VIRGINIA ELECTRIC AND POWER COMPANY
RICHMOND, VIRGINIA 23261

September 22, 1992

United States Nuclear Regulatory Commission
Attention: Document Control Desk
Washington, D.C. 20555

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Docket Nos. 50-280
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Gentleman:

VIRGINIA ELECTRIC AND POWER COMPANY
SURRY POWER STATION UNITS 1 AND 2
INDIVIDUAL PLANT EXAMINATION -
REQUEST FOR ADDITIONAL INFORMATION ON
RESOLUTION OF GENERIC ISSUE GI-23

In a letter dated July 17, 1992, the NRC requested additional information on the Surry Individual Plant Examination (IPE) regarding resolution of generic issue GI-23, "Reactor Coolant Pump Seal Failures." Attached are the specific responses to your request for additional information regarding compliance with the draft Regulatory Guide DG-1008.

The Surry IPE, submitted by an August 30, 1991 letter (Serial No. 134A), determined the core damage frequency (CDF) associated with RCP seal failure for Surry Power Station. NUREG-1401, "Regulatory Analysis for Generic Issue 23: Reactor Coolant Pump Seal Failures," identifies the associated CDF for the industry. As shown in the attached Table 1, the current Surry CDF associated with RCP seal failure is less than the industry CDF identified in NUREG-1401 and approaches the CDF identified in NUREG-1401 as the objective with improvements.

The Surry and industry CDFs can also be broken down into the portions associated with station blackout (SBO) and non-SBO, as indicated in Table 1. Comparing the Surry CDF associated with RCP seal failure SBO and non-SBO categories shows that Surry CDF is lower than the industry CDF identified in NUREG-1401 in both the SBO and non-SBO categories. Planned improvements in the ability of Surry to cope with a station blackout will also improve the overall CDF associated with RCP seal failures. The Surry SBO improvements are discussed in Item 4 in the attached responses.

In addition, we have reviewed the recommendations of NUREG/CR-4544, "Reactor Coolant Pump Seal Related Instrumentation and Operator Response," and the draft Regulatory Guide DG-1008, "Reactor Coolant Pump Seals." The current Surry instrumentation and procedures are slightly different from the recommendations in the

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draft Regulatory Guide. However, the differences are not considered significant, as detailed in Item 3 in the attached responses.

Based on these conclusions, GI-23 is considered to be resolved for Surry Power Station. Therefore, no additional procedure revisions or hardware modifications are required to ensure that reactor coolant pump seal failure is not a significant concern at Surry Power Station.

If you have further questions, please contact us.

Very truly yours,

W. L. Stewart
Senior Vice President - Nuclear

Attachments:

1. Table 1 - Core Damage Frequency (Per Reactor Year) Associated with RCP Seal Failure
2. Responses to NRC IPE Request for Additional Information on Generic Issue GI-23: RCP Seal Failures

cc: U. S. Nuclear Regulatory Commission
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Mr. M. W. Branch
NRC Senior Resident Inspector
Surry Power Station

TABLE 1

CORE DAMAGE FREQUENCY (PER REACTOR YEAR) ASSOCIATED WITH RCP SEAL FAILURE

	SBO	Non-SBO	Total
Surry IPE	4.6E-6*	7.9E-6	1.25E-5*
NUREG-1401	5.6E-6	2.23E-5	2.79E-5
NUREG-1401 with Improvements 1 and 2**	5.6E-6	1.66E-5	2.22E-5
NUREG-1401 with Improvements 1, 2, and 3**	6.0E-7	1.06E-5	1.12E-5

* This CDF value does not include the effect of future Surry SBO modifications planned to meet the requirements of 10CFR50.63.

