (ATWS) events concluded that a delay of 5 seconds in ECCS flow would not significantly affect the analysis results and would have no impact on meeting the acceptance criteria. The evaluation of station blackout events indicates that a delay of 10 seconds would not impact the ability of the water makeup system to maintain the vessel water level above the top of active fuel. Similarly, it is concluded that a delay of 10 seconds would have an insignificant impact on meeting the acceptance criteria in Appendix R fire safe shutdown analysis.

b. Drawing Reviews

A review of drawings (isometric, flow, vendor component, etc.) associated with the applicable systems was conducted to identify areas where gas could potentially accumulate (e.g., high points, components, and branch lines). In addition the systems were evaluated for the adequacy of existing vent valve locations and to determine if new vent valves needed to be installed.

The results of the drawing review identified a number of locations as potential areas for gas accumulation. These locations were further evaluated by comparing against current fill and vent guidance, historical system performance, existing analysis, and the use of engineering judgment. As a result, no new vent valves were identified as needing to be added. However, it was determined that some improvements could be made to system fill and vent procedures to ensure piping would be maintained sufficiently full. A further discussion on this is provided in the Procedure Review section below.

In addition, the drawing reviews revealed a number of minor discrepancies in the drawings, none of which are considered significant. These items have been entered into the corrective action process to resolve.

c. Procedure Reviews

A review of instructions and procedures was conducted with respect to gas accumulation. These documents included design change procedures as well as procedures affecting system fill and vent.

With respect to design change procedures, these procedures were reviewed to determine if they adequately challenged engineers to consider potential gas accumulation concerns. As a result, it was noted that a procedure for design changes did not specifically require engineers to evaluate whether a design change would either introduce gas or potentially increase the amount of gas that could accumulate in these systems. This item was entered into the action tracking process. In the interim, until a procedure change is developed, engineering staff were advised to be aware of this concern.

With respect to procedures affecting system fill and vent, these procedures were reviewed for adequacy of scope, sequencing of vent valves, duration of vent, need for dynamic venting, flexibility to adjust to changes in work scope, and verifications that the system was sufficiently full. As a result, a number of enhancements were recommended that would increase the confidence that piping systems would be established and maintained sufficiently full. These enhancements include:

1) Including guidance in Clearance Order Instructions to ensure pump suction piping, discharge piping, and any instrument lines are vented following maintenance which might introduce air into any ECCS systems.

2) Requiring in the Clearance Order Instructions that ultrasonic tests of applicable sections of piping be performed after filling following on-line maintenance.

3) Ensuring that the annunciator response procedures for all low pressure annunciators on these systems require a vent to be performed following restoration of the alarm.

4) Improving the methods in all ECCS fill procedures to prevent voids in the systems.

All these items have been entered into the condition report/action tracking system to resolve.

d. Gas Intrusion Mechanism Review

Reviews of isometric drawings and flow diagrams associated with the applicable systems were conducted to identify potential gas intrusion mechanisms. These reviews included assessment of system instruments (e.g., low pressure alarms, high temperature alarms) to ensure conservative setpoints had been selected when applicable. In addition, system operating procedures were evaluated for potential operator induced sources of gas accumulation. As a result of this review, the following potential gas intrusion mechanisms were identified at Columbia:

1) Back-leakage across pressure isolation valves (PIVs) from the reactor coolant system into the suction of RHR piping systems, or the discharge of HPCS, LPCS or RHR piping systems, resulting in steam pockets due to exceeding saturation conditions.

2) Inadvertent draining, system realignments, and incorrect performance of maintenance and testing procedures associated with HPCS, LPCS, and RHR systems.

It should be noted that there are no air or gas accumulators directly applied to or connected with the HPCS, LPCS, or RHR piping systems and therefore, these mechanisms do not provide a credible source of gas intrusion. It follows then that pressure drops across components (e.g., control valves, orifices) in which entrained gas could come out of solution would likewise not be a credible source of gas intrusion.

Back-leakage from the RCS past pressure isolation valves (PIVs) could result in a steam pocket. High pressure alarms are provided on LPCS and RHR systems if leakage pressurizes the system. Relief valves located on each system are designed to protect the system from over pressurization. The system is vented monthly just upstream of the injection valve to remove any accumulated gases.

The PIVs are not cycled during normal operations, and leakage rates past the valves would not be expected to change for static valve position. On the suction

side of RHR, a procedure is in place to monitor and address any leakage that might exist, up to and including declaring the system inoperable.

