VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

August 19, 2015

10CFR50.90

U. S. Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, DC 20555-0001

Serial No.: 15-330
SPS/LIC-CGL: R7
Docket Nos.: 50-280/281
License Nos.: DPR-32/37

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
PROPOSED LICENSE AMENDMENT REQUEST
TECHNICAL SPECIFICATIONS SURVEILLANCE REQUIREMENT FOR GENERIC LETTER 2008-01 (GAS ACCUMULATION)
RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

By letter dated January 14, 2015 (Serial No. 14-485), Virginia Electric and Power Company (Dominion) submitted a license amendment request (LAR) to add a Technical Specification (TS) Surveillance Requirement (SR) to verify the Surry Power Station (Surry) Units 1 and 2 Safety Injection (SI) Systems' locations susceptible to gas accumulation are sufficiently filled with water. The proposed change addresses the concerns discussed in Generic Letter 2008-01, "Managing Gas Accumulation in Emergency Core Cooling, Decay Heat Removal, and Containment Spray Systems." The proposed amendment is consistent with Technical Specification Task Force (TSTF) Traveler TSTF-523, Revision 2, "Generic Letter 2008-01, Managing Gas Accumulation."

In a June 24, 2015 e-mail from Ms. Karen Cotton Gross (NRC Project Manager) to Mr. Gary Miller (Dominion Corporate Licensing), the NRC technical staff requested additional information regarding the proposed LAR. Dominion's response to the NRC request for additional information (RAI) is provided in the attachment to this letter. A 60-day time frame for responding to the RAI was agreed upon by Ms. Gross and Mr. Miller.

The information provided in this letter does not affect the conclusions of the significant hazards consideration or the environmental assessment included in the January 14, 2015 LAR.

A134
NRR

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

Respectfully,

Mark D. Sartain
Vice President Nuclear Engineering

Commitments contained in this letter: None

Attachment: Response to NRC Request for Additional Information - Technical Specifications (TS) Surveillance Requirement for Generic Letter 2008-01 (Gas Accumulation)

STATE OF CONNETICUT)
)
COUNTY OF NEW LONDON)

The foregoing document was acknowledged before me, in and for the County and State aforesaid, today by Mr. Mark D. Sartain, who is Vice President – Nuclear Engineering, of Virginia Electric and Power Company. 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 19 day of August, 2015.

My Commission Expires: March 31, 2016.

WM. E. BROWN
NOTARY PUBLIC
MY COMMISSION EXPIRES MAR. 31, 2016

Notary Public

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

State Health Commissioner
Virginia Department of Health
James Madison Building – 7th floor
109 Governor Street
Suite 730
Richmond, VA 23219

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

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

NRC Senior Resident Inspector
Surry Power Station

Attachment

Response to NRC Request for Additional Information

Technical Specifications (TS) Surveillance Requirement for Generic Letter 2008-01 (Gas Accumulation)

**Virginia Electric and Power Company (Dominion)
Surry Station Units 1 and 2**

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION
SURRY POWER STATION UNITS 1 AND 2

NRC Comment: *The following additional information is needed to assess the requested surveillance frequency change from TSTF-523:*

1. *Is the Surry design basis "water solid" for systems that are important for safety? If not, please describe the design basis condition and how this condition was established.*

   Dominion Response:

   Surry UFSAR Section 6.2.4.1.5 states "Accessible portions of ECCS [Emergency Core Cooling System] subsystems that are susceptible to gas sources are demonstrated operable periodically by verifying that the ECCS piping outside of containment is sufficiently full of water through Ultrasonic Testing (UT), venting or other means. Maintaining the piping in the ECCS sufficiently full of water as determined by engineering analysis ensures that the system will perform properly when required to inject into the RCS." Consistent with this UFSAR statement, the primary purpose of the Units 1 and 2 surveillance procedures for ultrasonic examination of the SI piping is "To ensure that Safety Injection piping is free of gas." Although the ECCS design basis does not explicitly state that it is water solid, the UFSAR and the UT examination surveillance procedures clearly reflect a design expectation that the ECCS will be sufficiently full of water.

