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October 14, 2008

U.S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2378

Serial No. 08-0013C
NLOS/GAW R0
Docket Nos. 50-336/423
License Nos. DPR-65
NPF-49

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNITS 2 AND 3
NINE-MONTH RESPONSE TO NRC GENERIC LETTER 2008-01, MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS

The Nuclear Regulatory Commission (NRC) issued Generic Letter (GL) 2008-01 on January 11, 2008, to request each licensee evaluate the licensing basis, design, testing, and corrective actions for the Emergency Core Cooling System (ECCS), Residual Heat Removal system (RHS), and Containment Spray (CS) system to ensure that gas accumulation is maintained less than the amount that challenges operability of these systems, and that appropriate action is taken when conditions adverse to quality are identified.

GL 2008-01 specified 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 following information:

a) A description of evaluation results performed pursuant to the requested actions,

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,

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.

Additionally, GL 2008-01 required a three-month written response if a licensee proposed an alternative course of action, including schedule extensions. Dominion Nuclear Connecticut, Inc. (DNC) submitted a request for schedule extension on May 8, 2008, (Serial No. 08-0013A) which identified the need for additional time to complete walkdowns for the inaccessible portions of Millstone Power Station Unit 3 (MPS3) during the fall 2008 refueling outage. The NRC approved the extension request via letter dated July 23, 2008, with a new submittal date of January 15, 2009. The supplemental information associated with the January 15, 2009 submittal date is limited to only those systems not accessible prior to the MPS3 refueling outage.

In summary, DNC has concluded, with respect to the concerns outlined in GL 2008-01 regarding gas accumulation that Millstone Power Station Unit 2 (MPS2) and MPS3 ECCS, RHS, and CS systems are in compliance with their Technical Specifications (TS) definitions of operability and are capable of performing their intended safety function.

MPS2 and MPS3 are currently in compliance with 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII. As committed in DNC letter (Serial No. 08-0013A), DNC will complete its assessments of those inaccessible portions of applicable systems during the fall 2008 refueling outage at MPS3, and provide a supplemental report with those results per the NRC-approved schedule.

The attachments to this letter contain the DNC nine-month response to the requested information in GL 2008-01.

Please contact Mr. Geoffrey A. Wertz at (804) 273-3572 if you have any questions or require additional information.

Sincerely,

J. Alan Price
Vice President – Nuclear Engineering
Dominion Nuclear Connecticut, Inc.

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by J. Alan Price, who is Vice President – Nuclear Engineering of Dominion Nuclear Connecticut, Inc. He has affirmed before me that he is duly authorized to execute and file the foregoing document in behalf of that company, and that the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 14th day of October, 2008.

My Commission Expires: My Commission Expires March 31, 2010

Angela B. Fitzgerald
Notary Public

ANGELA B FITZGERALD NOTARY PUBLIC MY COMMISSION NUMBER 7022016 COMMONWEALTH OF VIRGINIA

Attachments:

1. Attachment 1 - Millstone Power Station Unit 2: Response to GL 2008-01
2. Attachment 2 - Millstone Power Station Unit 3: Response to GL 2008-01

Commitments made in this letter: None

cc: U. S. Nuclear Regulatory Commission
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ATTACHMENT 1

NINE-MONTH RESPONSE TO NRC GENERIC LETTER 2008-01, MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 2

NINE-MONTH RESPONSE TO NRC GENERIC LETTER 2008-01, MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS

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NINE-MONTH RESPONSE TO NRC GENERIC LETTER 2008-01, MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS

This attachment contains the Millstone Power Station Unit 2 (MPS2) 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, Decay Heat Removal (DHR) system, and Containment Spray (CS) 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 the response:

a) A description of evaluation results 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 piping system evaluations are *"in-scope"* to the GL 2008-01 for MPS2:

Table 1: In-Scope Piping System Evaluations for GL 2008-01

System	Piping
High Pressure Safety Injection (HPSI) / Low Pressure Safety Injection (LPSI) / Containment Spray (CS)	Common Suction Piping (from the Refueling Water Storage Tank)
HPSI / LPSI / CS	Common Suction Piping (from the Containment Sump)
CS	Discharge Piping – Outside Containment
CS	Discharge Piping – Inside Containment
HPSI	Discharge Piping – Outside Containment
LPSI	Discharge Piping – Outside Containment
HPSI / LPSI	Common Discharge Piping – Inside Containment
HPSI / LPSI	Simultaneous Hot and Cold Leg Injection
Shutdown Cooling (SDC)	LPSI Piping
Charging System	Discharge Piping (Alternate Boron Precipitation Control)

A. EVALUATION RESULTS

A.1. <u>Licensing Review:</u>

The licensing basis was reviewed with respect to gas accumulation in the piping systems described in Table 1 above. This review included the Technical Specifications (TS), TS Bases, Final Safety Analysis Report (FSAR), the Technical Requirements Manual (TRM), TRM Bases, and License Conditions.

A.1.1 Summary of Licensing Review Observations:

TS Surveillance Requirements and TS Bases of MPS2 do not provide requirements for periodic venting of in-scope piping systems evaluated. The only discussion in TS of venting is in Section 1.0, Definitions, where VENTING is defined as:

> *"the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process."*

TS 3.5, EMERGENCY CORE COOLING SYSTEMS (ECCS), does not explicitly address potential gas accumulation in ECCS. Also, Surveillance Requirements are not in the TRM for periodic venting of the piping systems that are in-scope per GL 2008-01 at MPS2.

No changes were determined necessary to the TRM, TS, or their Bases.

Engineered Safety Feature Systems, Design Bases, Availability and Reliability, of FSAR Section 6.1.4.1.2, states:

> *"Water hammer effects are minimized in the engineered safety features system by keeping process lines flooded where possible. Air pockets will be eliminated by periodic opening of isolation valves during testing and by high point vents provided on the process lines. The safety injection system is flooded up to the connection to the reactor coolant system while the containment spray system is flooded up to the risers in containment. The remaining piping is vertical or sloped upward to eliminate air pockets."*

FSAR Section 6.2.4.1, Special Features states:

> *"The RWST ....all suction lines are flooded to assure priming."*

Components – Safety Injection Tanks (SITs), FSAR Section 6.3.2.2 describes that the safety injection tanks have provisions for sampling, filling, draining, venting and correcting boron concentration. However, no mention is made of venting and filling the downstream piping from the SITs.

Emergency Conditions of FSAR Section 6.3.3.1 state:

> *"During normal operation, the containment sump suction lines between motor operated valves (2-CS-16.1A and 2-CS-16.1B) and the high-pressure safety injection pumps (See Figure 6.1-1) will be filled with stagnant water. The portion of piping between the containment sump inlets and the motor-operated valves is designed to be full of water."*
>
> *"These portions of line will flood gradually as the sump level rises. In portions of the lines where air pockets would form, vent and fill connections are provided."*
>
> *"Figure 6.3-1 shows the routing of the recirculation lines and the provisions for venting air that may be trapped in these lines."*

The FSAR contains a sufficient level of information stating 1) how ECCS system piping is maintained full of water where possible and 2) how elimination of potential air pockets would be accomplished. Changes to the FSAR as a result of the regulatory considerations of GL 2008-01 are not required.

A.1.2. Completed Changes Related to the Licensing Review:

A Technical Evaluation (M2-EV-08-0027) has been completed for MPS2 that documents this review and requires the following activity:

GL 2008-01 states that TS Surveillance Requirements should be complete and address both the suction and discharge piping, when applicable, and that the Bases for the TS Surveillance Requirements should be written to ensure the systems are *"sufficiently full of water."*

TS improvements are being addressed by the Technical Specifications Task Force (TSTF) to provide an approved TSTF Traveler for making changes to 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. Accordingly, the following activity is being tracked in the corrective action plan of the MPS2 Technical Evaluation M2-EV-08-0027:

> *This evaluation establishes monitoring of the status of the industry/NRC Technical Specifications Task Force (TSTF) Traveler that will be developed as a follow-up to GL 2008-01. Support to the industry and NEI Gas Accumulation Management Team activities regarding the resolution of generic TS changes via the TSTF Traveler process will continue at MPS2.*

A.1.3. Corrective Action(s) Related to the Licensing Review:

A corrective action is in place to monitor the status of the TSTF Traveler described above (Corrective Action C.2).

A.2 Design Review:

This Design Review was documented through the completion of a Technical Evaluation M2-EV-08-0027, addressing the considerations and regulatory requirements discussed in the GL 2008-01. A summary of results from the design review with respect to gas accumulation for the piping systems are described in Table 1 and in the balance of this section.

A.2.1 Summary of Results from a Review of Design Basis Documents:

There were no required changes or corrective actions identified for the in-scope review of design basis documents, other than completion of a Technical Evaluation to document the basis for response to GL 2008-01 at MPS2, that includes the description of results of related evaluations, and the required and completed corrective actions. The review of previously existing design basis documents included system descriptions, calculations, engineering evaluations, vendor technical manuals and Piping and Instrumentation Drawings (P&IDs) are described in the following:

A.2.1.1 Review of System Descriptions:

There were no required changes or corrective actions identified for the in-scope design basis system descriptions. The Safety Injection (SI), CS and SDC piping and components are designed to be full of water. The design relies on properly sloped piping and strategically located vent valves to support the filling of system piping. The design basis summaries for safety injection tanks (SITs), LPSI, HPSI, CS, SDC, the Refueling Water Storage Tank (RWST) and Containment Sump, do not specifically address air accumulation in system piping. System descriptions are summarized in Table 2.

Table 2: System Description Summary
SI
The SI system includes subsystems that use the SITs, HPSI pumps and LPSI pumps. The SI is used to inject borated water into the Reactor Coolant System (RCS). The injection system also provides continuous long-term post accident cooling of the core by recirculation of borated water from the containment sump. The SI system is treated as an integrated system consisting of three complementary subsystems. High-pressure and low-pressure injection subsystems utilize centrifugal pumps, and a passive injection subsystem maintains a reservoir of borated water under pressure in the SITs, where the driving head for water injection is provided by nitrogen gas pressure within the tanks. SITs: The water from the safety injection tanks recovers the core following a reactor coolant system blowdown to minimize core damage until the safety injection pumps can provide adequate water for reactor coolant. The tanks are designed to inject large quantities of borated water into the reactor coolant system immediately following a large pipe break. One tank is connected to each of the four reactor vessel inlet pipes. The driving head for water injection is provided by nitrogen gas pressure within the tanks at a minimum pressure of 200 psig. HPSI: Two HPSI pumps take suction from two independent suction headers. These headers are initially supplied with borated water from the RWST and when low level is

Table 2: System Description Summary

reached in the tank, borated water is recirculated from the sump of the containment. The third HPSI pump is available as an installed spare. The HPSI pump discharge piping outside containment consists of two main discharge headers that separately branch off into four (4) injection lines. The two sets of four injection lines come together before connecting with the four discharge lines from the LPSI system. The four (4) common LPSI/HPSI lines breach Containment Penetrations and inject into the four (4) RCS cold legs.

LPSI: The LPSI system utilizes two LPSI pumps. Each of the two pumps is connected to one of the two independent suction headers to assure an adequate supply of borated water. The LPSI pump discharge piping outside containment consists of portions of SDC piping and a main header that branches off into four (4) separate injection lines. The four discharge lines connect with the four discharge lines from the HPSI system before reaching the Containment Penetrations. The four LPSI lines are also used as the return path to the reactor from the SDC Heat Exchangers when aligned for SDC.

The SI system does not differ in any significant respect from those described in other Combustion Engineering (CE) applications such as Calvert Cliffs (Docket Nos. 50-317 and 50-318) and Palisades (Docket No. 50-255).

CS

The CS system removes heat by spraying cool borated water through the containment atmosphere. The water is then collected in the containment sump and cooled by the reactor building closed cooling water system through the SDC heat exchangers and recirculated into the containment atmosphere.

The CS system functions as an Engineered Safety Feature (ESF) to limit the containment pressure and temperature after a loss-of-coolant accident (LOCA) and Main Steam Line Break (MSLB) accident and thus reduces the possibility of leakage of airborne radioactivity to the outside environment.