The most viable source of gas intrusion into the ECCS, RHR system and Containment Spray system is considered to be inadequate venting practices following maintenance activities. Procedures exist to fill and vent all or a portion of the affected systems (depending on the extent of work performed) prior to returning the system to service. However, it was recognized that improvements could be made to this process. These improvements are described above in the Procedure Review section.

e. Confirmatory Walkdowns

As a confirmatory measure, accessible system piping segments were walked down and measurements were taken to identify slopes and other potential gas accumulation areas. Energy Northwest staff primarily used a ZIPLEVEL™ Pro-2000 Elevation Measurement System manufactured by Technidea™ Corporation, often coupled with aluminum extension rods to reach overhead piping. The device has an advertised leveling accuracy, and a reading repeatability, of (+/-) 1/8 inches, typical. A small number of measurements were also obtained using a rotating laser to establish a horizontal reference and then elevation measurements were obtained with a laser distance-measuring device.

Survey teams were instructed to obtain measurements on accessible horizontal ECCS piping with lengths of 6 foot or greater, however a number of measurements were recorded on accessible horizontal piping less than 6 feet as well. Survey teams were also instructed to obtain data points at changes of horizontal direction and at piping supports, whenever possible.

Insulation was found primarily on RHR system piping and consisted of blanket type and Calcium-Silicate (CALSIL). With regard to blanket type, measurements were taken either between the seams of co-joining blankets or by poking through the blanketed material itself and contacting the pipes. With regard to CALSIL, due to its relatively uniform dimensions, measurements were made on the outside of the CALSIL to evaluate slope.

The following conclusions were made from the confirmatory walkdowns:

1) Thirty areas were identified as potential gas accumulation sites that were determined to need UT verification. The following is a general breakdown of those locations:

   HPCS (3 suction, 2 discharge)

   LPCS (1 suction, 5 discharge)

   RHR Train A (0 suction, 7 discharge)

RHR Train B (1 suction, 4 discharge)

RHR Train C (3 suction, 4 discharge)

2) All but two of these areas were assessed using UT. All areas evaluated using UT were determined to have no gas. The remaining two areas, located on the RHR-A heat exchanger outlet piping, are located in high radiation areas and substantial dose was estimated for performing the work. Follow-up discussions were held and determinations were made that UTs would not be conducted at these areas based on the following:

   - The first location was on piping that supplies the LPCI mode, SDC return, and Wetwell Spray. Even though this negative sloped piping could create an air trap, no trapped gas would be expected since this piping had high flow conditions for both the LPCI flow test and for shutdown cooling during the last refueling outage that would have swept the gas.

   - The second location is a blind branch line that supplies the Drywell Spray header. However, other than startup testing, it has most likely never experienced a flow condition sufficient to sweep gas. This line also has a negatively sloped section that could trap gas. The potential volume of gas was calculated using an Auto-Cad feature developed before the UT testing was started. The Auto-Cad volume result was approximately 156 cubic inches which is significantly below the allowable limit of 1071 cubic inches. Knowing that no air was found in the other five susceptible RHR-A locations it was concluded that, based on ALARA considerations and the large volume margin, UT of this second location was not justified.

3) Energy Northwest believes that, in addition to monthly fill tests that vent at system highpoints, and the use of keep-fill pumps on each of these systems, the results of the UT may be due in part to inservice check valve testing performed during every refueling outage in which the ECCS pumps are manually started and operated at full flows into the vessel. In addition, on a quarterly basis, full flow tests are performed on the pumps through test lines returning to the suppression pool. These tests can have the effect of removing accumulated gas from a large portion of the ECCS piping had it been present.

4) Two areas located on HPCS discharge piping and one area on LPCS discharge piping were identified as potential locations to add vent valves. Performance of UTs at these locations revealed no gas pockets, however should the system be drained at these locations, there appears to be no way to vent the gas without performing a full flow test into the reactor pressure vessel. This concern has been entered into the corrective action process.

5) It was also determined that RHR B system venting could be improved by adding a clear tygon tubing on the piping downstream of the high point vent to better evaluate the presence of gas during venting. This item has been entered into the action tracking process.

6) Lastly, there were a few minor drawing discrepancies identified between the as-built isometric drawings and the actual plant measurements (e.g., elevation values were different and a non-existent portion of a spool piece was reflected on one drawing but not on another). These concerns have been entered into the corrective action process.

