

September 9, 1998

Mr. Harold B. Ray
Executive Vice President
Southern California Edison Company
San Onofre Nuclear Generating Station
P.O. Box 128
San Clemente, California 92674-0128

SUBJECT: ISSUANCE OF AMENDMENT FOR SAN ONOFRE NUCLEAR GENERATING STATION, UNIT NO. 2 (TAC NO. MA2341) AND UNIT NO. 3 (TAC NO. MA2342)

Dear Mr. Ray:

The Commission has issued the enclosed Amendment No. 141 to Facility Operating License No. NPF-10 and Amendment No. 133 to Facility Operating License No. NPF-15 for San Onofre Nuclear Generating Station, Unit Nos. 2 and 3. The amendments consist of changes to the Technical Specifications (TS) in response to your application dated July 22, 1998.

The amendments revise the TS to extend the allowed outage time (AOT) for off-site circuits and for the emergency diesel generator.

A copy of our Safety Evaluation is also enclosed. The Notice of Issuance will be included in the Commission's next biweekly Federal Register notice.

Sincerely,
Original Signed by
James W. Clifford, Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Docket Nos. 50-361
and 50-362

Enclosures: 1. Amendment No. 141 to NPF-10
2. Amendment No. 133 to NPF-15
3. Safety Evaluation

cc w/encls: See next page

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Mr. Harold B. Ray

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September 9, 1998

cc w/encs:

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SOUTHERN CALIFORNIA EDISON COMPANY

SAN DIEGO GAS AND ELECTRIC COMPANY

THE CITY OF RIVERSIDE, CALIFORNIA

THE CITY OF ANAHEIM, CALIFORNIA

DOCKET NO. 50-361

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT NO. 2

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 141
License No. NPF-10

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Southern California Edison Company, et al. (SCE or the licensee) dated July 22, 1998, 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 rules and 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.

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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. NPF-10 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. 141 , are hereby incorporated in the license. Southern California Edison Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. The license amendment is effective as of the date of its issuance and is to be implemented within 30 days from the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



James W. Clifford, Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications

Date of Issuance: September 9, 1998

license amendment request. Due to staff concerns, SCE subsequently revised its analysis and performed a risk analysis without reliance on the inter-unit cross-tie. This analysis was provided in the July 22, 1998, submittal. Therefore the cross-tie is not credited by the licensee in the risk analysis and is not credited in this safety evaluation.

Sections 3.1 and 3.2 of this evaluation address the deterministic aspects of the proposed changes. The probabilistic risk assessment review is addressed in Section 3.3.

2.0 BACKGROUND

SONGS Units 2 and 3 are each equipped with two Class 1E EDGs which supply backup power to the 4160 V vital buses in the event of a loss of offsite power. Each EDG is connected to the 4160 V bus of a load group. Each EDG is designed to automatically start in the event of a bus under voltage signal or upon receipt of a safety injection actuation signal. Each EDG is designed to start automatically within 10 seconds following receipt of a start signal. Each EDG is sized to supply reliable power to all safety-related loads in its respective load group, as well as specific non-safety related loads.

Each EDG system consists of two tandem diesel generators per unit. Each diesel generator has two engines (one 16 cylinder engine #1 and one 20 cylinder engine #2) connected to one ac generator manufactured by Ideal Electric. Each diesel engine is a General Motors Electro-Motive Division turbo-charged Model 645E4. Each tandem unit is rated at 6670 hp at 900 rpm and has a continuous rating of 4700 kW.

3.0 EVALUATION

In their submittal dated July 22, 1998, Southern California Edison Company proposed the following changes to TS 3.8.1, "AC Sources - Operating:"

1. Extend the second Completion Time in Required Action A.2 for an inoperable Offsite circuit from "6 days from discovery of failure to meet LCO" to "17 days from discovery of failure to meet LCO."
2. Extend the Completion Time in Required Action B.4 for a single inoperable EDG from "72 hours AND 6 days from recovery of failure to meet LCO" to "14 days AND 17 days from discovery of failure to meet LCO."

Additionally, the pertinent Bases sections are revised to reflect the above TS changes in Section 3.8.1. In particular, the following statement is added to Bases 3.8.1, "AC Sources - Operating," under Action A.2:

"As required by TS 5.5.2.14, a Configuration Risk Management Program is implemented in the event of Condition A."

