VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

July 3, 1996

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

Serial No. 96-315
NL&OS/MAE: R1
Docket Nos. 50-338/339
50-280/281
License Nos. DPR-4/7
DPR-32/37

Gentlemen:

VIRGINIA ELECTRIC AND POWER COMPANY
NORTH ANNA POWER STATION UNITS 1 AND 2
SURRY POWER STATION UNITS 1 AND 2
GENERIC LETTER 95-07 PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES
REQUEST FOR ADDITIONAL INFORMATION

On August 17, 1995, the NRC issued Generic Letter 95-07, entitled "Pressure Locking and Thermal Binding Of Safety-Related Power-Operated Gate Valves." Virginia Power responded to the Generic Letter on October 16, 1995 (Serial No. 95-438), November 15, 1995 (Serial No. 95-566) and February 7, 1996 (Serial No. 95-566A).

On June 6, 1996, the NRC requested additional information. The information requested is provided in Attachments 1 and 2 for North Anna and Surry, respectively.

If you have any questions, please contact us.

Very truly yours,

James P. O'Hanlon

James P. O'Hanlon
Senior Vice President - Nuclear

A056

Attachments

030044

9607100239 960703
PDR ADOCK 05000280
P PDR

cc: Regional Administrator
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Mr. R. D. McWhorter
NRC Senior Resident Inspector
North Anna Power Station

Mr. M. W. Branch
NRC Senior Resident Inspector
Surry Power Station

COMMONWEALTH OF VIRGINIA)
)
COUNTY OF HENRICO)

The foregoing document was acknowledged before me, in and for the County and Commonwealth aforesaid, today by J. P. O'Hanlon, who is Senior Vice President - Nuclear, of Virginia Electric and Power Company. He is duly authorized to execute and file the foregoing document in behalf of that Company, and the statements in the document are true to the best of his knowledge and belief.

Acknowledged before me this 3rd day of July, 1996.

My Commission Expires: May 31, 1998.

Vicki L. Hull
Notary Public

(SEAL)

Attachment 1

North Anna Power Station

Request For Additional Information

Generic Letter 95-07

North Anna Power Station
Request For Additional Information

1. Regarding valves 2-SI-MOV-2860A/B, LHSI Containment Sump Isolation, the licensee's submittal states that the containment sump at North Anna #2 is maintained in a water-filled condition that provides a thermal barrier to prevent rapid heating of the fluid remaining in the bonnets of the normally closed valves. The NRC staff believes that reliance on water-filled containment sump piping to preclude thermally induced pressure locking under design basis accident conditions is uncertain. Therefore, the NRC staff believes it is important to review your calculations which demonstrate that water-filled piping will preclude thermally induced pressure locking of these valves. Please provide this analysis for our review. In addition, please discuss why valves 1-SI-MOV-1860A/B are not susceptible to thermally induced pressure locking under the same scenario.

   Response

   The Unit 1 Low Head Safety Injection (LHSI) containment sump isolation valves are motor operated valves 1-SI-MOV-1860A/B. These valves are furnished with an external line that connects the bonnet region to the upstream side of the valve as well as providing leakage monitoring connections (LMC) and associated small bore, capped isolation valves. This configuration prevents a pressure locking condition from developing. Therefore, these valves were evaluated and determined not to be susceptible to thermally induced pressure locking.

   It should be noted that since issuance of Virginia Power's response to Generic Letter 95-07, it was discovered that valve 1-SI-MOV-1860B, containment sump isolation valve, was leaking by the Refueling Water Storage Tank side of the seat. As a result of this leakage, the valve's bonnet equalization line isolation valve (1-SI-176) was closed. The justification for isolating the valve's equalization line was based on the analysis done for Unit 2 valves 2-SI-MOV-2860A/B which do not have equalization lines. As described below, the physical arrangement of the LHSI sump suction piping creates a thermal barrier due to the water in the pipe which provides a passive barrier to prevent thermally induced pressure locking.

   The Unit 2 LHSI containment sump isolation valves are motor operated valves 2-SI-MOV-2860A/B. These valves are equipped with a bonnet connection, however, this connection is presently capped. As previously stated, an operational characteristic which precludes pressure locking of the subject valves is the water filled condition of the sump suction lines. The physical arrangement of the sump suction piping, located entirely below the sump with the high point being a vertical section of pipe that ends at the floor of the sump, creates a thermal barrier when the pipe is full of water. This barrier is considered a passive means of preventing thermally induced pressure locking.

   Calculation ME-0465, Attachment 3, includes a heat transfer analysis to evaluate the insulating capabilities of the water filled piping and heat transmission entering and exiting the valve pit area during accident conditions. The results of the calculation showed that heat gain from equipment and environs is offset by the available heat sink afforded by the underground location of the subject valves and does not result in appreciable temperature rise which would contribute to a pressure locked condition. In addition, the heat transmitted through the LHSI containment sump suction piping and water medium is minimal and no significant increase in valve bonnet temperature is expected.

