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PG&E Letter DCL-00-083

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

Docket No. 50-275, OL-DPR-80
Docket No. 50-323, OL-DPR-82
Diablo Canyon Units 1 and 2
License Amendment Request 00-05
Revise Improved Technical Specification 3.5.5, "Emergency Core Cooling Systems (ECCS) - Seal Injection Flow"

Dear Commissioners and Staff:

Enclosed is an application for amendment to Facility Operating License Nos. DPR-80 and DPR-82 pursuant to 10 CFR 50.90. This license amendment request (LAR) proposes to revise Improved Technical Specification (ITS) 3.5.5, "Emergency Core Cooling Systems - Seal Injection Flow," to replace the description of seal injection flow with a description representative of the method used to establish and verify reactor coolant pump seal injection flow limits. This change is consistent with the industry Standard Technical Specification Change Traveler TSTF-337 submitted to the NRC for review on June 16, 1999.

A description of the proposed TS change, and the basis for the change, are provided in Enclosure A. The proposed ITS change is noted on the marked-up copy in Enclosure B. The proposed ITS pages are provided in Enclosure C.

The changes proposed in this LAR are not required to address an immediate safety concern. PG&E requests that the NRC assign a medium priority for review and approval of this LAR, and that the LAR be made effective upon issuance.

A001

Sincerely,

Gregory M. Rueger

cc: Edgar Bailey, DHS
Steven D. Bloom
Dennis F. Kirsch
Ellis W. Merschoff
David L. Proulx
Diablo Distribution

Enclosures

GRC/A0421586

PG&E Letter DCL-00-083

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of PACIFIC GAS AND ELECTRIC COMPANY	)	Docket No. 50-275 Facility Operating License No. DPR-80
Diablo Canyon Power Plant Units 1 and 2	)	Docket No. 50-323 Facility Operating License No. DPR-82

AFFIDAVIT

Gregory M. Rueger, of lawful age, first being duly sworn upon oath says that he is Senior Vice President - Generation and Chief Nuclear Officer of Pacific Gas and Electric Company; that he has executed LAR 00-05 on behalf of said company with full power and authority to do so; that he is familiar with the content thereof; and that the facts stated therein are true and correct to the best of his knowledge, information, and belief.

Gregory M. Rueger
Senior Vice President
Nuclear Power Generation

Subscribed and sworn to before me this 8th day of June 2000.
County of San Luis Obispo
State of California

Notary Public

LISA M. NELSON
Commission # 125[illegible]
Notary Public - California
San Luis Obispo County
My Comm. Expires Mar 31, 2004

Revise Improved Technical Specification 3.5.5, "Emergency Core Cooling Systems (ECCS) - Seal Injection Flow"

A. DESCRIPTION OF AMENDMENT REQUEST

This change revises Improved Technical Specification (ITS) 3.5.5, "Emergency Core Cooling Systems (ECCS) - Seal Injection Flow," to make the limiting condition for operation (LCO) description consistent with the method of establishing and verifying reactor coolant pump (RCP) seal injection flow limits. The specific changes are as follows:

1. LCO 3.5.5, "Reactor coolant pump seal injection flow shall be ≤ 40 gpm with RCS pressure ≥ 2215 psig and ≤ 2255 psig and the charging flow control valve full open," is replaced by, "Reactor coolant pump seal injection flow resistance shall be within limit."
2. The word "resistance" is added after "flow" in Condition A, Required Action A.1 and Surveillance Requirement (SR) 3.5.5.1.
3. Required Action A.1 is truncated after "within limit."
4. The text "≥ 2215 psig and ≤ 2255 psig" is replaced with "nominal pressurizer pressure of 2235 psig" in the SR 3.5.5.1 note.
5. In SR 3.5.5.1 the text, "limit with RCS pressure ≥ 2215 psig and ≤ 2255 psig and the charging flow control valve full open," is replaced by "the ECCS safety analysis limit."

The associated ITS Bases are also appropriately revised.

B. BACKGROUND

The centrifugal charging pumps (CCPs) are used to provide flow to both the high head safety injection (SI) system and the RCP seals. To assure that excessive flow is not diverted from the SI flow path to the seal injection flow path during an accident, the seal injection flow path flow resistance is controlled. The intent of LCO 3.5.5 is to control that resistance. The seal injection flow is adjusted through positioning of the manual seal injection throttle valves.

The seal injection flow path flow limit supports safety analyses assumptions that are required because RCP seal injection is not isolated by a SI signal, and RCP seal injection is not credited for core cooling.

C. JUSTIFICATION

The 40 gpm flow value in the current and ITS can lead to misunderstanding. The controlling parameter to satisfy the safety intent of the ITS LCO is the hydraulic flow resistance, rather than the flow value itself. During operation, the flow value can vary depending on the position of charging flow control valves, and, if the flow is higher than 40 gpm, operation can be questioned as not being in compliance with the ITS. This clarification precludes such a misunderstanding.

This change revises the ITS to identify the specific parameter which must be controlled to support the analyses assumption. The change provides improved consistency with the method by which the seal flow limits are set, with how the surveillance requirement is performed, and with the ECCS analyses.

The change to relocate technical requirements from the LCO is consistent with the philosophy of NUREG-1431, Rev. 1, and the Industry Standard Technical Specification Change Traveler, TSTF-337.

D. SAFETY EVALUATION

All ECCS subsystems including the charging system, are credited for injection during the large break loss of coolant accident (LOCA). The LOCA analyses establish the minimum flow for the ECCS pumps, while the inadvertent SI and the steam generator tube rupture analyses establish the maximum flow for the ECCS pumps. The CCPs are also credited in the small break LOCA analysis.

