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submit a proposed schedule for providing an ECCS reanalysis, for both large and small break loss of coolant accident (LOCA), using approved methods, within 30 days of the date of issuance of these amendments.

A copy of the related Safety Evaluation is enclosed. A notice of issuance will be included in the Commission's next regular biweekly Federal Register notice.

Sincerely,

ORIGINAL SIGNED BY

Harry Rood, Senior Project Manager
Project Directorate V
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Enclosures:
1. Amendment No. 65 to License No. DPR-80
2. Amendment No. 64 to License No. DPR-82
3. Safety Evaluation

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Diablo Canyon

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON NUCLEAR POWER PLANT, UNIT NO. 1

DOCKET NO. 50-275

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 65
License No. DPR-80

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Pacific Gas & Electric Company (the licensee) dated December 21, 1990, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-80 is hereby amended to read as follows:

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(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 65 , are hereby incorporated in the license. Pacific Gas & Electric Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan, except where otherwise stated in specific license conditions.

3. This license amendment becomes effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

James E. Dyer

James E. Dyer, Director
Project Directorate V
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: September 5, 1991

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON NUCLEAR POWER PLANT, UNIT NO. 2

DOCKET NO. 50-323

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 64
License No. DPR-82

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Pacific Gas & Electric Company (the licensee) dated December 21, 1990, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and paragraph 2.C.(2) of Facility Operating License No. DPR-82 is hereby amended to read as follows:

(2) Technical Specifications

The Technical Specifications contained in Appendix A and the Environmental Protection Plan contained in Appendix B, as revised through Amendment No. 64 , are hereby incorporated in the license. Pacific Gas & Electric Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan, except where otherwise stated in specific license conditions.

3. This license amendment becomes effective as of the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

James E. Dyer

James E. Dyer, Director
Project Directorate V
Division of Reactor Projects III/IV/V
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Technical
Specifications

Date of Issuance: September 5, 1991

ATTACHMENT TO LICENSE AMENDMENT NOS. 65 AND 64

FACILITY OPERATING LICENSE NOS. DPR-80 AND DPR-82

DOCKET NOS. 50-275 AND 50-323

Revise Appendix A Technical Specifications by removing the pages identified below and inserting the enclosed pages. The revised pages are identified by the captioned amendment number and contain marginal lines indicating the area of change. Overleaf pages are also included, as appropriate.

REMOVE PAGE	INSERT PAGE
3/4 5-6	3/4 5-6
--	3/4 5-6a
B 3/4 5-2	B 3/4 5-2
--	B 3/4 5-2a
B 3/4 6-1	B 3/4 6-1
B 3/4 6-2	B 3/4 6-2

3/4.6.1 CONTAINMENT

3/4.6.1.1 CONTAINMENT INTEGRITY

CONTAINMENT INTEGRITY ensures that the release of radioactive materials from the containment atmosphere will be restricted to those leakage paths and associated leak rates assumed in the safety analyses. This restriction, in conjunction with the leakage rate limitation, will limit the SITE BOUNDARY radiation doses to within the dose guideline values of 10 CFR Part 100 during accident conditions.

3/4.6.1.2 CONTAINMENT LEAKAGE

The limitations on containment leakage rates ensure that the total containment leakage volume will not exceed the value assumed in the safety analyses at the peak accident pressure, P_a. As an added conservatism, the measured overall integrated leakage rate is further limited to less than or equal to 0.75 L_a or less than or equal to 0.75 L_t, as applicable, during performance of the periodic test to account for possible degradation of the containment leakage barriers between leakage tests.

The surveillance testing for measuring leakage rates is consistent with the requirements of Appendix J of 10 CFR Part 50.

3/4.6.1.3 CONTAINMENT AIR LOCKS

The limitations on closure and leak rate for the containment air locks are required to meet the restrictions on CONTAINMENT INTEGRITY and containment leak rate. Surveillance testing of the air lock seals provide assurance that the overall air lock leakage will not become excessive due to seal damage during the intervals between air lock leakage tests.

3/4.6.1.4 INTERNAL PRESSURE

The limitations on containment internal pressure ensure that: (1) the containment structure is prevented from exceeding its design negative pressure differential with respect to the outside atmosphere of 3.5 psig, and (2) the containment peak pressure does not exceed the design pressure of 47 psig during LOCA conditions.

The maximum peak pressure expected to be obtained from a LOCA event is less than 47 psig, which is the maximum design pressure of containment. This includes the limit of 1.2 psig for initial positive containment pressure. The total pressure is less than design pressure and is consistent with the safety analyses.

3/4.6.1.5 AIR TEMPERATURE

The limitations on containment average air temperature ensure that the overall containment average air temperature does not exceed the initial temperature condition assumed in the safety analysis for a LOCA.

3/4.6.1.6 CONTAINMENT STRUCTURAL INTEGRITY

This limitation ensures that the structural integrity of the containment will be maintained comparable to the original design standards for the life of the facility. Structural integrity is required to ensure that the containment will withstand the maximum pressure in the event of a LOCA. The visual examination of the concrete, liner, and the Type A leakage test are sufficient to demonstrate this capability.

3/4.6.1.7 CONTAINMENT VENTILATION SYSTEM

Use of the containment purge lines is restricted to two of the three following lines: (1) a supply line, (2) an exhaust line of the purge system, and (3) the vacuum/pressure relief line to ensure that the SITE BOUNDARY dose guidelines of 10 CFR Part 100 would not be exceeded in the event of a loss-of-coolant accident during containment purging operations. The vacuum/pressure relief valves must be blocked to open no more than 50° because these valves have not yet been qualified to close under accident conditions.

