BEFORE THE UNITED STATES NUCLEAR REGULATORY COMMISSION

Application of SOUTHERN CALIFORNIA EDISON COMPANY and SAN DIEGO GAS & ELECTRIC COMPANY for a Class 104(b) License to Acquire, Possess, and Use a Utilization Facility as Part of Unit No. 1 of the San Onofre Nuclear Generating Station	))))))	DOCKET NO. 50-206 Amendment No. 182

SOUTHERN CALIFORNIA EDISON COMPANY and SAN DIEGO GAS & ELECTRIC COMPANY, pursuant to 10 CFR 50.90, hereby submit Amendment Application No. 182.

This amendment consists of Proposed Change No. 224 to Provisional Operating License No. DPR-13. Proposed Change No. 224 requests approval of a revision to the decay heat removal requirements of the Spent Fuel Pool (SFP) Cooling System as described in Section 9.1.3 of the Updated Final Safety Analysis Report (UFSAR). A modification to the SFP Cooling System is being implemented to reflect the higher heat loads than previously calculated.

The modifications to the SFP Cooling System are being made to reflect a higher SFP decay heat load under certain conditions than is currently specified in the UFSAR. This higher heat load than specified resulted from an erroneous calculation of maximum decay heat load which was performed in 1982 in support of the SFP heat removal capability stated in Section 9.1.3 of the UFSAR. The incorrect calculation was discovered during preparations for the upcoming full core off-load and was reported to the Commission in accordance with 10 CFR 50.72 on April 24, 1990.

In the event of conflict, the information in Amendment Application No. 182 supersedes the information previously submitted.

9005230149 900516
PDR ADOCK 05000206
P PDC

Based on the significant hazards analysis provided in the Description and Significant Hazards Consideration Analysis of Proposed Change No. 224, it is concluded that (1) the proposed change does not involve a significant hazards consideration as defined in 10 CFR 50.92, and (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed change.

Subscribed on this 16 day of May, 1990.

Respectfully submitted,

SOUTHERN CALIFORNIA EDISON COMPANY

By: Harold B. Ray
Harold B. Ray
Vice President

Subscribed and sworn to before me this
16 day of May, 1990.

OFFICIAL SEAL
YOMAR V. CLEARY
Notary Public–California
ORANGE COUNTY
My Comm. Exp. May 8, 1992

Yomar V. Cleary
Notary Public in and for the
State of California

Charles R. Kocher
James A. Beoletto
Attorneys for Southern
California Edison Company

By: James A. Beoletto
James A. Beoletto

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

In the Matter of SOUTHERN CALIFORNIA EDISON COMPANY and SAN DIEGO GAS & ELECTRIC COMPANY (San Onofre Nuclear Generating Station, Unit No. 1)	))))	Docket No. 50-206

CERTIFICATE OF SERVICE

I hereby certify that a copy of Amendment Application No. 182 was served on the following by deposit in the United States Mail, postage prepaid, on the 17 day of May, 1990.

Benjamin H. Vogler, Esq.
Staff Counsel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

David R. Pigott, Esq.
Samuel B. Casey, Esq.
Orrick, Herrington & Sutcliffe
600 Montgomery Street
San Francisco, California 94111

Charles W. Lacey
Senior Vice President
Bechtel Power Corporation
12440 East Imperial Highway
Norwalk, California 90650

Michael L. Mellor, Esq.
Thelen, Marrin, Johnson & Bridges
Two Embarcadero Center
San Francisco, California 94111

Huey Johnson
Secretary for Resources
State of California
1416 Ninth Street
Sacramento, California 95814

Janice E. Kerr, General Counsel
California Public Utilities Commission
5066 State Building
San Francisco, California 94102

C. J. Craig
Manager U.S. Nuclear Projects I
ESSD
Westinghouse Electric Corporation
Post Office Box 355
Pittsburgh, Pennsylvania 15230

A. I. Gaede
23222 Cheswald Drive
Laguna Niguel, California 92677

Frederick E. John, Executive Director
California Public Utilities Commission
5050 State Building
San Francisco, California 94102

Docketing and Service Section
Office of the Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

James A. Beoletto

DESCRIPTION AND SIGNIFICANT HAZARD CONSIDERATION ANALYSIS OF PROPOSED CHANGE NO. 224 TO PROVISIONAL OPERATING LICENSE NO. DPR-13

I. INTRODUCTION

This is a request for NRC approval of a revision to the decay heat removal requirements for the Spent Fuel Pool (SFP) Cooling System as described in Section 9.1.3 of the Updated Final Safety Analysis Report (UFSAR). The SFP Cooling System is being modified to reflect the higher SFP heat load that can exist under certain conditions.

During preparations for the Cycle 11 outage, an error was identified in the calculation that supports the SFP maximum normal and abnormal heat loads that are reported in Section 9.1.3.4 of the UFSAR. The calculational error resulted in a non-conservative estimate of the SFP maximum normal and abnormal heat loads. This was reported to the Commission on April 24, 1990, in accordance with 10 CFR 50.72. This proposed change requests NRC approval of a revision of the UFSAR SFP cooling requirements to allow higher heat loads than presently specified. Based on these higher heat loads, the SFP Cooling System is being modified to provide a permanently installed spare SFP Cooling System pump.

II. DESCRIPTION OF CHANGE

This proposed change requests NRC approval to place a higher heat load in the SFP than is currently specified in the UFSAR. The maximum heat loads, pool temperatures and times to boil have been conservatively recalculated for several plant conditions assuming a worst case active component failure. A comparison of the preliminary results of the calculations with the current UFSAR maximum abnormal heat load case is given in Table 1.