The CS system consists of two redundant, independent subsystems. Each CS subsystem consists of a CS pump, SDC heat exchanger, spray nozzles, piping, valves and instrumentation. The RWST and containment sump provide a source of borated water for the CS system.

In the event of a LOCA or MSLB accident, the CS system is automatically initiated. The CS pumps initially take suction from the RWST. When low level is reached in this tank, the pump suction, in the absence of operator action, is automatically transferred to the containment sump by a sump recirculation actuation signal (SRAS). The recirculated spray water is cooled by the SDC heat exchangers prior to discharge into the containment through the spray headers.

During refueling operations the SDC heat exchanger is isolated from the CS system and aligned with the LPSI system for SDC operations. This alignment is made by closing two manual valves on the containment spray pump discharge and two valves downstream of the SDC heat exchanger, and opening the manual isolation valves upstream and downstream of the SDC heat exchanger to the LPSI header.

Table 2: System Description Summary

To assure the availability of water to the pumps, separate suction headers from the RWST are provided for the CS pumps. Two separate headers, one to each of these pump rooms, are also provided from the containment sump.

CS pumps are located in the lowest elevation of the auxiliary building at elevation (-) 45'-6" to assure a flooded suction. This assures pump priming and protects the mechanical seals in the spray pumps. In this location, the available Net Positive Suction Head (NPSH) is always greater than the required NPSH.

RWST and Containment Sump

The RWST is an atmospheric tank which stores borated water during normal operation. The RWST is the initial source of suction for the HPSI and LPSI pumps and the CS pumps. The RWST is provided with two separate, independent outlet headers.

The valves on the RWST suction headers are normally in the open position. The SI and CS systems are flooded from the RWST to their respective containment isolation valves. In the unlikely event of a LOCA, borated water from the RWST is immediately available to the pumps' suction.

The SRAS opens the isolation valves on the containment sump recirculation piping, which permits the pumps to take suction from the containment sump.

The containment sump is formed by the floor of the lowest elevation of containment. The borated water from the SI, CS system and RCS is collected and subsequently recirculated to the pumps' suction. Two 24-inch containment sump recirculation pipes are provided from the sump to the suction of the SI and CS pumps. The recirculation piping inside the containment extends approximately 11 inches above the floor elevation (-)22'-6" to prevent clogging. A vortex breaker is provided on each containment sump recirculation pipe inlet to avoid air locks.

Under normal operating conditions the header from the RWST can not be emptied since the elevation head from the containment sump at elevation (-)22'-6" maintains the water level in the RWST headers at this minimum elevation. The interconnection between the containment sump recirculation line and the RWST header is located at elevation (-)30'-1 5/8" and (-)33'-7". The RWST is located at grade elevation 14'-6". The containment sump inlet is located at the lowest elevation of the containment building (-)22'-6". The ECCS pumps are located in the lowest elevation of the auxiliary building (-)45'-6". Therefore, all suction lines are flooded to assure priming.

Decay Heat Removal (DHR) System - SDC

The SDC system is designed to reduce the temperature of the reactor coolant in post-shutdown periods from normal operating temperature to the refueling temperature.

Refueling water transfer from the RWST to the refueling cavity in the containment building is normally accomplished after the reactor vessel head has been removed by using the HPSI pumps or LPSI pumps. The HPSI pumps take suction from the RWST and discharge into the RCS and then to the refueling cavity via the open reactor vessel. Pumping continues until

Table 2: System Description Summary
the refueling cavity is filled. The LPSI pumps can be used to return the refueling water from the refueling cavity to the RWST. In the SDC system, reactor coolant is circulated using the LPSI pumps. The flow path from the pump discharge runs through normally locked closed valves through the SDC heat exchangers, through normally closed valves to the LPSI header, and enters the RCS through the four (4) SI header legs. The circulating fluid flows through the core and is returned from the RCS through the SDC nozzle in the Loop No. 2 reactor vessel outlet (hot leg) pipe. The coolant is then returned to the suction of the LPSI pumps through normally closed valves. During cold shutdown and refueling, as long as there is fuel in the reactor, SDC operation is continuous (with brief exception to support fuel movement). The SDC heat exchangers are used to remove decay and sensible heat during plant cooldowns and cold shutdowns. The units are of a U-tube design with two (2) tube-side passes and one (1) shell-side pass.
Boron Precipitation Control
Following a LOCA, when the CS system is no longer required, the RCS is filled, and the SDC system entry conditions have been met, the preferred method to provide long-term cooling and boron precipitation control is with the SDC system in its normal plant operation alignment. In the event the RCS is not filled after the start of the LOCA, portions of the SDC system may be aligned for simultaneous hot and cold leg injection to provide long-term cooling and boron precipitation control. The SI system can provide both long-term cooling and boron precipitation control in the event of a LOCA. This is accomplished by simultaneous injection to both the hot and cold legs of the RCS. Hot leg injection is necessary for cold leg breaks to provide a dynamically swept flowpath through the core region such that boric acid solubility limits are not reached during post-LOCA boiloff periods. The preferred method of boron precipitation control is to employ one (1) LPSI pump to inject via the SDC system warmup and return line piping into the RCS hot leg. Cold leg injection would be provided by a HPSI pump and also by LPSI flow diverted through at least one (1) of the four (4) LPSI injection lines. An alternate method of providing boron precipitation dynamically swept flow is to use HPSI pump P-41A to inject via the charging system header to the pressurizer auxiliary spray line, and to the hot leg through the pressurizer surge line. This alternate alignment is provided by flow through the regenerative heat exchanger, and to the auxiliary spray line. Normal HPSI injection lines to the cold leg from pump P-41A are blocked. In this arrangement, cold leg injection is accomplished by the LPSI system. Adequate dynamically swept flow to preclude boron precipitation as well as adequate long-term cooling are provided by either the preferred LPSI or alternate HPSI hot leg injection methods.

A.2.1.2 Review of Design Basis Calculations:

There were no corrective actions required as a result of the review of calculations. DNC reviewed calculations which addressed the HPSI and LPSI delivered flow rates and available NPSH, CS flow analysis, the determination of available NPSH for the LPSI pumps during mid-loop operation and the minimum height above the LPSI inlet pipe that would prevent air entrainment. Additionally, post LOCA debris transport and head loss across the containment sump screen were reviewed for resolution of the Generic Safety Issue 191 (GSI-191). Containment sump and RWST vortex calculations were also reviewed with respect to the considerations in GL 2008-01. Vendor technical manuals reviewed included those for the HPSI, LPSI, and CS pumps.

A.2.1.3. Review of the System Piping and Instrumentation Drawings (P&IDs):

A review of the applicable P&IDs determined the following information regarding system vent valves in the normal system flow paths. Vent valve locations in the HPSI and LPSI portions of the Emergency Core Cooling Systems, DHR (SDC), and CS piping systems outside of containment that can be utilized for system fill and vent, and operational venting are summarized in Table 3. With the exception of the SDC vacuum fill connection, there were no other vent valve locations identified in containment. These vent valves are strategically located at the piping system high points. Table 3 shows the vent valves identified by this review.

Qty	Table 3: Vent Valve Location
	A/B Train Suction Piping
1	Common vent valve (2-SI-070) between RWST and 'A' HPSI / LPSI / CS pumps
1	Common vent valve (2-SI-048) between RWST and 'B' HPSI / LPSI / CS pumps
1	Vent valve (2-CS-059) between Sump discharge and common 'A' pump suction piping
1	Vent valve (2-CS-060) between Sump discharge and common 'B' pump suction piping
2	HPSI A pump casing vents (2-SI-029, 2-SI-006)
2	HPSI B pump casing vents (2-SI-028, 2-SI-004)
2	HPSI C pump casing vents (2-SI-732, 2-SI-002)
1	LPSI A pump casing vent (2-SI-740A)
1	LPSI B pump casing vent (2-SI-740B)
1	CS A pump casing vent (2-CS-023A)
1	CS B pump casing vent (2-CS-023B)
	A/B Train Discharge Piping
2	HPSI A pump discharge line vents (2-SI-074, 2-SI-727)
3	HPSI B (swing) pump discharge line vents (2-SI-747, 2-SI-019, 2-SI-027)
2	HPSI C pump discharge line vent (2-SI-728, 2-SI-018)
1	Common LPSI train vent valve (2-SI-073)
1	Common LPSI train vent valve (2-SI-719) to Loop 1A
1	Common LPSI train double vent valve (2-SI-724/2-SI-803) to Loop 1B

Qty	Table 3: Vent Valve Location
1	Common LPSI train double vent valve (2-SI-725/2-SI-805) to Loop 2A
1	Common LPSI train vent valve (2-SI-726) to Loop 2B
2	Common LPSI / HPSI train double vent valve (2-SI-715/2-SI-716, 2-SI-041A/2-SI-107) to Loop 1A
2	Common LPSI / HPSI train double vent valve (2-SI-720/2-SI-721, 2-SI-722/2-SI-723) to Loop 1B
1	Common LPSI / HPSI train double vent valve (2-SI-110/2-SI-041D) to Loop 2A
1	Common LPSI / HPSI train double vent valve (2-SI-735/2-SI-041F) to Loop 2B
1	CS A train vent valve (2-CS-091)
1	CS B train vent valve (2-CS-090)
1	Common SDC HX discharge vent valve (2-SI-067)
2	CS A train vent valves (2-CS-053, 2-CS-049C)
3	CS B train vent valves (2-CS-061, 2-CS-105, 2-CS-101)
2	SDC HX tube side vent valves (2-CS-073, 2-CS-080)
	SDC Common Suction
2	Common vent valve (2-SI-102A, 2-SI-075) between RCS and LPSI pump
1	Common vent valve (2-SI-043A) to shutdown cooling venting cabinet.
	SI & CS Test Line
1	SI & CS Test Line vent valve (2-SI-037)

A.2.2 Applicable Gas Volume Acceptance Criteria

Froude numbers (N_{Fr}) between 0.35 and 0.70 have been used as the limits for dynamically sweeping air pockets from a horizontal pipe through a vertically downward oriented pipe. For example, for flows with $N_{Fr} < 0.35$, no gas will transport with the flow vertically down a pipe. In this case, the accumulated gas would all tend to stay in the high point of the horizontal piping, if the end of the horizontal run turned vertically downward. If the end of the horizontal run turned vertically upward, some of the gas would transport vertically upward with the flow and some would remain in the high point.

For flows with $N_{Fr} > 0.55$ but < 0.70, all accumulated gas would transport to the end of the horizontal run and transport vertically upward, if the end of the horizontal run turned vertically upward. If the end of the horizontal run turned vertically downward, some of the gas would be transported downward and some would remain in the vertically down turning elbow.

For flows with $N_{Fr} > 0.70$, all accumulated gas in the horizontal high point will be transported with the flow, whether the end of the horizontal run turns vertically upward or downward.

The above Froude number values for flows in various piping systems have been used to evaluate the ability of the flow to transport gas through piping during operational scenarios, as well as to determine the effectiveness of a system flow "sweep" to remove residual gas (air) from the piping after filling and venting and prior to returning the system to service.

A.2.2.1 Pump Suction Piping

Gas Ingestion Tolerance Limits provided to the Pressurized Water Reactor Owners Group (PWROG) under PA-SEE-450 Task 2 were used by MPS2 to address pump mechanical integrity.

Completion of the Technical Evaluation for the in-scope piping systems has provided assurance that the volume of gas in the pump suction piping is limited such that pump gas ingestion is within the acceptance criteria.

Table 4 provides the pump criteria for steady state and transient void fraction tolerance limits, for single stage and multi-stage centrifugal pumps.

Table 4: Gas Ingestion Tolerance Limits

	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.

A.2.2.2 Pump Discharge Piping

a) Piping Susceptible to Pressure Pulsations After Pump Start:

A Joint Owner's Group program evaluated pump discharge piping gas accumulation. Gas accumulation in the piping downstream of a 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 that are less than the design rating of the axial restraint(s).