Operation will be limited to 200 hours during a calendar year. The 200-hour limit shall not become effective until after initial criticality. The total time the Containment Purge (vent) System isolation valves may be open during MODES 1, 2, 3, and 4 in a calendar year is a function of anticipated need and operating experience.

ECCS SUBSYSTEMS (Continued)

The maximum flow Surveillance Requirement ensures that the minimum injection line resistance assumptions are met. These assumptions are used to calculate maximum flows to the RCS for safety analyses which are limited by maximum ECCS flow to the RCS.

The Surveillance Requirement for the maximum difference between the minimum and maximum individual injection line flows ensures that the minimum individual injection line resistance assumed for the spilling line following a LOCA is met.

The maximum total pump flow Surveillance Requirements ensure the pump runout limits of 560 gpm for the centrifugal charging pumps and 675 gpm for the safety injection pumps are met.

The safety analyses are performed assuming the miniflow recirculation lines for the ECCS subsystems associated with the centrifugal charging and safety injection pumps are open. The flow balancing test is, therefore, performed with these miniflow recirculation lines open.

Some of the flow from the centrifugal charging pumps will go to the RCP seals during ECCS operation. Therefore, the flow balance test is performed with a simulated flow from the centrifugal charging pumps to the RCP seals. The simulated flow rate is consistent with the actual RCP seal resistance and the resistance of the RCP seals assumed in the calculation of ECCS flows for the safety analyses.

3/4.5.4 BORON INJECTION SYSTEM

The Boron Injection System is only required for Units 1 and 2 Cycle 4. The OPERABILITY of the Boron Injection System as part of the ECCS ensures that sufficient negative reactivity is injected into the core to counteract any positive increase in reactivity caused by RCS cooldown. RCS cooldown can be caused by inadvertent depressurization, a loss-of-coolant accident or a steam line rupture.

The limits on injection tank minimum contained volume and boron concentration ensure that the assumptions used in the steam line break analysis are met. The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics.

The OPERABILITY of the redundant heat tracing channels associated with the boron injection system ensure that the solubility of the boron solution will be maintained above the solubility limit of 135°F at 21,000 ppm boron.

3/4.5.5 REFUELING WATER STORAGE TANK

The OPERABILITY of the Refueling Water Storage Tank (RWST) as part of the ECCS ensures that a sufficient supply of borated water is available for injection by the ECCS in the event of either a LOCA or a steamline break. The limits on RWST minimum volume and boron concentration ensure that: (1) sufficient water is available within containment to permit recirculation cooling flow to the core; (2) the reactor will remain subcritical in the cold condition (68 to 212 degrees-F) following a small break LOCA assuming complete mixing of the RWST, RCS, spray additive tank, containment spray system piping and ECCS water volumes with all control rods inserted except the most reactive control rod assembly (ARI-1); (3) the reactor will remain subcritical in the cold condition following a large break LOCA (break flow area greater than 3 ft^2) assuming complete mixing of the RWST, RCS, ECCS water and other sources of water that may eventually reside in the sump post-LOCA with all control rods assumed to be out (ARO); and (4) long term subcriticality following a steamline break assuming ARI-1 and preclude fuel failure.

The maximum allowable value for the RWST boron concentration forms the basis for determining the time (post-LOCA) at which operator action is required to switch over the ECCS to hot leg recirculation in order to avoid precipitation of the soluble boron.

The contained water volume limit includes an allowance for water not usable because of tank discharge line location or other physical characteristics.

3/4.5.1 ACCUMULATORS

The OPERABILITY of each Reactor Coolant System (RCS) accumulator ensures that a sufficient volume of borated water will be immediately forced into the core through each of the cold legs in the event the RCS pressure falls below the pressure of the accumulators. This initial surge of water into the core provides the initial cooling mechanism during large RCS pipe ruptures.

The limits on accumulator volume, boron concentration and pressure ensure that the assumptions used for accumulator injection in the safety analysis are met.

The accumulator power operated isolation valves are considered to be "operating bypasses" in the context of IEEE Std. 279-1971, which requires that bypasses of a protective function be removed automatically whenever permissive conditions are not met. In addition, as these accumulator isolation valves fail to meet single failure criteria, removal of power to the valves is required.

The limits for operation with an accumulator inoperable for any reason except an isolation valve closed minimizes the time exposure of the plant to a LOCA event occurring concurrent with failure of an additional accumulator which may result in unacceptable peak cladding temperatures. If a closed isolation valve cannot be immediately opened, the full capability of one accumulator is not available and prompt action is required to place the reactor in a MODE where this capability is not required.

3/4.5.2 and 3/4.5.3 ECCS SUBSYSTEMS

The OPERABILITY of two ECCS subsystems ensures that sufficient emergency core cooling capability will be available in the event of a LOCA assuming the loss of one subsystem through any single failure consideration. Either subsystem operating in conjunction with the accumulators is capable of supplying sufficient core cooling to limit the peak cladding temperatures within acceptable limits for all postulated break sizes ranging from the double ended break of the largest RCS cold leg pipe downward. In addition, each ECCS subsystem provides long term core cooling capability in the recirculation mode during the accident recovery period.

With the RCS temperature below 350°F, one OPERABLE ECCS subsystem is acceptable without single failure consideration on the basis of the stable reactivity condition of the reactor and the limited core cooling requirements.