This proposed change will be accompanied by changes to the SFP Cooling System which we are implementing in accordance with 10 CFR 50.59. The modifications will include:

- Permanently connecting the spare SFP cooling pump to the SFP Cooling System. The additions to the system will be Seismic Category A and quality class safety-related.
- Powering the spare SFP pump from a separate electrical train. Due to extensive electrical system modification to be completed during the upcoming outage, a non-safety related construction power source that is fed directly from the San Diego Gas and Electric power grid, or is otherwise provided, will be the interim power source. The spare pump power supply will be upgraded to safety-related class prior to the Cycle 12 refueling.
- Providing appropriate controls that are consistent with existing system requirements. Due to the extensive electrical modifications to be completed during the Cycle 11 refueling, non-safety related local manual controls will be provided. The controls will be upgraded to safety-related prior to the Cycle 12 refueling.

TABLE 1

SFP COOLING SYSTEM DECAY HEAT REMOVAL CAPABILITY
COMPARED TO CURRENT UFSAR MAX. ABNORMAL HEAT LOAD*

Plant Condition	Max. SFP Heat Load (MBtu/h)	Max. SFP Temp (°F)	Time to Boil Upon Loss of Cooling (hr)
Current UFSAR Max. Abnormal Heat Load	6.8	116	47
Fuel Cycle 10 (current SFP fuel inventory)	0.5	<90	No Boiling (By Observation)
Cycle 11 Outage	8.6	138	21
Fuel Cycle 11 (with postulated emergency defueling)	14.7	179	6
Corrected UFSAR Max. Abnormal Heat Load	17.0	193	3

* See Section III.B, C and D for further descriptions of these data.

It is proposed that the following revised UFSAR SFP requirements be approved:

- SFP temperature no greater than 150°F for the SFP maximum normal heat load case (including assumption of failure of one cooling pump).
- No pool boiling for the SFP maximum abnormal heat load case (including assumption of failure of one cooling pump).
- Pumps, piping, valves, electrical power sources, and connections will satisfy the existing system quality and seismic requirements.
- The SFP cooling pumps will be powered and controlled from separate electrical trains.

III. DISCUSSION

A. BACKGROUND

During a review of administrative controls necessary for the full core off-load planned for the Cycle 11 outage, it was recognized that the actual heat loads on the SFP Cooling System would be greater than reported in the UFSAR. Subsequent engineering evaluation determined that the maximum normal and maximum abnormal heat loads calculated in 1982 and described in the UFSAR were underestimated due to calculational error. This was reported to the Commission on April 24, 1990, in accordance with 10 CFR 50.72. The most significant error discovered in the calculation involved the decay heat calculation in which the electrical rated capacity of the plant rather than the thermal rating was used. We believe that this basic error resulted from inadequate communication between different organizations involved at the time. The cause of this inadequate communication appears to have been unique to this calculation.

The erroneous calculation that supports the SFP maximum normal and abnormal heat loads of 2,364,240 Btu/h and 6,788,740 Btu/h, respectively, that are reported in Section 9.1.3.4 of the UFSAR was performed as part of the Systematic Evaluation Program (SEP) for SONGS 1. The results of that calculation were submitted to the NRC by SCE letter to D. M. Crutchfield dated September 1, 1982. The NRC reviewed that submittal and forwarded its Safety Evaluation Report to SCE by letter to R. Dietch dated December 7, 1982.

We are now in the process of correcting the errors discovered in the SEP calculation. Preliminary results of this ongoing analysis are discussed in Sections III.B, C, and D for three distinct cases:

- Maximum SFP heat load that may occur during the Cycle 11 full core off-load outage.
- Maximum SFP heat load that hypothetically could occur during Fuel Cycle 11 should an emergency full core off-load become necessary.
- The corrected hypothetical maximum abnormal SFP heat load as defined in Section 9.1.3.4 of the UFSAR (assuming the full core off-load resides in the SFP 150 hours after reactor shutdown).

The maximum normal heat load case was not included in this evaluation since it is bounded by the above three cases. The required independent review and verification process has not yet been completed on the analytical results provided herein. However, we believe these results accurately reflect the above conditions regarding the SFP heat loads and are not likely to change significantly during the verification process. We will provide formal confirmation of these results by May 31, 1990.

The modifications to the SFP Cooling System are described in Sections III.E through I. Section III.J discusses the effect of this discovery on the loss of the SFP heat exchanger scenario.

B. MAXIMUM SFP HEAT LOAD, CYCLE 11 OUTAGE

Fifty-nine fuel assemblies are currently stored in the SFP. These fuel assemblies have been decaying for at least 19 months and represent a small heat load (i.e., approximately 0.5 MBtu/h). A full core off-load will be added to this SFP inventory at the start of the upcoming outage. The present outage plan involves beginning the core off-load approximately 17 days after reactor shutdown and completing the off-load 5 days later.

Branch Technical Position ASB 9-2, "Calculation of Decay Heat Loads," was used to calculate the full core decay heat load as a function of time after reactor shutdown. The SFP heat load was evaluated by assuming that the entire full core decay heat load resides in the pool 2 days after the off-load is initiated and by assuming a 75°F seawater temperature for the ultimate heat sink. The maximum SFP heat load for the Cycle 11 outage of 8.6 MBtu/h was then determined by adding the decay heat from the full core off-load to that of the fuel assemblies already stored in the pool. The maximum SFP water temperature corresponding to this condition is 138°F.