The following statement is also added to Bases 3.8.1, "AC Sources-Operating," under Action B.4:

ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 141 TO FACILITY OPERATING LICENSE NO. NPF-10

DOCKET NO. 50-361

Revise Appendix A Technical Specifications by removing the pages identified below and inserting the enclosed pages. The revised pages are identified by Amendment number and contain marginal lines indicating the areas of change.

REMOVE

3.8-1
3.8-2

INSERT

3.8-1
3.8-2

3.8 ELECTRICAL POWER SYSTEMS

3.8.1 AC Sources - Operating

LCO 3.8.1 The following AC electrical sources shall be OPERABLE:

- a. Two qualified circuits between the offsite transmission network and the onsite Class 1E AC Electrical Power Distribution System; and
- b. Two diesel generators (DGs) each capable of supplying one train of the onsite Class 1E AC Electrical Power Distribution System.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required offsite circuit inoperable.	A.1 Perform SR 3.8.1.1 for required OPERABLE offsite circuit.	1 hour <u>AND</u> Once per 8 hours thereafter
	<u>AND</u> A.2 Restore required offsite circuit to OPERABLE status.	72 hours <u>AND</u> 17 days from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. One required DG inoperable.</p>	<p>B.1 Perform SR 3.8.1.1 for the OPERABLE required offsite circuits.</p>	<p>1 hour <u>AND</u> Once per 8 hours thereafter</p>
	<p><u>AND</u> B.2 Declare required feature(s) supported by the inoperable DG inoperable when its redundant required feature(s) is inoperable.</p>	<p>4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s)</p>
	<p><u>AND</u> B.3.1 Determine OPERABLE DG is not inoperable due to common cause failure.</p>	<p>24 hours</p>
	<p><u>OR</u></p>	
	<p>B.3.2 Perform SR 3.8.1.2 for OPERABLE DG.</p>	<p>24 hours</p>
	<p><u>AND</u> B.4 Restore required DG to OPERABLE status.</p>	<p>14 days <u>AND</u> 17 days from discovery of failure to meet LCO</p>

(continued)



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SOUTHERN CALIFORNIA EDISON COMPANY

SAN DIEGO GAS AND ELECTRIC COMPANY

THE CITY OF RIVERSIDE, CALIFORNIA

THE CITY OF ANAHEIM, CALIFORNIA

DOCKET NO. 50-362

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT NO. 3

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 133
License No. NPF-15

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Southern California Edison Company, et al. (SCE or the licensee) dated July 22, 1998 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 rules and 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. NPF-15 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. 133 , are hereby incorporated in the license. Southern California Edison Company shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This license amendment is effective as of the date of its issuance and is to be implemented within 30 days from the date of its issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



James W. Clifford, Senior Project Manager
Project Directorate IV-2
Division of Reactor Projects III/IV
Office of Nuclear Reactor Regulation

Attachment: Changes to the Technical
Specifications

Date of Issuance: September 9, 1998

ATTACHMENT TO LICENSE AMENDMENT

AMENDMENT NO. 133 TO FACILITY OPERATING LICENSE NO. NPF-15

DOCKET NO. 50-362

Revise Appendix A Technical Specifications by removing the pages identified below and inserting the enclosed pages. The revised pages are identified by Amendment number and contain marginal lines indicating the areas of change.

REMOVE

3.8-1

3.8-2

INSERT

3.8-1

3.8-2

3.8 ELECTRICAL POWER SYSTEMS

3.8.1 AC Sources - Operating

LCO 3.8.1 The following AC electrical sources shall be OPERABLE:

- a. Two qualified circuits between the offsite transmission network and the onsite Class 1E AC Electrical Power Distribution System; and
- b. Two diesel generators (DGs) each capable of supplying one train of the onsite Class 1E AC Electrical Power Distribution System.

