VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

June 8, 2010

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
One White Flint North
11555 Rockville Pike
Rockville, MD 20852-2738

Serial No:	10-304
NLOS/GDM	R7
Docket Nos.:	50-280, 281
License Nos.:	DPR-32, 37

VIRGINIA ELECTRIC AND POWER COMPANY (DOMINION)
SURRY POWER STATION UNITS 1 AND 2
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION
GENERIC LETTER 2008-01, MANAGING GAS ACCUMULATION IN EMERGENCY CORE COOLING, DECAY HEAT REMOVAL, AND CONTAINMENT SPRAY SYSTEMS

By letters dated October 14, 2008 (Serial No. 08-0013B) (ADAMS Accession No. ML082890094), November 3, 2008 (Serial No. 08-0013E) (ML0830900652), and July 6, 2009 (Serial No. 09-328) (ML09187130720), Dominion submitted information in response to Generic Letter (GL) 2008-01 "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," for Surry Units 1 and 2. Subsequent to these submittals, the NRC provided a request for additional information in an email dated April 12, 2010. Dominion's response to the NRC request is provided in the attachment.

If you have any questions or require additional information, please contact Mr. Gary D. Miller at (804) 273-2771.

Sincerely,

L. N. Hartz
Vice President – Nuclear Support Services

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by L. N. Hartz, who is Vice President – Nuclear Support Services of Virginia Electric and Power Company. She has affirmed before me that she 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 her knowledge and belief.

Acknowledged before me this 8th day of June, 2010.

My Commission Expires: 4/30/13

Notary Public

I was commissioned a notary public as Ginger L. Hilligood.

GINGER LYNN MELTON
Notary Public
Commonwealth of Virginia
310847
My Commission Expires Apr 30, 2013

Commitment made in this letter:

1. Upon NRC approval of the TSTF traveler, Dominion will evaluate it for applicability to Surry Units 1 and 2. If a license amendment is determined to be necessary, Dominion will submit a license amendment(s) within one year of NRC approval of the TSTF traveler.

Attachment:

- Response to GL 2008-01 Request for Additional Information

cc: U.S. Nuclear Regulatory Commission
Region II
245 Peachtree Center Avenue, NE
Suite 1200
Atlanta, Georgia 30303-1257

NRC Senior Resident Inspector
Surry Power Station

Ms. K. R. Cotton
NRC Project Manager
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop 08 G-9A
11555 Rockville Pike
Rockville, Maryland 20852-2738

Dr. V. Sreenivas
NRC Project Manager
U. S. Nuclear Regulatory Commission
One White Flint North
Mail Stop 08 G-9A
11555 Rockville Pike
Rockville, Maryland 20852-2738

ATTACHMENT

Response to GL 2008-01 Request for Additional Information

**VIRGINIA ELECTRIC AND POWER COMPANY
(DOMINION)
SURRY POWER STATION UNITS 1 AND 2**

Response to Generic Letter 2008-01 Request for Additional Information

Surry Power Station Units 1 and 2

NRC Comment:

By letters dated October 14, 2008 (Agencywide Document Access and Management System Accession No. ML092360423) [sic], November 3, 2008, (ML0830900652), and July 6, 2009, (ML09187130720), Virginia Electric Power Company (the licensee), submitted information in response to Generic Letter (GL) 2008-01 "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," for Surry Units 1 and 2. On the basis of the provided information, the NRC Staff has concluded that additional information is required to determine that the licensee has acceptably demonstrated "that the subject systems are in compliance with the current licensing and design bases and applicable regulatory requirements, and that suitable design, operational, and testing control measures are in place for maintaining this compliance" as stated in GL 2008-01. Guidance on Nuclear Regulatory Commission (NRC) staff expectations is provided by Reference 1 which is generally consistent with Nuclear Energy Institute (NEI) guidance provided to industry in Reference 2 as clarified in later NEI communications. The NRC staff recommends that the licensee consult Reference 1 when responding to the following RAIs:

1. *Provide a regulatory commitment and a schedule for applying the Technical Specification Task Force (TSTF) process to any Technical Specification (TS) changes resulting from GL 2008-01.*

Dominion Response

Upon NRC approval of the TSTF traveler, Dominion will evaluate it for applicability to Surry Units 1 and 2. If a license amendment is determined to be necessary, Dominion will submit a license amendment(s) within one year of NRC approval of the TSTF traveler.