Should the primary SFP cooling pump become inoperable under the above worst case heat load condition for the Cycle 11 outage, it was calculated that it would require approximately 21 hours for the SFP water to reach boiling. While this time to boiling is shorter than the 47 hour period currently stated in UFSAR Section 9.1.3.4, it remains sufficiently long in comparison to the time required to place the installed spare pump in operation. If the existing 125°F SFP alarm setpoint is activated, the alarm setpoint will be increased to 150°F or an individual will be assigned to monitor the system's performance. Should the pool temperature ever exceed the 150°F level, a dedicated individual will continuously monitor the operation of the SFP Cooling System. This level of surveillance will assure that at elevated temperatures the spare pump will be placed in-service within approximately 30 minutes of a primary pump failure. This is acceptable since at 150°F it would take at least 15 hours to reach pool boiling upon pump failure. The system performance will be monitored once per shift during times when the SFP temperature is below 150°F. (Modifications for the spare pump are discussed in Section III.E through I.)

C. MAXIMUM SFP HEAT LOAD, FUEL CYCLE 11

The adequacy of the revised SFP Cooling System was also investigated for the case when the unit is returned to service for Cycle 11 operation. In the unlikely event it becomes necessary to defuel the reactor during Cycle 11, it may be possible that the SFP heat load could exceed the values projected for the Cycle 11 outage.

The decay heat that would result from such an off-load depends on the irradiation history of the core. For conservatism, our investigation assumed the core achieved 485 effective full power days of operation during Cycle 11 and then had to be off-loaded. The resulting maximum SFP heat load and corresponding SFP temperature (assuming 75°F seawater) during Cycle 11 operation was calculated as 14.7 MBtu/h and 179°F, respectively. The time to boil assuming failure of the primary SFP cooling pump was calculated as 6 hours for this case. Therefore, ample time remains available for this hypothetical situation to complete the switchover to the installed spare pump if the primary pump experiences a failure.

D. MAXIMUM ABNORMAL SFP HEAT LOAD

The hypothetical maximum abnormal heat load case has also been evaluated. This situation was investigated even though it is not possible for the hypothetical decay heat load for one and one third cores as calculated by Branch Technical Position ASB 9-2 to be placed in the SFP during this outage or at any time during Fuel Cycle 11.

The maximum SFP abnormal heat load defined in UFSAR Section 9.1.3.4 is that resulting from "a full core off-load 30 days following a refueling off-load." On this basis, our ongoing analysis has preliminarily found that the maximum abnormal heat load from one and one third cores in the SFP is 17 MBtu/h and that the corresponding maximum SFP temperature is 193°F. Under these conditions, it would take approximately 3 hours to pool boiling if the primary cooling pump became inoperable.

E. SFP COOLING SYSTEM MODIFICATIONS

The SFP Cooling System is being modified to improve the spare pump availability and accommodate the shortened time intervals to SFP boiling upon loss of cooling. The modification is focused on reducing the time required to place the spare SFP cooling pump in-service should the primary pump experience a failure. The present system configuration includes one permanently installed pump and a spare pump which can be connected to the system if required. Since the spare pump is not presently connected to the SFP Cooling System, up to 16 hours is now required to install the piping spool pieces and electrical connections so it can be utilized. While this time was considered adequate for the 47 hours to boiling that is indicated in the UFSAR, it does not provide adequate margin given the corrected time to boiling conservatively calculated for full core off-load conditions.

The following SFP Cooling System modifications are being completed so that the time to place the spare pump in-service when the primary pump fails is reduced to approximately 30 minutes (for SFP temperature >150°F):

- Permanently connecting the spare SFP cooling pump to the SFP Cooling System. The additions to the system will be Seismic Category A and quality class safety-related.

- Powering the spare pump from a separate electrical train. Due to the extensive electrical system modification to be completed during the upcoming outage, a non-safety related construction power source that is fed directly from the San Diego Gas and Electric power grid, or is otherwise provided, will be the interim source. The spare pump power supply will be upgraded to safety-related class prior to the Cycle 12 refueling.

- Providing appropriate controls that are consistent with existing system requirements. Due to the extensive electrical modifications to be completed during the Cycle 11 refueling, non-safety related local manual controls will be provided. The controls will be upgraded to safety-related prior to the Cycle 12 refueling.

F. MECHANICAL CONNECTION OF SPARE SFP PUMP

In order to maintain the relative time between spare pump availability and time to boil, the spare SFP cooling pump is being fully connected to the SFP Cooling System. Such connection is desirable to minimize the time required to place the pump in-service if the primary pump becomes inoperable.

The mechanical connection of the spare pump involves piping and manual valves that meet the quality requirements of the existing system and physical connection of the spare pump to the primary pump suction and discharge piping. This modification will be operable prior to conducting the upcoming full core off-load during the Cycle 11 outage. In this configuration, the spare SFP cooling pump will be able to be placed in-service within approximately 30 minutes of the discovery of a primary pump failure.

G. PUMP POWER SOURCES

Coordination with 480 Volt System Modifications

The primary SFP Cooling System pump is presently powered from safety-related 480 volt Bus No. 2 through Motor Control Center 2. Because of reconfigurations to the 480 volt system to be completed during the Cycle 11 outage (see Amendment Application No. 180 submitted to the NRC on April 19, 1990), Bus No. 2 will be taken out of service for approximately one month. Prior to taking Bus No. 2 out of service and prior to the defueling, power to the primary SFP pump will be switched to safety-related 480 volt Bus No. 1.