ECCS SUBSYSTEMS (Continued)

The requirement to maintain the RHR Suction Valves 8701 and 8702 in the locked closed condition in MODES 1, 2 and 3 provides assurance that a fire could not cause inadvertent opening of these valves when the RCS is pressurized to near operating pressure. These valves are not part of an ECCS subsystem.

The limitation for a maximum of one centrifugal charging pump to be OPERABLE and the Surveillance Requirement to verify all centrifugal charging pumps and Safety Injection pumps except the required OPERABLE charging pump to be inoperable below 323°F provides assurance that a mass addition pressure transient can be relieved by the operation of a single PORV.

For Unit 1 Cycle 5 and Unit 2 Cycle 4:

The Surveillance Requirements provided to ensure OPERABILITY of each component ensures that, at a minimum, the assumptions used in the safety analyses are met and that subsystem OPERABILITY is maintained. Surveillance requirements for throttle valve position stops and flow balance testing provide assurance that proper ECCS flows will be maintained in the event of a LOCA. Maintenance of proper flow resistance and pressure drop in the piping system to each injection point is necessary to: (1) prevent total pump flow from exceeding runout conditions when the system is in its minimum resistance configuration, (2) provide the proper flow split between injection points in accordance with the assumptions used in the ECCS-LOCA analyses, and (3) provide an acceptable level of total ECCS flow to all injection points equal to or above that assumed in the ECCS-LOCA analyses.

For Unit 1 Cycle 6 and after, and Unit 2 Cycle 5 and after:

The Surveillance Requirements provided to ensure OPERABILITY of each component ensure that, at a minimum, the assumptions used in the safety analyses are met and that subsystem OPERABILITY is maintained. The safety analyses make assumptions with respect to minimum total system resistance, minimum and maximum total injection line resistance, and minimum individual injection line resistance. These resistances in conjunction with the ranges of potential pump performance are used to calculate the minimum and maximum ECCS flows assumed in the safety analyses.

The minimum flow Surveillance Requirement ensures that the maximum injection line resistance assumptions are met. These assumptions are used to calculate minimum flows to the RCS for safety analyses which are limited by minimum ECCS flow to the RCS.

SURVEILLANCE REQUIREMENTS (Continued)

b) The total flow rate through all four injection lines is less than or equal to 461 gpm, and

c) The difference between the maximum and minimum injection line flow rates is less than or equal to 15.5 gpm, and

d) The total pump flow rate is less than or equal to 560 gpm.

2) For safety injection pumps, with a single pump running:

a) The sum of the injection line flow rates, excluding the highest flow rate, is greater than or equal to 427 gpm, and

b) The total flow through all four injection lines is less than or equal to 650 gpm, and

c) The difference between the maximum and minimum injection line flow rates is less than or equal to 20.0 gpm, and

d) The total pump flow rate is less than or equal to 675 gpm.

i. By performing a flow test, during shutdown, following completion of modifications to the RHR system that alter the system flow characteristics, and verifying that with a single pump running, and delivering to all four cold legs, a total flow rate greater than or equal to 3976 gpm.

SURVEILLANCE REQUIREMENTS (Continued)

c. By a visual inspection which verifies that no loose debris (rags, trash, clothing, etc.) is present in the containment which could be transported to the containment sump and cause restriction of the pump suctions during LOCA conditions. This visual inspection shall be performed:

   1) For all accessible areas of the containment prior to establishing CONTAINMENT INTEGRITY, and

   2) Of the areas affected within containment at the completion of each containment entry when CONTAINMENT INTEGRITY is established.

d. At least once per 18 months by a visual inspection of the containment sump and verifying that the subsystem suction inlets are not restricted by debris and that the sump components (trash racks, screens, etc.) show no evidence of structural distress or corrosion;

e. At least once per 18 months by:

   1) Verifying that each automatic valve in the flow path actuates to its correct position on a Safety Injection actuation test signal.

   2) Verifying that each of the following pumps start automatically upon receipt of a Safety Injection actuation test signal:

      a) Centrifugal charging pump,

      b) Safety Injection pump, and

      c) Residual Heat Removal pump.

f. By verifying that each of the following pumps develops the indicated differential pressure on recirculation flow when tested pursuant to Specification 4.0.5:

   1) Centrifugal charging pump $\geq$ 2400 psid,

   2) Safety Injection pump $\geq$ 1455 psid, and

   3) Residual Heat Removal pump $\geq$ 165 psid.

SURVEILLANCE REQUIREMENTS (Continued)

g. By verifying the correct position of each electrical and/or mechanical position stop for the following ECCS throttle valves:

1) Within 4 hours following completion of each valve stroking operation or maintenance on the valve when the ECCS subsystems are required to be OPERABLE, and

2) At least once per 18 months.

Boron Injection Throttle Valves	Safety Injection Throttle Valves
8810A	8822A
8810B	8822B
8810C	8822C
8810D	8822D

h. By performing a flow balance test, during shutdown, following completion of modifications to the ECCS subsystems that alter the subsystem flow characteristics and verifying that:

For Unit 1 Cycle 5 and Unit 2 Cycle 4:

1) For centrifugal charging pump lines, with a single pump running:

a) The sum of the injection line flow rates, excluding the highest flow rate, is greater than or equal to 346 gpm, and

b) The total pump flow rate is less than or equal to 550 gpm.