2. *Please provide a description of the process used to restore the plant to the design basis condition at the earliest practical time following discovery of a gas volume that exceeds the design basis.*

   Dominion Response

   Evaluations have been performed to identify void sizes at specific locations in the Safety Injection (SI) system that would not compromise the ability of the system to perform its design function, such that the system would be considered "sufficiently full of water" as discussed in NEI 09-10 Rev. 1a-A. A table of allowable void volumes has been developed to ensure the ECCS is "sufficiently full" of water and remains operable should a void be identified when the system is in service.

   If a void is detected during the performance of the Units 1 and 2 surveillance procedures for ultrasonic examination of the SI piping, the following actions are directed by the procedures and action is taken promptly:

1 – Suspend further inspections until the void size is calculated and Operations is notified,
2 – Quantify the size of the void,
3 – Calculate the actual void volume,
4 – Notify the Operations Shift Manager that a void has been detected that requires venting in accordance with the procedure for venting of the SI piping, and
5 – Submit a Condition Report to document the condition (which would require an operability review by the Operations Shift Manager).

Required venting of a detected void will be accomplished in accordance with this procedural direction as soon as practical.

3. *Reference is made to use of water flow to remove voids. What is the Froude number that exists during this process and how long is flow maintained when gas removal is being accomplished?*

Dominion Response

A table of Froude Number versus flow rates in various pipe sizes has been developed for use during pump testing evolutions to ensure the water flow removes voids. The adequacy of flowing water for void removal during pump testing has been validated by UT.

The Surry response to GL 2008-01 credited water flow in ECCS piping during full flow refueling outage (RFO) tests. These tests produce flow capable of removing gas voids that may be trapped within the piping thus removing it from the system. UT was performed following these tests during the spring 2009 Unit 1 RFO and the fall 2009 Unit 2 RFO. The UT results are as follows:

- During the spring 2009 Unit 1 RFO, as-found UT data confirmed the effectiveness of water flow to remove voids and, when used in combination with gas venting, the removal of voids was reasonably assured. It should be noted that the areas where large as-found voids were discovered were downstream of 1-SI-MOV-1890C, which was closed during the Low Head Safety Injection (LHSI) full flow test to the RCS hot legs. (See Figure 1.) The voids were successfully vented following the full flow test. Similarly, the UT revealed voids in the charging pumps' suction piping, which was isolated; therefore, these locations were not flow swept. However, these locations were successfully vented. The locations that were subjected to water flow during the LHSI full flow test to the RCS hot legs were filled, and no voids were found during the performance of the venting procedure.

- During the fall 2009 Unit 2 RFO, as-found UT data again confirmed the effectiveness of using water flow to remove voids, and further confirmed that when this method is used in combination with system venting, there is reasonable assurance that gas voids are removed. Also, UT performed after full flow of the LHSI pumps to the cold legs showed no voids downstream of 2-SI-MOV-2890C, which was open. This further confirms the void discovered downstream of the 1-SI-MOV-1890C MOV during the U1 verification was due to the MOV being closed and not subjected to flow after core on-load. Since 2-SI-MOV-2890C was open for the performance of check valve testing after empty vessel, any void that could have potentially been present at the location would have been swept away. During these tests, the LHSI pumps were flow tested at approximately 1000 - 3200 gpm and 3500 gpm. For the LHSI 3500 gpm flow testing, the Unit 2 "A" LHSI pump was run for 10 minutes and the "B" LHSI pump was run for 7 minutes. For the LHSI 1000 - 3200 gpm flow testing, the Unit 2 "A" LHSI pump was run for 20 minutes and the "B" pump was run for 18 minutes. As stated above, Engineering has developed a table of Froude Number versus flow rates in various pipe sizes. An example of the Froude Number that would have been seen during these tests is 3.299. This Froude Number would occur in the 10"-SI-352-1502 piping during a flow rate of approximately 3000 gpm. This example is provided as this pipe is known to be susceptible to voids during an RFO, and it has been shown that the LHSI full flow test is capable of removing voids from this area.