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. One required offsite circuit inoperable.	A.1 Perform SR 3.8.1.1 for required OPERABLE offsite circuit.	1 hour <u>AND</u> Once per 8 hours thereafter
	<u>AND</u> A.2 Restore required offsite circuit to OPERABLE status.	72 hours <u>AND</u> 17 days from discovery of failure to meet LCO

(continued)

ACTIONS (continued)

CONDITION	REQUIRED ACTION	COMPLETION TIME
<p>B. One required DG inoperable.</p>	<p>B.1 Perform SR 3.8.1.1 for the OPERABLE required offsite circuits.</p>	<p>1 hour <u>AND</u> Once per 8 hours thereafter</p>
	<p><u>AND</u></p>	
	<p>B.2 Declare required feature(s) supported by the inoperable DG inoperable when its redundant required feature(s) is inoperable.</p>	<p>4 hours from discovery of Condition B concurrent with inoperability of redundant required feature(s)</p>
	<p><u>AND</u></p>	
	<p>B.3.1 Determine OPERABLE DG is not inoperable due to common cause failure.</p>	<p>24 hours</p>
	<p><u>OR</u></p>	
	<p>B.3.2 Perform SR 3.8.1.2 for OPERABLE DG.</p>	<p>24 hours</p>
	<p><u>AND</u></p>	
	<p>B.4 Restore required DG to OPERABLE status.</p>	<p>14 days <u>AND</u> 17 days from discovery of failure to meet LCO</p>

(continued)



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
RELATED TO AMENDMENT NO. 141 TO FACILITY OPERATING LICENSE NO. NPF-10
AND AMENDMENT NO. 133 TO FACILITY OPERATING LICENSE NO. NPF-15
SOUTHERN CALIFORNIA EDISON COMPANY
SAN DIEGO GAS AND ELECTRIC COMPANY
THE CITY OF RIVERSIDE, CALIFORNIA
THE CITY OF ANAHEIM, CALIFORNIA
SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3
DOCKET NOS. 50-361 AND 50-362

1.0 INTRODUCTION

By letter dated July 22, 1998, Southern California Edison (SCE) Company proposed to modify San Onofre Nuclear Generating Station (SONGS) Units 2 and 3 Technical Specification (TS) 3.8.1 to extend the emergency diesel generator (EDG) allowed outage time (AOT) for one EDG inoperable. To be consistent with the requested EDG AOT extension, SCE requested extensions to TS 3.8.1 AOT's that limit the time that combinations of power sources can be inoperable for a continuous period of time. The purpose of the proposal is to allow on-line EDG maintenance activities that are normally performed during refueling outages. The licensee indicates that performing EDG maintenance at power using the proposed extended EDG AOT would result in a net risk decrease due to increased EDG availability during refueling outages. The licensee's risk analysis indicates that the reduction in shutdown risk due to increased EDG availability would be greater than the increase in at-power risk due to decreased EDG availability at power.

The July 22, 1998, amendment application supersedes a previous SCE submittal dated January 9, 1998. The previous submittal requested an extension to the EDG AOTs based in part on a risk analysis that credited the use of an inter-unit cross-tie for EDGs. This cross-tie would provide the capability to manually cross-connect one SONGS unit's EDG to the same train of the other SONGS unit's 4160 V Class 1E ac bus to satisfy the power needs of both units. On July 10, 1998, a meeting was held between SCE and the NRC staff to discuss the

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"As required by TS 5.5.2.14, a Configuration Risk Management Program is implemented in the event of Condition B."

3.1 Deterministic Evaluation

The purpose of the proposal is to allow the licensee to perform on-line the preventive maintenance work on the EDGs normally performed during refueling outages, including the major six year and twelve year preventive maintenance overhauls.

The staff evaluated the request to ensure that the overall availability of the EDGs will not be reduced significantly as a result of increased on-line preventive maintenance activities. In order to determine that the decrease in severe accident risk achieved with the issuance of 10 CFR 50.63, "Loss of All Alternating Current Power," is not eroded, the staff used review guidelines based on engineering judgement (identified below) to evaluate the proposal to extend the AOTs for EDGs.

The staff formally communicated to the Combustion Engineering Owners Group (CEOG) the review guidelines for the EDG AOT extension in a request for additional information dated December 24, 1996. The licensee's responses were included in CEOG's responses provided in a letter dated May 14, 1996, and are summarized below:

1. In evaluating the licensee's request to extend the EDG AOT, the staff requested the licensee to state the reason for requesting EDG AOT extension from the current 3 days to 14 days and why the current 3 day AOT is not sufficient.

The licensee stated that the SONGS's EDG system has two diesel engines per generator unit. Consequently each unit requires twice as many support systems (filters, pumps, radiators, air starters, etc.). Therefore it takes more time to perform maintenance on this dual system than an EDG design with one diesel engine. Based on the previous outage experience, the typical six year preventive maintenance work will take approximately 11 days per diesel to complete. This estimate includes the initial clearance time through post-maintenance testing. Similarly, the licensee estimated it would take approximately 13 days to perform and complete the twelve year preventive maintenance work on these engines. This twelve year maintenance work is due this year. Based on the above, the staff finds that the 14 day EDG AOT meets the industry norm for a major EDG overhaul and is reasonable.