** Improvements from Table 2-1 of NUREG-1401:

1. Improvements that treat the RCP seal assembly as an item performing a safety related function similar to other components of the reactor coolant pressure boundary, applying quality assurance requirements consistent with 10CFR50 Appendix B and applicable General Design Criteria of 10CFR50 Appendix A. Such improvements include quality control over 1) seal materials and fabrication, 2) installation and maintenance through the use of process specifications, and 3) plant operations through the use of operating procedures designed to avoid damage during pump startup and shutdown.

2. Improvements that provide RCP-manufacturer-recommended instrumentation and instructions for monitoring RCP seal performance and detecting incipient RCP seal failures. Such improvements include improved monitoring capability that identifies degraded seal performance early enough to take corrective action to mitigate seal failures.

3. Improvements that provide RCP seal cooling during off-normal plant conditions involving loss of all seal cooling, such as station blackout. Such improvements include maintaining RCP seal temperatures within system design conditions and avoiding two-phase flow through the seals.

RESPONSES TO NRC IPE REQUEST FOR ADDITIONAL INFORMATION ON GENERIC ISSUE GI-23: RCP SEAL FAILURES

1. Are the QA provisions for the reactor coolant pump (RCP) seal provided at the Surry Power Station, Units 1 & 2, consistent with Item 1 of the regulatory position of Draft Regulatory Guide DG-1008? Section 3.4.4.2 of the Surry IPE report does not mention any QA provisions for installation and maintenance of RCP seals. If the provisions are not consistent with the above-cited Regulatory Guide, what are the provisions?

Response:

Virginia Power provides quality assurance provisions for the reactor coolant pump (RCP) seals at Surry Units 1 and 2 consistent with the Item 1 of the regulatory position of draft Regulatory Guide DG-1008. The number 1 and 2 RCP seals are classified as safety related under our Q-List Program. Technical evaluations of the safety related seal components were performed using various design documents as a basis. As a result of this review, technical and quality assurance requirements were assigned to each item based on its safety related application. Some of the items related to the number 1 and 2 seals in the warehouse were dedicated for safety related use by a Commercial Grade Item Evaluation because they were procured prior to a July 31, 1990 Quality Classification Analysis and were originally classified as non-safety related. All subsequent number 1 and 2 seal stock items have been procured from the vendor under their 10CFR50 Appendix B and 10CFR21 programs. The vendor's QA program covers the design and manufacture of RCP seals.

Quality assurance (QA) provisions for installation and maintenance have been incorporated into station procedures. The RCP seals are installed, inspected, and maintained in accordance with station maintenance procedure MMP-C-RC-009, "Disassembly, Inspection and Reassembly of the Reactor Coolant Pump and Seals." This procedure includes quality assurance witness hold points during the installation and maintenance of the number 1 and 2 seals. By virtue of the safety related classification, QA hold points, and Station Nuclear Safety Operations Committee (SNSOC) approval, this procedure's activities are controlled by Virginia Power's QA program that meets the intent of Criterion 2 of 10CFR50 Appendix B.

2. Are the operating procedures for RCP seal at the Surry Power Station, Units 1 and 2 consistent with Item 2.1 of the regulatory position of Draft Regulatory Guide DG-1008? Although Section 3.4.4.2 (page 3-137) of the Surry IPE report briefly mentions that adequate instructions are available to operators to provide backup seal injection and thermal barrier cooling by referring operators to the seal cooling abnormal procedures, it does not provide sufficient detail for the staff to make a judgment. Please provide a more detailed description of the operating procedures for our review.

Response:

The Surry procedures regarding the reactor coolant pump (RCP) seals are generally consistent with the intent of the draft Regulatory Guide and are discussed in the following paragraphs.

Many Surry procedures provide guidance for proper operation of the RCP seals under normal conditions and to detect and identify the corrective action for off-normal situations. Surry procedures provide station personnel with adequate guidance to address the concerns of draft Regulatory Guide DG-1008, "Reactor Coolant Pump Seals."

Operations personnel use Maintenance Operating Procedures to remove a RCP from service or to return a RCP to service following maintenance. There are separate procedures for removing and returning a RCP from service, and these procedures are unique for each RCP. These procedures perform valve lineups necessary for RCP seal operation.