The proposed LCO ensures that total seal injection flow resistance meets the analysis requirements. With seal injection flow resistance properly established, seal injection flow will be sufficient for RCP seal integrity, but will also be limited so that the ECCS trains are capable of delivering sufficient water to match boiloff rates in sufficient time to minimize uncovering of the core following a large LOCA consistent with the accident analysis. It also ensures that the CCPs will deliver sufficient borated water during a small LOCA and to cool and maintain the core subcritical. For smaller LOCAs, the charging pumps alone deliver sufficient fluid to maintain RCS inventory.

The ECCS analysis models the RCP seal injection flow path as a hydraulic flow resistance. The method used in the ECCS analysis model determines RCP seal flow as a function of system conditions rather than specifying an actual flow rate. The seal flow rate can vary during operation, but the hydraulic flow resistance is fixed by positioning the manual seal injection throttle valves. The resistance does not change if the valves are not adjusted. Since resistance is a function of pressure divided by flow squared, RCP seal flow variation due to changing RCS back pressure following a LOCA is explicitly determined as a result of modeling the RCP seal injection flow path resistance. Seal injection flow to the RCP seals is maintained during the injection phase of an SI following a design basis accident. The ECCS analyses do not credit core cooling from that portion of the safety injection flow that enters the RCP through the seal injection flow path under minimum safeguards conditions. The limitation on seal injection flow ensures that in the event of an accident, the safety injection flow will be controlled within the constraints assumed in the accident analyses. The minimum RCP seal flow resistance analyses is based on the RCP seal injection flow rate of 40 gpm. The ECCS model utilizes a hydraulic flow resistance for the RCP seal injection flow path to determine the seal flow rather than specifying an actual flow rate. The hydraulic flow resistance is established by positioning the manual seal injection throttle valves and does not change if the valves are not adjusted. Utilizing this hydraulic resistance model, allows the accident analyses assumptions (based on hydraulic resistance) to be satisfied for various charging flow rates, even though the indicated RCP seal injection flow may exceed 40 gpm for various plant operating conditions.

The ECCS analysis model assumes that RCS pressure is based on the RCP balance chamber pressure. The RCP balancing chamber is the area above the thermal barrier and around the radial bearing. The pressure within the RCP balancing chamber is in a location which is not instrumented. Therefore, to establish the proper RCP seal injection flow line resistance, the differential pressure across the manual seal injection throttle valves is measured using the pressurizer pressure corrected to the discharge of the RCP seal injection flow path at the RCP balancing chamber.

The limitation set on RCP seal injection line hydraulic flow resistance is generally verified at a nominal pressurizer pressure of 2235 psig. However, resistance flow can be measured and established within the ECCS safety analysis limit anytime there is a differential pressure between the charging header and the RCS. The proposed TS surveillance will normally be performed at nominal pressurizer pressure, which is the pressure required to support plant operation.

Methodology

The restriction on seal injection flow is established by maintaining the seal water injection hydraulic resistance greater than or equal to 0.2117 ft/gpm^2. With the flow resistance within limits, the resulting total seal injection flow will be within the assumption made for seal flow during accident conditions.

In order to establish the proper seal injection line resistance, the CCP discharge header pressure, the RCP seal injection flow rate, and the pressurizer pressure are measured. The line resistance is then calculated from those inputs. A reduction in RCS pressure with no concurrent decrease in CCP discharge header pressure would increase the differential pressure across the manual throttle valves, and result in more flow being discharged through the RCP seal injection line. The flow resistance limit assures that when RCS pressure drops during a LOCA and seal injection flow increases in response to the higher differential pressure, the resulting flow will be consistent with the accident analyses.

The flow resistance is dependent on the pressurizer pressure, the CCP discharge header pressure, and the RCP seal injection flow. The following formula is used to calculate RCP seal injection line resistance (refer to Enclosure D for drawing).

Charging Header Pressure = (P_{chg})

RCS Pressure = (P_{P0480A})

RCP Seal Injection Line Resistance = (R_{seal})

RCP Seal flow = (Q_{Total})

DP_{seal} = RCP Seal Injection Line DP = (P_{chg} - P_{P0480A}) - 31.8 PSID

$$R_{seal} = \frac{DP_{seal}}{Q_{Total}^2} \times 2.31 \frac{FT}{GPM^2}$$

The 31.8 PSID value added to the dP_{seal} accounts for the pressure difference between the RCP seal injection and the measured pressurizer pressure due to frictional losses and elevation change. The formula for R_{seal} is Bernoulli's equation with a conversion factor to account for the units.

If it is necessary to change the RCP seal injection line hydraulic flow resistance, the position of the manual seal injection throttle valves are adjusted to provide the desired resistance value. Following adjustment, the throttle valves are sealed by an engineering controlled process. The function of the seal injection throttle valves during an accident is similar to the function of the ECCS throttle valves in that each restricts flow from the CCP header to the RCS. For example, an adjustment to position the seal injection throttle valves to a more open position with a constant differential pressure between the charging header and the RCS will decrease the hydraulic resistance, increase the seal injection flow, and decrease the CCP ECCS injection to the core via the RCS cold legs.