A.2.2 Summary of Corrective Actions from the Design Evaluation

As a result of the design evaluation a number of concerns were identified. Below is a summary of actions generated from the design evaluation, the schedule for completion, and the corresponding Action Request/Condition Report # tracking the concern:

#	Description	Schedule for Completion	AR/CR #
Actions Identified During the Calculation Review			
1.	Prepare a technical memo addressing acceptance criteria for gas accumulation in ECCS piping.	Complete	00176497-24
Actions Identified During the Drawing Review			
2.	Correct discrepancies associated with RHR-A drawings.	12/31/08	00186665 00176497-28
3.	Correct discrepancies associated with RHR-B drawings.	12/31/08	00186665 00176497-26
4.	Correct discrepancies associated with RHR-C drawings.	12/31/08	00186665 00176497-25
5.	Correct discrepancies associated with HPCS drawings.	12/31/08	00186665 00176497-27
Actions Identified During the Procedure Review			
6.	Improve the fill process of the HPCS system.	Complete	00185427
7.	Revise procedures to ensure adequate venting after maintenance including pump suction, discharge, and instrument lines following any maintenance which may introduce air: -Revising clearance order instructions process -Post maintenance/modification testing	10/20/08	00186454-02

#	Description	Schedule for Completion	AR/CR #
8.	Revise ECCS procedures for addressing low pressure alarm and void recovery to include: -ensuring venting is performed following receipt of an alarm in all low pressure annunciator procedures -providing guidance on how to recover from a potential voided condition	10/20/08	00186454-04
9.	Improve the methods in all ECCS fill procedures including: -utilizing additional vent locations -proper keep-fill pump venting -ensuring proper vent sequencing	10/20/08	00186454-05
10.	Revise design process to include consideration regarding whether the design change introduces or increases the potential for gas accumulation beyond established acceptance criteria.	12/19/08	00176497-29
Actions Identified During the Confirmatory Walkdowns			
11.	Perform UT on selected portions of HPCS system high-points.	Complete	WO 01156821
12.	Perform UT on selected portions of LPCS system high-points.	Complete	WO 01156822
13.	Perform UT on selected portions of RHR A system high-points.	Complete	WO 01156818
14.	Perform UT on selected portions of RHR B system high-points.	Complete	WO 01156819
15.	Perform UT on selected portions of RHR C system high-points.	Complete	WO 01156820
16.	Evaluate two locations on HPCS discharge piping for the need to add vent valves.	10/15/08	00186138
17.	Evaluate whether or not a vent line or re-sloping of LPCS discharge piping is feasible.	10/26/08	00186666
18.	Evaluate the feasibility of adding a tygon tube to RHR B system high point vent.	1/29/09	00176497-33

A.2.3 Summary of Items to be Completed for the Design Evaluation

Beyond those items described above as being open to resolve discovered conditions, the following items need to be performed for Energy Northwest to complete the design evaluation requested by GL 2008-01:

- Necessary walkdowns of piping systems located inside containment.

- If determined to be necessary, walkdown of one section of piping outside of the containment on the RHR Train B discharge piping.

As committed to in Columbia's three-month response, walkdowns that could not be accomplished prior to October 11, 2008 due to the need to erect scaffolding, the restrictions on removal of insulation from piping, the need for entry into high radiation areas, and the need for containment entries that cannot be accomplished during power operation will be completed prior to the end of the next scheduled refueling outage, currently scheduled for May-June 2009.

A.2.4 Conclusion of the Design Evaluation

Based on the design evaluation and confirmatory walkdowns of accessible piping, and with exception of those items being addressed in accordance with Criterion XVI of Appendix B of 10 CFR 50, Energy Northwest has determined that Columbia is in compliance with the applicable requirements of 10 CFR 50, Appendix B Quality Assurance Criteria III.

A.3 TESTING EVALUATION

Columbia's testing process was reviewed with respect to gas accumulation in the Emergency Core Cooling, Residual Heat Removal, and Containment Spray Systems. This included a review of the associated periodic surveillance test procedures. The following is a description of the results of the testing evaluation.

A.3.1 Summary of Review for the Testing Evaluation

a. Test Procedure Reviews

With respect to assessing for indications of gas accumulation or the potential for gas accumulation, various test procedures are employed at Columbia to assess ECCS, RHR systems and Containment Spray systems. These procedures include fill verification and system integrity test procedures.