2) For safety injection pump lines, with a single pump running:

a) The sum of the injection line flow rates, excluding the highest flow rate, is greater than or equal to 463 gpm, and

b) The total pump flow rate is less than or equal to 650 gpm.

For Unit 1 Cycle 6 and after, and Unit 2 Cycle 5 and after:

1) For centrifugal charging pumps, with a single pump running:

a) The sum of injection line flow rates, excluding the highest flow rate, is greater than or equal to 299 gpm, and

UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 65 TO FACILITY OPERATING LICENSE NO. DPR-80

AND AMENDMENT NO. 64 TO FACILITY OPERATING LICENSE NO. DPR-82

PACIFIC GAS AND ELECTRIC COMPANY

DIABLO CANYON NUCLEAR POWER PLANT, UNIT NOS. 1 AND 2

DOCKET NOS. 50-275 AND 50-323

1.0 INTRODUCTION

By letter dated December 21, 1990, Pacific Gas and Electric Company (PG&E or the licensee) requested amendments to Facility Operating License DPR-80 and DPR-82 for Diablo Canyon Units 1 and 2, respectively. The amendment application is designated License Amendment Request LAR-90-13 (Reference 1). The amendments change the combined Diablo Canyon technical specifications (TS) by modifying the flow rates for the centrifugal charging pumps (CCPs) and the safety injection (SI) pumps. Also, the value of the maximum containment design pressure is rounded up to a whole number. During the course of its review of the amendment application the staff obtained clarifying information from the licensee by telephone (Reference 2). This information did not alter the proposed action or affect the initial determination noticed in the Federal Register on January 23, 1991.

The purpose of these amendments is to: (1) allow operation of the subsystems of the emergency core cooling system (ECCS) associated with the CCPs with the recirculation (miniflow) lines open during the injection phase of ECCS operation, (2) provide additional margin between the minimum and maximum CCP and SI pump flow requirements, and (3) provide a surveillance requirement for the difference between minimum and maximum individual line flows (flow imbalance) for both the CCP lines and SI pump lines.

The revised flow rates provide a broader range between minimum and maximum flow rates which allows explicit inclusion of the orifice uncertainties associated with flow measurement in the TS. These changes also facilitate adjustment of the flow balance valves and performance of the associated surveillance test procedure.

Specifically, these amendments modify TS 3/4.5.2, "ECCS Subsystems - T_{avg} greater than or equal to 350°F," by revising values for minimum and maximum centrifugal charging and safety injection flow rates and revised values for injection line flow imbalance for operation of Unit 1 in Cycle 6 and Unit 2 in Cycle 5 and for the succeeding cycles. The TS changes are as follows:

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(1) Minimum Flow - 3 Loops

Surveillance requirements for the sum of the injection line flow rates, excluding the highest flow rate, is reduced from 346 gpm to 299 gpm for the centrifugal charging pumps (CCPs), and from 463 gpm to 427 gpm for the safety injection (SI) pumps.

(2) Maximum Pump Flow

Two surveillance requirements are renumbered and the total pump flow rate requirements is increased from 550 gpm to 560 gpm for the CCPs, and from 650 gpm to 675 gpm for the SI pumps.

(3) Flow - Sum of 4 Loops

New surveillance requirements are added to require the total flow rate through all four injection lines to be less than or equal to 461 gpm for the CCPs and 650 gpm for the SI pumps.

(4) Maximum Unbalance

New surveillance requirements are added to require the difference between the maximum and minimum individual injection line flow rates to be less than or equal to 15.5 gpm for the injection lines associated with the CCPs and 20.0 gpm for the injection lines associated with the SI pumps.

The associated TS Bases are also appropriately revised.

2.0 BACKGROUND

TS 4.5.2.h identifies surveillance requirements for flow rates for the portions of the ECCS associated with the CCPs and SI pumps. The purpose of these surveillance requirements is to verify that the plant configuration is consistent with the assumptions used in the design, the values in the Final Safety Analysis Report (FSAR), and calculation of the pump operability limits and net positive suction head (NPSH) requirements. Verification is made by measuring flows using the pressure drop across flow orifices. Previously, the licensee did not include orifice uncertainties when comparing the flow test results to the TS 4.5.2.h limits. These amendments allow the measurement uncertainties associated with the flow orifices to be explicitly included in the TS, and broaden the range between minimum and maximum flow limits.

Diablo Canyon Unit 2 Licensee Event Report (LER) 2-85-030-1, "ECCS Safety Injection System Flow Balance Test," dated October 1, 1989, described how the previous TS limits on minimum and maximum flow provided a narrow band within which the flows must be adjusted. The narrow band makes the flow balancing difficult, which may result in running the pumps for an unnecessarily long period of time while balancing flows. The narrow band also provides little margin to accommodate minor system performance changes. The current emergency

operating procedures (EOPs) direct the operator to close the CCP miniflow valves during the injection phase of ECCS operation in the event the ECCS is actuated and the reactor coolant system (RCS) pressure is reduced. This is because the design and safety analysis ECCS flows were calculated assuming zero miniflow. These amendments delete this requirement. The licensee has performed calculations of ECCS flows to support the CCP miniflow valves being open and remaining open during injection.

TS 4.5.2.h previously had no limits for flow unbalance between individual injection lines. Injection line flows were adjusted during the flow balance test to minimize flow imbalance between lines. The revised TS 4.5.2.h specifies an allowed maximum flow imbalance between injection lines. The licensee has supported this change with a safety evaluation.