MPS2 has utilized this methodology in Technical Evaluation (M2-EV-08-0027) for evaluation of any gas accumulation found in the discharge piping of susceptible GL 2008-01 in-scope systems. This approach is being used as conservative initial screening criteria to determine acceptance of gas accumulation, and for the development of periodic trending and monitoring procedures (Corrective Action C.5). More detailed calculation of acceptance criteria for in-scope piping systems for pressure pulsations and force imbalance considerations are also being evaluated for MPS2.

In 1997, MPS2 completed stress calculations of ECCS piping and supports for various, significant magnitude water hammer transients. These calculations were performed as a result of system damage from an unanticipated water hammer transient associated with opening an isolation motor operated gate valve to empty system piping with the vents closed. Structural margin exists in these systems for the analyzed water hammer transients using current operating procedures. Review of these stress calculations for RWST, CS, HPSI, and LPSI Train A and B show design margin over the type of force imbalance loads postulated from GL 2008-01 transient loadings.

b) Piping not Susceptible to Water Hammer or Pressure Pulsation:

The Joint Owners Group methodology for CS evaluates the piping response as the CS header is filled and compares the potential force imbalances with the weight of the piping. The net force resulting from the pressurization of the CS header during the filling transient is a small fraction of the dead weight of the filled piping, and therefore the filling transient is well within the margin of the pipe hangers. The MPS2 CS header is maintained full to containment isolation valves. The remaining portion of the system is self filling/venting.

The methodology also assesses when a significant gas-water water hammer could occur during switchover to Hot Leg Injection. The Hot Leg Injection piping is not considered susceptible to limiting water hammer loads due to the expected low RCS pressure condition at the time Hot Leg Injection is placed in service, and gas voids in the piping systems would be effectively swept downstream.

A.2.2.3 RCS Allowable Gas Ingestion

MPS2 has evaluated the potential impact of non-condensable gases entering the RCS, and the ability of post-accident core cooling functions of the RCS. The evaluation concludes that the potential quantities of gas in the piping segments do not prevent the ECCS from performing its core cooling function.

The following acceptance criteria for the total non-condensable void volume entering the RCS has been developed and evaluated as acceptable:

1. For the high pressure system piping, an initial sum total of 5 ft^3 of gas at a system pressure of 400 psia and ambient temperature of 68 ºF (or 173.2 ft^3 at 14.7 psia and 212 ºF).

2. For the low pressure system piping, an initial sum total of 5 ft^3 of gas at a system pressure of 100 psia and ambient temperature of 68 °F (or 43.3 ft^3 at 14.7 psia and 212 °F).

The MPS2 evaluation concludes the injection of non-condensable gas void volumes during cold leg injection is not expected to impact the core cooling response during LOCA and Non-LOCA events. The conclusion is predicated on the assumption that there is no delay or change in ECCS flowrates. Maximum allowable void volumes in each ECCS and CS subsystem that support the existing accident analysis assumptions for each subsystem were calculated and will be utilized in the establishment of a monitoring procedure (Corrective Action C.5).

A.2.3 Modifications Status

No new vent locations or other modifications were determined necessary to comply with the MPS2 licensing or design basis, or to maintain system operability as a result of design or drawing review. Several new vent locations are proposed to improve the ability to fill and vent, and manage a potential gas intrusion mechanism. These are included in the corrective action plan as enhancements to the system design (Corrective Action C.8).

A.2.4 Results from Walkdowns

System walkdowns in containment were performed during the spring 2008 refueling outage. Piping outside containment was walked down during the summer and fall of 2008. Piping slope measurements were taken of outside containment piping using a digital zip level. The system walkdowns identified some piping locations that required further confirmation of the effectiveness of the fill and vent or dynamic sweeping processes utilized. Technical evaluations have demonstrated continued system operability for these locations. Ultrasonic Test (UT) measurements of these potential voids will be performed to validate void size (Corrective Action C.3). Additionally, Corrective Action C.8 includes six (6) additional vent valve locations to improve the capabilities to fill and vent in-scope systems. Four (4) new vent valves are proposed for suction lines from the RWST. Two (2) new vent valves are proposed at the SI loops to allow venting of two potential SIT back-leakage pathways. These corrective actions are considered design enhancements, since the potential void volumes at these locations have been evaluated to be within defined acceptance criteria.

A.3 <u>Testing Evaluation</u>

MPS2 does not currently conduct periodic UT or venting of in-scope systems. This is acceptable because operational experience at MPS2 has not identified an operating history of significant gas accumulation in the systems evaluated. Fill and vent procedures specify vent points that are used to ensure the subject system piping is sufficiently full of water for each system following system draining.

With the exception of SIT back-leakage, there are no known gas intrusion mechanisms that impact these piping systems during the plant operating cycle. The MPS2 Charging system does have a history of gas accumulation issues due to failures of gas filled pulsation dampeners in the charging system. These failures do not affect the ECCS, CS, or DHR functions. Corrective action plans are in place and working to address MPS2 Charging pump gas accumulation susceptibility.

Fill and vent procedures for GL 2008-01 in-scope systems have been reviewed and determined to be effective at filling systems using a combination of dynamic sweeps, gravity fill and vents, and/or vacuum fill. A review of existing procedures and instructions described below was performed to evaluate system fill and vent evolutions.

Existing Fill and Vent Procedures Reviewed:

- The operating procedure for filling and venting the various ECCS piping and components was reviewed. This included the RWST suction headers, RWST recirculation header, SDC suction header, LPSI and CS pumps, HPSI and LPSI discharge header, SDC Heat Exchangers, and Containment Sump suction lines. The procedure provides fill and vent instruction during Mode 5, 6 and defueled.
- The operating procedure for filling and venting SIT recirculation headers provides instructions for SI piping downstream of SIT outlet check valves. This is performed in mode 6 or defueled.
- The plant cooldown operating procedure provides instruction for RCS cooldown from mode 3 (hot standby) to mode 5 (cold shutdown) and includes initial preparation of SDC. Initial SDC preparations include the venting of the LPSI discharge header and the SDC heat exchanger header to prevent water hammer.
- SDC operation for reduced inventory operating procedure provides instruction for operating SDC in such conditions.
- System fill and vent evaluation of the procedure for filling and venting the RCS using a HPSI pump or the Charging pumps was performed.
- There are instructions for filling the RCS using a HPSI pump with the reactor defueled.
- There are instructions to fill the RCS while drawing a vacuum on the pressurizer.
- An operating procedure is in place that provides instructions on refueling cavity fill and drain.
- Plant heat up operating procedure was evaluated for fill and vent instruction. This provides instructions for plant operations from mode 5 (cold shutdown) to mode 3 (hot standby). The RCS is filled and vented as a prerequisite.
- An operating procedure provides restoration of SIT level during plant operating modes.
- Operations procedures for LPSI system valve line up and LPSI flow verification, provide instruction for ECCS flow balance verification of all four LPSI injection lines if any portion of the system flow characteristics were altered as a result of a plant modification.
- Surveillance procedures for LPSI pump and valve tests, performed quarterly, and LPSI pump discharge check and high flow Inservice Testing while in modes 5, 6 or defueled were reviewed.
- The SI and CS check valve test, post maintenance and extended cold shutdown surveillance procedure was evaluated for fill and vent instructions.
- HPSI instructions for shifting HPSI pumps, system valve lineups, HPSI pump maintenance, and surveillance pump inservice testing were evaluated for fill and vent instructions.
- An Emergency Operating Procedure for aligning the SI system to provide simultaneous hot and cold leg injection was evaluated for fill and vent instructions.
- The abnormal operating procedure for loss of SDC was evaluated for fill and vent instructions. Steps are provided to vent the affected LPSI pump via a casing vent prior to starting.

- Several alarm response procedures related to SI and CS systems were reviewed.
- Alarm response procedures related to the charging system were also reviewed and have previously been revised to include contingency plans for gas intrusion.

Enhancements to some of these procedures will be made to validate fill effectiveness using the GL 2008-01 insights documented in the MPS2 Technical Evaluation (MP2-EV-08-0027). Procedure revisions will include the addition of appropriate acceptance criteria by adding UT verification, flow rate criteria for dynamic sweeping, or other appropriate methods of verification. (Corrective Actions are provided in Section C.)

The results of the evaluation have identified corrective actions that will enhance and confirm system fill and vent and dynamic fill procedure effectiveness (Corrective Actions C.4 and C.7). Corrective actions are also in place that will implement use of acceptance criteria documented in the Technical Evaluation for periodic monitoring (Corrective Action C.5). The technical evaluation utilized current industry guidance to assess the operability of the in-scope systems for gas intrusion mechanisms. DNC has concluded that the in-scope systems are operable.

A.4 Summary of Evaluation Conclusions:

Following plant restart, GL 2008-01 in-scope system piping is left 'sufficiently full of water'. Credit is taken for gravity fill and vent of suction piping. Due to piping geometry, air voids may be left in some areas. Pump flowrates when aligned to the RWST do not have sufficient velocity to sweep air pockets that potentially may remain. Air voids evaluated as potentially present are also expected to be small and within defined acceptance criteria for the evaluation. Follow-up UT verification of piping high points selected by the MPS2 evaluation is a corrective action for MPS2 to conduct that is intended to confirm the suction piping is left 'full of water'. Corrective actions are provided in Section C.3. Credit is given to proceduralized fill and vent processes followed by pump runs with appropriate alignments and sufficient velocity to sweep clear any remaining air voids.

With the exception of SIT back-leakage, there are no known gas intrusion mechanisms that impact these piping systems during the plant operating cycle. The MPS2 Charging system does have a history of gas accumulation issues due to failures of gas filled pulsation dampeners in the charging system. These failures do not affect the ECCS, CS, or DHR functions. Corrective action plans are in place and working to address MPS2 Charging pump gas accumulation operating experience and susceptibility.

A.4.1 Common Suction Piping (from the RWST)

The 18-inch common suction piping is gravity filled with RWST static pressure. Vent valves at the containment sump isolation valves and the HPSI suction provide vent paths along with the vented RWST. Acceptance criteria were developed for different elevations of the 18-inch and 24-inch suction headers from the RWST. Generally the flowrates were too low to move potential air voids and piping has multiple points in the run where small pockets of air could become trapped. The evaluation also concluded there were limited vent locations and proceduralized venting practice was not totally effective in removing the air. Trapped air pockets would need to be removed by sweeping and/or new installation of vent valves. The evaluation recommends that installation of vent valves be considered, and this is addressed by Corrective Action C.8. Additionally, follow-up UT examination of this pipe section is recommended to confirm void volume assumptions utilized in the evaluation (Corrective Action C.3). Calculations were performed using gas transport methodologies in WCAP-16631-NP, "Testing and Evaluation of Gas Transport to the Suction of ECCS Pumps." The calculation concluded that the air volume that could be transported to each pump suction would be within the Pump Interim Gas Ingestion Tolerance Criteria developed by the PWROG, PA-SEE-450 Task 2, for use in evaluating GL 2008-01.

A.4.2 Common Suction Piping (from Containment Sump)

The 24-inch common sump suction piping is gravity filled with RWST static pressure. Vent valves located on both sides of the sump isolation valves are used to fill and vent the suction piping up to the elevation of the sump inside containment. A dynamic sweep of these lines cannot be performed. However, the slope of piping ensures air can be vented out and the fill and vent technique will be effective.

A.4.3 CS, Discharge Piping – Outside Containment

No external gas intrusion mechanisms were identified and no pump air binding events have been experienced for CS piping outside containment. A quarterly Inservice Testing (IST) ensures the CS pump casings are maintained full of water. Spray header piping fill relies solely on the effectiveness of gravity fill/vent techniques. The proceduralized venting practice may not be effective in removing all air due to multiple points in the run where small pockets could be trapped. However, all potential void volumes evaluated are within defined acceptance criteria for the CS discharge header.

A.4.4 CS, Discharge Piping – Inside Containment

The CS piping within containment is filled to the level of the lower RWST. This piping is self filling/self venting from containment isolation valves to the ring header.