Other Potential Affects on System Resistance

However, the seal injection flow resistance is not dependent on the position of the charging flow control valve FCV-128. FCV-128 throttles the CCP discharge flow as required to maintain the programmed level in the pressurizer. The flow control valve fails open to ensure that, in the event of either loss of air or loss of control signal to the valve, when the CCPs are supplying charging flow, seal injection flow to the RCP seals is maintained. The accident analysis model assumes CCP header pressure is measured at the discharge of the CCP, upstream of FCV-128. The flow control valve, which provides a modulating flow restriction to maintain pressurizer level during operation, is assumed to fail open during an accident resulting in no flow resistance. Any system resistance provided by the flow control valve during normal operation would result in non-conservative throttle valve settings if the CCP header pressure were measured at the discharge of the CCP upstream of the flow control valve. To avoid this problem, the CCP discharge header pressure is measured downstream of the flow control valve. This conservative measurement location also avoids the need to place the flow control valve in a full open test position during operation, thus avoiding perturbations in pressurizer water level. Positioning of the charging flow control valve may vary during normal plant operating conditions, resulting in a proportional change to RCP seal injection flow. The hydraulic resistance of the RCP seal injection throttle valves will remain fixed when FCV-128 is repositioned as long as the manual seal injection throttle valve(s) position is not adjusted.

Additionally, the seal water injection filters can affect the system. As differential pressure across the filter increases over the life of the filter element, certain operating adjustments may be made in conjunction with surveillance testing to maintain the RCP seal flow within the allowed TS limits. For both the minimum and maximum ECCS analyses, a higher filter dP is more conservative. Therefore, an increase in filter dP due to the filter clogging during a cycle does not challenge the analysis limit. The effect on the system resulting from valving in a clean standby filter, after having adjusted the system over time, could result in a resistance flow value outside the TS limit. Therefore, when placing a filter in service, instructions are provided to ensure that flow characteristics of the seal injection flow path satisfy the accident analysis by performing the surveillance test to verify compliance with ITS 3.5.5.

The proposed ITS change does not impact the way the RCP seal flow is established and thus cannot affect RCP seal integrity. Therefore, the ITS change to clarify the way RCP seal flow is established will not adversely affect the health and safety of the public.

E. NO SIGNIFICANT HAZARDS EVALUATION

PG&E has evaluated the no significant hazards considerations (NSHC) involved with the proposed amendment, focusing on the three standards set forth in 10 CFR 50.92(c) as set forth below:

> *"The commission may make a final determination, pursuant to the procedures in paragraph 50.91, that a proposed amendment to an operating license for a facility licensed under paragraph 50.21(b) or paragraph 50.22 or for a testing facility involves no significant hazards considerations, if operation of the facility in accordance with the proposed amendment would not:*
>
> *(1) Involve a significant increase in the probability or consequences of an accident previously evaluated; or*
>
> *(2) Create the possibility of a new or different kind of accident from any accident previously evaluated; or*
>
> *(3) Involve a significant reduction in a margin of safety."*

The following evaluation is provided for the NSHC.

1. *Does the change involve a significant increase in the probability or consequences of an accident previously evaluated?*

The emergency core cooling system (ECCS) analyses model the reactor coolant pump (RCP) seal injection flow path as a hydraulic flow resistance. This proposed change clarifies that RCP seal flow is a function of system conditions rather than specifying an actual flow rate. The seal flow rate can vary during operation, but the hydraulic flow resistance is fixed by positioning the manual seal injection throttle valves. The resistance does not change if the valve adjustments are not changed. Thus, RCP seal flow variation due to changing reactor coolant system (RCS) back pressure following a loss of coolant accident (LOCA) is explicitly determined as a result of modeling the RCP seal injection flow path resistance.

The proposed improved Technical Specification change is only a clarification and does not impact the way the RCP seal flow is established and thus cannot affect RCP seal integrity. The seal flow resistance otherwise only affects ECCS flow. Since ECCS flow occurs after an accident the proposed change cannot impact the probability of an accident.

There are no hardware changes nor are there any changes in the method by which any safety-related plant system performs its safety function. The change continues to ensure that the assumed ECCS flow is available. Therefore, the proposed change does not involve a significant increase in the consequences of an accident previously evaluated.

2. *Does the change create the possibility of a new or different kind of accident from any accident previously evaluated?*

There are no hardware changes nor are there any changes in the method by which any safety-related plant system performs its safety function. Since the change continues to ensure that the assumed ECCS flow is available, no new accident scenarios, transient precursors, failure mechanisms, or limiting single failures are introduced. Therefore, the proposed change does not create the possibility of a new or different kind of accident from any previously evaluated.

3. *Does the change involve a significant reduction in a margin of safety?*

The proposed change does not affect the acceptance criteria for any analyzed event. There will be no effect on the manner in which safety limits or limiting safety system settings are determined nor will there be any effect on those plant systems necessary to assure the accomplishment of protection functions. Since the change continues to ensure the assumed ECCS flow is available, there will be no impact on any margin of safety.

F. NO SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

Based on the above safety evaluation, PG&E concludes that the changes proposed by this LAR satisfy the NSHC standards of 10 CFR 50.92(c), and accordingly a no significant hazards finding is justified.

G. ENVIRONMENTAL EVALUATION

PG&E has evaluated the proposed change and determined the change does not involve: (i) a significant hazards consideration, (ii) a significant change in the types or significant increase in the amounts of any effluents that may be released offsite, or (iii) a significant increase in individual or cumulative occupational radiation exposure. Accordingly, the proposed change meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Therefore, pursuant to

10 CFR 51.22(b), an environmental assessment of the proposed change is not required.

MARKED-UP IMPROVED TECHNICAL SPECIFICATIONS

Remove Page	Insert Page
3.5-8	3.5-8
3.5-30	3.5-30
3.5-31	3.5-31
3.5-32	3.5-32

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.5 Seal Injection Flow

LCO 3.5.5 Reactor coolant pump seal injection flow shall be ≤ 40 gpm with RCS pressure ≥ 2215 psig and ≤ 2255 psig and the charging flow control valve full open.