Once all of the modifications to 480 volt Bus No. 2 are completed and the bus fully inspected, tested, and declared operable, the power to the primary SFP cooling pump will be switched back from Bus No. 1 to Bus No. 2. This switchover to Bus No. 2 will occur no sooner than 50 days into the outage and will be completed within a 72 hour period. The spare pump will be placed in-service during the switchover of the primary pump's electrical power. Completing the switchover of the primary pump's power source back to Bus No. 2 at this time will occur when the SFP decay heat level will have reduced significantly. Also, the probability of a failure of the spare pump during the power switchover is low.

Interim Power Supply for Spare Pump

The installed spare SFP cooling pump will be powered via an interim connection to the permanently installed, non-safety related 12 kV construction power source (stepped down to 480 V) that is fed directly from the San Diego Gas and Electric power grid, or is otherwise provided. The interim power connection to the spare pump will be completed prior to the Cycle 11 outage and will be under local manual control. After the fuel is returned to the reactor, the electrical power to the spare pump may be intermittently removed to facilitate a switch to an alternate non-safety related power source or the conversion to the permanent safety-related power supply.

Long-Term Power Supply for Spare Pump

The interim power arrangement for the installed spare pump will be replaced with a safety-related permanent power source prior to the Cycle 12 refueling. The spare pump's permanent power supply will be redundant from that for the primary pump.

H. PROPOSED REVISION OF UFSAR SFP COOLING REQUIREMENTS

We request NRC approval of the following revised SFP Cooling System decay heat removal requirements:

- SFP temperature no greater than 150°F for the SFP maximum normal heat load case (including assumption of failure of one cooling pump).

- No pool boiling for the SFP maximum abnormal heat load case (including assumption of failure of one cooling pump).

- Pumps, piping, valves, electrical power sources, and connections will satisfy the existing system quality requirements.

- The SFP cooling pumps will be powered and controlled from separate electrical trains.

I. SFP COOLING SYSTEM OPERATION, CYCLE 11

A single train of SFP cooling will be operating at all times during the Cycle 11 outage. For the bulk of this period, the single train will be composed of the SFP heat exchanger, the primary SFP pump and one train of the component cooling water and saltwater cooling systems. As an added conservatism, a second component cooling water pump and auxiliary saltwater cooling pump will be functional during the Cycle 11 outage. These two backup pumps will be powered from the same 12 kV construction power source that will power the spare SFP cooling pump. During the brief period (up to 72 hours) that the primary cooling pump is out of service for the switch back to 480 volt Bus No. 2, the spare pump will be placed in-service. SFP cooling via primary pump operation will again be re-established upon completion of the power source switch.

J. LOSS OF SFP HEAT EXCHANGER

UFSAR Section 9.1.3.4 discusses use of the lower component cooling water system heat exchanger for the emergency replacement of a failed SFP heat exchanger. The UFSAR states that sufficient time is available to provide for emergency hookup to the component cooling water system in an emergency condition.

Sufficient time is available to complete these emergency connections for all heat load cases except a worst case full core off-load. However, it has been concluded that failure of a passive component such as the SFP heat exchanger is no more likely than concurrent failure of both cooling pumps. Therefore, this event is not considered credible and need not be considered. The UFSAR will be revised accordingly.

IV. SIGNIFICANT HAZARD CONSIDERATION ANALYSIS

As required by 10 CFR 50.91(a)(1), this analysis is provided to demonstrate that a proposed license amendment to allow operation of a modified SFP Cooling System for heat loads exceeding that described in UFSAR Section 9.1.3 (see Attachment 1 for an annotated version of UFSAR Section 9.1.3 that highlights information most relevant to this Proposed Change) does not represent a significant hazard consideration. As discussed below, in accordance with the three factor test of 10 CFR 50.92(c), implementation of the proposed license amendment was analyzed using the following standards and was found not to: 1) involve a significant increase in the probability or consequences for 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.

1. Will operation of the facility in accordance with this proposed change involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No

   The loss of SFP cooling due to pump failure is the only previously evaluated accident whose probability or consequences potentially may be affected by the proposed change of increasing the maximum SFP heat load above that specified in the UFSAR. However, because of the modifications being completed on the SFP Cooling System, neither the probability nor consequences of this accident are significantly changed by the higher heat load. The probability of the loss of SFP cooling due to pump failure is reduced with the addition of a redundant cooling pump.

   The modified SFP Cooling System assures that the consequences of a cooling pump failure are no worse for the higher heat load than they were for the UFSAR specified maximum abnormal heat load. With the higher heat load and implementation of the modification, the time to reach pool boiling is large in comparison to the time to place the spare pump in-service. For the maximum abnormal heat load currently reflected in the UFSAR, the time to pool boiling upon loss of cooling is 47 hours and the time to install the spare pump is approximately 16 hours. For the high heat loads, the switchover time to the spare pump remains acceptable in relation to the time to boil. During the upcoming outage, the worst case heat load is 8.6 MBtu/h and the time to boil upon loss of SFP cooling is 21 hours. During Cycle 11 operation, the worst case heat load (assuming an unplanned full core off-load at the end of the fuel cycle) is 14.7 MBtu/h and the time to boil is 6 hours. For the corrected hypothetical maximum abnormal heat load case, the heat load is 17 MBtu/h and the time to boil is 3 hours. In each case, the loss of the primary pump can be compensated for without approaching boiling in the pool since with the modified SFP Cooling System, the spare pump will be placed in operation within approximately 30 minutes of discovery of a primary pump failure. Therefore, the shorter times to pool boiling are not significant since boiling will be just as reliably averted with the higher SFP heat load as with the UFSAR specified limit.