In addition, the water flow method to remove voids in the Unit 2 High Head Safety Injection (HHSI) suction header from the Refueling Water Storage Tank (RWST) (Line No. 10"-SI-206-153) was previously performed to validate its effectiveness. The Charging Pump Head Curve Verification and Comprehensive Test procedure was performed on May 17, 2011 which provided full flow through these piping systems. Charging Pump "A" was run for 46 minutes, the "B" pump was run for 26 minutes, and the "C" pump was run for 128 minutes. During these time periods, the "A" and "B" pumps had flow rates of approximately 500 gpm, and the "C" pump had a flow rate range from approximately 320 to 500 gpm to perform the head curve test. A UT inspection was performed on the HHSI suction header after completion of the pump testing which flowed water in the suction line. The UT was performed to identify any potential voids in the piping that could potentially exceed the established engineering acceptance criteria. The UT readings revealed one void on the downstream end of the piping run at a location prior to entering the Auxiliary Building basement. The void size was calculated to be 0.128 cubic feet, or 24% of the allowable void size (0.54 cubic feet). These UT readings confirmed that voids created during the drain and fill evolutions for these lines are effectively removed during HHSI full flow testing performed during an RFO.

These pump tests confirmed the adequacy of water flow in combination with venting for providing reasonable assurance that gas voids are being effectively removed from SI piping.

4. *The statement is made that there are no identified gas intrusion mechanisms associated with the Containment Spray (CS) System, including the chemical additional subsystem. Please explain how potential operator error during initial filling is not a gas intrusion mechanism for this system.*

Dominion Response

Adherence to standards and procedures is a Dominion management expectation for all personnel during conduct of activities. Procedural use and adherence is one of the fundamental human performance tools used by the Dominion work force, as procedural adherence minimizes at-risk behaviors and reduces potential operator error.

Nonetheless, vent valves have been installed in the CS System, and procedures have been implemented to ensure that any potential gas intrusion from initial filling activities would be removed from the system before the system is declared operable and available for service.

Additionally, as stated in Dominion's nine-month response to GL 2008-01, dated October 14, 2008 (letter Serial No. 08-0013B), "The CS pump discharge piping from the pump(s) to the normally closed discharge header isolation MOV(s) is full of water at RWST head during normal unit operation. The CS pump discharge piping downstream of the discharge isolation MOV(s), which includes all CS piping inside containment, is dry during normal unit operation. Upon initiation of CS flow, the gas initially present in the discharge piping will be transported out of the system through the spray nozzles, thus ensuring that the piping is totally full during fulfillment of the CS safety function."

5. *A chemical sampling system that connects to multiple locations within containment has been known to cause gas accumulation due to multiple valve leaks. What is the potential for gas accumulation due to this system and how is it addressed?*

Dominion Response

The Surry GL 08-01 analysis did not consider sampling systems as credible gas intrusion paths; therefore, they were not addressed. A subsequent review of Surry chemistry procedures indicates that gas intrusion through the sampling system is not credible, since chemistry samples are withdrawn external to the system being sampled, and any flush volume (gas or liquid) is directed to the waste system(s).

A review of operating experience indicates the SI accumulator sample line has been identified as being susceptible to gas intrusion. However, a review of the Surry drawings for this system shows there are no system interconnections that would provide a gas intrusion concern.

6. *Please provide the void surveillance history starting at January 1, 2008. Include the following:*

   a. *The surveillance frequency.*

   Dominion Response

   Surveillance has been performed on a quarterly frequency since January 1, 2008. Prior to February 2012, the venting surveillance procedure used system vent valves to determine if any voids existed in the system being evaluated. Since February 2012, the surveillance is performed using UT on system piping susceptible to gas accumulation. If a void is identified, it is vented by Operations in accordance with the applicable station procedures.

   In addition to the quarterly surveillance test, the surveillance procedures are also performed when exiting an RFO to ensure the potentially affected SI system is sufficiently filled with water prior to returning the system to operability. These instances are not addressed in this response unless voids were unable to be vented.

   b. *For each discovered void, the Mode, date, location, void quantity, void acceptance criterion, post void action (location restored to a water-solid condition?) and reason for discovery of the void (examples include routine surveillance, accumulator behavior, reactor coolant leakage). If the void quantity exceeded the void acceptance criterion, then provide the disposition with respect to the impact on operability.*

   Dominion Response

   The instances where gas voids were discovered in the SI piping during the performance of the applicable surveillance procedures from January 2008 through July 2015 are discussed below. (Reference Figure 1.)