resistance within limit.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION		COMPLETION TIME
A. Seal injection flow not within limit. resistance	A.1	Adjust manual seal injection throttle valves to give a flow within limit with RCS pressure ≥ 2215 psig and ≤ 2255 psig and the charging flow control valve full open. resistance	4 hours
B. Required Action and associated Completion Time not met.	B.1	Be in MODE 3.	6 hours
	<u>AND</u>		
	B.2	Be in MODE 4.	12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.5.1	-------------------NOTE------------------- Not required to be performed until 4 hours after the Reactor Coolant System pressure stabilizes at ≥ 2215 psig and ≤ 2255 psig. nominal pressurizer pressure of 2235 psig. --	
	Verify manual seal injection throttle valves are adjusted to give a flow within limit with RCS pressure ≥ 2215 psig and ≤ 2255 psig and the charging flow control valve full open. resistance the ECCS safety analysis limit.	31 days

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.5 Seal Injection Flow

BASES

BACKGROUND

Insert A

This LCO is applicable because the CCPs are utilized for high head safety injection (SI). The function of the seal injection throttle valves during an accident is similar to the function of the ECCS throttle valves in that each restricts flow from the CCP pump header to the Reactor Coolant System (RCS).

The restriction on reactor coolant pump (RCP) seal injection flow limits the amount of ECCS flow that would be diverted from the injection path following an accident. This limit is based on safety analysis assumptions that are required because RCP seal injection flow is not isolated during SI.

APPLICABLE SAFETY ANALYSES

All ECCS subsystems are taken credit for in the large break loss of coolant accident (LOCA) at full power (Ref. 1). The LOCA analysis (e) establishes the minimum flow for the ECCS pumps while the inadvertent SI and the SGTR analyses establish the maximum flow for the ECCS pumps. The CCPs are also credited in the small break LOCA analysis. The SGTR and main steam line break event analyses also credit the CCPs but are not limiting in their requirements. (Maximum ECCS flow analyses) (for RCP seal flow) (and are) Reference to these analyses is made in assessing changes to the Seal Injection System for evaluation of their effects in relation to the acceptance limits in these analyses.

The ECCS flow balance assumes (a minimum resistance of 0.2117 ft/gpm² in the) RCP seal injection (path) is limited to 40 gpm with the flow control valve fully open. This LCO ensures that total seal injection flow of ≤ 40 gpm, with RCS pressure ≥ 2215 psig and ≤ 2255 psig and charging flow control valve full open (resistance is OPERABLE.) (seal injection flow) will be sufficient for RCP seal integrity but limited so that the ECCS trains will be capable of delivering sufficient water to match boiloff rates soon enough to minimize uncovering of the core following a large LOCA. It also ensures that the CCPs will deliver sufficient water for a small LOCA and sufficient boron to maintain the core subcritical. For smaller LOCAs, the charging pumps alone deliver sufficient fluid to overcome the loss and maintain RCS inventory.

Seal injection flow satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The intent of the LCO limit on seal injection flow (resistance) is to make sure that flow through the RCP seal water injection line is low enough to ensure that sufficient centrifugal charging pump injection flow is directed to the RCS via the cold legs (Ref. 1). This is accomplished by limiting the line resistance in the RCP seal injection lines to a value consistent with the assumptions in the accident analysis.

(continued)

BASES

LCO (continued)

The 40 gpm identified in the LCO is not an absolute flow limit, but rather a flow limit through the RCP seal injection line that is assumed in the accident analyses initial conditions when the ECCS systems are aligned in the injection mode following a LOCA. This flow value correlates to a line resistance in the seal injection flow path that is used in the accident analyses ECCS performance. Thus, the line resistance is the parameter which is controlled to ensure that the ECCS alignment is maintained consistent with the accident analysis assumptions. Charging flow control valve, FCV-128 full open is a test condition and is not indicative of normal operation. Consequently, during normal plant operation, it is possible to have the indicated total seal injection flow greater than 40 gpm while still being within the LCO because during normal plant operation, the ECCS system is not in post accident alignment.

Insert B

In order to establish the proper flow line resistance, the seal injection flow path differential pressure and flow are measured. The line resistance is then determined with the RCS pressure within normal limits and the CCP flow control valve fully open. A reduction in RCS pressure, with no concurrent decrease in CCP discharge header pressure, would result in more flow being discharged through the RCP seal injection line than at normal RCS operating pressure. The RCP seal injection valve settings established at the prescribed RCS pressure result in a conservative valve position should RCS pressure decrease. The additional modifier of this LCO, the charging flow control valve being full open, is consistent with the air operated valve assumed to fail open for the accident condition.

With the RCS pressure and control valve position as specified by the LCO, a flow limit is established which assures that the seal injection line resistance is consistent with the analysis assumptions. This limit assures that when the RCS depressurizes following a LOCA and the flow to the pump seals increases, the resulting flow to the seals will be less than the limit assumed in the accident analysis.

APPLICABILITY

In MODES 1, 2, and 3, the seal injection flow limit is dictated by ECCS flow requirements, which are specified for MODES 1, 2, 3, and 4. The seal injection flow limit is not applicable for MODE 4 and lower, however, because high seal injection flow is less critical as a result of the lower initial RCS pressure and decay heat removal requirements in MODE 4. Therefore, RCP seal injection flow must be limited in MODES 1, 2, and 3 to ensure adequate ECCS performance.

, and the potential for reduced ECCS flow

conditions

(continued)

BASES (continued)

ACTIONS

A.1

With the seal injection flow exceeding its limit, the amount of charging flow available for ECCS injection to the RCS may be reduced. Under this Condition, action must be taken to restore the seal injection flow to below its limit. The operator has 4 hours from the time the flow is known to be above the limit to correctly position the manual valves and thus be in compliance with the accident analysis. The Completion Time minimizes the potential exposure of the plant to a LOCA with insufficient injection flow and provides a reasonable time to restore seal injection flow within limits. This time is conservative with the Completion Times for other ECCS LCOs.