2. The NRC staff notes that the licensee has committed to modify valves X-SI-MOV-X890A/B, LHSI Pump Discharge to RCS Hot Legs, at Surry Power Station to preclude the potential susceptibility to pressure locking during a design basis event. Please discuss why these valves were not evaluated in the licensee's submittal for North Anna Power Station.

   Response

   Units 1 and 2 motor operated valves X-SI-MOV-X890A/B, LHSI Pump Discharge to RCS Hot Legs are equipped with disc cavity pressure equalization lines. Each equalization line contains a 3/4" isolation valve which is maintained open. Therefore, valves X-SI-MOV-X890A/B were excluded from further consideration during the component screening process. These valves were determined not to be susceptible to pressure locking during a Design Basis Event (DBA).

3. Valves X-SI-MOV-X867A/B/C/D, HHSI Pump Discharge to RCS Cold Legs, may be potentially susceptible to pressure locking during a loss of power concurrent with a loss of coolant accident. The licensee's submittal states that, upon restoration of emergency power, the HHSI pumps start quickly and will equalize pressure across the upstream disks of the valves creating a bonnet vent path prior to the valves reaching their respective thermal overload settings. Does the licensee have performance and/or test data to support the assertion that the pumps will quickly build up pressure immediately upstream of these valves? If so, please provide this information for our review. Through a review of piping and instrumentation diagrams for North Anna Power Station, the NRC staff notes that there is a pressure transmitter, PT-1934, between the BIT and valves X-SI-MOV-X867C/D. What pressure does this indicator read during normal plant operation? Has the licensee monitored this pressure during past startups/shutdowns of the HHSI pumps? If so, please provide this information for our review. Since valves X-SI-MOV-X867A/B are normally closed and are located between the HHSI pumps and valves X-SI-MOV-X867C/D, how can the licensee be assured that startup of the HHSI pumps will quickly build up pressure on the upstream side of valves X-SI-MOV-X867C/D?

   Response

   The High Head Safety Injection (HHSI) pumps are tested periodically for operability to meet North Anna Technical Specification 4.5.2.f.1. The test performed in the fourth quarter of each year includes a start time response measurement. The measurement is made by an operator with a stopwatch observing a pressure gage ported to the discharge pressure tap. The stopwatch is started when the pump starts. The stopwatch is stopped when the pressure gage indication passes 2410 psig. The fourth quarter periodic tests for 1995 were recorded in 1/2-PT-14.1/.2/.3. The following data was obtained:

CHARGING/HHSI PUMP	START TIME
1-CH-P-1A	0.74 seconds
1-CH-P-1B	1.10 seconds
1-CH-P-1C	1.34 seconds
2-CH-P-1A	0.91 seconds
2-CH-P-1B	0.78 seconds
2-CH-P-1C	0.76 seconds

The pressure transmitter identified as PT-1934 which was located between the Boron Injection Tank (BIT) and valves X-SI-MOV-X867C/D has been removed and the connection is presently capped. This information is reflected on Station Flow/Valve Operating Diagram 11715/12050-FM-096A sheet 3 of 3. Therefore, the pressure in the BIT has not been monitored during past startups/shutdowns.

In the Safety Injection standby mode, valves X-SI-MOV-X867A/B are exposed to Charging/HHSI pump discharge pressure on the upstream side of the disc. The piping downstream of valves X-SI-MOV-X867A/B and upstream of valves X-SI-MOV-X867C/D experiences the BIT operating pressure which is approximately 100 psig. During a LOCA, since the HHSI pumps start quickly, as documented above, pressure across the upstream side of the disc of valves X-SI-MOV-X867A/B will equalize permitting these valves to open. As valves X-SI-MOV-X867A/B lift off their seats, the BIT piping increases pressure rapidly. The upstream side of valves X-SI-MOV-X867C/D will experience HHSI pump discharge pressure which will equalize pressure across the upstream side of the disc permitting these valves to open. A review of the thermal overload settings for valves X-SI-MOV-X867C/D show that the shortest time for any of valves to reach their thermal overload setting is 7.4 seconds. Therefore, it is concluded that HHSI pump discharge pressure will be applied to the upstream side of valves X-SI-MOV-X867C/D prior to the valves reaching their thermal overload settings and allowing the pressure to equalize across the upstream seat permitting the valves to open.

4. Valves X-SI-MOV-X836, HHSI Pump Discharge to Alternate RCS Cold Legs, and valves X-SI-MOV-X869A/B, HHSI Pump Discharge to RCS Hot Legs, may be potentially susceptible to pressure locking during a design basis event. The licensee's submittal states that these valves may be potentially susceptible, but does not provide any further analysis regarding their susceptibility. Please discuss why no further analysis was provided for these valves.

Response

Valve X-SI-MOV-X836 provides HHSI pump discharge isolation of the alternate charging path. During normal operation the upstream side of the valve is exposed to Charging/HHSI pump discharge pressure. During a LOCA, valve X-SI-MOV-X836 is opened to establish a segregated HHSI pump discharge flow path. The initial evaluation for these valves was based on the upstream pressure on the valve disc being sufficient to equalize pressure across the upstream side of the disc allowing the valves to open. Calculation ME-0498, Addendum 00A, (Attachment 4) calculated the thrust requirements for these valves and determined that the valves are not susceptible to pressure locking during a large break LOCA.