2. *Consistent with Section 3.5.2 of Ref 1:*
   a. *describe surveillance coverage and frequency;*
   b. *where venting is accomplished, briefly describe how volumes are determined and provide estimated void volume determination uncertainty;*
   c. *describe any instructions for sampling and chemical analysis of accumulated gas.*

Dominion Response

As noted in Dominion's letter dated October 14, 2008, only the suction piping of the High Head Safety Injection (HHSI) System and the discharge piping of the Low Head Safety Injection (LHSI) System were determined to be susceptible to gas accumulation at Surry

Units 1 and 2. Periodic monitoring assures these systems are sufficiently full of water and will perform their required safety functions in accordance with design basis assumptions.

2.a. *describe surveillance coverage and frequency;*

2.a Full flow testing and system flow sweeping are performed each refueling outage in accordance with existing station procedures to provide dynamic venting of the system high points both outside and inside containment for each Safety Injection (SI) System piping train. Four (4) new high point vent valve locations previously identified by a confirmatory inspection were added and have been utilized to aid the operators in more efficiently venting the SI system inside containment following testing. Procedure revisions were completed to address the use of the new vent valves each refueling outage.

Static venting is performed at system piping high points outside of containment in accordance with existing station procedures for each SI System piping train upon return to service and on a quarterly basis. These vented system local high points were previously confirmed to be located correctly using laser scanning techniques and detailed isometrics. Ultrasonic testing (UT) inspections were conducted at the vented high points of the suction piping to the Emergency Core Cooling System (ECCS) pumps and on the LHSI discharge piping to confirm the effectiveness of the venting procedures.

2.b. *where venting is accomplished, briefly describe how volumes are determined and provide estimated void volume determination uncertainty;*

2.b Periodic venting procedures specify vent locations that are used to ensure the applicable system piping is sufficiently full of water for each system. If gas voids are identified during periodic testing, they are documented in the corrective action program and an operability assessment is performed. In addition, the identified voids are trended to determine frequency of development and possible sources.

Void size is primarily determined by performing a timed release using a flow meter (i.e., a Rotometer). The Rotometer methodology, which uses a device to separate water from the vented gas stream, estimates gas volume by multiplying the gas flow rate (scfh) by the time of the release. The Rotometers used during periodic venting measure flow rates within an instrument accuracy of ±5%. The overall accuracy of the void size estimate is based on the duration of the release, the instrument uncertainty, and the human factors associated with the venting. Removing any voids is the preferred method as venting immediately eliminates any potential operability concern due to gas accumulation. After gas is initially discovered and vented, subsequent volumetric examination (UT) will be performed to more accurately estimate the amount and rate of gas accumulating within the system.

UT procedures developed for this application use a straight beam ultrasonic examination technique to determine the liquid level in a pipe and have been used to successfully estimate void size. The UT methodology used is consistent with standard industry accepted practices. The void in a horizontal pipe is estimated by measuring the arc length of the sector to calculate the area of the pipe segment, which is then multiplied by the length of the void to arrive at a void volume. Identified voids are vented after sizing data is recorded.

2.c. *describe any instructions for sampling and chemical analysis of accumulated gas.*

2.c Surry procedures do not require sampling or chemical analysis of accumulated gas vented from ECCS piping. Plant systems were previously evaluated for potential sources of gas accumulation or intrusion. The evaluation determined the primary potential sources of gas were from one or more of the following: 1) degassing of hydrogen and other gases in stagnant lines due to changing ambient conditions, 2) degassing of hydrogen saturated leakage from interfacing systems through system boundaries, 3) gas stripping from pressure reduction, and/or 4) air inadvertently left in system piping following maintenance activities. Degassing within the SI piping was determined to not be a factor because ambient temperature and pressure do not change enough to create internal degassing. SI accumulator out-leakage and nitrogen degassing is not a concern because the accumulators interface directly with the higher pressure Reactor Coolant System (RCS). Consequently, there is no SI accumulator boundary interface with either the HHSI system or the LHSI discharge piping. As a result, the nitrogen blanket maintained in the accumulators does not pose a problem for ECCS operation. Gas stripping from pressure reduction is not a concern, as the HHSI pump recirculation orifice is a multi-stage design that inhibits gas stripping. Finally, air is removed after maintenance and after refueling utilizing static high point venting, which has been confirmed to be effective.