B.1 and B.2

When the Required Actions cannot be completed within the required Completion Time, a controlled shutdown must be initiated. The Completion Time of 6 hours for reaching MODE 3 from MODE 1 is a reasonable time for a controlled shutdown, based on operating experience and normal cooldown rates, and does not challenge plant safety systems or operators. Continuing the plant shutdown begun in Required Action B.1, an additional 6 hours is a reasonable time, based on operating experience and normal cooldown rates, to reach MODE 4, where this LCO is no longer applicable.

SURVEILLANCE REQUIREMENTS

SR 3.5.5.1

Verification every 31 days that the manual seal injection throttle valves are adjusted to give a flow below the limit ensures proper manual seal injection throttle valve position, and hence, proper seal injection flow, is maintained. The Frequency of 31 days is based on engineering judgment and is consistent with other ECCS valve Surveillance Frequencies. The Frequency has proven to be acceptable through operating experience.

As noted, the Surveillance is to be completed within 4 hours after the RCS pressure has stabilized within the specified pressure limits. The RCS pressure requirement is specified since this configuration will produce the required pressure conditions necessary to assure that the manual valves are set correctly. The exception is limited to 4 hours to ensure that the Surveillance is timely.

REFERENCES

1. FSAR, Chapter 6 and Chapter 15.
2. 10 CFR 50.46.

Insert A - Bases 3.5.5

This LCO is applicable because the centrifugal charging pumps (CCPs) are utilized for High Head Safety Injection (SI) while at the same time supplying flow to the reactor coolant pump (RCP) seals. The intent of the LCO is to ensure that the seal injection flow resistance remains within limit. This in turn will assure that flow through the RCP seal injection line during an accident is restricted. The seal injection flow is restricted by the injection line hydraulic flow resistance which is adjusted through positioning of the manual seal injection throttle valves.

The hydraulic resistance limits the amount of emergency core cooling system (ECCS) flow that would be diverted from the injection path to the reactor coolant system (RCS) into the RCP seal injection line. This limit supports safety analyses assumptions that are required because the RCP seal injection is not isolated by a SI signal and RCP seal injection is not credited for core cooling.

The flow resistance is determined by measuring the pressurizer pressure, the CCP discharge header pressure, and the RCP seal injection flow rate. If it is necessary to change the RCP seal injection line hydraulic flow resistance, the position of the injection throttle valves is adjusted to provide the desired resistance value.

The charging flow control valve FCV-128 throttles the centrifugal charging pump discharge flow as necessary to maintain the programmed level in the pressurizer. The flow control valve fails open to ensure that, in the event of either loss of air or loss of control signal to the valve, when the CCPs are supplying charging flow, seal injection flow to the RCP seals is maintained. Positioning of the charging flow control valve may vary during normal plant operating conditions, resulting in a proportional change to RCP seal injection flow. The hydraulic resistance of the RCP seal injection throttle valves will remain fixed when FCV-128 is repositioned provided the throttle valve(s) position are not adjusted. To avoid plant perturbation, the charging flow control valve may be positioned in a manner which is required to support periodic surveillance and normal plant operation.

The accident analysis model assumes CCP header pressure is measured at the discharge of the CCP, upstream of the charging flow control valve. The flow control valve, which provides a modulating flow restriction to maintain pressurizer level during operation, is assumed to fail open during an accident. Any system resistance provided by the flow control valve during normal operation would result in non-conservative throttle valve settings if the CCP header pressure was measured at the discharge of the CCP upstream of the flow control valve. To avoid this problem, the CCP discharge header pressure is measured downstream of the flow control valve. This conservative measurement location also avoids the need to place the flow control valve in a full open test position during operation, thus avoiding perturbations in pressurizer water level.

Seal injection flow to the RCP seals is maintained during the injection phase of an SI following the occurrence of a design accident. The ECCS analyses provide no core cooling credit for that portion of the safety injection flow that enters the RCP through the seal injection flow path under minimum safeguards conditions. The limitation on seal injection flow ensures that in the event of an accident, the safety injection flow will be controlled within the constraints assumed in the accident analyses. The ECCS model utilizes a hydraulic flow resistance for the RCP seal injection flow path to determine the seal flow rather than specifying an actual flow rate. The hydraulic flow resistance is established by positioning the manual seal injection throttle valves and does not change if the valves are not adjusted. The accident analyses assumptions (based on hydraulic resistance) are satisfied notwithstanding changes in charging flows even though the indicated RCP seal injection flow may exceed 40 gpm for plant operation.

The accident analysis model assumes that RCS pressure is referenced to the RCP balance chamber. The RCP balancing chamber is the area above the thermal barrier and around the radial bearing. The pressure within the RCP balancing chamber is in a location which is not instrumented. Therefore, to establish the proper RCP seal injection flow line resistance, the differential pressure across the manual seal injection throttle valves is measured using the pressurizer pressure corrected to the discharge of the RCP seal injection flow path at the RCP balancing chamber.

The limitation set on RCP seal injection line hydraulic flow resistance is verified at a nominal pressurizer pressure of 2235 psig. However, resistance flow can be measured and established within the ECCS safety analysis limit anytime there is a differential pressure between the charging header and the RCS. The surveillance will normally be performed at nominal pressurizer pressure which is considered the pressure required to support plant operation.

Insert B - Bases 3.5.5

The limit on RCP seal injection line hydraulic flow resistance must be met to assure that the ECCS is OPERABLE. If this limit is not met, the ECCS flow may not be as assumed in the accident analyses.