A.4.5 HPSI, Discharge Piping – Outside Containment

All air is effectively removed from the HPSI discharge header. Dynamic venting of the HPSI system piping occurs during plant shutdowns where the HPSI pumps are used to fill the reactor cavity. No external gas intrusion mechanisms were identified that could contribute to voids developing in high points. Quarterly IST surveillances ensure the HPSI pump casings are maintained full of water.

A.4.6 LPSI, Discharge Piping - Outside Containment

Both RWST suction headers and LPSI pumps are used to verify that the piping downstream of the pump discharge valves is completely filled and vented. A series of vent valves are employed in the venting process. Venting is performed twice, moving sequentially from the lowest to the highest elevation. Valves are throttled open to allow dead legs to fill completely. Air is effectively removed from the LPSI discharge header. Dynamic venting of the LPSI system piping occurs during plant shutdowns when SDC is in service. No external gas intrusion mechanisms were identified that could contribute to voids developing in high points. Quarterly IST surveillances ensure the LPSI pump casings are maintained full of water.

A.4.7 HPSI / LPSI Common Discharge Piping – Inside Containment

In summary, these pipe sections are procedurally filled and vented following drain down after maintenance/outages. Because the Froude number is large enough to dynamically sweep away gas in the SI discharge lines, they were evaluated to effectively fill.

Two potential gas intrusion concerns can affect SI discharge piping. RCS check valve back-leakage can affect SI discharge piping and may cause in-leakage to a SIT, resulting in increased SIT level and dilution of SIT boron concentration. The second concern relates to SIT back-leakage across SI discharge check valves. These check valves are located just inside the Containment Penetration. If leakage were to occur, nitrogen off-gassing would collect in the respective SI discharge line immediately upstream of the leaking check valve. The piping geometry at each of the four (4) SI Containment Penetrations is such that gas accumulation could be detected and vented from the outside of the Containment Penetrations at the point where the HPSI and LPSI piping intersect to monitor and mitigate this gas intrusion concern.

The evaluation requires the corrective action stated in Section C.8.b to consider installation of vent valves at Containment Penetrations for SI Loop headers 2A and 2B. Existing vent valves are located upstream of a check valve on the LPSI header and a flow element on the HPSI header. The evaluation also requires corrective action, stated in Section C.6, to perform UT confirmation at these locations following an unexpected drop in SIT level. The anticipated potential for gas accumulation for the four (4) pipes is still evaluated to be within acceptance criteria.

A.4.8 Simultaneous Hot and Cold Leg Injection

The primary hot leg injection path (the SDC suction line) is initially filled solid and in standby to be used for hot leg injection. The vent valve 2-SI-043A was confirmed to be at local high point and at top dead center of the pipe. For the alternate pathway, the charging pump flow rate in the 2-inch, inside containment piping will dynamically sweep the piping regardless of elevation changes in the flow path. Also, the approximately 5 feet of 4-inch downward sloped pipe that ties into the pressurizer spray nozzle will drain of water and be potentially full of air depending on whether or not the RCS is filled using the vaccum fill procedure. The total amount of air that could be trapped is small and would have no impact on the credited ECCS function of hot leg injection. When the line is used as a hot leg injection flow path, trapped gas will be dynamically swept to the pressurizer. This piping is adequately filled with water by the dynamic sweep.

A.4.9 SDC, LPSI Piping

The SDC line to the LPSI pumps is procedurally verified full and vented prior to placing the system into service. A vacuum pump is used to evacuate this line at its local high point in containment during initial fill. Any discharge side gas voids would be swept into the RCS without impact, since the RCS is depressurized when this system is placed in service. Procedural control of RCS water level and maximum flow rates precludes vortexing. The vacuum system allows removal of trapped air. The SDC piping is left full of water following SDC operations during plant heat-up from plant outages. The line has normally closed isolation valves that prevent gas intrusion during normal plant operation. There are no external gas intrusion mechanisms.

A.4.10 Charging System

Only the portion of the charging discharge piping used by the HPSI pumps for alternate boron precipitation control was included in the evaluation. Results of the piping evaluation are described above in Section A.4.8.

B. COMPLETED CORRECTIVE ACTIONS RELATED TO EVALUATION

The Dominion Nuclear Connecticut Inc. (DNC), Corrective Action Program (CAP) is used to document gas intrusion/accumulation issues as potential nonconforming conditions. Existing procedures for the affected systems require a Condition Report to be initiated, and the Shift Manager notified if unexpected accumulations of gas volume are discovered. As part of DNC's CAP, Condition Reports related to plant equipment are evaluated for potential impact on operability and reportability. Therefore, DNC's review has concluded that issues involving gas intrusion/accumulation will continue to be properly identified, prioritized and evaluated under the CAP.

Based upon the results of this evaluation, MPS2 is in conformance with its commitments to 10 CFR 50, Appendix B, Criterion III, V, XI, XVI, and XVII, as described in the DNC Quality Assurance Program. Deviations that have not yet been corrected are entered into the CAP for tracking and final resolution, as described in Sections B and C of this attachment.

C. CORRECTIVE ACTIONS AND SCHEDULE

C.1 DNC is monitoring the results of industry testing and analytical programs related to gas accumulation and pump suction acceptance criteria. DNC will evaluate the results of the industry testing and analytical efforts to determine if additional changes to licensing basis documents are required.

Schedule: Effective immediately and ongoing.

Existing acceptance criteria in place for Millstone is considered conservative, based upon historical results and empirical testing documented in the technical reviews.

C.2 DNC will monitor the status of the industry/NRC Technical Specifications Task Force (TSTF) Traveler that will be developed as a follow-up to GL 2008-01. Following NRC approval of this TSTF Traveler, DNC will evaluate adopting the TSTF recommendations.

Schedule: This activity has already been incorporated as a corrective action, by the evaluation of the GL 2008-01 for MPS2.

The corrective action will establish monitoring of the status of these activities.

C.3 UT verification of local high points in the ECCS / Containment Spray pump suction header piping will be performed to validate limiting void volume assumptions from plant walk-downs.

Schedule: January 15, 2009

Conservative evaluations of the potential susceptibility to upper bound gas voids collecting at these high points have been evaluated for the ECCS and Containment Spray systems. The proposed schedule date will allow performance of UT inspections in a planned manner.

C.4 Operations procedures credited to dynamically sweep piping systems of air or gas in GL 2008-01 in-scope systems will be reviewed and revised to ensure adequate flow velocities to dynamically sweep the piping of trapped air.

Schedule: April 1, 2009

Operations procedure revision, supportive to the next MPS2 refueling outage, scheduled for fall 2009.

C.5 Station procedures will be developed to periodically (every 92 days) monitor piping locations determined to be susceptible to gas intrusion using UT, venting, or other means.

Schedule: October 31, 2009

The development of the quarterly monitoring and trending procedures require planning for insulation removal, the generation of new procedures, the development of acceptance criteria analysis software, the formalization of data trending and documentation requirements, and training of engineers and operators in the performance of the program. The corrective action date has been developed based on similar past experience at MPS3.

C.6 Safety Injection Tank Levels will be trended for indications of leakage into the ECCS injection lines. Monitoring for possible gas in-leakage into the ECCS header will be performed using UT, venting, or other troubleshooting techniques when warranted by an indication of leakage trends from one of the SIT tanks.

Schedule: December 31, 2008

Trending of Safety Injection Tank levels to date during this cycle has not shown leakage that warrants the additional monitoring. The proposed corrective action date allows time to develop an administrative method for implementation.

C.7 Operations procedures will be revised to verify piping is sufficiently full of water following system fill and vent of GL 2008-01 systems, utilizing UT, venting, or other confirmatory means at select locations.

Schedule: April 1, 2009

Operations Procedure revision, supportive to the next MPS2 refueling outage, scheduled for fall 2009.

C.8 New vent valves will be installed by the end of refueling outage 2R19 (fall 2009) in the following locations:

a. Four (4) high point vent valves in the RWST to ECCS/Containment spray suction header piping to facilitate filling and draining the piping.
b. Two (2) high point vent valves in the Safety Injection discharge header piping to Loops 2A & 2B. These vent valves ensure the ability to vent any gas intrusion that might be detected in these SI headers.
c. Procedures will be revised to address the use of the added vents.

Schedule: Completed by the end of the fall 2009 refueling outage.

Conservative evaluations of the potential upper bound gas voids collecting at these high points have been used to evaluate the design function of the ECCS and Containment Spray systems. The schedule will allow installation of these system enhancement vent valves in a planned manner and is considered to be timely given the lack of identified issues with gas accumulation.

C.9 DNC will develop training programs and update the Fleet Design Control program to address gas accumulation concerns associated with GL 2008-1.

Schedule: December 31, 2009

This corrective action is to support long term improvement and is not required for compliance with the requirements discussed in GL 2008-01.

ATTACHMENT 2

NINE-MONTH RESPONSE TO NRC GENERIC LETTER 2008-01, MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS

DOMINION NUCLEAR CONNECTICUT, INC.
MILLSTONE POWER STATION UNIT 3

NINE-MONTH RESPONSE TO NRC GENERIC LETTER 2008-01, MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS

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NINE-MONTH RESPONSE TO NRC GENERIC LETTER 2008-01, MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS

This attachment contains the Millstone Power Station Unit 3 (MPS3) 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 (CS) 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 evaluation results 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 piping system evaluations are *"in-scope"* to the GL 2008-01 for MPS3:

Table 1: In-Scope Piping System Evaluations for GL 2008-01

System	Piping
Accumulator - Low Pressure Safety Injection (LPSI, SIL)	Discharge Piping – Inside Containment
Quench Spray System (QSS)	Suction and Discharge Piping Outside Containment
QSS	Discharge Piping – Inside Containment
Containment Recirculation System (RSS)	Suction and Discharge Piping Outside Containment
RSS	Suction and Discharge Piping Inside Containment
Residual Heat Removal System (RHS) / (LPSI, SIL)	Suction and Discharge Piping
Safety Injection System (SIH)	Suction and Discharge Piping
High Head Injection System / Charging Pumps	Suction and Discharge Piping
Chemical Volume and Control System (CVCS) - Charging Pumps System (CHS)	Suction and Discharge Piping

A. EVALUATION RESULTS

A.1. Licensing Review

The licensing basis was reviewed with respect to gas accumulation in the piping systems described in Table 1 above. This review included the Technical Specifications (TS), TS Bases, Final Safety Analysis Report (FSAR), the Technical Requirements Manual (TRM), TRM Bases, Regulatory Commitments and License Conditions.

A.1.1 Summary of Licensing Review Observations:

TS Surveillance Requirements (SRs) do not provide requirements for periodic venting of in-scope piping systems evaluated. The only discussion in TS of venting is in Section 1.0, Definitions, where VENTING is defined as:

> *"the controlled process of discharging air or gas from a confinement to maintain temperature, pressure, humidity, concentration or other operating condition, in such a manner that replacement air or gas is not provided or required during VENTING. Vent, used in system names, does not imply a VENTING process."*

TS 3.5.2, EMERGENCY CORE COOLING SYSTEMS, Surveillance Requirement (SR) 4.5.2.b.1 states:

> *"Each ECCS subsystem shall be demonstrated OPERABLE:*
> *b. At least once per 31 days by:*
> *1) Verifying that the ECCS piping, except for the operating centrifugal charging pump(s) and associated piping, the RSS pump, the RSS heat exchanger and associated piping, is full of water."*

Technical Specification Bases states the following:

> *"Surveillance Requirement 4.5.2.b.1 requires verifying that the ECCS piping is full of water. The ECCS pumps are normally in a standby, non-operating mode, with the exception of the operating centrifugal charging pump(s). As such, the ECCS 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 when required to inject into the RCS. This will also prevent water hammer, degraded performance, cavitation, and gas binding of the ECCS pumps, and reduce to the greatest extent practical the pumping of non-condensable gases (e.g., air, nitrogen, or hydrogen) into the reactor vessel following an SI signal or during shutdown cooling."*

> *"This Surveillance Requirement is met by:*
>
> - *VENTING the ECCS pump casings and VENTING or Ultrasonic Test (UT) of the accessible suction and discharge piping high points including the ECCS pump suction crossover piping (i.e., downstream of valves 3RSS*MV8837A/B and 3RSS*MV8838A/B to safety injection and charging pump suction). VENTING of the accessible suction and discharge piping high points including the ECCS pump suction crossover piping is required when gas accumulations exceed the gas accumulation limits. NOTE:*

Certain maintenance (e.g. ECCS pump overhaul) or other evolutions can cause gas or air to enter the ECCS. Venting of the affected portion of the ECCS is necessary for these evolutions.