During maintenance outages, there are specific procedures that are used during RCP maintenance. Corrective Mechanical Maintenance Procedure MMP-C-RC-009, "Disassembly, Inspection and Reassembly of Reactor Coolant Pump and Seals," is a 100 page procedure divided into six sections and fourteen attachments. The purpose of this procedure is to provide 1) instructions for inspection and maintenance of RCP controlled leakage mechanical seals, 2) instructions for removal, examination and reinstallation of RCP main flange bolts, 3) detailed instructions for removal and installation of the floating ring seals, the disassembly and reassembly of the RCP, and the inspection of the hydraulic components, and 4) detailed instructions for "in place" replacement of thermal barrier gaskets. The procedure includes detailed drawings of the RCP and seals.

The station procedures have a reference section that typically lists RCP seal manufacturer and NSSS vendor manuals, technical bulletins, or letters related to the procedure. Specific manufacturer or vendor instructions are incorporated as an initial condition, a precaution and limitation, an instruction step, or caution or note within the procedure.

During plant startup operations, the RCPs are started using Operating Procedure OP-5.2.1, "Starting Any Reactor Coolant Pump." This procedure contains an extensive list of precautions and instructions that must be observed during a RCP start to minimize the possibility of damage to the mechanical seals. Included in this procedure are expected and abnormal process parameters to allow the Control Room Operator (CRO) to evaluate the performance of the RCP seals.

During normal operation, the control room operator monitors instrumentation that allows evaluation of the RCP seal status on a continual basis. At least once per shift, the licensed CRO records the values of the RCP seal related instrumentation. This allows further evaluation of the process parameter compared to established limits and identification of long term trends of the parameters. This recorded information is reviewed by the on-duty Senior Reactor Operator and by the CROs who take over during the next shift. Additionally, there are numerous main control room annunciators that alarm when their limits are reached. The most significant of these annunciators are included in Table 2-1. Only annunciators related to 1-RC-P-1A are listed. There are similar annunciators for the other RCPs.

Each of the control room annunciators has an annunciator response procedure to provide guidance to the control room operators. These procedures include the actuation setpoint, references, a list of probable causes, and the operator action to be taken. Instructions for off-normal conditions provided by the RCP seal manufacturer have been incorporated into the annunciator response procedures. The reference section of these procedures includes references to the manufacturer's technical manual, letters, or information notices.

The annunciators may provide the operator with the first indication of a potential off-normal condition that may lead to seal failure. The CROs respond to a loss of RCP seal injection flow or loss of cooling to the thermal barrier heat exchanger conditions by following the guidance of the annunciator response procedures.

An inadvertent termination of RCP seal cooling is responded to using AP-9.02, "Loss of RCP Seal Cooling." This procedure is initiated 1) whenever all component cooling (CC) and charging pumps are lost, 2) at the direction of the Shift Supervisor, or 3) upon transitioning from any of several emergency operating procedures (EOPs) which reference AP-9.02. Operator guidance is provided for reestablishing RCP seal cooling. Restarting a RCP after loss of seal cooling is not allowed until a complete seal inspection is performed unless the RCP is needed to mitigate a RED or ORANGE path of the core cooling critical safety functions status tree.

Whenever a reactor trip occurs, regardless of the reason, the operators will initiate the emergency procedures beginning with E-0, "Reactor Trip or Safety Injection." If a station blackout is in progress then the operators will transition to ECA-0.0, "Loss of All AC power." This procedure provides guidance on isolating the RCP seals. During the recovery from a station blackout the operator will transition to ECA-0.1, "Loss of All AC Power Recovery Without SI Required," that provides direction to establish RCP seal cooling using AP-9.02.

NUREG/CR-4544, "Reactor Coolant Pump Seal Related Instrumentation and Operator Response," includes operator response procedure recommendations for Westinghouse related RCP seal systems. Virginia Power has previously reviewed these recommendations and incorporated appropriate changes into the annunciator response and emergency operating procedures.