The restriction on seal injection flow is accomplished by maintaining the seal water injection hydraulic resistance greater than or equal to 0.2117 ft/gpm^2. With the flow resistance within limits, the resulting total seal injection flow will be within the assumption made for seal flow during accident conditions.

The seal injection flow hydraulic resistance is the parameter which is controlled to ensure that the ECCS alignment is maintained consistent with the accident analysis model. The seal injection flow is a result of the control of hydraulic resistance and is not controlled directly. During normal plant operation, it is possible for the indicated total seal flow to be greater than 40 gpm while still being within the LCO requirements for OPERABILITY because the resistance limit ensures RCP seal flow will be within analyses during ECCS operation.

In order to establish the proper flow line resistance, the CCP discharge header pressure, the RCP seal injection flow rate, and the pressurizer pressure are measured. The line resistance is then determined from those inputs. A reduction in RCS pressure with no concurrent decrease in CCP discharge header pressure would increase the differential pressure across the manual throttle valves, and result in more flow being discharged through the RCP seal injection line. The flow resistance limit assures that when RCS pressure drops during a LOCA and seal injection flow increases in response to the higher differential pressure, the resulting flow will be consistent with the accident analyses.

Insert C - Bases 3.5.5

The seal water injection filters can affect the system flow. As differential pressure across the filter increases over the life of the filter element, certain operating adjustments may be made to maintain the RCP seal flow within the allowed limits. The effect on the system flow resulting from valving in a clean standby filter, after having adjusted the system over time, could result in a resistance flow value outside the TS limit. Therefore, instructions are provided that when a filter is removed from or returned to service, that the procedure to ensure flow characteristics of the seal injection water flow path satisfy the accident analysis and TS may need to be performed.

PROPOSED IMPROVED TECHNICAL SPECIFICATION PAGES

3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

3.5.5 Seal Injection Flow

LCO 3.5.5 Reactor coolant pump seal injection flow resistance shall be within limit.

APPLICABILITY: MODES 1, 2, and 3.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. Seal injection flow resistance not within limit.	A.1 Adjust manual seal injection throttle valves to give a flow resistance within limit	4 hours
B. Required Action and associated Completion Time not met.	B.1 Be in MODE 3. AND B.2 Be in MODE 4.	6 hours 12 hours

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.5.5.1	-----NOTE----- Not required to be performed until 4 hours after the Reactor Coolant System pressure stabilizes at nominal pressurizer pressure of 2235 psig. ---------- Verify manual seal injection throttle valves are adjusted to give a flow resistance within the ECCS safety analysis limit.	31 days

B 3.5 EMERGENCY CORE COOLING SYSTEMS (ECCS)

B 3.5.5 Seal Injection Flow

BASES

BACKGROUND

This LCO is applicable because the centrifugal charging pumps (CCPs) are utilized for High Head Safety Injection (SI) while at the same time supplying flow to the reactor coolant pump (RCP) seals. The intent of the LCO is to ensure that the seal injection flow resistance remains within limit. This in turn will assure that flow through the RCP seal injection line during an accident is restricted. The seal injection flow is restricted by the injection line hydraulic flow resistance which is adjusted through positioning of the manual seal injection throttle valves.

The hydraulic resistance limits the amount of emergency core cooling system (ECCS) flow that would be diverted from the injection path to the reactor coolant system (RCS) into the RCP seal injection line. This limit supports safety analyses assumptions that are required because the RCP seal injection is not isolated by a SI signal and RCP seal injection is not credited for core cooling.

The flow resistance is determined by measuring the pressurizer pressure, the CCP discharge header pressure, and the RCP seal injection flow rate. If it is necessary to change the RCP seal injection line hydraulic flow resistance, the position of the injection throttle valves is adjusted to provide the desired resistance value.

The charging flow control valve FCV-128 throttles the centrifugal charging pump discharge flow as necessary to maintain the programmed level in the pressurizer. The flow control valve fails open to ensure that, in the event of either loss of air or loss of control signal to the valve, when the CCPs are supplying charging flow, seal injection flow to the RCP seals is maintained. Positioning of the charging flow control valve may vary during normal plant operating conditions, resulting in a proportional change to RCP seal injection flow. The hydraulic resistance of the RCP seal injection throttle valves will remain fixed when FCV-128 is repositioned provided the throttle valve(s) position are not adjusted. To avoid plant perturbation, the charging flow control

(continued)

BASES

BACKGROUND (continued)

valve may be positioned in a manner which is required to support periodic surveillance and normal plant operation.

The accident analysis model assumes CCP header pressure is measured at the discharge of the CCP, upstream of the charging flow control valve. The flow control valve, which provides a modulating flow restriction to maintain pressurizer level during operation, is assumed to fail open during an accident. Any system resistance provided by the flow control valve during normal operation would result in non-conservative throttle valve settings if the CCP header pressure was measured at the discharge of the CCP upstream of the flow control valve. To avoid this problem, the CCP discharge header pressure is measured downstream of the flow control valve. This conservative measurement location also avoids the need to place the flow control valve in a full open test position during operation, thus avoiding perturbations in pressurizer water level.

Seal injection flow to the RCP seals is maintained during the injection phase of an SI following the occurrence of a design accident. The ECCS analyses provide no core cooling credit for that portion of the safety injection flow that enters the RCP through the seal injection flow path under minimum safeguards conditions. The limitation on seal injection flow ensures that in the event of an accident, the safety injection flow will be controlled within the constraints assumed in the accident analyses. The ECCS model utilizes a hydraulic flow resistance for the RCP seal injection flow path to determine the seal flow rather than specifying an actual flow rate. The hydraulic flow resistance is established by positioning the manual seal injection throttle valves and does not change if the valves are not adjusted. The accident analyses assumptions (based on hydraulic resistance) are satisfied notwithstanding changes in charging flows even though the indicated RCP seal injection flow may exceed 40 gpm for plant operation.