   Unit 1

   - January 2011 - Gas was discovered during quarterly performance of the venting surveillance procedure. Operations identified gas at vent valve 1-SI-435 after cycling 1-SI-MOV-1863B. A rotameter and stopwatch were used to estimate the size of the gas bubble. A total of 0.43 cubic feet of gas was vented through the rig with 1-SI-MOV-1863B in the closed position. A confirmatory UT was performed to verify the SI header downstream of

1-SI-MOV-1863B was free of gas. During the inspection, an additional 0.5067 cubic feet of gas was found. The void was then vented. Following venting, a total void size of 0.0204 cubic feet remained in the pipe. This volume was well below the acceptance criterion of 1.01 cubic feet. In addition to the initial void of 0.43 cubic feet, the total void yield was 0.9367 cubic feet at this location. The acceptance criterion for the HHSI pump suction piping from the LHSI pumps' discharge lines that would result in no more than 2% average void fraction at the pump suction was determined to be 1.01 cubic feet. Since the total void size in the "B" SI header was estimated to be 0.9367 cubic feet, which was less than the acceptance criterion, the SI system remained fully capable of performing is design safety function.

- <u>June 2012</u> - Two voids were detected in the SI system piping during the quarterly performance of the surveillance procedure. The first void was detected at 1-SI-1047, the vent valve on line 8"-SI-14-153 LHSI discharge to HHSI suction upstream of 1-SI-MOV-1863B. The void volume was 0.0036 cubic feet. The acceptance criterion is 0.8 cubic feet.

  The second void discovered was on line 8"-CH-204-152 downstream (charging suction) side of 1-SI-MOV-1863B. The void volume was 0.0039 cubic feet. The first identified void was on the same piping on the LHSI discharge side of 1-SI-MOV-1863B. Therefore, the total void size was 0.0075 cubic feet. The acceptance criterion for 8"-CH-204-152 is 1.01 cubic feet. Since this void was bounded by the acceptance criterion, the SI system remained fully capable of performing its design safety function. The voids were vented in accordance with station procedures.

- <u>September 2012</u> - During the quarterly surveillance, a void was found at 1-SI-187, upstream of 1-SI-MOV-1890B. The void size was calculated to be 0.0572 cubic feet. The acceptance criterion is 0.8 cubic feet. The void was vented in accordance with station procedures until the final void amount was 0.0017 cubic feet. Thus, venting effectively removed 97% of the original void size.

  Following venting at 1-SI-187, the surveillance was resumed and a void was discovered at 1-SI-1047, upstream of 1-SI-MOV-1863B. The void volume was calculated to be 0.0022 cubic feet. A similar void was found in June 2012. The void size discovered in June was 0.0036 cubic feet and the piping was vented. The identified void is believed to be a residual of the void discovered in June that had not been completely vented and not the result of additional transported air. Additionally, because both of the voids were found downstream of the LHSI pumps, the voids were cumulative. The acceptance criterion for the total void downstream of the LHSI pumps is 0.80 cubic feet. Following venting, the total void volume was 0.0039 cubic feet or 0.5% of the allowed void size. Therefore, with greater than 99% margin, the SI system remained fully capable of performing its design safety function.

A void was also discovered downstream (charging suction) side of 1-SI-MOV-1863B on line 8"-CH-204-152. The void volume was calculated to be 0.0036 cubic feet. This void is additive to the void discovered at 1-SI-187 (0.0022 cubic feet) as it was located on the same line as 1-SI-MOV-1863B. The total void size for the two voids was 0.0058 cubic feet with an acceptance criterion of 1.01 cubic feet. Since the voids were bounded by the acceptance criterion with greater than 99% margin, there was no operability concern. This void was similar to the void discovered and vented in June 2012 (0.0039 cubic feet), which was vented on June 17, 2012. Vent valve 1-SI-435 is on the LHSI side of 1-SI-MOV-1863B and the void is on the HHSI side. Due to the piping configuration, it is difficult to completely vent the void. Since the void was insignificant in comparison to the acceptance criterion, further venting was not required nor performed.

- December 2012 - During the quarterly surveillance, a small void was found at 1-SI-187, upstream of 1-SI-MOV-1890B. The void size was calculated to be 0.0039 cubic feet, which was 0.5% of available margin to the acceptance criterion of 0.80 cubic feet. A void of similar size (0.0017 cubic feet) had been previously noted on the as-left reading for this pipe during the September 2012 surveillance. This void was vented and, due to the size of the void, no as-left readings were required.