2. Will operation of the facility in accordance with this proposed change create the possibility of a new or different kind of accident from any accident previously evaluated?

Response: No

The proposed change involves placing a higher heat load in the SFP than is currently allowed by the UFSAR. The only accident previously evaluated that relates to this change is the loss of SFP cooling. The improved SFP Cooling System reduces the probability of occurrence for this accident since the redundant pump is being directly incorporated into the system.

The only new or different kind of accident not previously evaluated relates to the potential for a recirculation flow path that is introduced by connecting the spare pump to the system. A portion of the coolant flow potentially could be recirculated through a non-operating pump should that pump not be correctly isolated. Such an occurrence could lead to degraded cooling system performance since only a portion of the pump flow would be delivered to the component cooling water heat exchanger for cooling.

However, the probability of this situation is very low since the isolation of a non-operating pump will be assured through administrative controls on dual isolation valves. Each pump will be isolated via two manual isolation valves, one on the pump's discharge piping and one on the suction. For a recirculation path to occur, both of the non-operating pump's isolation valves would have to either fail or be incorrectly aligned.

Dual concurrent failure of both of a non-operating pump's manual isolation valves is not credible and need not be considered. Incorrect alignment of a non-operating pump's valves, while possible, is not significant. Any serious degradation in the cooling system performance due to isolation valve misalignment would be noticed and corrected once the SFP high temperature alarm was activated. Therefore, the potential for a recirculation flow path through a non-operating pump's piping loop is a new type of accident, but one whose probability and consequences are insignificant. Additionally, a check valve will be added to each of the pump piping loops prior to the Cycle 12 refueling to further reduce the potential for a recirculation flow path.

3. Will operation of the facility in accordance with this proposed change involve a significant reduction in a margin of safety?

   Response: No

   As discussed in response to Question No. 1, the SFP may experience higher heat loads than were previously calculated. These heat loads are important because they determine the equilibrium temperature with the SFP Cooling System in service, time to boil and time for alternate cooling to be established. Because of upgrades to the SFP Cooling System, the margin to boiling is maintained such that adequate time is available to provide alternate cooling. These higher heat loads will shorten the time for the SFP to reach boiling upon loss of cooling. However, this reduction in the time to boil interval is compensated for by the modification to the SFP Cooling System which greatly improves the reliability with which the spare pump can be quickly placed in-service. With the modification in place, no piping spool pieces need be installed or electric power leads need be connected to recover from a postulated failure of the primary pump. Rather, only four valves must be realigned and a circuit breaker closed to operate the spare pump. Therefore, the spare pump will be able to be placed in-service in sufficient time to preclude pool boiling under higher SFP heat loads than currently specified in the UFSAR.

SAFETY AND SIGNIFICANT HAZARDS CONSIDERATION DETERMINATION

Based on the preceding analysis, it is concluded that: (1) Proposed Change No. 224 does not constitute a significant hazards consideration as defined by 10 CFR 50.92; and (2) there is reasonable assurance that the health and safety of the public will not be endangered by the proposed change.

ATTACHMENT 1

ANNOTATED VERSION OF **CURRENT** UFSAR SECTION 9.1.3

TO

HIGHLIGHT INFORMATION RELEVANT TO PROPOSED CHANGE 224 assumed to be released in the event of a dropped and damaged fuel assembly.

To prevent accidental drainage of the pit or the fuel assemblies from being uncovered, piping connections into the pit are above the top of a fuel assembly when it is fully withdrawn from the storage racks. This arrangement prevents the outflow of water in the event of a pipe rupture outside the pit. The water level in the pit and cavity shall be the same during fuel transfer, and water temperature maintained by the SFP cooling and cleanup system as discussed in section 9.1.3.

The design of the spent fuel racks is such that a fuel assembly cannot be inserted anywhere other than in design locations because cross bars span the spaces between the fuel, which physically prevents a fuel assembly from being inserted. Calculation of the maximum k_{eff} for fully loaded spent fuel racks, assuming the worst case abnormal conditions including unborated water temperature ranging from 68 to 212°F, is a k_{eff} of 0.896, which is less than 0.95.

9.1.3 SPENT FUEL PIT COOLING AND CLEANUP SYSTEM

The SFP cooling and cleanup system removes fission product decay heat from the spent fuel assemblies stored in the SFP and maintains the SFP water level, purity, clarity, and boron concentration.

9.1.3.1 Design Bases

The spent fuel cooling system is classified as safety related and seismic category A. The fuel handling building was evaluated to the 0.67g modified Housner seismic criteria. This building houses this equipment which was designed to 0.5g Housner seismic criteria. The skimmer system is classified as nonsafety related and seismic category B.

The spent fuel pit cooling loop is designed to remove the residual heat produced by 40 percent of a reactor core, 150 hours after reactor shut-down, while maintaining the pit water temperature at or below 120 F when the salt water temperature is 62 F. The 40 percent heat load results from the storage of one third of an irradiated core (cycled, three region core) with an added contingency of approximately 7 percent. The 150 hours is the estimated time after reactor shutdown required to place the spent fuel into the pit. If the salt water temperature is 75 F, the pit water temperature is maintained below 133 F for these same positions.