Should alternate monitoring methodologies (see the response to Question 5 below) indicate that gas is present, it would be due to hydrogen; therefore, there would be no need to sample/analyze the vented hydrogen. Consequently, instructions for sampling and chemical analysis of accumulated gas are not required.

3. *Describe any process improvements made to guard against gas intrusion due to inadvertent draining, system realignments, incorrect maintenance procedures, or other evolutions.*

<u>Dominion Response</u>

Protection from gas accumulation is primarily provided by static and dynamic venting performed in accordance with existing station procedures for each SI system piping train upon return to service and on a quarterly basis. UT examination procedures have also been developed and used to inspect affected piping for gas accumulation and to validate venting effectiveness. One of the major potential contributors to gas accumulation at Surry is degassing of hydrogen saturated RCS leakage into the SI System due to leakage past the SI discharge check valves. Therefore, the maintenance procedures for these check valves have been revised to improve the leak-tightness of the affected valves during the operating cycle. The improved maintenance practices inhibit the degassing that could potentially occur due to leakage from the high pressure RCS to the lower pressure, stagnant SI System.

In addition, procedures that address a loss of normal charging flow (1/2-AP-8.00) were revised to prevent or mitigate the loss of the HHSI pumps in the event of gas intrusion. Procedures were also modified to monitor the LHSI discharge piping thermal relief valves and to include the option of recording the peak pressure at the start of a LHSI pump for quarterly testing (1/2-OPT-SI-005). This monitoring facilitates the early identification of any gas accumulation in LHSI piping inside containment. During a pump start, gas entrained in a dead ended water piping system creates an air spring effect, and a peak pressure pulse is generated that is a function of the amount of gas present and the size of the void. The thermal relief valves are observed for each quarterly LHSI pump test as required by the procedure. The failure of the relief valves to lift demonstrates that there is less than 0.8 ft^3 of gas in the discharge piping, which is well below the acceptance criterion for pump operation.

Also, the ECCS Gas Accumulation Monitoring Plan directs the review of ECCS design modifications and procedural changes for the possibility of increased susceptibility to gas intrusion and confirms the ECCS remains sufficiently full following the implementation of the changes.

4. *Consistent with Section 3.7 of Ref. 1, briefly discuss the training that is considered to be a necessary part of applying procedures and other activities when addressing the issues identified in the GL.*

Dominion Response

As part of the response to Institute of Nuclear Power Operations (INPO) Significant Operating Experience Report (SOER) 97-1, *Potential Loss of High Pressure Injection and Charging Capability from Gas Intrusion*, and Significant Event Report (SER) 2-05, Revision 1, *Gas Intrusion in Safety Systems*, Dominion provided training for station personnel who design, operate, or maintain systems and components that are susceptible to, or may cause, gas intrusion. In addition, Dominion is supporting the industry and NEI Gas Accumulation Management Team activities regarding the development of training requirements considered necessary for the successful implementation of a gas management program. We have received training modules from NEI that were developed by INPO for operations, engineering and general nuclear personnel training. This material is being provided to the Dominion nuclear training group for review and incorporation into the training program. A training module for maintenance personnel is also being developed and is expected to be received from

NEI within a month. This module will be provided to the nuclear training group upon receipt for review and incorporation into the training program as well.