Specifically, the licensee examined all the required safety analyses that could be affected by the changes in ECCS flows. These were determined to be:

(1) Loss of Coolant Accident (LOCA)

This includes (a) the large break LOCA, (b) the small break LOCA, (c) blowdown reactor vessel and loop forces, (d) post LOCA long term cooling, and (e) containment integrity.

(2) Steam Generator Tube Rupture (SGTR)

This includes the overfill case.

(3) Rupture of the Main Steam Line

This includes (a) core response, (b) containment analysis, (c) mass and energy release outside of containment, and (d) accidental depressurization of the main steam line system.

(4) Major Rupture of a Main Feedwater Line

(5) Spurious Actuation of the Safety Injection System at Power

(6) Low Temperature Overpressure System

In addition, the effects of the flow changes on pump operability were examined. These effects included: (a) adequate NPSH available for the increased flows (b) required motor horsepower.

The licensee stated that its safety evaluation of these proposed changes shows acceptable ECCS performance with respect to the analyses in the FSAR update. Our evaluation of these changes are given in Section 3.0 of this safety evaluation. The licensee states that the benefits of these amendments include enhanced plant operation, enhanced performance of the surveillance test, and a reduction in the possibility of violating the TS due to a narrow band for allowable operation. Similar requests have been made by other utilities and approved by NRC, e.g., the D.C. Cook and Trojan plants.

3.0 EVALUATION

In support of these amendments the licensee submitted safety evaluations in which the ECCS flows assumed in the safety analyses and the pump operability limits and NPSH requirements were calculated by modeling the pumps, valves, and piping of the ECCS system. Some safety analyses are limited by the minimum ECCS flow to the RCS and some analyses are limited by the maximum ECCS flow to the RCS. The FSAR Update-certified performance curves plus 2 percent were used for the maximum pump performance curves, and the FSAR Update minimum pump performance curves were used as the minimum performance curves. The pump operability and NPSH calculations are limited by the maximum flow through the pump. The window between minimum and maximum total injection flows was broadened to include orifice uncertainties and to allow a larger target band for balancing. This resulted in increasing the maximum safety analysis flow and decreasing the minimum safety analysis flows. The assumption that the CCP miniflow line will remain open had the effect of reducing both minimum and maximum safety analysis flows. The combination of these two changes has the net effect of reducing the minimum ECCS flows assumed in the analyses. The net effect on the maximum ECCS flows varies; for some analyses the maximum ECCS flow is decreased and for others the maximum ECCS flow is increased. The impact of these changes is evaluated below.

3.1 Loss of Coolant Accident (LOCA)

Minimum ECCS flows consistent with revised TS 4.5.2.h are limiting for the LOCA analysis of core cooling. The balancing of the flow in the individual injection lines to the four loops is not a concern for the analysis of a large break LOCA as the entire RCS depressurizes to nearly containment pressure and the back pressure for all injection lines is essentially the same. However, injection line balancing is a concern for small break LOCA where balancing of the injection flows from the SI pumps and CCPs is necessary to ensure that adequate flow goes to the RCS rather than spilling out the break. The large break LOCA and small break LOCA are evaluated below.

3.1.1 Large Break LOCA

The large break LOCA analysis of record for Diablo Canyon is described in the current FSAR Update, and is a double-ended cold leg guillotine break with a discharge coefficient of 0.4. This analysis was performed using the NRC-approved 1981 ECCS evaluation model with the BASH code, and resulted in a peak cladding temperature (PCT) of 2158°F. This result includes a 50°F transition core penalty for the transition to VANTAGE-5 fuel.

The licensee states in Reference 1 that since the ECCS analysis of record was performed, but before inclusion of the changes authorized by these amendments, other changes have been made which are estimated to increase the Diablo Canyon PCT, including penalties for ECCS evaluation model changes and previous safety evaluations, to a value of 2188.2°F. Thus, the cumulative effect on PCT of all changes made since the ECCS analysis of record was performed was 30.2°F before issuance of these amendments.

The ECCS flow rates modeled for the large break LOCA include minimum flow rates from one CCP, one SI and one RHR pump. For conservatism, the containment pressure was previously assumed to be 0.0 psig, which maximizes the spillage and minimizes flow to the RCS. With 0.0 psig containment pressure, the changes allowed by these amendments result in a decrease in the calculated minimum ECCS flow of 114 gpm for the pressure range of interest. The NRC staff estimates that this change alone would result in a PCT increase of greater than 20°F. However, as the licensee notes that at the time the PCT is computed to occur, the calculated containment pressure is above 17 psig. The licensee states that a revised ECCS analysis using the containment pressure of 17 psig would show that the spillage is reduced and a minimum of 145 gpm of additional safety injection flow would be delivered to the RCS. This would result in a decrease in PCT which is conservatively estimated to cancel out the PCT increase resulting from the 114 gpm safety injection flow decrease discussed above. On this basis the licensee states that the revised minimum ECCS flow rate requirements will not adversely affect the large break LOCA analysis, PCT will not be increased, and the current ECCS analysis results will remain valid. The staff has reviewed the licensee's conclusion and finds it to be acceptable.

However, the staff concludes that the changes authorized by these amendments, in combination with the changes previously made since the ECCS analysis of record was performed, result in a change in PCT which is significant per the 10 CFR 50.46 definition. Specifically, 10 CFR 50.46 defines a significant change to be a cumulation of changes and errors such that the sum of the absolute magnitudes of the changes is greater than 50°F. The staff concludes that these amendments result in such a cumulation, and therefore the licensee is required by 10 CFR 50.46 to perform a new large break LOCA analysis and to propose a schedule for this reanalysis within 30 days of the issuance of these amendments.