Table 2-1 Control Room Annunciators Which Monitor RCP Seal Status	
Window	Description
1C-A2	RCP 1A Thermal Barrier CC Hi Flow
1C-A3	RCP 1A Thermal Barrier CC Hi Temp
1C-A4	RCP 1A Seal Leakoff High Flow
1C-A5	RCP 1A Seal Water Return Low Differential Pressure
1C-D1	RCP 1A CC Return High Temperature
1C-D2	RCP Thermal Barrier Return Header High Flow
1C-D3	RCP 1A Shaft Seal Water Low Injection Flow
1C-D4	RCP 1A Shaft Seal Leakoff Low Flow
1C-D5	RCP 1A Seal Water Bypass Low Flow
1C-E3	Seal Water Injection Filter High Differential Pressure
1C-F2	RCP Bearing High Temperature
1B-A8	RCP 1A Vapor Seal Tank High Level
1B-D8	RCP 1A Vapor Seal Tank Low Level
1B-B3	RCP Shaft Alert
1B-C1	RCP Shaft Danger
1B-C2	RCP Frame Alert
1B-E4	RCP Frame Danger

3. Is the instrumentation relative to the RCP seal at the Surry Power Station, Units 1 & 2, consistent with Item 2.2 of the regulatory position of Draft Regulatory Guide DG-1008? Section 3.4.4.2 of the Surry IPE report does not appear to cover this instrumentation. If the instrumentation is not consistent with the above-cited Regulatory Guide, describe the installed instrumentation in sufficient detail to allow the NRC staff to evaluate its acceptability.

Response:

Surry Power Station has a majority of the instrumentation recommended by Table 2 of draft Regulatory Guide DG-1008. NUREG/CR-4544, "Reactor Coolant Pump Seal Related Instrumentation and Operator Response," contains the background information concerning the recommended instrumentation for Westinghouse related RCP seal systems. Table 3-1 is a listing of the draft Regulatory Guide's recommended instrumentation and the corresponding Surry instrumentation. Some inconsistencies exist between the draft Regulatory Guide's recommended instrumentation setpoints and ranges and Surry's instrumentation setpoints and ranges. However, these inconsistencies are not considered to be significant enough to require any instrumentation changes.

Table 3-1
Comparison of Reg Guide DG-1008 Recommended Instrumentation and Surry Instrumentation

Regulatory Guide DG-1008 Recommended Instrumentation				Surry Instrumentation	
Location	Parameter	Normal Value (Range)	Setpoint	Equipment # (Range)	Setpoint
No. 1 Seal Inlet (at Radial Bearing)	Temperature	130°F (60-150°F)	Hi = 170°F	1-CH-TI-1125	none
Outlet	Temperature	150°F (60-235°F)	Hi = 190°F	1-CH-TE-1126	180°F
	Leak Rate	3 gpm (0.2-5.0 gpm)	Hi = 5.0 gpm Lo = 0.8 gpm	1-CH-FT-1156A (0-6 gpm) 1-CH-FT-1156B (0-1 gpm)	Hi = 5 gpm Lo = 0.2 gpm
Inlet - Outlet	Differential Pressure	2235 psid (200 - 2470 psid)	Lo = 275 psid	1-CH-PI-1156B (0-400 psid)	200 psid
No. 2 Seal	Leak Rate	3 gph	Hi = 1.0 gpm	Standpipe or PDTT level	Annunciator for Hi and Lo Standpipe
	Pressure	30 psig (15-60 psig)	N/A	none	none
No. 3 Seal	Standpipe Level	Varies	Hi = 31 in Lo = 58 in.	none	none

Table 3-1
Comparison of Reg Guide DG-1008 Recommended Instrumentation and Surry Instrumentation