Valves X-SI-MOV-X869A/B provide HHSI pump discharge isolation for the hot leg recirculation flow path. These valves remain closed during the cold leg injection phase of a LOCA and the cold leg recirculation phase of a LOCA. During this time, the valves have Charging/HHSI pump discharge pressure on the upstream side of the disc. The valves are opened approximately nine hours after the initiation of a LOCA. The initial evaluation for these valves was based on the upstream pressure on the valve disc being sufficient to equalize pressure across the upstream side of the disc allowing the valves to open. Calculation ME-0498, Addendum 00A, (Attachment 4) calculated the thrust requirements for these valves and determined that the valves are not susceptible to pressure locking during a large break LOCA.

5. Regarding valves X-RC-MOV-X535, X536, Pressurizer PORV Block Valves, the licensee's submittal states that an analysis of the operator capability at the degraded voltage condition has demonstrated the valves have adequate margin to open against the postulated pressure locked condition and to overcome any thermal binding. Please provide this analysis for our review.

   Response

   Valves X-RC-MOV-X535/X536 are the isolation valves for the Pressurizer Power Operated Relief Valves (PORV). Calculation ME-0498 was developed to determine expected pullout thrust loads for valves X-RC-MOV-X535/X536. The pressure locking thrust requirements are determined with a method developed by Virginia Power and also by a method developed by Commonwealth Edison/Westinghouse Owner's Group. The stem effect thermal binding evaluation is performed using methodology developed by Commonwealth Edison/Westinghouse Owner's Group. A copy of the calculation is provided in Attachment 4.

6. Through review of operational experience feedback, the staff is aware of instances where licensees have completed design or procedural modifications to preclude pressure locking or thermal binding which may have had an adverse impact on plant safety due to incomplete or incorrect evaluation of the potential effects of these modifications. Please describe evaluations and training for plant personnel that have been conducted for each design or procedural modification completed to address potential pressure locking or thermal binding concerns.

   Response

   Operational experience has demonstrated that water collects in the containment sump suction piping. North Anna Unit 2 ensures that the containment sump is filled to a minimum level to provide the thermal barrier described in response 1 to prevent thermally induced pressure locking of valves 2-SI-MOV-2860A/B. The containment sump level is verified twice a day by an operator per procedure 2-LOG-4, "Unit 2 Control Room Operator Surveillance Sheets."

As described in response 1, the pressure equalization line isolation valve, 1-SI-176, for motor operated valve 1-SI-MOV-1860B has been closed. North Anna Unit 1 is ensuring that the containment sump is filled to a minimum level to provide the thermal barrier described in response 1 to prevent thermally induced pressure locking of valve 1-SI-MOV-1860B. The containment sump level is verified twice a day by an operator per procedure 1-LOG-4, "Unit 1 Control Room Operator Surveillance Sheets."

Attachment 2

Surry Power Station

Request For Additional Information

Generic Letter 95-07

Surry Power Station
Request For Additional Information

1. Regarding valves X-SI-MOV-X860A/B, LHSI Containment Sump Isolation, the licensee's submittal states that the containment sumps at Surry Power Station are maintained in a water-filled condition to provide a thermal barrier to prevent rapid heating of the fluid remaining in the bonnets of the normally closed valves. The NRC staff believes that reliance on water-filled containment sump piping to preclude thermally induced pressure locking under design basis accident conditions is uncertain. Therefore, the NRC staff believes it is important to review your calculations which demonstrate that water-filled piping will preclude thermally induced pressure locking of these valves. Please provide this analysis for our review.

   Response

   The Low Head Safety Injection (LHSI) containment sump isolation valves are X-SI-MOV-X860A/B. An operational characteristic which precludes thermally induced pressure locking of the subject valves is the water filled condition of the sump suction lines.. The physical arrangement of the sump suction piping, located entirely below the sump with the high point being a vertical section of pipe that ends at the floor of the sump, creates a thermal barrier when the pipe contains water. This barrier is considered a passive means of preventing thermally induced pressure locking.

   Calculation ME-0465, Attachment 3, includes a heat transfer analysis to evaluate the insulating capabilities of the water in the pipe and heat transmission entering and exiting the valve pit area during accident conditions. The results of the calculation showed that heat gain from equipment and environs is offset by the available heat sink afforded by the underground location of the subject valves and does not result in appreciable temperature rise which would contribute to a pressure locked condition. In addition, the heat transmitted through the LHSI containment sump suction piping and water medium is minimal and no significant increase in valve bonnet temperature is expected. Further, a review determined that there were no material concerns which would warrant the exclusion of water from the sump suction piping.