3.1.2 Small Break LOCA

The current small break LOCA analysis uses the NRC-approved small break LOCA ECCS evaluation model with the NOTRUMP code. For a 4-inch equivalent diameter break the most limiting PCT, including penalties for previous ECCS evaluation model changes and safety evaluations is 1677.7°F and 1760.7°F for Diablo Canyon Units 1 and 2 respectively.

In Reference 1 the licensee states that the small break LOCA will incur a PCT penalty of 58°F due to the revised minimum CCP and SI pump flows since the integrated ECCS flow will be lower than was assumed in the small break analysis. This 58° PCT penalty includes the effects of changing the containment back pressure from the previous conservative assumption of 0.0 psig to a more realistic value. See the discussion of this in Section 3.1.1, above. Therefore, these amendments will result in PCT values of 1735.7°F and 1818.7°F for Units 1 and 2, respectively. These values are below the 2200°F limit value. Therefore, the conclusions presented in the FSAR Update for small break LOCA remain valid and demonstrate that small break LOCAs continue to be non-limiting after this change.

However, the staff concludes that the changes authorized by these amendments result in a change in PCT which is significant per the 10 CFR 50.46 definition. Specifically, 10 CFR 50.46 defines a significant change to be one which results in a calculated PCT different by more than 50°F from the PCT calculated for the limiting transient using the last acceptable model. The staff concludes that these amendments result in such a change, and therefore the licensee is required by 10 CFR 50.46 to perform a new small break LOCA analysis and to propose a schedule for this reanalysis within 30 days of the issuance of these amendments.

3.1.3 Blowdown Reactor Vessel and Loop Forces

The blowdown hydraulic loads resulting from a LOCA are covered in Section 3.9.3.5 of the FSAR Update. The maximum loads are generated within the first few seconds after break initiation. This is well before ECCS flow is calculated to occur. Therefore, the revised CCP and SI pump flow requirements will not affect the results of the LOCA hydraulic forces calculation.

3.1.4 Post LOCA Long Term Cooling

The ECCS is also required for recirculation during recovery from a LOCA for long term core cooling where the ECCS draws water from the containment sump. The effects of the revised ECCS flow requirements on long term core cooling are discussed below for the: (1) subcriticality requirement, (2) hot leg switchover to prevent boron precipitation, and (3) minimum flow requirement.

3.1.4.1 Subcriticality Requirement

This requirement is to ensure that the reactor remains subcritical with the control rods out by use of borated ECCS water. The licensee has determined that the revised ECCS flow rates would have no effect on the boron concentrations and volumes assumed for the calculation. Therefore, the subcriticality requirement will be met with the revised ECCS performance requirements.

3.1.4.2 Hot Leg Switchover to Prevent Potential Boron Precipitation

During recirculation, borated water is injected into the RCS alternately from the cold legs and the hot legs to prevent boron from coming out of solution and plating out on the fuel rods. The licensee has determined that the revised ECCS flow rates would have no effect on the power level, or volumes assumed for the RCS, refueling water storage tank (RWST) and accumulators, and would have no effect on the boron concentrations. Therefore there is no effect on the post-LOCA hot leg switchover time.

3.1.4.3 Minimum Flow Requirement

As the basis for the minimum flow rate, a calculation is made for the hot leg injection mode in accordance with the requirements of 10 CFR 50.46 for long term cooling. The licensee stated that this calculation of the required flow

rate is based on the boil-off rate. This boil-off rate is increased by a factor of 50%. Because of only a small reduction in the minimum ECCS flow and the 50% factor, the resulting minimum ECCS flow rate will not violate the long term cooling requirement.

3.2 Steam Generator Tube Rupture (SGTR)

The ECCS flow maintains RCS inventory while the RCS is being depressurized following a SGTR. However, since ECCS flow is at higher pressure than the ruptured steam generator (SG) pressure, the ECCS flow must be terminated to stop break flow and recover from a SGTR. Maximum ECCS flows are assumed in the analysis to predict conservative values and are consistent with the proposed Surveillance Requirements in TS 4.5.2.h.(1)(b) and (2)(b). Flow balancing is not a concern for SGTR since all lines are subject to RCS pressure which is essentially equal in all four loops. The FSAR Update SGTR analysis assumed the primary to secondary break flow to be terminated at 30 minutes after initiation of the SGTR event. The SGTR analysis methodology was developed by the SGTR Subgroup of the Westinghouse Owners Group. In a revised SGTR analysis (Reference 3) the licensee used the NRC approved SGTR analysis methodology presented in WCAP-10698 and Supplement 1 to WCAP-10698. The LOFTTR2 program was used to model the operator actions during recovery from a SGTR event. The analyses included (1) an overfill case to demonstrate margin to SG overfill, and (2) an offsite case to demonstrate that offsite radiological consequences are acceptable. These cases are discussed below.

3.2.1 Overfill Case

The revised maximum ECCS flow for the margin to overfill case is increased over the values used in the analysis and is therefore less conservative. Therefore, the primary to secondary break flow rate would be increased and the steam release rate from the ruptured SG would be reduced with the revised maximum ECCS flows. Thus the margin to overfill would be adversely affected. Based on a sensitivity study of ruptured SG water volume to ECCS flow, the licensee estimated that the margin to overfill would decrease by approximately 25 cubic feet with the revised maximum ECCS flows. However, the available margin is greater than this. Therefore it was concluded that if the event were reanalyzed considering the increased maximum ECCS flows, acceptable results would be obtained. The staff agrees with this conclusion and finds it acceptable.