Regulatory Guide DG-1008 Recommended Instrumentation				Surry Instrumentation	
Location	Parameter	Normal Value (Range)	Setpoint	Equipment # (Range)	Setpoint
<u>No. 1 Seal Leakoff</u> (Return Line)	Pressure	40 psig	N/A	none	none
	Temperature	160°F	N/A	1-CH-TI-1133 (50-300°F)	none
	Flow Rate	Same as No. 1 Seal Outlet	Same as No. 1 Seal Outlet	none	none
<u>No. 2 Seal Leakoff</u>	Leak Rate	3 gph	Hi = 1.0 gpm	none	none
<u>Seal Injection</u>	Temperature	(120-130°F)	Hi = 135°F	none	none
	Flow Rate	8 gpm	Lo = 6 gpm	1-CH-FI-1130A (0-15 gpm)	Lo = 5 gpm
	Differential Pressure	N/A	N/A	none	none
<u>Component Cooling Water</u>	Temperature (Thermal Barrier Heat Exchanger Inlet)	80°F (60-105°F)	Hi = 105°F	1-CC-TE-145A (0-200°F)	Hi = 145 °F

Table 3-1
Comparison of Reg Guide DG-1008 Recommended Instrumentation and Surry Instrumentation

Regulatory Guide DG-1008 Recommended Instrumentation				Surry Instrumentation	
Location	Parameter	Normal Value (Range)	Setpoint	Equipment # (Range)	Setpoint
	Flow Rate (Thermal Barrier Heat Exchanger Inlet)	40 gpm (35-60 gpm)	Lo = 35 gpm	1-CC-FE-107A (0-60 gpm)	50 gpm
	Flow Rate (Combined RCP-CCW Return Flow)	N/A	N/A	1-CC-FT-140A (0 - 150 gpm)	130 gpm
<u>RCP Shaft</u>	Vibration (X&Y Shaft Orbit)	(3-6 mil peak to peak)	Hi = 10 mil		Alert = 15 mils Danger = 20 mils

4. Regarding off-normal conditions, Section 3.4.4.2 (page 3-137) of the Surry IPE report states that "...In view of the uncertainty of seal performance under off normal conditions such as station blackout, Virginia Power has decided to install equipment which will ensure the provision of seal injection under these off-normal conditions, as suggested in the draft regulatory guide." No details are provided for this equipment. The staff is not in a position to review and accept this commitment until more definitive details are provided.

Response:

The equipment Virginia Power will install to resolve the concerns associated with GI-23, "RCP Seal Failures," consists of two new diesel generators. These diesel generators and associated alternate AC buses are scheduled to be installed at Surry to address station blackout (SBO) concerns. This will allow an independent means to power emergency buses that supply power to the equipment necessary to provide RCP seal cooling. Sufficient redundancy currently exists for the RCP seal cooling fluid systems. The Surry IPE did not identify any RCP seal cooling system vulnerabilities that significantly contribute to core damage frequency.

Each SBO alternate AC diesel generator is considered to be a fully capable unit in accordance with NRC SBO criteria. Additionally, the diesel generators are being designed to meet the 10 minute alternate AC criteria of SBO. Further details on the plan for installation of this equipment and the NRC acceptance of this plan are provided in the following correspondence:

Virginia Electric and Power Company letters to the NRC:
- Serial Number 90-661, dated November 29, 1990
- Serial Number 91-242, dated April 30, 1991
- Serial Number 91-402, dated July 31, 1991
- Serial Number 91-738A, dated February 10, 1992
- Serial Number 91-738B, dated March 17, 1992
- Serial Number 92-356, dated June 24, 1992

NRC letters to Virginia Electric and Power Company:
- October 15, 1990 Letter, Safety Evaluation, and Technical Evaluation Report
- December 6, 1991 Letter and Supplemental Safety Evaluation
- May 12, 1992 Letter and Supplemental Safety Evaluation
- July 22, 1992 Letter and Final Acceptance

We were unable to provide further details in the IPE submittal because we were responding to NRC questions regarding SBO at that time. However, the referenced documents should provide the information needed regarding the planned Surry SBO improvements.