These procedures were reviewed for adequate documentation requirements, use of acceptance criteria, and use of the corrective action process when acceptance criteria were not met. The results of the review are documented below:

1) Monthly Fill Verification Procedures

   Fill verification procedures are used to satisfy the requirements of SRs 3.5.1.1 and 3.5.2.3 for verifying that each ECCS injection/spray subsystem piping is filled with water from the pump discharge valve to the injection valve.

   These procedures require venting at high point locations in the respective systems. They were determined to have no other acceptance criteria than to

ensure that a "steady and bubble-free stream of water is observed" when venting. This is consistent with meeting the specific requirement of the SRs to verify that the piping system "is filled with water."

This method or approach was discussed with the NRC staff during initial licensing and was understood by the NRC to serve the purpose of removing excess gas. Documented in Section C.5 of NUREG 0892, the Safety Evaluation report for Columbia (formerly WNP-2), the NRC staff stated (emphasis added):

> *WNP-2 has installed a system to preclude waterhammer from occurring in emergency core cooling system lines. This system consists of water leg pumps to keep the ECCS lines filled with water so that ECCS pumps will not start pumping into voided lines and steam will not collect in the ECCS piping. To ensure that the ECCS lines remain water filled, vents have been installed and a technical specification requirement to periodically vent air from the lines has been imposed.*

In addition, the current TS Bases for these surveillance requirements, which are consistent with NUREG-1434, BWR 6 Standard Technical Specifications, state (emphasis added):

> *The flow path piping has the potential to develop voids and pockets of entrained air. Maintaining the pump discharge lines of the HPCS System, LPCS System, and LPCI subsystems full of water ensures that the systems will perform properly, injecting their full capacity into the RCS upon demand. This will also prevent a water hammer following an ECCS initiation signal. One acceptable method of ensuring the lines are full is to vent at the high points. The 31 day Frequency is based on operating experience, on the procedural controls governing system operation, and on the gradual nature of void buildup in the ECCS piping.*

Therefore, Energy Northwest has concluded that the monthly surveillance procedures as written meet both the original and current intent of the TS requirements in that there was not a requirement to establish acceptance criteria other than to ensure gas was vented.

However, in regards to assessment of discovered air, each of these procedures required the Control Room Supervisor (CRS) to be notified, following the venting process, of the amount of gas that was vented (i.e., the time it took to vent the pipe). There were no requirements in the procedures

to document how much gas was discovered, what to compare it against for consideration of acceptability, or what the CRS should do with the information once it was provided.

A review of closure records for these tests over the past 5 years indicates that on an inconsistent basis, a statement was provided indicating how much air was discovered while performing the test (i.e., how many seconds before a solid stream of water was achieved).

The lack of guidance establishing either qualitative or quantitative acceptance criteria to compare the venting results against was considered a missed opportunity to identify conditions adverse to quality and therefore, a procedural weakness. In addition, the lack of guidance for documenting results of the amount of gas discovered was also considered a procedural weakness. These procedures have been revised to address these concerns. As a conservative measure, these procedures now require the initiation of a condition report any time gas is discovered.

2) Annual System Integrity Test Procedures

Energy Northwest has established additional requirements in the LCS to provide added assurance that ECCS systems are being maintained operable.

System integrity test procedures are used to satisfy the annual testing requirement of LCS SR 1.5.2.1 for verifying that the discharge piping pressure retention times for each ECCS system or subsystem meet minimum time limits following de-energization of the associated system keep-fill pump.

Verification of the discharge pressure retention time for each ECCS discharge line once every 12 months ensures that, assuming a loss of the associated discharge line keep-fill pump, the discharge lines will remain full of water during an accident or Appendix R fire until the main ECCS pump is either automatically or manually started.

The ECCS discharge line keep-fill pumps are not safety related active or protected from the effects of fire. Therefore, to ensure that the ECCS discharge lines remains filled during an accident or Appendix R fire scenario assuming a loss of the associated discharge line keep-fill pump, the ECCS pump discharge line must be maintained full of water until the main ECCS pump is either automatically or manually started. Minimum ECCS pump discharge line pressures have been established to ensure that this occurs.

These procedures require documentation of the time it takes to reach the low pressure alarm (to a maximum of 6 minutes for HPCS, LPCS, and RHR-C pumps, and 40 minutes for RHR-A and RHR-B pumps, if the low pressure alarm had not been received).

These procedures also include requirements to initiate condition reports if the systems are unable to meet their acceptance criteria. In conclusion, no deficiencies were identified with these procedures.

b. Testing Results Review

A review was conducted of the results of periodic tests which involve venting high points of the applicable systems.