- *VENTING of the non-operating centrifugal charging pumps at the suction line test connection. The non-operating centrifugal charging pumps do not have casing vent connections and VENTING the suction pipe will assure that the pump casing does not contain voids and pockets of entrained gases.*
- *Using an external water level detection method for water filled portions of the RSS piping upstream of valves 3RSS*MV8837A/B and 3RSS*MV8838A/B. When deemed necessary by an external water level detection method, filling and venting to reestablish the acceptable water levels may be performed after entering LCO Action statement 3.6.2.2 since VENTING without isolation of the affected train would result in a breach of the containment pressure boundary."*

There are no TRM Surveillance requirements regarding periodic venting requirements for the piping systems in question. Additionally, the Safety Functional Requirements Manual (SFRM) does not specifically address gas accumulation or system venting.

FSAR Section 6.2.2, CONTAINMENT HEAT REMOVAL SYSTEM, provides no specific mention of filling and venting the system piping and components. The System Design section describes the vortex suppression assembly in the Refueling Water Storage Tank (RWST) for the QSS suction lines and assurances of no vortex formation for the range of operating conditions. Vortex suppression is also provided for the suction of the RSS pumps by the design of the containment sump strainer, as confirmed by analysis and head loss testing. RSS Pump NPSH and pump suction line flashing margin have also been demonstrated under worst-case debris clogging scenarios through analysis and testing. Thus water is available to the suctions of the containment recirculation pumps under all design basis accident conditions. The 8" thermal expansion loops on the discharge side of the containment recirculation coolers will be maintained filled with borated water during normal plant operation. This will prevent air from becoming trapped in these lines during system filling after an accident in containment.

The Accumulators have provisions for sampling, filling, draining, venting and correcting boron concentration. No mention is made in FSAR Section 6.3.2.2.1, EMERGENCY CORE COOLING SYSTEM (ECCS) of venting and filling the downstream piping between the Accumulators and the Reactor Coolant System (RCS).

FSAR Section 6.3.2.2.3, ECCS – Pumps, does not mention venting and filling of the RHR, Centrifugal Charging and Safety Injection pumps and piping between the RWST and the RCS. No mention is made of venting and filling the RSS piping and pumps.

FSAR Section 6.3.2.5, ECCS - System Reliability describes that the ECCS has been designed and proven by analysis to withstand any single credible active failure during injection or active or passive failure during recirculation and maintain the performance objectives desired. The ECCS is designed with the ability for online testing of most components so the availability and operational status can be readily determined.

The FSAR contains a sufficient level of information stating 1) how ECCS system piping is maintained full of water where possible and 2) how elimination of potential air pockets would be accomplished. Changes to the FSAR as a result of the regulatory considerations of GL 2008-01 are not required.

A.1.2. Completed Changes Related to the Licensing Review

A Technical Evaluation (M3-EV-08-0026) has been completed and documented for MPS3 requiring the following activity.

The GL 2008-01 states TS Surveillance Requirements should be complete and address both the suction and discharge piping, when applicable, and the Bases for the TS Surveillance Requirements should be written to ensure the systems are *"sufficiently full of water."*

TS improvements are being addressed by the Technical Specifications Task Force (TSTF) to provide an approved TSTF Traveler for making changes to 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. Accordingly, the following activity is being tracked in the corrective action plan of the MPS3 Technical Evaluation M3-EV-08-0026:

> *This evaluation establishes monitoring of the status of the industry/NRC Technical Specifications Task Force (TSTF) Traveler that will be developed as a follow-up to GL 2008-01. Support of the industry and NEI Gas Accumulation Management Team activities regarding the resolution of generic TS changes via the TSTF Traveler process will continue at MPS3.*

A.1.3. Corrective Action(s) Related to the Licensing Review

Corrective action is in place to monitor the status of the TSTF Traveler described above (Corrective Action C.2).

A.2 Design Review:

This design review was documented through the completion of Technical Evaluation M3-EV-08-0026, addressing the considerations and regulatory requirements discussed in GL 2008-01. A summary of results from the design review with respect to gas accumulation for the piping systems that are described in Table 1 are included in the balance of this section.

A.2.1 Summary of Results from a Review of Design Basis Documents

There were no required changes or corrective actions identified for the in-scope review of design basis documents, other than completion of a Technical Evaluation to document the basis for response to GL 2008-01 at MPS3, that includes the description of results of related evaluations, the required and completed corrective actions and a basis for their schedule to complete. The review of previously existing design basis documents included system descriptions, calculations, engineering evaluations, vendor technical manuals and Piping and Instrumentation Drawings (P&IDs).

A.2.1.1 Review of System Descriptions

There were no required changes or corrective actions identified for the in-scope design basis system descriptions. The ECCS consists of the High Head Safety Injection System using the CHS, SIH, RHS, SI Accumulators, RSS and RWST, including the associated piping, valves, instrumentation, and other related equipment. System descriptions are summarized in Table 2.

Table 2: System Description Summary
Accumulator Injection System
The four (4) safety injection Accumulators are pressure vessels partially filled with borated water and pressurized with nitrogen gas. All the tanks and piping are located inside the containment structure and connect to the RCS cold legs (4). During normal operation each Accumulator is isolated from the RCS by two check valves in series. Should the RCS pressure fall below the Accumulator pressure, the check valves open and borated water is forced into the RCS. One Accumulator is attached to each of the four cold legs of the reactor coolant system. Mechanical operation of the swing disc check valves is the only action required to open the injection path from the Accumulators to the core via the cold leg. During the operating cycle, if any of the Accumulators need to have water added due to level decreases, borated water is added by a pump and flow path directly to the Accumulators. This utilizes the safety injection pumps to add the water to the Accumulators and minimizes flow through the Accumulator check valves, which helps prevent check valve seat leakage. The pump has a gas filled discharge pulsation dampener, however, gas leakage from the dampener into the fluid system would be pumped into the Accumulator which is a partially gas filled vessel so any additional gas void would have no impact on its operation.
High Head Injection System
The high head (high pressure) safety injection system utilizes the three (3) Chemical Volume and Control System (CVCS) charging pumps (High Pressure Safety Injection (HPSI) is the ECCS function of the CVCS Charging pumps). When aligned in the ECCS mode the Charging Pumps take suction directly from the RWST and discharge directly into the RCS cold legs. The Charging pumps perform two functions with respect to plant operations. In normal mode, the pumps serve the CVCS system and provide normal charging (makeup) flow to the RCS cold legs while taking suction from the VCT. When in the ECCS High Pressure Safety Injection mode the system is realigned such that the pumps take suction directly from the RWST and inject the water into the RCS at the cold leg high pressure safety injection points. In the event of an accident, the charging pumps are started automatically and are automatically aligned to take suction from the RWST during injection. During the ECCS mode the pumps take suction from a common supply header connected to the RWST. The pumps discharge to a common discharge line that is then separated into four injection lines which each connect to one of the four RCS cold legs. Flow rates for this system are low but the discharge pressure is high, providing the capability to maintain coolant inventory at high system pressure. Each centrifugal charging pump is a multistage centrifugal diffuser design (barrel-type casing) with vertical suction and discharge nozzles. During the recirculation phase the suction to the three pumps is realigned to take suction from the containment recirculation pump discharge lines, which take their suction from the containment sump. The CVCS system is normally in service to provide letdown and makeup flow for the RCS with one pump train in service and the other pump train in standby. This operation maintains the pump suction and discharge header piping full and vented during CVCS operation and ensures the common piping between CVCS and ECCS is maintained full and vented for ECCS required operations. The normal function of the CVCS Charging system to provide RCS letdown and makeup for reactivity and chemistry control is not included in the GL 2008-01 scope of systems.

Intermediate Pressure Safety Injection System

The SI pumps consist of two pumps that are automatically started on an SIS signal. The pumps take suction from a common supply header connected to the RWST. The pumps discharge to a common discharge line that is then separated into four injection lines which connect to one of the four RCS cold legs. The Safety Injection System is maintained full of water and has the static head of the RWST on the system from the RWST to the RCS cold leg injection check valves. The system is designed to supply intermediate pressure safety injection in the event of an ECCS actuation. During the recirculation phase of a Loss of Coolant accident the suction water to the pumps is provided from the containment recirculation pump discharge piping. The containment recirculation pumps take their suction from the containment sump. The system also supplies injection flow to the RCS hot legs during the hot leg recirculation mode of operation and has the capability to be utilized to fill the Safety Injection Accumulators.

Residual Heat Removal System (RHS)

RHS is maintained full of water. In its normal mode of operation it functions to provide cooling of the RCS decay heat during plant shutdowns. When actuated to meet its ECCS function it draws water directly from the RWST and pumps it into the RCS cold legs. The RHS system consists of two trains with each train containing a pump and residual heat exchanger. In Modes 4, 5, and 6 the pumps are aligned to take suction from the RCS. The RHS system transfers heat from the RCS to the component cooling system to reduce the temperature of the RCS to the cold shutdown temperature at a controlled rate during the second part of normal plant cooldown or a safety grade cold shutdown, and maintains this temperature until the plant is restarted. The RHS system may be used to transfer refueling water between the refueling cavity and the RWST at the beginning and end of the refueling operations. Parts of the RHS also serve as parts of the ECCS during the injection phase of a LOCA. When utilized as part of the ECCS it is considered a Low Head Injection System (LHIS). The pumps discharge pressure is low but flow rate is high. Each Residual Heat Removal (RHR) pump is a single stage vertical position centrifugal pump. Both pumps are aligned to take suction from a common supply header connected to the RWST in Modes 1, 2 and 3. The RHR pumps suction source comes from the RCS hot leg during the decay heat removal mode of operation. Each RHR pump discharge line connects to its respective RHS heat exchanger. Each RHS discharge line connects to two RCS cold legs in the ECCS mode of operation. The RHR pumps are started automatically on receipt of a SIS signal. The pumps deliver water to the RCS cold legs from the RWST during the injection phase. A portion of the RHS is also utilized for recirculation for long term core cooling following an accident. This system also has an alternate discharge path that allows for the pumps to discharge into two of the RCS hot legs. This flow path is administratively controlled and is not utilized as the normal ECCS flow path.

Quench Spray System (QSS)

The quench spray system is one of two systems that provide for containment heat removal. The containment heat removal systems are designed to reduce the containment pressure following a break in either the primary or secondary piping system inside the containment. Heat is transferred from the containment atmosphere to the quench spray system spray water. The system consists of two pumps that discharge to two parallel 360 degree spray headers. Each pump independently takes suction from the RWST. A vortex suppression assembly is installed in the RWST at the quench spray suction lines to eliminate vortex formation. The quench spray pumps are automatically tripped at the RWST empty level, which is set such that with allowance for negative instrument error, vortex formation does not occur. Each quench spray pump is capable of supplying approximately 4,000 gpm of borated water solution to the two 360 degree quench spray headers located in the dome of the containment structure. The quench spray pumps are located in the Engineered Safety Features (ESF) building adjacent to the containment structure. The quench spray system is maintained full of water from the RWST through the pumps up to the containment isolation valves. The two spray headers inside containment are maintained full to the height of RWST level.