3.2.2 Offsite Dose Case

Since the revised maximum ECCS flow is lower than the ECCS flows assumed in the analysis for offsite dose, the revised maximum ECCS flow would have no adverse effect on the offsite dose. Therefore we find the revision to be acceptable as the FSAR Update results are bounding.

3.3 Rupture of Main Steam Line

For a Steam Line Break (SLB) the ECCS provides borated water which offsets the reduction of shutdown margin resulting from moderator cool down. The analysis of a SLB assumes minimum ECCS flows. The minimum flows calculated for the safety evaluation were consistent with the proposed minimum flow Surveillance Requirements in TS 4.5.2.h.(1)(a) and (2)(a). Flow balancing is not a concern for SLB since all lines inject to RCS pressure which is essentially the same in all four loops. The staff finds that the revised ECCS flows are acceptable for the SLB as the revised flows are consistent with the calculations used in the safety evaluation which indicated an insignificant effect on the return to power.

3.3.1 Core Response

The ECCS delivers borated water to the core to provide negative reactivity in order to limit the return to power. Section 15.4.2.1 of the FSAR Update demonstrates core integrity in the event of a SLB by verifying that the Departure from Nucleate Boiling (DNB) design basis is met. The licensee stated that a sensitivity analysis was performed that confirmed that the reduction in minimum ECCS flow would have a negligible effect on the calculated core heat flux (return to power). At the time of peak heat flux, which corresponds to the time of minimum DNBR, the core thermal hydraulic conditions would be essentially unchanged. Therefore the DNB design basis would be met and the conclusions of the FSAR Update would remain valid. The staff finds this to be acceptable.

3.3.2 Mass and Energy Release Inside Containment

The mass and energy release inside containment are calculated to ensure that the containment pressure and temperature do not exceed acceptable levels. The design pressure is 47 psig. A temperature response transient is used to demonstrate that the safety-related temperature instrumentation will be in compliance with IEEE requirements.

As discussed above for core response to SLB, the reduced minimum ECCS flow would have an insignificant effect on the return to power. Therefore the releases are limited mainly by the characteristics of the break and secondary side steam generator conditions. Sensitivity analyses were made that confirmed that the reduction in minimum ECCS flow would have insignificant effects on the calculated mass and energy releases. Therefore, the calculated containment response would be unaffected and the conclusions of the FSAR Update remain valid.

3.3.3 Mass and Energy Release Outside Containment

As discussed above for core response to SLB, the reduced ECCS flow would have an insignificant effect on the return to power. Sensitivity studies confirmed that a reduction in ECCS flow does not significantly impact the calculated mass releases. Therefore, the mass and energy release outside of containment remains applicable and the conclusions of the FSAR Update remain valid.

3.4 Major Rupture of a Main Feedwater Line

The feedwater line rupture transient analysis assumes the actuation of one CCP to provide ECCS flow following a low steam line pressure safety injection signal. The primary RCS heat removal is provided by the auxiliary feedwater flow with the ECCS flow providing an additional heat sink to remove decay heat. The licensee stated that the feedwater line rupture analysis takes credit for steam line check valves to prevent reverse flow and to limit the cooldown from the secondary side break in the faulted SG. Therefore the RCS pressure remains high during the transient. The flow from the CCP is a relatively unimportant source of heat removal. Therefore the reduced ECCS flow rate requirement does not have a significant effect on the feedwater rupture transient and the conclusions of the FSAR Update remain valid.

3.5 Spurious Actuation of the Safety Injection System at Power

The analysis of the inadvertent operation of the ECCS during power operation is to show that the core integrity is maintained by verifying that the DNB design basis is met. The licensee stated that this event is non-limiting with respect to DNB as the addition of borated water to the RCS serves to greatly reduce core power and increase the margin to DNB. The revised maximum ECCS flows based on the proposed surveillance requirements are less than the flows assumed in the analysis and would not adversely impact the analysis. Therefore the conclusion is in the FSAR Update remain valid.

3.6 Low Temperature Overpressure System

The low temperature overpressure system (LTOPS) provides RCS overpressure protection during startup and shutdown. The CCPs discharge into the RCS through the normal charging lines and are used during a charging/letdown mismatch transient. The proposed changes to the surveillance requirements are only for the flows from the CCP associated with the ECCS. Therefore the normal charging flows are not affected and there is no impact on flows modeled in the LTOPS analysis or LTOPS initiation setpoint. Also, the operational change of leaving the miniflow lines open does not adversely affect the LTOPS analysis because the current analysis assumes that the miniflow lines are closed which results in more flow to the RCS. Therefore the current analysis is bounding for operation with the miniflow lines open.

3.7 Pump Operability

For the CCP and SI pumps the two main concerns for pump operability related to the increase in pump runout operation conditions are: (1) cavitation, and (2) horsepower capability. Cavitation will occur if the NPSH required by the pumps is not satisfied by the available NPSH at the increased runout flow rates. Also, the pump motors must be capable for operating satisfactorily at the increased runout flow rates which could require increased horsepower. These concerns are discussed below.