The spent fuel pit cooling loop is also capable of removing the residual heat produced by one and one third reactor cores while maintaining the pit water temperature below 150 F when using 62 F salt water. This condition can occur if it becomes necessary to remove a complete core from the reactor while one third core remains in the spent fuell pit from the previous refueling.

Suspended solids, in pit water, are controlled by circulating about 10% (80 gal/min) of the total recirculation flow through a filter. A skimmer system is provided to maintain surface cleanliness, and demineralization is provided to maintain purity and clarity of the fuel pool water.

Protection of the safety-related portions of the SFP cooling and cleanup system from wind and tornado loads is discussed in section 3.3. Flood design including tsunami is discussed in section 3.4. Missile protection is discussed in section 3.5. Protection against dynamic effects associated with the postulated rupture of piping is discussed in section 3.6. The seismic design is discussed in section 3.7. Environmental qualification of electrical equipment is discussed in section 3.11. Fire protection is described in section 9.5.1.

The SFP cooling system is designated as safety-related as shown in drawing 5178300. This system and components are designed to the codes and standards indicated in appendix 3.2A.

9.1.3.2 System Description

Safety-related portions of the SFP cooling system are shown in drawing 5178300. The SFP cooling system consists of a pump, heat exchanger, filter, demineralizer, piping, valves, and associated power and instrumentation. The decay heat is transferred from the SFP cooling system to the component cooling water system which in turn transfers it to the saltwater cooling system. The main flow path (see drawing 5178300) of this cooling system is from the SFP through the pit pump through the pit heat exchanger and returns to the SFP.

Flow paths for filling the SFP can be accomplished by:

(1) Aligning flow from the boric acid storage tanks through the boric acid transfer pumps and connecting to the SFP return line, downstream of the SFP heat exchanger, or

(2) Aligning the primary makeup water to the SFP through the primary makeup pumps and connecting to the SFP return line downstream of the SFP heat exchanger, or

(3) Aligning the refueling water storage tank (RWST) to the SFP through the RWST filter pump and connecting to the SFP return line downstream of the SFP heat exchanger. The boric acid concentration can be maintained by the makeup path selection.

To maintain SFP water clarity and purity, filter and ion exchanger flow paths are available as follows:

(a) SFP heat exchanger 10% (80 gal/min) bypass loop is manually aligned through the SFP filter, upstream of the SFP heat exchanger.

(b) SFP heat exchanger 10% bypass loop is manually aligned through the radioactive waste ion exchangers and returned through the SFP filter.

To prevent accidental drainage of the pit or fuel assemblies from being uncovered, piping connections into the pit are above the top of a fuel assembly when it is fully withdrawn from the storage racks. This arrangement prevents the outflow of water in the event of a pipe rupture outside the pit. The recirculation return line discharges about 12 feet below the surface of the water. This minimizes direct recirculation between suction and return lines and helps to distribute cooled water through the pit.

A low level suction is available to drain the pit to about 28 feet 0 inch. This line is normally isolated to ensure proper administrative control of its suction. The pit should only be drained below 28 feet 0 inch when no spent fuel assemblies are in the racks. Drainage below 28 feet 0 inch is achieved by a temporary arrangement.

A skimmer system on the SFP, consisting of a pump and filter, is used to control water surface debris. It is manually aligned and takes suction from the SFP surface and discharges through a filter to the SFP skimmer return header.

9.1.3.2.1 Instrumentation

Instrumentation is provided in the spent fuel cooling and cleanup system to measure temperature, pressure, flow, and level.

Temperature. Instrumentation is used to measure the temperature of the pool and the outlet temperature of the spent fuel heat exchanger. High temperatures in the pool or heat exchanger trigger an alarm in the control room at 125°F.

Pressure. Instrumentation is provided to give local indication of the SFP pump discharge pressure and the differential pressure across the spent fuel cooling filter and the SFP skimmer filter.

Flow. Instrumentation is used to measure and indicate the flow through the spent fuel filter.

Level. Instrumentation is provided to measure the SFP pool level and to alarm the spent fuel pool high and low levels.

9.1.3.3 Component Description

The components of the cooling and cleanup system are the SFP pump, heat exchanger, filter, and water skimmer system.

9.1.3.3.1 SFP Pump

The SFP pump is located at elevation 14 feet 0 inch, west of the sphere enclosure building and northeast of the refueling water storage tank (see table 9.1-1 for operational data). The SFP pump recirculates pit water through the SFP heat exchanger back to the pit. In addition, a parallel partial flow path is used to maintain water chemistry and clarity. The SFP pump is also used to partially drain the pit to the liquid radwaste collection system.

The pump casing priming water is supplied from the primary plant makeup water system and is locally controlled by a hand-operated valve. The pump packing gland drains are routed to the auxiliary building sump and are locally controlled by a hand-operated valve. A spare SFP pump is provided. It is similar to the SFP pump and is partially installed ready for final connection into the piping system, when required.

9.1.3.3.2 SFP Heat Exchanger

The SFP heat exchanger is located on the roof of the auxiliary building. It transfers heat from the SFP water to the component cooling water system, for rejection to the ultimate heat sink--the Pacific Ocean. (See table 9.1-1 for operational data.)

Spent fuel cooling water flows through the tube side, and component cooling water flows through the shell side. Local, manually operated isolation valves allow isolation of the heat exchanger tube side. Maintenance work on the heat exchanger is possible during continued operation of pit cooling. Emergency connections are available on piping upstream and downstream of the heat exchanger isolation valves. Temporary piping must be connected to the bottom of the E-20B component cooling water heat exchanger tube side emergency connections and to the piping emergency connections in order to provide pit cooling during maintenance.