- March 2013 - A void was discovered at 1-SI-179, downstream of 1-SI-MOV-1890, during the quarterly surveillance. The void size was calculated to be 0.1722 cubic feet, which was 21.5% of available margin of the acceptance criterion of 0.80 cubic feet. Based on this margin, the LHSI system remained capable of performing its design function, despite the presence of the void. 1-SI-179 was successfully vented in accordance with station procedures, and as-left readings on the pipe indicated that it was water solid. Additionally, the quarterly surveillance was completed with no other voids identified.

- November 2013 - Two voids were discovered that could not be removed by venting during the performance of the UT examination of the SI piping when exiting a Unit 1 RFO. The first void was detected at 1-SI-MOV-1863B. The calculated void volume was 0.0003 cubic feet. The acceptance criterion for this line is 1.01 cubic feet. Since the void was bounded by the analysis, the SI system was determined to be fully capable of performing its design safety function.

  The second void was detected at 1-CH-458 adjacent to 1-CH-MOV-1115B. The void volume was calculated to be approximately 0.0021 cubic feet. The acceptance criterion for the charging pump suction is 0.0135*43.7/P2, where P2 is pressure in psia found at the void elevation when the void is detected. The 1C charging pump (1-CH-P-1C) suction pressure indicator, 1-CH-PI-1189, indicated 39.2 psig following the void size quantification. The "C" charging pump was not in service during the quantification of the void, and there were no pressure losses within the piping between the void and the pressure indicator. The indicator was approximately 2 feet higher in elevation than the void location, so the absolute pressure at the void was calculated to be 54.766 psia. Therefore, the allowable void is 0.0108 cubic feet. The void was acceptable at approximately 19.2% of allowable margin. The void was unable to be vented due to its location upstream of 1-CH-458.

- <u>July 2015</u> - While performing the quarterly surveillance, three voids were found in the SI System. The first void was discovered at 1-SI-192, upstream of 1-SI-MOV-1863A. The void was calculated to be 0.0177 cubic feet. The acceptance criteria for the LHSI discharge to HHSI suction piping is 0.7 cubic feet. This void was approximately 2.53% of available margin to the acceptance criteria for the area; therefore, the SI System remained fully capable of performing its design safety function. The void was successfully vented, and the pipe was confirmed to be water solid through UT after venting.

  The second void was discovered at 1-SI-179, downstream of 1-SI-MOV-1890C. The void was calculated to be 0.0131 cubic feet, which was well below the allowable void size of 0.8 cubic feet for the LHSI discharge piping. This void was approximately 1.63% of current available margin. The void at 1-SI-192 was added to the void at 1-SI-179 for a total void size of 0.0308 cubic feet, which was well below the acceptance criteria of 0.8 cubic feet (3.84% of available margin). Therefore, the SI System remained fully capable of performing its design safety function despite the presence of the two voids. The void was successfully vented, and the piping was confirmed to be water solid through UT after venting.

  The third void was discovered at 1-SI-435, downstream of 1-SI-MOV-1863B. The void size was calculated to be 0.0039 cubic feet, which is well below the allowable void size of 0.7 cubic feet for the piping from the LHSI discharge to the suction of the HHSI pump. This void was 0.55% of current available margin to the acceptance criteria. When combined with the two voids noted above, the total void size discovered during this inspection was 0.0346 cubic feet. This is well below the allowable void size of 0.8 cubic feet for the LHSI discharge piping. The total void size was 4.33% of available margin. Based on this margin, the SI System remained fully capable of performing its design safety function in spite of the presence of the voids. The third void was vented, and the piping was confirmed to be water solid through UT after venting.

This inspection was the first quarterly performance after the Unit 1 spring 2015 RFO.

Unit 2

- November 2009 - During performance of venting after a Unit 2 RFO, three locations had indications of voids. The locations were 2-SI-197 (Line 8"-SI-214-152), 2-SI-1051 (8"-SI-214-152), and 2-SI-1055 (8"-214-152). The three locations had as-found voids prior to venting, and the voids decreased significantly after venting. The total as-left void for the three locations was calculated to be 0.005 cubic feet. The acceptance criterion for this line is 1.01 cubic feet. Due to the considerable amount of available margin remaining to the acceptance criterion, these voids were not removed following the Unit 2 outage.