3.7.1 Centrifugal Charging Pump (CCP)

The licensee reported that the calculated NPSH available for the CCP at 560 gpm was 44 feet, whereas the NPSH required is 24 feet. Therefore the NPSH available is ample. Regarding the horsepower, the licensee reported that the CCP falling head curve results in a brake horsepower curve that is flat at rates beyond 550 gpm. Therefore, the horsepower requirements for 560 gpm are not increased and are within the capability of the motor.

3.7.2 Safety Injection (SI) Pump

The licensee reported that the calculated NPSH available for the SI pumps at 675 gpm is 31 feet, whereas the NPSH required is 29 feet. Therefore the NPSH available is satisfactory. Regarding horsepower, the licensee reported that the SI pump falling head curve results in a brake horsepower curve is flat at rates beyond 650 gpm. Therefore, the horsepowers requirements for 675 gpm are within the capability of the motor.

4.0 EVALUATION OF TECHNICAL SPECIFICATIONS

As a result of the changes requested to modify the CCP and SI pump flow rates, the following changes to the Technical Specifications were proposed.

1. Page 3/4 5-6 - TS 3/4.5.2, "ECCS Subsystems - T_{avg} greater than or equal to 350°F."

   The following changes to Surveillance Requirement 4.5.2.h were proposed:

   a. Surveillance Requirements 4.5.2.h(1)(a) and (2)(a) - The sum of the injection flow line flow rates, excluding the highest flow rate, was reduced from 346 gpm to 299 gpm for the CCPs and from 463 gpm to 427 gpm for the SI pumps.

   b. Two surveillance Requirements 4.5.2.h(1)(b) and (2)(b) were renumbered to 4.5.2.h(1)(d) and (2)(d), and the total pump flow rate requirements were increased from 550 gpm to 560 gpm for the CCPs, and from 650 gpm to 675 gpm for the SI pumps.

   c. New Surveillance Requirements 4.5.2.h(1)(b) and (2)(b) were added to require the total flow rate through all four injection lines to be less than or equal to 461 gpm for the CCPs and 650 gpm for the SI pumps.

   d. New Surveillance Requirements 4.5.2.h(1)(c) and (2)(c) were added to require the difference between the maximum and individual injection line flow rates to be less than or equal to 15.5 gpm for the injection lines associated with the CCPs and 20.0 gpm for the injection lines associated with the SI pumps.

   The above TS changes were found to be consistent with applicable requirements and acceptable as discussed above in Section 3.0.

2. Page B 3/4 5-2

Bases section B 3/4.5.2, "ECCS Subsystems," includes background information on the Surveillance Requirements for minimum flow, maximum flow, maximum difference between the minimum and maximum individual injection line flows, and the maximum total pump flows to ensure that the runout limits of the CCP and SI pumps are met. We find these to be acceptable as discussed above in Section 3.0 of this safety evaluation.

3. Page B 3/4 6-1

Bases section B 3/4.6.1.4, "Internal Pressure," was modified to change the maximum peak pressure expected to be obtained from a LOCA event from "less than 46.65 psig" to "less than 47 psig." We find this acceptable because it is a small change obtained by rounding up the value of the previous value given.

4. Page B 3/4 6-2

Bases section B 3/4.6.1.6, "Containment Structural Integrity," was modified to delete "of 46.65 psig" from the sentence "Structural integrity is required to ensure that the containment will withstand the maximum pressure of 46.65 psig in the event of a LOCA." We find this acceptable because the maximum pressure was previously defined and therefore use of the value here is redundant.

In summary, the NRC staff has reviewed the licensee's basis for the proposed changes to the Combined Technical Specifications for Diablo Canyon Units 1 and 2 and finds them acceptable.

5.0 STATE CONSULTATION

In accordance with the Commission's regulations, the California State official was notified of the proposed issuance of these amendments. The State official had no comments.

6.0 ENVIRONMENTAL CONSIDERATION

These amendments involve changes with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20 or changes in surveillance requirements. The staff has determined that the amendments involve no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendments involve no significant hazards consideration and there has been no public comment on such finding (56 FR 2552). Accordingly, these amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of these amendments.

7.0 CONCLUSION

The NRC staff has evaluated the proposed changes and their impact on the FSAR Chapter 15 accidents. Specifically considered was the proposed modification of the values for minimum and maximum centrifugal charging and safety injection pump flow rates and revising the values for injection line flow imbalance. The staff finds that (1) the conclusions currently included in the FSAR remain valid and (2) the proposed TS changes are acceptable, as described in Section 4.0 of this safety evaluation.

However, because the changes authorized by these amendments result in changes in peak cladding temperature that are significant (as defined in 10 CFR 50.46), the licensee is required by 10 CFR 50.46 to submit within 30 days of the date of issuance of these amendments a proposed schedule for providing a reanalysis or taking other action as may be needed to show compliance with the requirements of 10 CFR 50.46.

The NRC staff has concluded, based on the considerations discussed above, that (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and (2) such activities will be conducted in compliance with the Commission's regulations, and the issuance of these amendments will not be inimical to the common defense and security or to the health and safety of the public.

8.0 REFERENCES

1. Letter No. DCL-90-297 from J. D. Shiffer, PG&E, to USNRC, "Diablo Canyon Units 1 and 2 License Amendment Request 90-13," dated December 21, 1990.

2. Telephone conversation between Roger Johnson, PG&E, and Harry Balukjian, USNRC, on May 9, 1991.

3. Letter No. DCL-88-114 from J. D. Shiffer, PG&E, to USNRC, "Revised Steam Generator Tube Rupture (SGTR) Analysis for Diablo Canyon Units 1 and 2," dated April 29, 1988.

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