9.1.3.3.3 SFP Filter

The SFP filter is located at elevation 14 feet 0 inch west of the sphere enclosure building and northeast of the refueling water storage tank (RWST). It removes particulate materials from pit cleanup flow. (See table 9.1-1 for operational data)

The filter can be isolated with local, manually operated globe valves. Local samples are obtained by operating the local, manually operated sample valve. Local grab samples of water are obtained downstream of flow indicator, and upstream of filter, for laboratory analysis.

9.1.3.3.4 SFP Water Skimmer System

The SFP water skimmer system consists of a pump and a filter. It removes dust, dirt, and debris floating on the pit's surface. Two suction nozzles at the pit's water surface allow only the surface layer of water to be drawn into the skimmer pump. The pump discharges through a filter to three discharge nozzles which discharge the water at the pit water surface and promote surface recirculation. Local pressure gauges indicate pressure upstream and downstream of the filter to evaluate conditions of the filter cartridges. To remove dirt from below the pit water surface, a portable pump may be used to take suction below the water surface and discharge to the skimmer water system upstream of the skimmer filter.

9.1.3.4 Safety Evaluation [1-3]

In the event of a failure at any point in the SFP cooling loop, the design is such that the loss in water inventory could not drop the water level more than 12 feet since neither the suction nor return line of the cooling loop extends below that point. In the event of failure of the SFP pump, a spare SFP pump is provided and can be connected to the system soon enough to prevent extensive heating of pit water.

In the event of failure of the spent fuel heat exchanger, a component cooling heat exchanger can be used. There are two component cooling heat exchangers, one above the other. The bottom heat exchanger (CCW-E-20B), which is more accessible, can be temporarily substituted for the SFP heat exchanger by connecting it to the SFP cooling loop with existing emergency cooling connections, flexible hoses, and piping.

The SFP cooling system maintains the pit water temperature at or below 88.5°F for the maximum normal heat load (2,364,240 Btu/h) generated by four discharges of one-third cores consisting of 52 fuel assemblies each.

An analysis has been performed of the SFP heat loads based on Branch Technical Position ASB 9-2, "Calculation of Decay Heat Loads." The following assumptions were used in making the calculations. After shutdown, 90 hours are required to transfer the spent fuel into the pit. This is a conservative assumption because administrative controls require that fuel not be moved for at least 148 hours after being subcritical. It was also conservatively assumed that there is no heat loss through the walls, and residual heat release is based on a reactor operating time of 16,000 hours.

The calculation found that the maximum abnormal heat load and pit temperature resulting from a full core off-load 30 days following a refueling off-load is 6,788,740 Btu/h and 116°F, respectively. Assuming the worst single active failure, it would take about 47 hours before pit boiling would occur for the maximum abnormal heat load.(2) The temporary modifications of connecting the spare SFP pump or connecting the CCW heat exchanger as a spare SFP heat exchanger can be accomplished before the onset of pit boiling.

A more realistic calculation which considered heat losses from the pit due to evaporation has been performed for the maximum normal heat load case (2,364,240 Btu/h) following a loss of pit cooling. The calculation found that for heat loads of 2.5×10^6 Btu/h or less, the pit will not reach 212°F. Therefore, the SFP will not boil for the maximum normal heat load, including a loss of pit cooling. A local indication of water temperature is available with a range from 50 to 200°F and sounds an annunciator in the control room at 125°F.

Heavy loads cannot be handled above the stored spent fuel. The cask loading pit area is separated from the fuel storage area by a weir. The elevation of the weir is such that the loss of all water in the cask loading pit area, caused by a load drop of the cask, would not result in the stored spent fuel being uncovered. Therefore, load drops would not cause a significant loss of water level in the spent fuel pool. The makeup rate is controlled only by the boil-off rate as a load drop would not result in a significant loss of water.

A maximum boil-off rate is 40 gal/min. Makeup water for the SFP is normally provided via the spent fuel cooling water return line by the refueling water filter pump (80 gal/min) from the seismic category A refueling water storage tank (240,000 gal). A backup source of makeup water is the primary plant makeup pumps (two at 100 gal/min each) from the primary plant makeup tank (150,000 gal). In addition, the fire protection water system could also provide makeup water to the spent fuel pit. The fire pumps (two at 1000 gal/min each) provide makeup water from the service water reservoir (3,000,000 gal) or the circulating water system (through the 1000 gal/min screen wash pumps) via hydrants at strategic points in the plant and fire hoses (100 gal/min each). Makeup water to the spent fuel pit could also be provided by gravity flow from the condensate storage tank (240,000 gal) through the fill/drain connection with fire hoses. Therefore, the makeup water rate is greater than the boil-off rate. The redundancy and makeup rate from the various makeup sources satisfy Regulatory Guide 1.13, Position C.8.(1)

Water is clarified by diverting a portion of loop flow through the spent fuel pit filter. Corrosion products, fission products, and water impurities are removed by manually bleeding part of loop flow through demineralizers and ion exchangers.