As identified above, the surveillance procedures did not require that the amount of air or the time to achieve a solid stream of water out of a vent was documented. However, a review of closure records for these tests over approximately the past 5 years indicates that a number of the control room staff had in fact documented the findings during the venting process in the closure record. Approximately 25% of the records (98 out of 368 records) made a positive statement about the presence of air (i.e., "no air", or else the time to vent was recorded).

Of the closure records that made a statement regarding the time to vent air, there were three instances in which potentially substantial quantities of air had been present:

08/20/07 – RHR Train B, approximately 15 minutes to vent
10/30/05 – RHR Train A, approximately 2 minutes to vent
06/07/07 – RHR Train C, approximately 30 seconds to vent

In addition, there were 6 other instances where the time to vent was recorded (3 in RHR-A, 2 in RHR-B, 1 in LPCS), all less than or equal to 5 seconds. Since the procedure lacked controls on how far to open the vent valve, the actual amount of air that was present can not be known with certainty.

In conclusion, with the exception of three known instances of potentially substantial amounts of gas, testing results in general indicate that the systems have been maintained sufficiently full throughout the past 5 years. A condition report has been issued for engineering to evaluate those conditions identified above where gas was discovered.

A.3.2 Summary of Corrective Actions from the Testing Evaluation

As a result of the testing evaluation a few concerns were identified. Below is a summary of actions from the testing evaluation, the schedule for completion, and the corresponding Action Request/Condition Report # tracking the concern:

#	Description	Schedule for Completion	AR/CR #
Actions Identified During the Test Procedure Review			
1.	Revise ECCS monthly venting verification procedures to include: -Direction for length of vent times -Valve opening position and rate -Recording results -Trending results -Condition report initiation -Acceptance criteria as applicable	Complete	00186454-03
Actions Identified During the Test Results Review			
2.	Quantifications of gas discovered during performance of monthly fill procedures should be evaluated by system engineering to determine if amounts were substantial and if a cause should be determined.	10/27/08	00186571-02

A.3.3 Summary of Items to be Completed for the Testing Evaluation

Beyond the one item described above as being open to resolve a discovered condition, Energy Northwest has completed the testing evaluation requested in GL 2008-01.

A.3.4 Conclusion of the Testing Evaluation

Based on the testing evaluation, Energy Northwest has determined that Columbia is in compliance with the applicable requirements of 10 CFR 50, Appendix B Quality Assurance Criteria V, XI, and XVII.

A.4 CORRECTIVE ACTIONS EVALUATION

Columbia's corrective actions process was reviewed with respect to gas accumulation in the Emergency Core Cooling, Residual Heat Removal, and Containment Spray Systems. This included a review of the corrective action program, required actions in periodic surveillance test procedures, and trending performed by plant staff. The following is a description of the results of the corrective actions evaluation.

A.4.1 Summary of Reviews for the Corrective Action Evaluation

Columbia's Corrective Action Program requires that conditions adverse to quality are entered in the corrective action process for resolution.

As has been previously referred to in the testing evaluation, it was noted that there were no requirements in the monthly surveillance test procedures to assess the gas that was discovered during the performance of the test. It therefore provided no entry point into the corrective action process. The procedures as written had left it up to the Operations staff to make a qualitative judgment on when to enter the Corrective Action Program.

The results of this evaluation indicate that there is no evidence that the corrective action process was entered following discovery of gas. In addition, since there was no requirement to document the amount of air that was discovered, there was no process for trending gas accumulation. These concerns were addressed in the Test Evaluation section of this attachment.

A.4.2 Summary of Corrective Actions from the Corrective Action Evaluation

Existing surveillance test procedures for the affected systems have been revised to require a Condition Report to be initiated if gas is indicated while venting. As part of Energy Northwest's Corrective Action Program, Condition Reports related to plant equipment are evaluated for potential impact on operability and reportability. Therefore, based on the completed actions, Energy Northwest concludes that issues involving gas intrusion/accumulation are properly identified, prioritized and evaluated under Columbia's Corrective Action Program.

A.4.3 Summary of Items to be Completed for the Corrective Action Evaluation

Based on the corrective action review and completion of necessary actions, there are no further actions required.

A.4.4 Conclusion of the Corrective Action Evaluation

Based on the corrective action evaluation, Energy Northwest has determined that Columbia is in compliance with the applicable requirements of 10 CFR 50, Appendix B Quality Assurance Criterion XVI.