Containment Recirculation Spray System (RSS)

The containment RSS is one of two systems that provide for containment heat removal. The containment heat removal systems are designed to reduce the containment pressure following a break in either the primary or secondary piping system inside the containment. Heat is transferred from the containment atmosphere to the RSS spray water which then transfers the heat to the service water system. Each of the two RSS subsystems consist of two containment recirculation coolers and pumps which share two 360 degree spray headers. Each RSS spray header is fed by two risers, each riser running from one of the containment recirculation coolers in each of the subsystems. The two pumps in each subsystem are connected to different spray headers. The four RSS pumps take suction from a common containment sump. All four containment recirculation pumps and motors are located outside the containment structure in the ESF building. The pumps are vertical deep well type, each mounted in a separate stainless steel well casing. The pumps are located adjacent to the containment structure at an elevation sufficiently below the containment structure sump to ensure adequate available net positive suction head (NPSH). The RSS pumps are started automatically on RWST Low Low Level signal coincident with a containment depressurization actuation signal. When the RWST level is reduced the system can be manually realigned such that two of the RSS pumps will supply recirculated water to the suction headers of the safety injection and charging pumps. The containment recirculation coolers are conventional shell and tube heat exchangers with containment recirculation water flowing through the shell, where the water is cooled by service water flowing in the tubes.

A.2.1.2 Review of Design Basis Calculations

There were no required corrective actions identified as a result of review of calculations. DNC reviewed calculations which addressed the adequacy of NPSH to the QSS pumps, head loss across the containment recirculation sump screen during recirculation, minimum NPSH for each ECCS pump (Charging, Safety Injection (SIH), RHR pumps), and the margin between available NPSH and required NPSH for conditions during the injection phase from the RWST. Vendor Technical Manuals reviewed included QSS, RSS, CHS, and SI/SIH system pumps and their general guidance on priming and venting, self venting, or end vent connection characteristics.

A.2.1.3 Review of System Piping and Instrumentation Drawings (P&IDs)

A review of the applicable P&ID's has determined the following information regarding system vent valves in the normal system flow paths. Vent valve locations in the ECCS, QSS and RSS piping systems outside of containment are strategically located for effective system fill and vent and operational venting. There are also a large number of vent valve locations installed inside containment that can be utilized. A summary of the vent valves is identified in Table 3.

Qty	Table 3: Vent Valve Location	
	Low Pressure Safety Injection	
1	3-SIL*V875	Pump 3-RHS*P1A suction piping
2	3-RHS*V15, V973	Pump 3-RHS*P1A discharge piping
1	3-RHS*V976	Pump Seal Cooler vent
2	3-RHS*V991, V990	Residual Heat Exchanger vent
2	3-RHS*V969, V967	discharge piping
2	3-SIL*V934, 3-SIL*V877	discharge piping
1	3-SIL*V992	cross connect to charging piping
3	3-SIL*V937, V927, V926	discharge piping inside containment
1	3-SIL*V876	Pump 3-RHS*P1B suction piping
2	3-RHS*V32, V971	Pump 3-RHS*P1B discharge piping
1	3-RHS*V977	Pump Seal Cooler vent
2	3-RHS*V989, V988	Residual Heat Exchanger vent
2	3-RHS*V965, V974	discharge piping
1	3-SIL*V935	discharge piping
2	3-SIL*V939 and 3-SIL*V938	discharge piping inside containment
4	3-SIL*V945, V946, V947, V948	Accumulator discharge piping inside containment
	Low Pressure Safety Injection / CTMT Recirculation	
1	3-RSS*V905	Pump casing to discharge pipe vent
1	3-RSS*V962	discharge piping
1	3-RSS*V62	CTMT Recirc Cooler vent
2	3-RSS*V953, V992	discharge piping inside containment
1	3-RSS*V901	Pump casing to discharge pipe vent
1	3-RSS*V961	discharge piping
1	3-RSS*V63	CTMT Recirc Cooler vent
2	3-RSS*V952, V993	discharge piping inside containment
1	3-RSS*V913	system cross connect piping
1	3-RSS*V903	Pump casing to discharge pipe vent
1	3-RSS*V959	discharge piping
1	3-RSS*V66	CTMT Recirc Cooler vent
2	3-RSS*V951, V994	discharge piping inside containment
1	3-RSS*V899	Pump casing to discharge pipe vent
1	3-RSS*V958	discharge piping
1	3-RSS*V67	CTMT Recirc Cooler vent
2	3-RSS*V950, V995	discharge piping inside containment
1	3-RSS*V15	system cross connect piping

Qty	Table 3: Vent Valve Location	
	High Pressure Safety Injection	
1	3-SIH*V964	suction piping strainer vent
2	3-SIH*V871, V872	Pump 3-SIH*PIA casing vent
2	3-SIH*V875, V877	discharge piping
7	3-SIH*V856, V857, V858, V859, V860, V861, V967	discharge piping inside containment
1	3-SIH*V963	suction piping strainer vent
2	3-SIH*V873, V874	Pump 3-SIH*PIB casing vent
1	3-SIH*V130	system cross connect piping
1	3-SIH*V792	vent on 3-SIH*P1A discharge piping
	QSS and Hydrogen Recombiner	
1	3-QSS*V969	Pump 3-QSS*P3A casing vent
1	3-QSS*V934	pump discharge piping
1	3-QSS*V951	discharge piping
2	3-QSS*V950, V973	discharge piping inside containment
1	3-QSS*V968	Pump 3-QSS*P3B casing vent
1	3-QSS*V949	discharge piping
2	3-QSS*V948, V972	discharge piping inside containment
	Chemical & Volume Control	
1	3-CHS*V276	Charging Pump 3-CHS*P3A suction piping
1	3-CHS*V277	Charging Pump 3-CHS*P3C suction piping
1	3-CHS*V278	Charging Pump 3-CHS*P3B suction piping
3	3-CHS*V675, V676, V679	system cross connect piping
2	3-CHS*V948, V623	Train A, gravity boration line
2	3-CHS*V949, V886	Train B, gravity boration line
8	3-CHS*V590, V589, V476, V477, V630, V631, V471 and V475	discharge piping

A.2.2 Applicable Gas Volume Acceptance Criteria

Froude numbers (N_{Fr}) between 0.35 and 0.70 have been used as the limits for dynamically sweeping air from a horizontal pipe through a vertically downward oriented pipe. For example, for flows with $N_{Fr} < 0.35$, no gas will transport with the flow vertically down a pipe. In this case, the accumulated gas would all tend to stay in the high point of the horizontal piping, if the end of the horizontal run turned vertically downward. If the end of the horizontal run turned vertically upward, some of the gas would transport vertically upward with the flow and some would remain in the high point.

For flows with $N_{Fr} > 0.55$ but < 0.70, all accumulated gas would transport to the end of the horizontal run and transport vertically upward, if the end of the horizontal run turned vertically upward. If the end of the horizontal run turned vertically downward, some of the gas would be transported downward and some would remain in the vertically down turning elbow.

For flows with $N_{Fr} > 0.70$ all accumulated gas in the horizontal high point will be transported with the flow, whether the end of the horizontal run turns vertically upward or downward.

The above Froude number values for the flows in the various piping systems are used to evaluate the ability of the flow rates to transport gas through system piping during operational scenarios, as well as to determine the effectiveness of a system flow "sweep" to remove residual gas (air) from the piping after filling and venting, and prior to returning the system to service.

A.2.2.1 Pump Suction Piping

ECCS and water filled portions of the RSS are monitored on a monthly basis utilizing UT. The UTs are performed at each high point horizontal run on at least a monthly basis in accordance with the requirements of TS surveillance 4.5.2.b.

A 5% void criteria is used as acceptance criteria for the high point horizontal pump suction piping runs. This was concluded to prevent the pumped fluid void fraction from exceeding a 5% limit. This limit is only applicable for the small size suction lines (i.e., eight inch diameter and smaller) of the Charging and SIH pumps (high head injection system and safety injection system pumps). Testing for MPS3 specific piping geometry has demonstrated that gas voids transported towards the suction of the high head injection and the safety injection pumps tend to collect in the ten inch diameter suction lines until a critical volume is achieved, then the gas void is metered out into the pump suction inlet with a void fraction rate less than 2%. Since the velocity of smaller lines (i.e., eight inch and less) is greater than the ten inch lines, the gas in the smaller lines will be transported at a faster rate than the gas that collects in the ten inch lines (i.e., gas voids travel with the fluid in the small lines).

For the RHR pumps, a one time gas ingestion of 9 standard cubic feet was used as acceptable criteria as this volume is approximately three quarters of the total pump casing volume. This acceptance criteria for one time gas ingestion was established in consultation with an established industry expert for this specific application.

When gas voids were present in pump suction lines, the pumps were evaluated to ensure the gas would not accumulate within the pumps due to low flow rates (e.g., less than approximately 30% best efficiency point per NUREG/CR 2792).

Pump suction piping has been designed and equipped with vent valves to enable adequate venting upon system return to service and to allow venting if required during monthly piping surveillances to ensure that the piping is full. As part of the GL 2008-01 review, additional high points have been identified since some piping has been found to be sloped. Corrective action plans are underway at MPS3 to install vent valves at these locations or verify that piping can be dynamically swept (Corrective Action C.8).

Based on recent information available through reviews initiated from GL 2008-01, MPS3 is evaluating recent industry guidance including Pump Interim Gas Ingestion Tolerance Criteria developed by the Pressurized Water Reactor Owners Group (PWROG), PA-SEE-450 Task 2, for use in evaluating GL 2008-01 and will update the TS Surveillance Procedure acceptance criteria following this review (Corrective Action C.7).

A.2.2.2 Pump Discharge Piping

The acceptance criteria for pump discharge piping small lines (eight inch and less) was based on a maximum void fraction on any horizontal run of 25%. For larger pump discharge pipe lines the allowable void fraction in any horizontal run was set equal to 10%. The subject piping systems were designed and evaluated for water hammer effects due to transients such as pump start, check valve slam, etc. (without gas voids). With respect to piping and support analysis, the identified water hammer loads are combined by the square root sum of the squares method with seismic loads. Adequate margin was considered to be available in the piping and pipe support systems to accommodate the transient loading due to a pump start with the above described voids. However, the above evaluation did not specifically address the impact on relief valve lift. The relief valves are designed to lift and close, therefore they are considered adequate for the existing limits. A historical review of system operation indicates the relief valves have not been challenged due to the existence of gas voids creating pressure transients. The existing system fill and vent procedures have been used to minimize the existence of gas voids.

Pump discharge piping has been designed and equipped with vent valves to enable adequate venting upon system return to service and to allow venting if required during monthly piping surveillances to ensure that the piping is full. As part of the GL 2008-01 review, additional high points have been identified since some piping has been found to be sloped. Corrective actions are underway at MPS3 to install vent valves at these locations or verify the piping can be dynamically swept. The corrective actions are provided in Section C.8.

During the current operating cycle, gas accumulation was discovered in the safety injection pump discharge piping header during routine monthly surveillance. This accumulation has been determined to be a result of back-leakage from the Accumulator tanks. The nitrogen saturated Accumulator fluid degasses after passing through a valve when a significant pressure drop exists. In order to limit gas accumulation to an acceptable volume, more frequent monitoring has been instituted and venting has been scheduled on a weekly basis. Corrective actions are ongoing in the fall 2008 RFO. The corrective actions are described in Section A.4.1.

Based on information available through reviews initiated from GL 2008-01, MPS3 plans on adopting the more stringent pump discharge pipe void limits. Initial screening has resulted in smaller allowable gas voids than previously considered to be acceptable (Corrective Action C.7).

A.2.2.3 RCS Allowable Gas Ingestion

Prevention of pumping non-condensable gases (e.g., air, nitrogen or hydrogen) into the reactor vessel following a Safety Injection Signal or during shutdown cooling is addressed in the MPS3 Technical Specification Bases. Injection is directed to the cold legs. If the RCS is intact, the gas will be transported to the reactor vessel. Once the gas reaches the reactor vessel, it will tend to accumulate in the upper plenum and reactor vessel head due to the reactor vessel configuration and the reduced flow rates of ECCS injection, relative to normal power operation flow rates. If there is a break, the gas may be transported to the break and may exit out of the break. While good operating practices demand limiting gas accumulations in the RCS and reactor vessel, a gas volume approaching the volume of the upper plenum and the reactor vessel head would have to be present before natural circulation cooling would be adversely impacted. The volume of the upper plenum and upper head above the hot leg is estimated at 980 ft^3. A gas volume of approximately 150 ft^3 in one steam generator would be necessary to interfere with reactor coolant flow through the steam generator tubes. A conservative limit of 150 ft^3 of transportable non-condensable gas into the reactor vessel has been used at MPS3. This is about 15% of the upper plenum and reactor vessel head volume. This compares favorably to the acceptance criteria developed by Westinghouse for the PWROG in support of GL 2008-01, as summarized below:

1. For the high pressure system piping, an initial sum total of 5 ft^3 of gas at a system pressure of 400 psia and ambient temperature of 68 °F (or 173.2 ft^3 at 14.7 psia and 212 °F).
2. For the low pressure system piping, an initial sum total of 5 ft^3 of gas at a system pressure of 100 psia and ambient temperature of 68 °F (or 43.3 ft^3 at 14.7 psia and 212 °F).