5. Please also confirm that the seal injection will be reestablished within 10 minutes following a loss of seal cooling, and not from the "declaration" of an event such as station blackout or loss of seal cooling, which may include the time required for the plant staff to perform a number of emergency operating procedures.

Response:

Virginia Power has expressed its position on this item in an October 1, 1991 letter (Serial No. 91-283), which provided comments on the draft for Regulatory Guide DG-1008. Our position is that, to be consistent with the guidelines of the station blackout (SBO) program, RCP seal cooling will be established within ten minutes of declaration of an event, not within ten minutes from the start of off-normal plant conditions. This allows the control room operators time to attempt to utilize emergency power supplies before attempting to start the alternate power supply. The October 1, 1992 Virginia Power response was as follows:

> **"The proposed resolution as presently stated, would not allow credit for Alternate AC power sources installed in accordance with the provisions of Regulatory Guide 1.155 or NUMARC 87-00.**
>
> **Discussion**
>
> Appendix E to NUREG-1401 indicates that PWR licensees should "provide RCP seal cooling during off-normal plant conditions such as station blackout" by initiating "cooling flow to the RCP seal in accordance with the specifications used for normal operation within 10 minutes from the start of the off-normal plant conditions." This 10 minute criterion is evaluated in draft Regulatory Guide DG-1008 in view of station blackout guidance. In this regard, draft Regulatory Guide DG-1008 states that
>
> > "if, as part of the implementation of the station blackout rule, a plant is reestablishing seal cooling within 10 minutes (e.g., by an alternate ac supply which power the seal injection function), then seal cooling is not considered lost."
>
> This position is not consistent with the 10-minute AAC availability provisions associated with the station blackout rule (See Regulatory Guide 1.155 and NUMARC 87-00) because the time periods do not start at the same time. NRC station blackout guidance provides that:
>
> > "if the AAC power source can be demonstrated by test to be available to power the shutdown buses within 10 minutes of the onset of the station blackout, no coping analysis is required." (Regulatory Guide 1.155, Section 3.3.5.3)

NRC Staff approved guidance, NUMARC 87-00, clarifies the AAC availability and the 10-minute criterion as follows:

> "Available within 10 minutes means that circuit breakers necessary to bring power to safe shutdown buses are capable of being actuated from the control room within that period." (NUMARC 87-00, Section 7.1.2)

and

> "The 10 minute requirement was meant to cover the period from when the operators realized that a station blackout has occurred until the AAC source is started from the control room. Therefore, operators would perform the immediate steps in the EOPs to verify scram, primary system parameter, etc., and attempt to restore offsite power and start the EDGs from the control room per the EOPs. Station blackout begins when actions from the control room are unsuccessful in restoring offsite and onsite emergency AC power. The ten minute criteria is met if the operators can start and be ready to load the AAC source within the following ten minutes from within the control room." (NUMARC 87-00, Seminar Questions/Answers No. 65).

The provision that "seal injection function" or "independent seal cooling" be reinitiated within 10 minutes from the onset of the station blackout (or loss of cooling event) may effectively disqualify the use of existing 10-minute AAC sources for meeting Regulatory Position 3. The 10-minute period following the onset of a loss-of-seal-cooling initiating event would not accommodate the implementation of Emergency Operating Procedures (EOPs), starting and loading the AAC source, and reestablishing seal cooling. The proposed resolution may therefore necessitate the utilization of an (AC-independent) "independent seal cooling system" that would be automatically actuated upon sensing of a loss-of-cooling event. In this case, any proposed automatic independent seal cooling system would need to be carefully evaluated in view of the recommendations of NUREG/CR-4544 which states that "automatic actions related to maintaining RCP seal integrity involved a tradeoff between the benefit gained by proper operation of automatic devices and the potential drawbacks associated with their malfunction or inadvertent operation." Automatic independent seal cooling systems may require complicated control circuitry which must be capable of differentiating between actual loss-of-cooling events and plant transients.