5. *Please describe the "alternate monitoring methodology" discussed in Ref. 3. Describe how pump start pressure transient recording, thermal relief valve monitoring, pump discharge header temperature monitoring, and RWST level trending will be used to monitor for gas.*

Dominion Response

In response to the issues discussed in GL 08-01, additional monitoring activities were implemented for evidence of gas accumulation. Specifically, monitoring and trending of: 1) vented gas at system high points, 2) SI check valve back leakage during refueling outage testing, 3) thermal relief valve lift and LHSI pump discharge pressure response during quarterly testing, 4) increase in LHSI discharge header temperature and 5) Refueling Water Storage Tank (RWST) inleakage. In addition, UT has been performed and is available to inspect system high points to confirm adequate system fill and/or void sizing.

As noted in the response to Question 3 above, one of the potential primary contributors to gas accumulation at Surry is degassing of hydrogen saturated RCS leakage into the SI System due to leakage past the SI discharge check valves. If the check valves are confirmed to be seated without leak by, off gassing during the operating cycle is minimized. Furthermore, as stated earlier, actions have been taken to improve the leak-tightness of the check valves. However, should leakby occur, it would be evidenced by lifting of the LHSI pump thermal relief valves during performance of the quarterly pump periodic test or by RWST inleakage.

LHSI Thermal Relief Valves - It was previously determined that the total void volume in the LHSI discharge piping needs to remain below 0.8 ft^3 to prevent lifting the relief valves, which are set at 242 psig. The LHSI pump test procedures were modified to monitor the discharge piping thermal relief valves when starting a LHSI pump. Upon LHSI pump start, transient peak pressures will remain under the relief valve setpoint for gas void volumes of less than 0.8 ft^3 in the LHSI discharge piping to the RCS cold legs. Although larger voids may also result in lower pressure pulses below the relief valve setpoint, periodic venting and system monitoring as described below significantly limits the possibility of voids of that magnitude from occurring. Consequently, if the thermal relief valves do not lift when the pump is started, it provides further assurance that gas accumulation is not a concern.

LHSI Pump Discharge Peak Pressure - The LHSI pump test procedure also includes the option of recording the LHSI pump discharge peak pressure. If the thermal relief valve lifts, accumulated gas is vented and quantified and the peak pressure at the start of the pump is measured and recorded during the next pump test. During a pump start, gas entrained in a dead-ended water piping system creates an air spring effect, and a peak pressure pulse is generated that is a function of the amount of gas present. The pump test procedure includes provisions for installing instrumentation to measure and record pump peak pressure to facilitate void size determination.

LHSI Pump Discharge Header Temperature Monitoring – The LHSI pipe temperature outside containment is monitored during system walkdowns to determine whether the pipe temperature is higher than normal. A higher than normal pipe temperature would be an indication of RCS back leakage past the SI check valves and the possibility of gas accumulation due to degassing hydrogen. This indication can be further validated by checking for RWST inleakage as discussed below.

RWST Level Inleakage - The RWST contains a supply of borated water maintained at a useable volume of 370,000 gallons borated between 2300 and 2500 ppm. The tank is equipped with high level alarms to prevent inadvertent overfilling. Should RCS back leakage past the SI check valves occur, it would eventually flow to the RWST. This check valve back leakage can be indicated by RWST level and chemistry changes as the RCS fluid migrates through the pipe. RWST level trending and monitoring is accomplished using the installed tank level alarms and the plant computer system. Indication of such back leakage would require an assessment of the SI piping for gas accumulation and the need for venting, and entry of the back leakage concern into the corrective action system for resolution.

References

1. Ruland, William H., "Preliminary Assessment of Responses to Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," and Future NRC Staff Review Plans," NRC letter to James H. Riley, Nuclear Energy Institute, ML091390637, May 28, 2009.

2. Riley, James H., "GL 2008-01, 'Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Contain Spray Systems' Evaluation and 3 Month Response Template," Letter to Administrative Points of Contact from Director, Engineering, Nuclear Generation Division, Nuclear Energy Institute, Enclosure 2, "Generic Letter 2008-01 Response Guidance," March 20, 2008.

3. Price, J. Alan, "Nine Month Response to NRC GL 2008-01, Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems," Letter from Vice President, Nuclear Engineering, Virginia Electric and Power Company (Dominion) ML082890094, October 14, 2008.