2. Valves X-SI-MOV-X842, HHSI Pump Discharge to Alternate RCS Cold Legs, and valves X-SI-MOV-X869A/B, HHSI Pump Discharge to RCS Hot Legs, may be potentially susceptible to pressure locking during a design basis event. The licensee's submittal states that these valves may be potentially susceptible, but does not provide any further analysis regarding their susceptibility. Please discuss why no further analysis was provided for these valves.

   Response

   Valve X-SI-MOV-X842 is the High Head Safety Injection (HHSI) Pump Discharge isolation valve for the alternate RCS cold leg injection/recirculation path. During SI standby operations, the upstream side of the valve is exposed to Charging/HHSI pump discharge pressure. During a LOCA, valve X-SI-MOV-X842 is opened per procedure X-E-1, "Loss of Reactor or Secondary Coolant" to establish a segregated HHSI pump discharge flow path. The initial evaluation for these valves was based on the upstream pressure on the valve disc being sufficient to equalize pressure across the upstream side of the disc allowing the valves to open. Calculation ME-0498, Addendum 00A, (Attachment 4) provides the thrust requirements for these valves and determined that the valves are not susceptible to pressure locking during a large break LOCA.

Valves X-SI-MOV-X869A/B are the HHSI pump discharge isolation valves for the RCS Hot Leg recirculation path. These SI valves remain closed during the injection phase and the cold leg recirculation phase of a LOCA. The valves are opened approximately nine hours after the initiation of a LOCA per procedure X-E-1.4, "Transfer to Hot Leg Recirculation". The initial evaluation for these valves was based on the upstream pressure on the valve disc being sufficient to equalize pressure across the upstream side of the disc allowing the valves to open. Calculation ME-0498, Addendum 00A, (Attachment 4) provides the thrust requirements for these valves and determined that the valves are not susceptible to pressure locking during a large break LOCA.

3. Valves X-SI-MOV-X867C/D, HHSI Pump Discharge to RCS Cold Legs, may be potentially susceptible to pressure locking during a design basis event. Please discuss why these valves were not evaluated in the licensee's submittal.

   Response

   Valves X-SI-MOV-X867C/D are the HHSI Pump Discharge to RCS Cold Leg isolation valves. These valves were determined not to be potentially susceptible to pressure locking because each valve has a drilled hole in the upstream disc of the valve. Design Change package 84-04, "Removal of Boron Injection Tank," verified the existence of a pressure relief hole in each of the valve discs for valves 1-SI-MOV-1867C/D. Design Change package 84-05, "Removal of Boron Injection Tank," drilled a pressure relief hole in each disc for valves 2-SI-MOV-2867C/D.

4. Valves X-RC-MOV-X535/X536, Pressurizer PORV Block Valves, may be potentially susceptible to pressure locking if needed to open to mitigate the consequences of a steam generator tube rupture event, as discussed for the PORV Block Valves at North Anna Power Station. However, the licensee's submittal for Surry Power Station does not address this potential susceptibility. Please address this issue. In addition, the licensee's submittal states that an analysis of the operator capability at degraded voltage condition demonstrated that the valves have adequate margin to open against the postulated thermally bound case. Please provide this analysis for our review.

   Response

   Valves X-RC-MOV-X535/X536 are the isolation valves for the Pressurizer Power

Operated Relief Valves (PORVs). Valves X-RC-MOV-X535/X536 are maintained on steam by a loop seal drain line located upstream of the valves. Therefore, the valves were determined not to be susceptible to pressure locking. Since the valves are on steam, the temperature of the valves is not expected to reduce significantly if the valves were closed. Valves X-RC-MOV-X535/X536 were evaluated for stem effect thermal binding using the Commonwealth Edison/Westinghouse Owner's Group methodology and the results showed the increase in pullout force as a result of stem growth to be small and does not encroach upon any motor operator limits. Calculation ME-0498 is provided in Attachment 4 for staff review.

5. Through review of operational experience feedback, the staff is aware of instances where licensees have completed design or procedural modifications to preclude pressure locking or thermal binding which may have had an adverse impact on plant safety due to incomplete or incorrect evaluation of the potential effects of these modifications. Please describe evaluations and training for plant personnel that have been conducted for each design or procedural modification completed to address potential pressure locking or thermal binding concerns.

   Response

   Surry Power Station has not completed any modifications to preclude pressure locking or thermal binding as a result of the generic letter. It should be noted that Surry Power Station will be performing a modification to valves X-SI-MOV-X890 A/B during the 1997 Unit 1 and 2 refueling outages, as discussed in our February 7, 1996 letter (Serial No. 95-566A). As part of the design modification process, reviews are accomplished to determine the potential impact the modification may have on plant systems, programs and design documents.

   Operational experience has demonstrated that water collects in the containment sump suction piping. Surry Power Station is ensuring that the containment sumps are filled to a level in excess of the amount assumed in the analysis, calculation ME-0465, to provide the thermal barrier to prevent thermally induced pressure locking of valves X-SI-MOV-X860A/B. The water level in Unit 1/2 containment sumps is verified during containment readiness verification per procedure 1/2-GOP-1.1, "Unit Startup, RCS Heatup from Ambient to 195°F." In addition, the containment sump levels are verified daily by procedure 1/2-PT-36, "Operations Periodic Test/Instrument Surveillance."