The accident analysis model assumes that RCS pressure is referenced to the RCP balance chamber. The RCP balancing chamber is the area above the thermal barrier and around the radial bearing. The pressure within the RCP balancing chamber is in a location which is not instrumented. Therefore, to establish

(continued)

BASES

BACKGROUND (continued)

the proper RCP seal injection flow line resistance, the differential pressure across the manual seal injection throttle valves is measured using the pressurizer pressure corrected to the discharge of the RCP seal injection flow path at the RCP balancing chamber.

The limitation set on RCP seal injection line hydraulic flow resistance is verified at a nominal pressurizer pressure of 2235 psig. However, resistance flow can be measured and established within the ECCS safety analysis limit anytime there is a differential pressure between the charging header and the RCS. The surveillance will normally be performed at nominal pressurizer pressure which is considered the pressure required to support plant operation.

APPLICABLE SAFETY ANALYSES

All ECCS subsystems are taken credit for in the large break loss of coolant accident (LOCA) at full power (Ref. 1). The LOCA analyses establish the minimum flow for the ECCS pumps while the inadvertent SI and the SGTR analyses establish the maximum flow for the ECCS pumps. The CCPs are also credited in the small break LOCA analysis. Maximum ECCS flow analyses credit the CCPs and are limiting in their requirements for RCP seal flow. Reference to these analyses is made in assessing changes to the Seal Injection System for evaluation of their effects in relation to the acceptance limits in these analyses.

The ECCS flow balance assumes a minimum resistance of 0.2117 ft/gpm^2 in the RCP seal injection path with the flow control valve fully open. This LCO ensures that seal injection flow resistance is operable. Seal injection flow will be sufficient for RCP seal integrity but limited so that the ECCS trains will be capable of delivering sufficient water to match boiloff rates soon enough to minimize uncovering of the core following a large LOCA. It also ensures that the CCPs will deliver sufficient water for a small LOCA and sufficient boron to maintain the core subcritical. For smaller LOCAs, the charging pumps alone deliver sufficient fluid to overcome the loss and maintain RCS inventory.

Seal injection flow satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The intent of the LCO limit on seal injection flow resistance is to make sure that flow through the RCP seal water injection line is low enough to ensure that sufficient centrifugal charging pump injection flow is directed to the RCS via the cold legs (Ref. 1). This is accomplished by limiting the line resistance in the RCP seal injection lines to a value consistent with the assumptions in the accident analysis. The limit on RCP seal injection line hydraulic flow resistance must be met to

(continued)

BASES

LCO (continued)

assure that the ECCS is OPERABLE. If this limit is not met, the ECCS flow may not be as assumed in the accident analyses.

The restriction on seal injection flow is accomplished by maintaining the seal water injection hydraulic resistance greater than or equal to 0.2117 ft/gpm². With the flow resistance within limits, the resulting total seal injection flow will be within the assumption made for seal flow during accident conditions.

The seal injection flow hydraulic resistance is the parameter which is controlled to ensure that the ECCS alignment is maintained consistent with the accident analysis model. The seal injection flow is a result of the control of hydraulic resistance and is not controlled directly. During normal plant operation, it is possible for the indicated total seal flow to be greater than 40 gpm while still being within the LCO requirements for OPERABILITY because the resistance limit ensures RCP seal flow will be within analyses during ECCS operation.

In order to establish the proper flow line resistance, the CCP discharge header pressure, the RCP seal injection flow rate, and the pressurizer pressure are measured. The line resistance is then determined from those inputs. A reduction in RCS pressure with no concurrent decrease in CCP discharge header pressure would increase the differential pressure across the manual throttle valves, and result in more flow being discharged through the RCP seal injection line. The flow resistance limit assures that when RCS pressure drops during a LOCA and seal injection flow increases in response to the higher differential pressure, the resulting flow will be consistent with the accident analyses.

APPLICABILITY

In MODES 1, 2, and 3, the seal injection flow limit is dictated by ECCS flow requirements, which are specified for MODES 1, 2, 3, and 4. The seal injection flow limit is not applicable for MODE 4 and lower, because high seal injection flow, and the potential for reduced ECCS flow, is less critical as a result of the lower initial RCS conditions and decay heat removal requirements in MODE 4. Therefore, RCP seal injection flow must be limited in MODES 1, 2, and 3 to ensure adequate ECCS performance.

(continued)

BASES (continued)

ACTIONS

A.1

With the seal injection hydraulic flow resistance less than its limit, the amount of charging flow available for ECCS injection to the RCS may be reduced. Under this Condition, action must be taken to restore the seal injection flow resistance to within its limit. The operator has 4 hours from the time the seal injection hydraulic flow resistance is known to be below the limit to correctly position the manual valves and thus be in compliance with the accident analysis. The Completion Time minimizes the potential exposure of the plant to a LOCA with insufficient injection flow and provides a reasonable time to restore seal injection flow within limits. This time is conservative with the Completion Times for other ECCS LCOs.

B.1 and B.2

When the Required Actions cannot be completed within the required Completion Time, a controlled shutdown must be initiated. The Completion Time of 6 hours for reaching MODE 3 from MODE 1 is a reasonable time for a controlled shutdown, based on operating experience and normal cooldown rates, and does not challenge plant safety systems or operators. Continuing the plant shutdown begun in Required Action B.1, an additional 6 hours is a reasonable time, based on operating experience and normal cooldown rates, to reach MODE 4, where this LCO is no longer applicable.