A.2.3 Modifications Status

No new vent locations or other modifications were determined necessary to comply with the MPS3 licensing or design basis or to maintain system operability as a result of design or drawing review. Several new vent locations are proposed as enhancements to improve the ability to fill, vent, and manage a potential gas intrusion mechanism. These are included in the corrective action plan as enhancements to the system design (Corrective Action C.8).

A.2.3.1 Related Action Completed - Accumulator Check Valve Leakage

A Root Cause Evaluation previously identified that due to SI Accumulator check valve leakage, and subsequent off-gassing of the fluid, a pocket of gas accumulates in the SI piping at Containment Penetration 98, for SI pumps discharge to cold legs. As a corrective action, UT is periodically performed at this location. The piping does not have a vent valve located outside of containment to vent off the gas void, so venting is performed using a vent valve inside containment.

MPS3 is currently managing the gas intrusion mechanism of Accumulator inventory back-leakage into the SIH common discharge header. The condition has been evaluated for operability, with corrective actions and compensatory measures implemented. In February 2008, the completed actions resulted in:

- the installation and closure of a manual isolation valve, isolating the Accumulator Fill Header from the Loop 3 injection check valve test valves;
- installation of a vent valve in the pipe upstream of the 3SIH*P1A discharge check valve, which allows venting of a gas void trapped at that location; and,

In April 2008, the completed actions resulted in:

- the installation of a Accumulator Fill Pump to allow filling Accumulators without running SIH pumps, and unseating RCS injection check valves. The Operating Procedure was changed to fill the Accumulators with the fill pump, rather than running SIH pumps.

- MPS3 modified the SIH Pump Operability Surveillance Tests to keep the SIH Pump discharge isolation valves shut during pump runs to eliminate pressurizing the SIH injection header and unseating check valves.

A.2.4 Results from Walkdowns

Walkdowns will continue at MPS3 during the fall 2008 refueling outage, as previously discussed during the three month response to the GL 2008-01. UT inspections of several local high points identified during outside containment walk-downs will be performed to confirm assumed limited gas pockets that were previously evaluated are bounding.

SER 2-05, Rev. 1 recommended simple one-line isometrics be developed to aid in the review process. In response, 3-dimensional computer aided design piping isometrics were constructed both inside and outside containment. These 3-dimensional CAD drawings were used in support of walkdowns conducted outside containment and will be utilized for inside containment walkdowns.

A.2.4.1 Inside Containment

The flow path of the piping located inside containment was reviewed by evaluating drawings and isometrics. Each line was reviewed for line slope, existing vent valve locations, pipe diameter transitions and locations that contribute to gas accumulation. Walkdowns of in-scope areas are scheduled during the refuel outage 3R12 (fall 2008) to verify specific configurations, confirm the adequacy of gas accumulation management plans and to determine the corrective actions necessary. Specifically, the following walkdowns are to be performed:

- Accumulator Injection System, piping from Accumulator outlet to RCS cold legs.
- High Pressure Safety Injection, piping from Containment Penetration (51) to the RCS cold legs.
- Safety Injection, piping from Containment Penetration (98) to the RCS cold legs.
- RHS / LPSI supply piping from Containment Penetrations (93, 94) to the RCS cold legs.
- RHS, suction piping from the RCS hot legs to Containment Penetrations (91, 92).

QSS and RSS piping located inside containment does not require walkdowns as the piping is directly vented to the containment atmosphere through the spray header nozzles. The piping between the containment sump and the RSS spray pump is self filling and venting due to the piping configuration and the pump vent configuration.

A.2.4.2 Outside Containment

Walkdowns outside containment were performed during the MPS3 operating cycle 12. The pipe runs examined consisted of suction piping from the RWST and the containment sump to the ECCS, QSS and RSS pumps and the main discharge piping from each pump to the various Containment Penetrations. Piping slope measurements were obtained using a digital Zip level.

The evaluation identified some piping segments in which new vent valve installations would improve the ability to manage gas accumulation. These are incorporated into the corrective action plan item C.8. The planned vent additions follow:

Corrective Action	Location
Corrective Action C.8.a:	Penetration 98
Corrective Action C.8.b:	Penetration 94 Penetration 96 Penetration 97
Corrective Action C.8.c:	Piping adjacent to 3CHS*HCV190B
Corrective Action C.8.d:	Charging Pump suction piping from RWST
Corrective Action C.8.e:	Procedure Changes to do dynamic sweep: 3CHS*P3A Alternate recirculating piping 3CHS*P3C Alternate recirculating piping

A.3 Test Evaluation

The technical evaluation utilized available industry guidance to assess the design function of the in-scope systems for gas intrusion mechanisms. Dominion Nuclear Connecticut, Inc. (DNC) has concluded in-scope MPS3 systems are operable. Engineering activities will continue to further develop acceptance criteria for monitoring program development in the CAP. Corrective actions are provided in Section C. A summary of conclusions associated with the evaluation is provided in Section A.4.

The evaluation of testing identified additional new corrective actions described in Section C of this attachment. Procedures have been implemented at MPS3 to verify portions of the ECCS (piping) remain sufficiently filled with water during the operating cycle. This testing is based upon TS Surveillance Requirement 4.5.2.b.1, which requires periodic monitoring of ECCS piping to ensure the evaluation acceptance criteria are met. The existing UT surveillances and the associated void limits utilized by MPS3 are concluded to maintain system operability. The existing limits, considering the piping system design and analysis, provide adequate assurance that piping and pipe supports are designed to accommodate transient loadings due to system void sizes used in MPS3 surveillance procedures for gas monitoring. Calculations performed using the conservative methodology in Fauske and Associates Report FAI/08-78 predicted some relief valve lift for void size limits currently utilized. However, the relief valves are designed to lift and close, therefore, they are considered adequate for the existing limits. Relative to pumps, the 5% void criteria continues to support design function for the MPS3 centrifugal pumps for short term ingestion. Based on previous vendor evaluation, RHR pumps can accommodate a single large void volume ingestion equal to the approximate volume of the pump volute. A conservative RCS vessel gas transport limit has been established and MPS3 anticipates continued use of this limit. Therefore, the existing criteria in use for evaluating gas intrusion are considered appropriate for the purposes of demonstrating ECCS and RSS design function. The criteria will be reviewed and revised as required to improve margins (Corrective action is provided in Section C.7).

A review of existing procedures and instructions described below was performed to evaluate system fill and vent evolutions.

- Instructions are provided to gravity fill each Quench Spray header from the RWST outlet through the pumps to the containment isolation valves and in containment the risers are filled to RWST level.

- Gravity fills and vents are performed of the QSS from the RWST through the Quench Spray pumps up to the containment isolation valves.
- Procedures are provided on filling and venting the charging pumps after maintenance. Procedure guidance fills and vents the pump and the suction and discharge lines between the pump suction and discharge isolation valves.
- Procedures are provided for obtaining measurements of gas accumulation in the gravity feed boration lines using UT equipment.
- Procedures are provided to vent the A and B gravity feed boration line if gas accumulation is identified by surveillance.
- Procedures provide instructions to verify the Containment RSS loop seals and RSS to ECCS cross connect is full of water utilizing UT equipment.
- A surveillance procedure provides instructions to verify the High Pressure Safety Injection (Charging Pumps) system pumps and piping are full of water. The verification is performed utilizing ultrasonic examination of identified piping locations. If gas accumulation is found the procedure provides direction to vent the applicable piping sections.
- A surveillance procedure provides instructions to verify the RHR pumps and piping are full of water by UT measurements at designated points. This procedure was developed to meet TS 4.5.2.b.1.
- An operating procedure provides instructions on Train A and Train B RHS system restoration by filling, venting and subsequent sweeping.
- Surveillance procedures provide instructions to operate the RHR pumps on recirculation flow in Modes 1, 2, 3 or 4 and at a flow of 4000 gpm when in Modes 5,6 or 0.
- Procedures provide instruction to operate the Quench Spray pumps while recirculating flow back to the RWST at a flow rate of > 4000 gpm.
- A procedure provides instructions to fill and vent the High Pressure Safety Injection system piping and to verify the system is full of water by performing UT measurements of identified piping locations.
- An operations procedure provides instructions for filling the Accumulator tanks and venting of the injection piping following back-leakage from the Accumulators.
- A surveillance procedure provides instructions for flow testing the High Pressure Safety Injection (Charging) pumps when aligned with pump suction from the RWST and discharging to the four RCS cold legs.
- A surveillance procedure provides instructions to operate the Safety Injection pump 3SIH*P1A on min flow recirculation from the RWST through the pump back to the RWST.
- A surveillance procedure provides instructions to operate the Safety Injection pump 3SIH*P1B on min flow recirculation from the RWST through the pump back to the RWST.

- A surveillance procedure provides instructions for full flow testing the Safety Injection pumps (3SIH*P1A/P1B) and piping from the RWST to the RCS cold leg injection locations and the RCS hot leg injection locations.

- A surveillance procedure provides instructions for flow testing the Charging pumps recirculation flow and RCP seal supply flow when the charging pumps are aligned for normal operation.

- An operations procedure provides instructions for restoration and fill of reactor coolant loops utilizing charging system, the refueling cavity or a vacuum assist method.

MPS3 does not currently have specific fill and vent procedures for all piping and pump sections on QSS, RSS and ECCS. Where a specific procedure does not exist, MPS3 has developed an operating procedure that provides guidance for system piping/component filling evolutions using a detailed plan when specific procedure for filling and venting is not available. The detailed plan is developed based upon the system/component tagout boundaries and the sections of piping that require filling and venting. The detail plan includes items such as reference to tagging clearances or restorations, applicable procedures, warnings, cautions and notes, contingency actions if necessary and how to document completion of filling and venting. The plan is then independently reviewed by a Senior Reactor Operator (SRO), with discussions and corrections made as necessary. Prior to actual implementation, a pre-job briefing of individuals involved in the evolution is completed. Once the detailed plan has been worked and the system/component has been filled and vented the completed form is returned to work control.

All pipe sections/components drained for maintenance work are refilled and vented as much as practicable based upon the applicable procedure. Additionally, when available and practical, system piping sections are dynamically swept utilizing the system pumps and normal flow paths prior to returning the system to normal service. This process has been established to ensure any maintenance performed does not result in unacceptable gas intrusion in the subject systems.

A.4 <u>Summary of Evaluation Conclusions</u>

A summary of conclusions reached by the Evaluation of GL 2008-01 for MPS3 is included in this section. The completed corrective actions are provided in Section B. Corrective actions identified in response to the GL 2008-01 are in Section C.

A.4.1 Accumulator Injection System

Since this system is located totally within the containment structure, corrective actions related to GL 2008-01 require that system walkdowns be performed during 3R12 (fall 2008), and the results evaluated against the GL 2008-01 criteria. It is known that the Accumulator system is currently a source of gas intrusion into the SI system piping through back-leakage of several check valves. Several known leaking check valves are scheduled to be worked during 3R12.