50-280 VP SURRY 1

RESPONSE TO RAI RE GL 95-07"PRESSURE LOCKING AND THERMAL BINDING OF SAFETY-RELATED POWER-OPERATED GATE VALVES".

50-280 7/3/96

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VIRGINIA POWER — CALCULATION COVER/INPUT SHEET

Type	Sub	Station	Unit	Status	System	Total pages:
[CALC]	[MEC]	[59]	[00]	[ACTIVE]	[SI]	13

Doc. No.	Rev.	QA Class	Aprvd Date	Attachments:
[___ME-0465___]	[___0___]	[SR]	[__________]	

CALC. Title/Subject: DETERMINATION OF HEAT TRANSFER IMPACT TO LHSI SUMP RECIRCULATION VALVES DURING INITIAL DBA EVENT
(Plus any Key Words for Retrieval purposes) LHSI, SUMP, RECIRCULATION VALVES

REFERENCE NUMBERS: IR NO.:__________ JOB No: __________
Initiating Document:(DCP,EWR, etc.) __________

ORIGINATOR: VP [X] Discipline. DE&S MECHANICAL ENGINEERING
A/E [_] Firm Name __________ Vendor Code:______
A/E Calc. No.: __________

Mark Number References:

Station	Unit	System	Prefix/ID		Component/ID	
[_59__]	[01]	[SI]	[_MOV_]	[_1860A ___]	[VALVE]	[__________]
[_59__]	[01]	[_SI]	[_MOV_]	[_1860B______]	[VALVE]	[__________]
[_59__]	[02_]	[_SI_]	[_MOV_]	[_2860A______]	[VALVE]	[__________]
[_59__]	[02_]	[_SI]	[_MOV_]	[_2860B______]	[VALVE]	[__________]
[______]	[___]	[_____]	[_______]	[____________]	[______]	[__________]

Use Associated Information Sheet to continue.

OBJECTIVE:

Determine impact to LHSI sump recirculation valves due to heat transfer from the containment sump piping (ORS piping and LHSI piping). Evaluate the potential for bonnet pressure locking of these valves during the initial phase of a Design Basis Accident.

SUMMARY OF RESULTS/CONCLUSIONS:

The LHSI sump recirculation valves will have no appreciable temperature increase to the bonnet area (< 1°F). It is concluded that bonnet pressure locking of these valves is not a concern during the initial phase of a Design Bases Accident.

Is Associated Information Form attached ( )YES (X)NO

PREPARED BY:	DATE:	REVIEWED BY:	DATE:	IND. REVIEW	DATE:
B. DeMars	4/3/95	J. J. Wolak	4/3/95	B. R. Laraia	4/3/95

VIRGINIA POWER	Document Type —	Engineering Work Sheet POW 14		
	Project —	Doc. No. ME-0465	Rev. No. 0	Sheet No. 2 of 13
	Subject LHSI VALVE BONNET PRESSURIZATION	Prepared By B. DEMARS		Date 4/3/95
	System SAFETY INJECTION	Checked By J.J. [illegible]		Date 4/3/95

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	Subject LHSI VALVE BONNET PRESSURIZATION	Prepared By B. DeMars		Date 3/31/95
	System SAFETY INJECTION	Checked By J. T. Wolck		Date 4/3/95

REFERENCES

1. NORTH ANNA DWGS 11715-FP-4A REV. 17 AND -4D REV. 16 CONTAINMENT RECIRCULATION SPRAY AND LOW HEAD SAFETY INJECTION
2. ASHRAE 1993 FUNDAMENTALS HANDBOOK PG. 22.8
3. MECHANICAL ENGINEERING REFERENCE MANUAL - LINDEBURG, 1992
4. NORTH ANNA NCRODP # 53 - QUENCH SPRAY SYSTEM
5. NORTH ANNA NCRODP # 54 RECIRCULATION SPRAY SYSTEM
6. NORTH ANNA ENVIRONMENTAL ZONE DESCRIPTIONS - CONTAINMENT
7. NAS-1009 REV. 16 NORTH ANNA PIPING SPECIFICATION
8. STANDARD HANDBOOK FOR MECHANICAL ENGINEERS, MARK'S EIGHTH EDITION
9. ALOYCO VALVE DWG. E-48921 LHSI SUMP ISOLATION MOV DWG.
10. FLOW OF FLUIDS THROUGH VALVES, FITTINGS AND PIPE CRANE CO. 1981 TECHNICAL PAPER NO. 410

VIRGINIA POWER	Document Type —	Engineering Work Sheet POW 14		
	Project —	Doc. No. ME-0465	Rev. No. 0	Sheet No. 4 of 13
	Subject LHSI VALVE BONNET PRESSURIZATION	Prepared By B. DEMARS		Date 3/31/95
	System SAFETY INJECTION	Checked By J. J. Wolk		Date 4/3/95

OBJECTIVE

THE PURPOSE OF THIS CALCULATION IS TO DETERMINE THE HEAT TRANSFER TO AMBIENT IN THE SAFEGUARDS VAULT (EL 210'-11") DURING OPERATION OF THE OUTSIDE RECIRCULATION SPRAY PUMPS. IN ADDITION, A DETERMINATION WILL BE MADE ON THE POTENTIAL FOR PRESSURE LOCKING OF SAFETY INJECTION SUMP RECIRCULATION MOVS (1860 A/B & 2860 A/B). DUE TO THE HEAT TRANSFER FROM THE AMBIENT TO THE SUBJECT MOVS BONNET DURING A DESIGN BASES ACCIDENT.