- March 2013 – The void size identified during this surveillance is the only void that has exceeded an acceptance criterion since January 2008. On March 22, 2013, a 1.76 cubic feet void was found at 2-SI-179, downstream of 2-SI-MOV-2890C. At the time of void identification, the acceptance criterion was 0.80 cubic feet. This void size was listed as the acceptance criterion since it was believed that at a greater void size the relief valves would potentially lift on the LHSI pumps' discharge piping due to pressure spikes within the system. However, a Westinghouse analysis evaluated five cubic feet of air (at 100 psia) for impact on the Reactor Coolant System (RCS) during accident conditions and concluded this amount of gas would have no impact on the various accident analyses. Therefore, the identified void volume was bounded by the Westinghouse evaluation. In January 2013, the quarterly surveillance procedure was performed satisfactorily, which verified the relief valves do not lift on pump start, thus indicating the volume of air in the system was not sufficient to cause a pressure spike such that the relief valves would lift.

  Additionally, the LHSI cold leg check valves tested satisfactorily during the previous RFO with no leakage. The RWST level trends were reviewed and indicated the level was not increasing, thereby providing a second indication that there was no back leakage from the cold leg check valves. Finally, there was no HHSI to LHSI back leakage through 2-SI-MOV-2863A/B. Chemistry personnel performed an analysis of a sample of the air void, which determined the sample was 80.1% nitrogen, 18.6% oxygen, and 1.3% hydrogen. The low hydrogen content and high atmospheric content indicated the void was residual air remaining in the system since the previous outage, and not from RCS back leakage and off-gassing. Based on the above findings, there was no evidence to indicate the system would have been unable to perform its design function as intended prior to identifying the void in the system. Operations personnel vented the void, and UT was performed to confirm the pipe was water solid. Consequently, there was no concern regarding prior system operability or the ability of the system to perform its intended design safety function. No other voids were discovered during the performance of the surveillance procedure.

- May 2014 - A void was discovered downstream of 2-SI-MOV-2863B during the quarterly surveillance. The void size was calculated as 0.0010 cubic feet. The void was vented in accordance with station procedures from 0.0010 cubic feet to 0.0005 cubic feet as determined by a follow-up UT exam. This void was only 3.95% of the allowable gas volume. Since it was significantly less than the allowable void volume, the SI System was fully operable with regard to gas intrusion criteria, and further venting was not recommended due to location of the void (downstream of 2-SI-MOV-2863B while vent 2-SI-424 is upstream).

c. *A statement that if a void is not identified in Item b, then routine surveillances determined that there was no void.*

Dominion Response

If a surveillance period is not discussed in Item b above, the routine surveillances through either venting or UT determined that a void did not exist.

d. *The total number of surveillances conducted.*

Dominion Response

As of July 27, 2015, thirty-five Unit 1 surveillances have been performed since January 1, 2008, and thirty-four Unit 2 surveillances have been performed. These surveillance numbers include the quarterly surveillances, as well as post-RFO surveillances. The surveillances were performed through venting identified high point locations, performing UT, or both.

e. *Monitoring of equipment such as accumulators or reactor coolant system leakage and follow-up from outages with respect to void assessment.*

Dominion Response

After an RFO and prior to unit restart, venting procedures are performed as required to ensure susceptible areas of the SI System are free of voids. This post-RFO void assessment is performed in addition to the quarterly UT examination of SI piping. While monitoring of accumulators and RCS leakage is performed, it has not been used for void assessment since February 2012 when UT examination started being used for the identification of gas voids.

However, when a void is discovered, potential accumulator or RCS leakage is considered to determine if a chemistry sample is warranted to assess the source of the void being vented.

7. *The statement is made that if an emergency core cooling system (ECCS) subsystem is opened, it will be refilled and "demonstrated operable prior to return to service by verifying that the ECCS piping is sufficiently full of water through Ultrasonic Test (UT), venting or other means." Describe "other means."*

Dominion Response

"Other means" refers to water flow during pump testing to remove voids.