Regarding the condition of check valves back-leakage in this system, corrective actions are in place. Completed corrective actions for this condition are described in Section A.2.3.1. Corrective actions scheduled for the back-leakage include the following activities:

a. replacement of check valves 3SIH*V022 (SI Pump Discharge to Cold Leg Check Valve) and 3SIH*V028 (SI Pump Discharge to Cold Leg Check Valve) with spring assist lift check valves (installation in 3R12)
b. installation of manual isolation valves for the A, B, and D test headers (installation in 3R12)
c. expansion of existing program and procedures to establish the following criteria (Corrective Action C.7):
   - UT inspection of SIH common discharge piping at Containment Penetration 98 at least every 31 days
   - acceptance criteria to allow gas to be controlled at SIH Containment Penetration 98, and RHS gas collection points 3RHS*V877 (A Train Vent Valve) and 3RHS*V975 (B Train Vent Valve)
   - the implementation of Action Limits to change UT inspection frequency based on gas accumulation rates
   - procedural guidance to vent gas at Containment Penetration 98, and at RHS Vent Valves 3RHS*V877 and 3RHS*V975 to prevent gas accumulations greater than the new surveillance acceptance criteria
   - procedural guidance to monitor for gas accumulation after running an SIH or RHR pump

A.4.2 Quench Spray System

QSS is maintained full from the RWST to an equivalent level in the piping headers located inside containment. The quarterly pump operability surveillances ensure adequate water volume is pumped through suction and discharge (up to the recirculation connection) piping at a velocity to adequately sweep the system piping. There are no identified gas intrusion mechanisms for this system. It is therefore concluded this system is free of potential gas voids in accordance with GL 2008-01. Walkdown of the piping located in containment is not required.

A.4.3 Containment Recirculation System

The RSS system piping is not maintained water filled by design, excluding the ECCS cross connect piping. The pump and piping fill and self-vent during the course of the loss of coolant event and initial system operation. A one inch diameter pump casing vent line is installed on each RSS pump casing to ensure the RSS pumps are water filled prior to pump start. The system will only actuate based upon specific actuation signals which will ensure there is adequate water available. In summary, the Containment RSS, with the exception of the RSS to ECCS cross connect piping, does not require a review to ensure it is free of potential gas voids in accordance with GL 2008-01.

A.4.4 Residual Heat Removal System

When in shutdown cooling mode, the velocity of the fluid in the piping is adequate to dynamically vent the piping of any accumulated gas. An Operations surveillance performed during refueling outages tests the system in its ECCS lineup. When in the ECCS lineup, the velocity is adequate to dynamically vent the piping of any accumulated gas. Since the system is maintained at a relatively low pressure and there are no gas intrusion mechanisms, RHR meets the requirements of GL 2008-01. The RHR system is monitored by surveillance to ensure the piping is full of water. There is one known and monitored location for gas accumulation to occur when the "A" pump is operated on its minimum recirculation flow. The gas is collected in a high point in the suction piping and vented using an available high point vent. The surveillance criteria for gas collection in this location ensures system operability for this condition. There are sections of piping for RHR located in containment. Walkdowns of this piping are required to occur in the fall 2008 refueling outage (3R12) as described in the three month response. The results of those walkdowns will be evaluated against the requirements of GL 2008-01 and the Technical Evaluation.

A.4.5 Safety Injection System

The SI system has several known locations for gas accumulation. These locations are routinely checked by a surveillance procedure. The system is also susceptible to gas intrusion from the Accumulator system. Back-leakage through several check valves allows nitrogen saturated Accumulator fluid to leak back into the lower pressure safety injection piping. When at the lower pressure the nitrogen saturated fluid off-gasses and produces pockets of nitrogen. When identified, pockets of nitrogen are vented off through existing system vent valves. A vent valve is scheduled to be installed during 3R12 (fall 2008) at Containment Penetration 98. Installation of this vent valve will allow venting of that pipe section without the need for containment entry. During refueling outages the system is flow tested at ECCS flow rates. This flow rate in the normal system piping is acceptable to dynamically vent the system piping of accumulated gas. There are only two sections that the velocity is not high enough to adequately dynamically vent the lines. One location is in the 24-inch common suction line from the RWST, and the other is in the piping section that connects to RCS and is the common safety injection point for the Accumulators. The system piping outside of containment has been reviewed by Technical Evaluation for potential gas pockets, and one location has been identified which will be evaluated by ultrasonic measurement. Once ultrasonic measurements results are obtained (during 3R12) that pipe section will be evaluated for further corrective actions. There are sections of system piping located inside containment. Walkdowns of this piping are scheduled for 3R12. The results of the walkdowns will be evaluated against the requirements of GL 2008-01 and documented in a revision to the Technical Evaluation and the supplement letter in January 2009, as discussed in the three month response to GL 2008-01.

A.4.6 High Pressure Safety Injection (Charging Pumps) System

The pumps are tested in their ECCS alignment during refueling outages by a surveillance procedure. This procedure tests the pumps and their suction and discharge piping but does not flow water through the minimum flow recirculation line back to the RWST. A corrective action is scheduled for a procedure change to flow water through the recirculation line to ensure is it adequately filled and vented. Corrective Action is provided in Section C.4. Flow through this line is adequate to dynamically vent the line of accumulated gas back to the RWST. The system walkdowns identified one discharge piping section and one section on suction piping that have high points without effective vent valves. Corrective action is in place to install vent valves at both locations (Corrective Actions C.8.c and C.8.d). There are sections of system piping that are located in containment. Walkdowns of this piping are required by corrective action to occur in 3R12. The results of the walkdowns will be evaluated against the requirements of GL 2008-01 and the Technical Evaluation.

A.4.7 CVCS (Charging Pumps) System

The system is included in this evaluation due to the ECCS function as a HPSI system. This system is also known to accumulate gas in the Boric Acid gravity feed boration lines. These locations have been identified and are being ultrasonically tested (UT) on a periodic basis by surveillance procedure, and when necessary, vented to purge the accumulated gas. For further system information see the HPSI (Charging Pumps), Section A.4.6.

B. COMPLETED CORRECTIVE ACTIONS RELATED TO EVALUATION

The DNC Corrective Action Program (CAP) is used to document gas intrusion/accumulation issues as potential nonconforming conditions. Existing procedures for the affected systems require a Condition Report to be initiated, and the Shift Manager notified if unexpected accumulations of gas volume are discovered. As part of DNC's CAP, Condition Reports related to plant equipment are evaluated for potential impact on operability and reportability. Therefore, DNC's review has concluded that issues involving gas intrusion/accumulation will continue to be properly identified, prioritized and evaluated under the CAP.

The gas monitoring program on MPS3 addresses the requirements discussed in GL 2008-01. MPS3 continues to refine its program to ensure continued compliance with quality assurance criteria in Section 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 of GL 2008-01.

The existing acceptance criteria in place for the MPS3 evaluation of GL 2008-01 considerations and potential adverse conditions on in-scope systems, structures or components has been evaluated and assessed appropriate based upon historical results and empirical testing documented in the completed Technical Evaluation.

C. CORRECTIVE ACTIONS AND SCHEDULE:

C.1 DNC is monitoring the results of industry testing and analytical programs related to gas accumulation and pump suction acceptance criteria. DNC will evaluate the results of industry testing and analytical efforts to determine if additional changes to licensing basis documents are required.

Schedule: Effective immediately, and ongoing.

Existing acceptance criteria in place for Millstone is considered conservative, based upon historical results and empirical testing documented in the technical reviews.

C.2 DNC will monitor the status of the industry/NRC Technical Specifications Task Force (TSTF) Traveler that will be developed as a follow-up to GL 2008-01. Following NRC approval of this TSTF Traveler, DNC will evaluate adopting the TSTF recommendations.

Schedule: This activity has been incorporated into activities required by the evaluation of the GL 2008-01 for MPS3 and is tracked by this corrective action.

The corrective action will establish monitoring of the status of these activities.

C.3 UT verification of approximately 13 local high points identified during outside containment walk-downs will be performed to determine if gas voids exist. As-found conditions from UT will be utilized to validate limiting assumptions of void volumes from the plant walk-downs.

Schedule: Complete prior to the end of the fall 2008 refueling outage

UTs will be performed during the current fall 2008 refueling outage.

C.4 Operations procedures credited to dynamically sweep piping systems of air or gas in GL 2008-01 systems will be reviewed and revised as necessary to ensure adequate flow velocities to dynamically sweep the piping of trapped air.

Schedule: December 15, 2009

Revised procedures will be supportive to the next MPS3 refueling outage which is scheduled for spring 2010. Corrective Action C.6 addresses interim corrective actions that Millstone will take to ensure proper fill and vent of GL 2008-01 systems during the fall 2008 Refueling Outage.

C.5 DNC will develop and/or revise fill and vent procedures including confirmation measures to assure sufficiently full criteria using UT confirmation where appropriate.

Schedule: This change will be completed prior to December 15, 2009

Revised procedures will be supportive to the next MPS3 refueling outage which is scheduled for spring 2010. Corrective Action C.6 addresses interim corrective actions that Millstone will take to ensure proper fill and vent of GL 2008-01 systems during the fall 2008 Refueling Outage.

C.6 During the restoration of GL 2008-01 systems Operations personnel will ensure systems are sufficiently filled prior to return to service. This will be performed by either:

a) ensuring procedures credited to dynamically sweep piping systems of air or gas in GL 2008-01 systems provide adequate flow velocities to dynamically sweep the piping of trapped air or,
b) ensuring gravity fill and vent sequences adequately address any local high points that may retain trapped air. UT confirmation will be utilized if necessary to confirm areas in question are sufficiently filled.

Schedule: This will be performed during the fall 2008 refueling outage (Completion prior to Mode 4).

Interim actions will be taken to ensure systems are sufficiently full of water, utilizing insights gained from GL 2008-01 walk-downs of piping systems and completed technical evaluations until procedure modifications are complete.

C.7 The existing Technical Specification Surveillance Procedures utilized to verify ECCS systems are sufficiently full of water (implementing TS 4.5.2.b.1) will be reviewed and revised as needed to reflect insights from the Technical Evaluation associated with GL 2008-01. This will involve re-evaluation of currently monitored locations for gas intrusion and a review/revision of the acceptance criteria.

Schedule: October 31, 2009

Revisions to the surveillance procedures may require planning for insulation removal, the generation of new procedures, the development of revisions to the acceptance criteria analysis software, the formalization of data trending and documentation requirements, and training of engineers and operators in the performance of the program. The corrective action date has been developed based on previous experience at MPS3 with establishing new surveillance procedures.

C.8 Six (6) vent valves will be installed to facilitate venting of non-condensable gases based on technical reviews and walk-downs performed of outside containment piping. Additional vent locations may be identified based on walk-downs planned during the fall 2008 refueling outage.

a. One (1) high point vent valve in the SI discharge piping to facilitate venting non-condensable gas intrusion identified from the SI Accumulators from outside containment.
b. Four (4) high point vent valves at additional locations outside containment allowing venting of potential gas voids that could occur in the future without entering containment.
c. One (1) vent valve to allow fill of a one inch diameter bypass section of piping off of the Charging System discharge piping.
d. One (1) vent valve in the charging pump suction header from the RWST.
e. Procedures will be revised to address the use of the added vents

Schedule: Corrective Action 'C.8.a' will be completed by the end of the MPS3 fall 2008 refueling outage. Corrective Actions 'C.8.b', 'C.8.c', 'C.8.d' and 'C.8.e' will be completed by the end of the MPS3 spring 2010 refueling outage as these are considered enhancements.

Corrective action C.8.a has been planned to eliminate an ongoing need to enter containment to vent off gas intrusion into the SI discharge header at penetration 98. Corrective action C.8.b will add four (4) new vent valves that will enhance the ability to manage possible gas intrusion if it were to occur in these piping systems in the future. Corrective Action C.8.c adds a vent valve to facilitate filling of a bypass section of piping off of the system header. Corrective Action C.8.d adds a vent valve to facilitate filling a local high point in the charging pump suction piping from the RWST. UT verification of item C.8.d will be performed during the MPS3 Fall 2008 refueling outage to verify that the potential void site did not impact system operability limits. All other vent additions are enhancements. The proposed schedule will allow installation of all of the new vent valves in a planned manner.

C.9 DNC will develop training programs and update the Fleet Design Control program to address gas accumulation concerns associated with GL 2008-1.

Schedule: December 31, 2009

This corrective action is to support long term improvement and is not required for compliance with GL 2008-1.