ALSO, THE HEAT TRANSFER THRU THE LHSI PIPING AND WATER TO THE LHSI SUMP ISOLATION MOVS (1860 A/B AND 2860 A/B) WILL BE DETERMINED IN ORDER TO CALCULATE A CONDUCTION HEAT INPUT TO THESE VALVES.

IT SHOULD BE NOTED THAT DUE TO THE SIMILARITY BETWEEN NORTH ANNA AND SURRY SAFEGUARDS DESIGN THE RESULTS OF THIS CALCULATION WILL BE APPLICABLE TO SURRY. HOWEVER, ELEVATIONS DO NOT COINCIDE.

VIRGINIA POWER	Document Type —	Engineering Work Sheet		POW 14
	Project —	Doc. No. ME-0465	Rev. No. 0	Sheet No. 5 of 13
	Subject LHSI VALVE BONNET PRESSURIZATION	Prepared By B. DEMARS		Date 3/31/95
	System SAFETY INJECTION	Checked By T. Wolfe		Date 4/3/95

DESIGN INPUTS

1. LENGTH OF OUTSIDE RECIRCULATION SPRAY SUCTION PIPING IN SAFEGUARDS LOWER VAULT @ EL. 210'-11" IS 14 FEET (REF. 1). PIPE IS 12.75 IN OD (REF. 1 & 7) AREA IS EQUAL TO .162 FT^2 (REF 10)

2. TEMPERATURE OF FLUID IN OUTSIDE RECIRCULATION PIPING IS 170°F.

$$T_{ORS} = T_{BULK} = \frac{280°F + 45°F}{2} = 162.5 \text{ ROUND TO } 170°F.$$

(REF. 6 & 4) NOTE 280°F FROM DBA AND 45°F FROM QUENCH SPRAY TO CONTAINMENT SUMP

3. CONDUCTION HEAT TRANSFER COEFFICIENT $= K_{WATER} = .390 \frac{BTU}{hr \cdot FT^2 \cdot °F}$ (REF. 3)
WATER @ 170 °F

4. SAFEGUARDS VAULT REAR WALL CONCRETE VOLUME IS 315 FT^3 (REF. 1)

5. SAFEGUARDS VAULT DENSITY IS 140 lb/FT^3 AND SPECIFIC HEAT IS .19 BTU/lb.·°F (REF. 2)

6. LENGTH OF LHSI PIPING TO MOVS 1860 A/B (2860 A/B) IS 6 FEET. (REF. 1)

7. THERMAL CONDUCTIVITY COEFFICIENT FOR STAINLESS STEEL IS 9.1 $\frac{BTU}{hr \cdot FT \cdot °F}$
(REF. 3) NOTE CORRECTED TO 170°F

8. $T_S = T_{BULK} = 170°F$ (SEE INPUT #2)

9. LHSI SUCTION PIPING 12.75 OD, INTERNAL AREA = .7854 FT^2 (REF 10)
(REF. 1 & 7) L = 6 FT FROM CONTAINMENT WALL TO LHSI MOV.
AREA PIPE = .10 (REF 10)

VIRGINIA POWER	Document Type —	Engineering Work Sheet		POW 14
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	Subject LHSI VALVE BONNET PRESSURIZATION	Prepared By B. DeMars		Date 3/31/95
	System SAFETY INJECTION	Checked By [illegible]		Date 4/3/95

METHOD OF ANALYSIS

1. DETERMINE HEAT TRANSFER TO THE AMBIENT AIR IN THE SAFEGUARDS VAULT DUE TO OPERATION OF THE OUTSIDE RECIRCULATION SPRAY PUMPS.

2. THE RESULT OF (1) ABOVE WILL BE DIVIDED BY 30 MINUTES TO TAKE IN TO ACCOUNT THE TIME IN TAKES THE RWST TO REACH THE SUMP RECIRCULATION SET POINT (ASSUMPTION 4).

3. THE SAFEGUARDS VAULT IS APPROXIMATELY 60 FEET BELOW GROUND LEVEL AND CONSTRUCTED OF CONCRETE. THEREFORE, PRIOR TO A DBA THE AMBIENT TEMPERATURE IN THE VAULT IS APPROXIMATELY GROUND TEMPERATURE (ASSUMPTION 5). SINCE THE VAULT AND FOR THAT MATTER THE GROUND WILL ACT AS A LARGE HEAT SINK, THE HEAT TRANSFER THRU ONE WALL WILL BE CALCULATED RESULTING IN A VERY SMALL INCREASE IN AMBIENT TEMPERATURE.