8. *Justify the statements that the recirculation spray (RS) pump suction cans are self-venting. What are the Froude numbers for downward flow in the pump suction cans that are stated to prevent "any significant amount of gas entering the suction can from being transported downward to the pump suction bell?"*

Dominion Response

Dominion's GL 08-01 analysis states that the expected Froude number in the RS can annulus in steady state has a velocity of 2.44 fps in the pump suction can annulus, resulting in N_{Fr} =0.297. At a Froude number below 0.32, gas is expected to rise to the top of the can. During steady state operation, an air ejector removes approximately 1.5 cfm of gas that is released to the suction of the outside RS pump to maintain water level in the can. This results in less than 1% air entrainment at a nominal pump flow of 3300 gpm. In the process of responding to this question, a review of the GL 08-01 analysis and various calculations determined that steady state and transient operation during pump startup is not well described and documented. Further review and analysis to succinctly describe and document both transient and steady state system response has been initiated and is in progress. Resolution of this issue will be tracked in the corrective action program.

9. *Describe assessment of vortexing in the refueling water storage tank (RWST). Include substantiation that 0% RWST level corresponds to the non-usable volume.*

Dominion Response

The RWST has been evaluated for vortexing for the LHSI, HHSI, and CS pumps that take suction from the RWST. The automatic recirculation mode transfer (RMT) signal at 13.5% wide range level transfers the suction of the LHSI pumps to the containment sump and the suction of the HHSI pumps to the LHSI pump discharge.

The RMT sequence is complete before any potential for vortexing the SI pumps running with suction from the RWST.

The CS pumps are procedurally controlled to allow operation until the operators see indications of cavitation on low RWST level (e.g., fluctuating amps). The CS pumps have completed their design function at this point in the accident response. The emergency operating procedures allow Operations to restart the CS pumps after 30 minutes following SI RMT and if the RWST remains at a level greater than 3%. This CS pump restart is to drawdown the RWST until cavitating. Procedural guidance is provided for Operations to restart the CS pumps and to allow CS pump cavitation following restart.

The SPS Curve Book and various engineering calculations show the unusable RWST volume is considered to be 0% RWST using wide range instrument level.

10. *The statement is made that "the relatively low peak pressures in conjunction with the (low pressure safety injection) suction can design would ensure that any transient pressure waves transmitted from the discharge piping back through the pump would be greatly dissipated in the suction can and have virtually no impact on the suction piping." Provide backup for this conclusion.*

Dominion Response

LHSI pump testing was performed at North Anna in the 1990s, and the results are applicable to Surry due to similarity in piping systems arrangement and function. The testing produced peak pressures near 400 psig. Using a transient modeling analysis, the peak pressures were correlated to entrapped air volume. Further, after pump shutdown, the piping downstream of the pump main discharge check valve trapped pressure at approximately 190 psig (the recirculation test line is upstream of the main pump discharge check valve). By bleeding water from the line and recording the volume of water bleed-off for a given line pressure drop, the amount of trapped air in the piping system could be accurately calculated. This compared well to the volumes determined by peak pressure and transient analysis. During multiple test pump starts with various piping void volumes, resulting in peak pressures between approximately 200 and 400 psig, no adverse pump operation or suction side issues were identified. By modeling and actual testing, it was determined that a specific air volume would maximize the peak pressure at approximately 400 psig. Volumes smaller and greater than this air volume resulted in lower peak pressures. Multiple vents were added to the system to vent trapped air. Transients were short lived (i.e., 10 seconds) and varied based on void size. In summary, based on the North Anna LHSI pump testing, LHSI pump discharge pressure peaks caused by entrapped air will not have any impact on the operation of the LHSI pump or LHSI suction piping. Application of the GL 08-01 program to this system maintains the piping sufficiently full of water.

11. *The statement is made that "when the RHR system is not in operation, it is isolated with both its suction and discharge piping full of water from the RCS.... Prior to placing the system in service, procedural controls quantify the amount of fluid required to re-fill the system to allow accommodations to be made if fill volumes in excess of the analyzed allowable volumes are required." Describe the procedural controls.*

Dominion Response

As stated in the January 14, 2015 LAR, "The Residual Heat Removal (RHR) System is located entirely inside containment, is not safety related but has special regulatory considerations (NSQ), and does not serve a dual function as Low Head Safety Injection (LHSI). The RHR System is a NSQ system because the RHR System is required to provide decay heat removal: 1) following an Appendix R event, and 2) when the units are in cold shutdown and/or cooling units from hot shutdown to cold shutdown conditions following a hurricane. The system is isolated and maintained sufficiently full of water when the system is not in operation."