SURVEILLANCE REQUIREMENTS

SR 3.5.5.1

Verification every 31 days that the manual seal injection throttle valves are adjusted to give a hydraulic resistance within the limit ensures proper manual seal injection throttle valve position, and hence, proper seal injection flow, is maintained. The Frequency of 31 days is based on engineering judgment and is consistent with other ECCS valve Surveillance Frequencies. The Frequency has proven to be acceptable through operating experience.

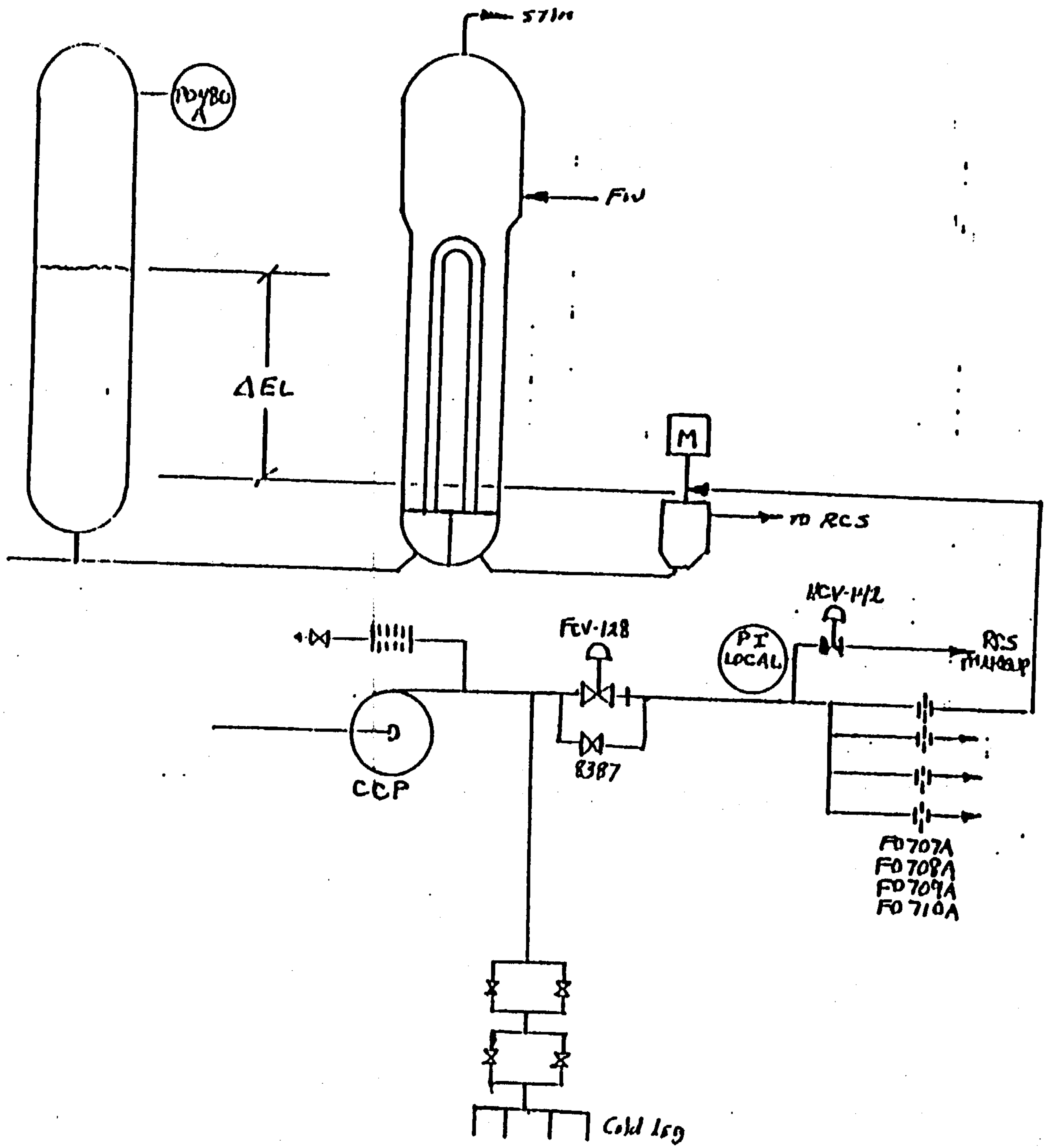
The seal water injection filters can affect the system flow. As differential pressure across the filter increases over the life of the filter element, certain operating adjustments may be made to maintain the RCP seal flow within the allowed limits. The effect on the system flow resulting from valving in a clean standby filter, after having adjusted the system over time, could result in a resistance flow value outside the TS limit. Therefore, instructions are provided that when a filter is removed from or returned to service, that the procedure to ensure flow characteristics of the

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)	<u>SR 3.5.5.1</u> seal injection water flow path satisfy the accident analysis and TS may need to be performed. As noted, the Surveillance is to be completed within 4 hours after the pressurizer pressure has stabilized at nominal operating pressure. The pressurizer pressure requirement is specified since this configuration will produce the required pressure conditions necessary to assure that the manual valves are set correctly. The exception is limited to 4 hours to ensure that the Surveillance is timely.
REFERENCES	1. FSAR, Chapter 6 and Chapter 15. 2. 10 CFR 50.46.

DRAWING OF RCP SEAL INJECTION LINE RESISTANCE MEASUREMENT POINTS



ΔEL
M
TO RCS
FCV-128
PI
LOCAL
RCS
8387
CCP
F0707A
F0708A
F0709A
F0710A
Cold leg