4. THE HEAT LOSS CALCULATED FOR STEP 3 WILL BE COMPARED TO STEP ONE TO EVALUATE TEMPERATURE RISE IN VAULT.

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	System SAFETY INJECTION	Checked By J. T. Wolk		Date 4/3/95

METHOD OF ANALYSIS (CONTINUED)

5. DETERMINE HEAT TRANSFER TO LHSI MOVS 1860 A/B AND 2860 A/B DUE TO CONDUCTION THRU LHSI PIPING AND WATER

A PARALLEL NETWORK ANALYSIS WILL BE USED TO DETERMINE THE THERMAL RESISTANCE OF THE PIPING AND WATER

$$\frac{1}{R_{TH}} = \frac{1}{R_{PIPE}} + \frac{1}{R_{WATER}} = \frac{1}{\frac{\Delta X}{K_{PIPE} \times A_{PIPE}}} + \frac{1}{\frac{\Delta X}{K_{WATER} \times A_{WATER}}}$$

$$Q_{CONDUCTION} = \frac{T_{BULK} - T_{AMBIENT}}{R_{TH}}$$

6. NOTE NO COMPUTER CODES WERE USED IN THIS ANALYSIS.

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ASSUMPTIONS

1. HEAT GENERATED IN THE SAFEGUARDS VAULT WOULD RISE UP THRU THE ACCESS LADDER WAY. THIS CHIMNEY EFFECT WAS NOT INCLUDED IN THE ANALYSIS FOR CONSERVATISM.

2. THE HEAT SINK PROVIDED BY THE 12 INCH LHSI SUCTION PIPING TRANSPORTING 45°F BORATED WATER FROM THE RWST TO THE LHSI PUMPS WAS NOT CONSIDERED FOR CONSERVATISM.

3. ADDITIONAL HEAT SINKS PROVIDED BY THE OTHER VAULT WALLS/ CEILING WERE NOT CONSIDERED.

4. ASSUMED 30 MINUTES FOR RWST FLOW DURING DESIGN BASES ACCIDENT. ACTUAL TIME IS 25 MINUTES DUE TO A 5 MINUTE TIME DELAY IN STARTING ORS PUMP. FOR CONSERVATISM, 30 MINUTES WAS USED FOR ORS PUMP OPERATION.

5. NO CONTRIBUTION WAS TAKEN FOR HEAT TRANSFER THRU THE CONTAINMENT WALL. THE LHSI MOV VALVES ARE LOCATED BELOW THE CONTAINMENT FLOOR AND WOULD BE SHIELDED. ANY HEAT TRANSFER WHICH DOES OCCUR ABOVE THE MOV LOCATIONS WOULD RISE AND NOT IMPACT THE MOVS.

6. ASSUMED GROUND TEMPERATURE OF 60°F (VAULT TEMPERATURE).

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CALCULATION

1) DETERMINE HEAT ADDED TO SAFEGUARDS VAULT @ ELEVATION 210'-11 DUE TO OPERATION OF OUTSIDE RECIRCULATION SPRAY PUMPS

$$Q = \frac{T_{ORS} - T_{AMB}}{\frac{1}{h \times \pi \times OD \times L}}$$

$$= \frac{(170°F - 60°F)}{\left(\frac{1}{1.65 \frac{BTU}{hr \cdot FT^2 \cdot °F} \times \pi \times 1.063 FT \times 14 FT}\right)}$$

$$Q = 8485.7 \frac{BTU}{HR}$$

$$Q_{@ 30 \text{ MINUTES (LBLOCA)}} = \underline{\underline{4242.8 \text{ BTU}}}$$

2) DETERMINE HEAT ABSORBED BY ONE CONCRETE WALL WITH A 1°F CHANGE IN THE EL. 210'-11" SAFEGUARDS VAULT AMBIENT TEMPERATURE

$$Q = V_{CONCRETE} \times \rho_{CONCRETE} \times \text{SPECIFIC HEAT} \times \Delta T_{VAULT}$$

$$= 315 FT^3 \times 140 \frac{lb}{FT^3} \times .19 \frac{BTU}{lb \cdot °F} \times (1°F)$$

$$Q = \underline{\underline{8379.0 \text{ BTU}}}$$

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3) CALCULATION (CONTINUED)