Verifying that the RHR system is full, or filling the RHR system if required, is performed in accordance with Operations procedures. The letdown line pressure is verified to be greater than 100 psig or increased to greater than 100 psig by throttling the letdown line pressure control. The letdown line flow is then recorded in gallons per minute. The hydraulic control valve is then opened to allow the RHR system to be filled. The RHR system is determined to be filled when the letdown line flow is approximately equal to the previously recorded flow. It is noted in the procedure that the volume required to fill the RHR system will be the total make-up to the VCT during the fill, or the volume may be calculated using the reduction in the letdown line flow multiplied by the fill time. After filling, the RHR system may contain pockets of air. Experience shows that venting the RHR system to prevent pump cavitation is not necessary even after 500 gallons of letdown have been added. Operations shift supervision determines the need to vent if the fill volume is greater than 500 gallons.

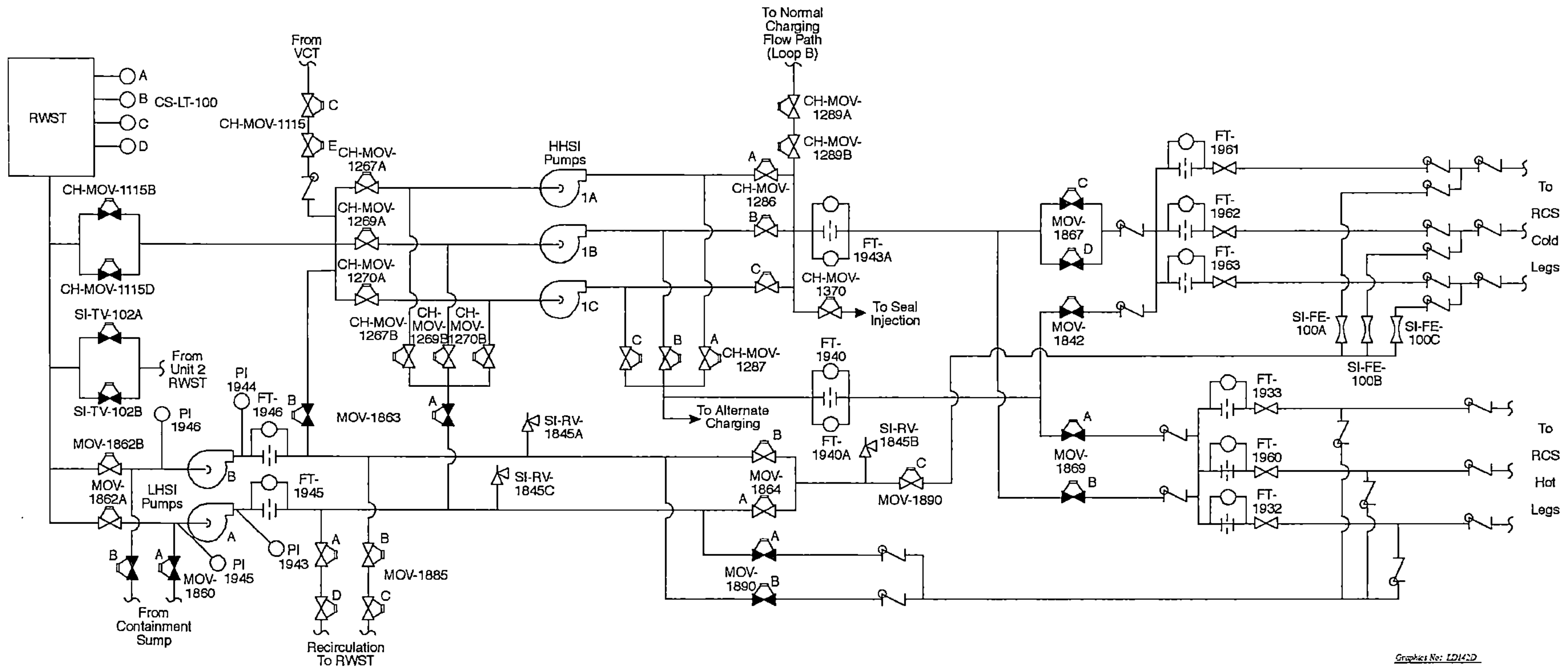

Figure 1
Surry Unit 1 Safety Injection System
(Unit 2 similar)