For the same reasons, it appears that 1-hour AAC sources installed as part of compliance with 10CFR50.63 could not be credited towards addressing RCP seal failure induced safety concerns. The proposed resolution would thus involve substantial modifications to these newly-installed systems at considerable cost.

The incompatibility of the proposed resolution with SBO AAC provisions is in part due to the deficiencies in Staff's supporting data which did not properly consider all aspects of the restoration of seal cooling. In particular, draft Regulatory Guide DG-1008 only suggests that an independent seal cooling system be implemented that is capable of restoring cooling flow to RCP seals within 10 minutes of the onset of a postulated loss-of-cooling event. However, DG-1008 does not provide any guidance for the evaluation of potential event sequences in which the 10 minute criterion would not need to be observed. Hence, it is not clear whether the restoration of seal cooling flow within other defined time frames would be acceptable and whether such actions would result in an acceptable reduction (if necessary) of the risk associated with the predicted leakage rates."

6. The Surry IPE report does not appear to address inadvertent termination of RCP seal cooling from causes such as: (1) containment isolation, (2) loss of pneumatic system, or (3) a safety injection signal. Please confirm that the HPI will continue to provide seal injection under these conditions.

Response:

At Surry the charging (CH) pumps are used for high pressure injection functions including RCS makeup, RCP seal injection, and safety injection flow. Each pump is capable of discharging to either the normal discharge header using MOV-1286A/B/C (one for each pump) or the alternate discharge header using MOV-1287A/B/C (one for each pump). From the normal discharge header, flow may be directed to the following three flow paths:

(1) normal charging using MOV-1289A/B,

(2) RCP seal injection using MOV-1370 (RCP seal injection isolation valve) and HCV-1186 (total RCP seal injection flow control valve), and

(3) safety injection flow paths using MOV-1867C/D (RCS cold leg, valves in parallel) or MOV-1869B (RCS hot leg).

From the alternate discharge header, flow may be directed to the following three flow paths:

(1) alternate charging using FCV-1160,

(2) RCP seal injection using 1-CH-278 (a manually operated valve), and

(3) safety injection flow paths using MOV-1842 (RCS cold leg) or MOV-1869A (RCS hot leg).

During normal operation, charging flow is provided to the normal charging path and to the normal RCP seal injection path.

<u>Containment Isolation Effect on RCP Seal Cooling</u>

When containment isolation occurs, a safety injection signal is initiated causing the charging pump discharge valves to operate as they do upon initiation of a safety injection. Specifically, flow is established to the RCS cold leg safety injection path (MOV-1867C/D open) and isolated from the normal charging header (MOV-1289A/B close). The RCP seal injection flow remains available because MOV-1370 and HCV-1186 do not change position on a containment isolation signal or a safety injection signal.

Loss of Pneumatic System Effect on RCP Seal Cooling

When there is a loss of the pneumatic systems (instrument air and service air), the charging pump discharge motor operated valves (MOVs) are unaffected. There are no air operated valves in the safety injection flow paths. The only air operated valve in the RCP seal injection flow path is HCV-1186. This valve requires air to close and will stroke open upon the loss of air pressure. If necessary, RCP seal injection can bypass HCV-1186 by utilizing the charging pump alternate discharge header flow path. The normal charging flow path has two air operated valves HCV-1310 and FCV-1122, which both fail open upon the loss of instrument air.

Safety Injection Effect on RCP Seal Cooling

When a safety injection signal occurs, the charging pump discharge valves realign to allow flow to the RCS cold leg safety injection path (MOV-1867C/D open) and isolate the normal charging header (MOV-1289A/B close). The RCP seal injection flow remains available because MOV-1370 and HCV-1186 do not change position on a containment isolation signal or a safety injection signal.