DETERMINE HEAT TRANSFER TO LHSI MOVS VIA CONDUCTION THRU PIPE AND WATER

$$Q = \frac{T_{BULK} - T_{AMBIENT}}{R_{TH}}$$

$$R_{TH} = \frac{1}{RE} = \frac{1}{\dfrac{.6\ FT}{9.1\ \frac{BTU}{hr \cdot FT \cdot °F} \times .10\ FT^2}} + \frac{1}{\dfrac{16\ FT}{.390\ \frac{BTU}{hr \cdot FT \cdot °F} \times .7854\ FT^2}}$$

$$\frac{1}{RE} = .15\ \frac{BTU}{hr \cdot °F} + .05\ \frac{BTU}{hr \cdot °F}$$

$$R_{TH} \approx 5.0\ \frac{HR \cdot °F}{BTU}$$

$$Q = \frac{170°F - 60°F}{5.0\ \frac{HR \cdot °F}{BTU}} = 22.0\ \frac{BTU}{HR}$$

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	System SAFETY INJECTION	Checked By J. T. Wo[illegible]		Date 4/3/95

RESULTS / CONCLUSIONS

THIS CALCULATION SHOWED THAT THE AMOUNT OF HEAT TRANSFERRED TO THE AMBIENT ENVIRONMENT IN THE VAULT (4242.8 BTUs) DUE TO ORS OPERATION CAN BE ABSORBED BY THE REAR VAULT WALL WITH ONLY A SMALL INCREASE IN TEMPERATURE. THIS IS THE RESULT OF THE LARGE HEAT SINK WHICH THE VAULT ACTS AS. THEREFORE, IT IS CONCLUDED THAT NO APPRECIABLE TEMPERATURE RISE (< 1°F) CAN OCCUR IN THE BONNET AREAS OF THE LHSI SUMP SUCTION ISOLATION VALVES AND BONNET PRESSURIZATION IS NOT A CONCERN. THIS CONCLUSION DOES NOT TAKE IN TO ACCOUNT THE SIGNIFICANT CONTRIBUTIONS OF THE OTHER VAULT MASSES (FLOOR, CEILING & OTHER WALLS. HEAT CAN ALSO LEAVE THE ROOM VIA THE ACCESS LADDER SPACE. THE OPERATION OF THE LHSI PUMPS, TAKING SUCTION FROM THE RWST (45° BORATED WATER), WOULD ALSO ACT AS A HEAT SINK.

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	System SAFETY INJECTION	Checked By J. J. Wolke		Date 4/5/95

RESULTS / CONCLUSIONS (CONTINUED)

AS SHOWN BY THIS CALCULATION, THE HEAT CONDUCTED VIA THE LHSI SUMP PIPING AND WATER TO THE LHSI MOVS 1860 A/B AND 2860 A/B IS SMALL, 22 BTU/HR. AS A RESULT, NO SIGNIFICANT INCREASE IN BONNET TEMPERATURE IS EXPECTED.

IT SHOULD BE NOTED THAT NO CONVECTIVE LOSSES WERE USED IN THIS DETERMINATION. THE CALCULATION SHOWED THAT THE VAULT AREA IS CAPABLE OF REMOVING SIGNIFICANT HEAT LOADS FROM THE SPACE. IN ADDITION, NO HEAT LOSS CREDIT WAS TAKEN FOR THE LHSI SUCTION PIPING IN THE CONTAINMENT MAT.

CALCULATION REVIEW CHECKLIST

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CALCULATION TITLE: LHSI SUMP RECIRCULATION VALVES PRESSURE LOCKING

A "NO" answer to any questions requires that an explanation be provided.
NOTE: Reference may be made to explanations contained in the calculation.

	QUESTIONS	YES	NO	N/A
1.	Is the calculation number and revision identified on on each page of the calculation and attachments?	[x]	[_]	[_]
2.	Does the objective statement identify the reason for performing the calculation and give sufficient background information?	[x]	[_]	[_]
3.	Have the sources of design inputs been correctly selected and referenced in the calculation?	[x]	[_]	[_]
4.	Are the sources of design inputs up-to-date and retrievable (and/or a copy attached to the calc.)?	[x]	[_]	[_]
5.	Where appropriate, have the other disciplines reviewed or provided the design inputs for which they are responsible?	[ ]	[_]	[x]
6.	Have design inputs been confirmed by analysis, test, measurement, field walkdown, or other pertinent means as appropriate for the configuration analyzed?	[x]	[_]	[_]
7.	Are assumptions adequately described and bounded by the Station Design Basis?	[x]	[_]	[_]
8.	Have the bases for engineering judgements been adequately and clearly presented?	[x]	[_]	[x] BD JW
9.	Were appropriate calculation/analytic methods used and are outputs reasonable when compared to inputs?	[x]	[_]	[_]
10.	Are computations technically accurate and has the calculation made appropriate allowances for instrument errors and calibration equipment errors? (Reference STD-EEN-0304)	[x]	[_]	[_]
11.	Have those computer codes used in the calculation been listed in the "references" or has a statement been placed in the "methods of analysis" section which states - "No computer code used.",if no computer codes were used?	[_]	[_]	[x]
12.	Have all exceptions to station design basis criteria and regulatory requirements been identified and justified in accordance with ANSI N45.2.11-1974?	[ ]	[_]	[x]

Comments: (N/A if none)

[_] Additional comment pages added.

Prepared By:	Date:	Reviewed By:	Date:
B. DeMars (signature)	4/3/95	J. J. Wolak (signature)	4/3/95