An area radiation monitor is provided in the spent fuel building with readouts locally and in the control room. In addition, high activity level is alarmed locally and in the control room. A SFP water level alarm is provided that annunciates in the control room as discussed in section 9.1.2.3.(1)

9.1.3.5 Inspection and Testing Requirements

An inspection for low fuel pit level is required after a seismic event. An examination is to be made of the new and spent fuel storage rooms. This inspection would include visual inspection of the SFP and, using the leak detection features on the pit, to inspect for pit leaks. The SFP cooling system is used in normal plant operation and is subject to inspection periodically. Routine sampling of the SFP water is performed to assess water quality. Parameters tested include pH, conductivity, and boron and chloride concentrations.

To ensure that there is adequate shielding and bulk cooling water, the SFP level is to be verified periodically in accordance with the technical specifications. Similarly, while fuel assemblies or RCCs are being moved, the refueling cavity water level is to be verified in accordance with the technical specifications.

9.1.3.6 Reactor Cavity

9.1.3.6.1 Reactor Cavity Design

The reactor cavity provides a reservoir of 240,000 gal of borated water around the reactor vessel head to supply biological shielding during refueling. The cavity is of sufficient area and volume to contain the new fuel elevator, the rod cluster control change fixture, reactor upper internals lay-down stand, refueling tool racks, fuel transfer system, and control rod drive shaft racks and to allow manipulation of the fuel.

The reactor cavity is located inside the containment and extends from the refueling deck and the reactor vessel head flange. It is also extended downward beyond the head flange to accommodate the fuel transfer system and storage of radioactive components.

The cavity is constructed of reinforced concrete and lined with stainless steel. It is a part of the containment's internal structure supporting the NSSS components and providing biological shielding. A stainless steel seal ring is placed between the stainless steel liner and the reactor vessel head flange during refueling to ensure that the cavity is watertight. Any water leakage is discharged through a pipe visible from the 10-foot elevation at the west side of the cavity structure.

Access to the containment's refueling deck is directly from the north turbine extension at elevation 42 feet, through the equipment door. Access can also be gained through the personnel access lock just east of the equipment door at the same elevation, and through the personnel escape hatch, at the north northeast end of containment.

9.1.3.6.2 Reactor Cavity Filtration System

The reactor cavity filtration system consists of a skid-mounted motor and pump, four skid-mounted filter cartridge housings, and associated piping. The system improves the clarity of the water in the reactor cavity which improves underwater visibility during refueling. A flow diagram is shown in figure 9.1-4.

This system is used only during refueling outages when the reactor cavity is flooded. All components of the system are installed on the operating deck at elevation 42 feet. Piping not installed within the reactor cavity will be above the water level in the reactor cavity. This precludes the possibility of a pipe break creating a siphon on the cavity.

9.1.3.6.3 Reactor Cavity Refueling Cooling Requirements

During refueling, the reactor cavity is filled with about 240,000 gallons of borated water. Operation of decay heat removal equipment is provided to ensure continuous mixing flow of refueling water through the reactor vessel during the refueling period. Operation of decay heat removal equipment ensures that sufficient cooling capacity is available to remove decay heat and that sufficient cooling circulation is maintained through the reactor core to minimize the effect of a boron dilution incident and prevent boron stratification.

Two methods of decay heat removal are required to be operable when the water level in the refueling pool is less than elevation 40 feet 3 inches. This ensures that a single failure of an operating component will not result in a complete loss of decay heat removal capability. One RHR train or one refueling water pump is required to take suction from the refueling pool through the recirculation heat exchanger (with supporting heat removal systems operating) and discharge via the safety injection system piping to one reactor coolant loop cold leg.

With the reactor vessel head removed and 23 feet of water above the reactor pressure vessel flange, a large heat sink is available for core cooling;

thus, in the event of a failure of an operating component, adequate time is available to initiate alternative means to cool the core.

9.1.4 FUEL HANDLING SYSTEMS

The fuel handling and transfer systems are designed to provide safe, effective measures for handling and transferring fuel from the time it reaches SONGS until it is shipped offsite. The system is designed to perform new fuel transfers from the new fuel storage racks through the equipment door to the new fuel elevator, then to the reactor core via the manipulator crane. The system transfers spent fuel from the reactor core to the containment upender via the manipulator crane and from the refueling cavity to the SFP via the fuel transfer system, then into the SFP racks via the SFP crane.

In addition to the equipment directly associated with the handling of fuel, equipment is provided for the disassembly and assembly of the reactor vessel for refueling, to handle thimble plugs, neutron sources, and internals, and for exchanging RCCAs.

9.1.4.1 Operation

9.1.4.1.1 Fuel Transfer

Fuel handling and transfer operations are described below. The refueling plan and individual maintenance procedures for equipment prescribe requirements and controls for each refueling and maintenance activity.

New fuel elements which are stored in the new fuel building (see section 9.1.1) are removed from the new fuel racks by the new fuel crane, using the new fuel handling tool, and loaded into the fork-lift truck's new fuel racks. They are then driven to the south end of the refueling cavity. The reactor service crane transports the new fuel assemblies from the fork-lift truck's new fuel racks to the raised new fuel elevator using the new fuel handling tool. Once a new fuel assembly is lowered into the elevator basket, the new fuel handling tool is removed. The elevator is then lowered to its fully down position.

If a thimble plug is to be placed in the fuel assembly, it is inserted into the fuel assembly with the fuel assembly in the elevator. The fuel assembly is removed from the new fuel elevator and then transported to the core by the manipulator crane. See section 9.1.1.2 for additional description of new fuel transfer operation.

When an RCCA is to be inserted in a new fuel assembly, the manipulator crane is positioned over a new fuel assembly in the new fuel elevator, and with its gripper, the manipulator crane grips the new fuel assembly. The