A.5 EVALUATIONS CONCLUSION

Based upon the above evaluations, Energy Northwest has concluded that Columbia is in conformance with its commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in Columbia's OQAPD with exception of the identified deviations that have not yet been corrected and are entered into Columbia's Corrective Action Program for tracking and final resolution, as described in Section C of this Attachment.

Any remaining walkdowns are expected to be confirmatory in nature. Results from walkdowns on accessible system piping, ultrasonic testing of potentially vulnerable areas, as well as the results from the licensing basis, design, testing, and corrective action evaluations provide a reasonable expectation that the ECCS, RHR, and Containment Spray systems at Columbia are operable.

B. DESCRIPTION OF NECESSARY CORRECTIVE ACTIONS

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

- Develop acceptance criteria for gas accumulation in ECCS, RHR, and Containment Spray system piping.
- Revise monthly surveillance procedures to require entry into the corrective action process when gas is discovered.
- Correct drawing discrepancies associated with HPCS, RHR-A, RHR-B, and RHR-C system drawings.

C. CORRECTIVE ACTION SCHEDULE

C.1 Corrective Actions that have been Completed

Below is a list of corrective actions that have been completed:

- Establishment of acceptance criteria for gas accumulation in ECCS piping.
- Revision of ECCS monthly venting verification procedures to include direction for length of vent times, valve opening position, recording results, and condition report initiation
- Revision of the HPCS Fill and Vent procedure to address the potential to trap gas during the fill process of the HPCS system.

C.2 Corrective Actions Still to be Completed

Below is a list of corrective actions still to be completed:

Description	Schedule for Completion	AR/CR #
Evaluate two locations on HPCS discharge piping for the need to add vent valves.	10/15/08	00186138
Revise procedures to ensure adequate venting after maintenance including pump suction, discharge, and instrument lines following any maintenance which may introduce air: -Revising clearance order instructions process -Post maintenance modification testing	10/20/08	00186454-02
Revise ECCS procedures for addressing low pressure alarm and void recovery to include: -ensuring venting is performed following receipt of an alarm in all low pressure annunciator procedures -providing guidance on how to recover from a potential voided condition	10/20/08	00186454-04
Improve the methods in all ECCS fill procedures including: -utilizing additional vent locations -proper keep-fill pump venting -ensuring proper vent sequencing	10/20/08	00186454-05
Evaluate whether or not a vent line or re-sloping of LPCS discharge piping is feasible.	10/26/08	00186666
Quantifications of gas discovered during performance of monthly fill procedures should be evaluated by system engineering to determine if amounts were substantial and if a cause should be determined.	10/27/08	00186571-02
Evaluate need to walkdown and/or UT inaccessible regions of RHR B piping. Also evaluate areas inside containment.	10/29/08	00176497-31

Description	Schedule for Completion	AR/CR #
Revise design process to include consideration regarding whether the design change introduces or increases the potential for gas accumulation beyond established acceptance criteria.	12/19/08	00176497-29
Correct discrepancies associated with RHR-A drawings.	12/31/08	00186665 00176497-28
Correct discrepancies associated with RHR-B drawings.	12/31/08	00186665 00176497-26
Correct discrepancies associated with RHR-C drawings.	12/31/08	00186665 00176497-25
Correct discrepancies associated with HPCS drawings.	12/31/08	00186665 00176497-27
Evaluate the feasibility of adding a tygon tube to RHR B system high point vent.	1/29/09	00176497-33

C.3 Basis for the Corrective Action Schedule

Proposed procedure changes above are considered enhancements. In addition, there is no scheduled maintenance that will breach the affected systems before January 2009. Recent UT results at vulnerable locations indicate that the systems are being maintained full of water. In addition, the identified drawing discrepancies are considered minor corrections.

Therefore, delays in completing the actions related to discovered conditions described in the table above are reasonable based on the current operability of the affected systems, increased awareness of engineering staff to the GL concerns, and the unlikely need to utilize post maintenance fill and vent procedures before January 2009.

LIST OF REGULATORY COMMITMENTS

The following table identifies the action committed to by Energy Northwest in this document. Any other statements in this submittal are provided for information purposes and are not considered to be regulatory commitments. Please direct questions regarding this commitment to MC Humphreys.

Regulatory Commitments
1. Within 60 days after NRC approval of a generic Technical Specifications Task Force (TSTF) Traveler relating to gas accumulation, Energy Northwest will evaluate its applicability to Columbia and evaluate adopting the Traveler to either supplement or replace the current TS requirements.