2. In evaluating the request to determine whether the request in any way invalidates the assumptions or results of the station blackout (SBO) analysis for SONGS, the licensee stated that the assumptions of the SBO analysis regarding the reliability of the EDGs are unaffected by this proposed change. The current SBO analysis for SONGS Units 2 and 3 demonstrates a 4-hour coping duration. The results of the SBO analysis are unaffected by this change because unavailability of EDGs is not included in the coping analysis. Based on the above, the staff finds this response acceptable.

3. The staff requested the licensee to provide a discussion of the loss of offsite power at its facility and include a quantitative discussion on how industry data on offsite power losses compares with its facility.

The licensee stated that there has been no complete loss of offsite power at SONGS Units 2 and 3 since the beginning of commercial operation. A complete loss of offsite power is defined as an event where no offsite power source is available to supply either SONGS units' 4 kV ESF buses. Since there is limited plant specific data for loss of offsite power events at SONGS, the licensee used the methodology in NUREG-1032 and NUMARC 87-00 to determine the appropriate loss of offsite power frequency for the SONGS individual plant examination (IPE). Based on the above, the staff finds this response acceptable.

4. The staff requested the licensee to describe how the following compensatory measures will be implemented during the extended EDG AOT to ensure safe operation of the plant:
 - a. The TS should include verification that required systems, subsystems, trains, components, and devices that depend on the remaining EDG as a source of onsite power are verified to be operable before removing an EDG for extended maintenance. In addition, positive measures should be provided to preclude subsequent testing or maintenance activities on these subsystems, trains, components, and devices associated with the operable EDG.
 - b. Voluntary entry into a Limiting Condition for Operation (LCO) action statement should not be abused by repeated entry into and exit from the LCO.
 - c. Removal from service of safety systems and important non-safety equipment, including offsite power sources, should be minimized during the outage of the EDG for preventive maintenance (PM).
 - d. Voluntary entry into an LCO action statement should not be scheduled when adverse weather is expected.

In response to item a), the licensee stated that the existing SONGS TS ensure that systems, subsystems, trains, components, and devices that depend on the remaining EDG as a source of emergency power are operable before removing an EDG for preventative maintenance and will not voluntarily be removed from service during EDG maintenance. In addition, the licensee proposed a Configuration Risk Management Program (CRMP) to support risk-informed TS to ensure that a proceduralized PRA-informed process is in place that assesses the overall impact of plant maintenance on plant risk. The CRMP is codified in SONGS TS 5.5.2.14. The staff finds the response acceptable.

In response to item b), the licensee stated that SONGS has demonstrated through prior operation, and will continue to ensure, that voluntary entries into LCO action statements

are not abused by repeated entry into and exit from the LCO. The staff finds this response acceptable.

In response to item c), the licensee stated that Work Process Procedure SO123-XX-4, "SONGS Work Scheduling and Coordination Process" and Maintenance Policy Guideline MPG-SO123-G-31, "Utilization of the Safety Monitor in Support of Work Control" provide assurance that important non-safety and safety systems are not voluntarily removed from service concurrent with EDG preventative maintenance. The staff finds this response acceptable.

In response to item d), the licensee stated that SONGS Abnormal Operating instruction SO23-13-3, "Natural Disaster/Severe Weather" requires restoration of the EDGs to operable status in the event of notification from the Energy Control Center, Dispatcher, or California Department of Emergency Services of imminent severe weather such as hurricanes, tornados, high winds, or tsunamis which could impact the plant site. Further, the licensee's on-line risk monitor includes operational factors such as grid conditions, external events, switchyard maintenance, and plant equipment tests for scheduling work. The staff finds this response acceptable.

3.2 Summary of Deterministic Review

The staff evaluated the requested changes to ensure that the overall availability of the EDGs will not be reduced unnecessarily due to preventive maintenance activities. The staff concludes that the licensee's request for a 14 day EDG AOT to perform major maintenance meets the industry norm for EDG major overhauls and, therefore, the request is reasonable. Further, we believe that precluding testing and maintenance of other electrical systems during the extended EDG outage will reduce the probability of a station blackout (SBO) at SONGS. The staff also evaluated the requested increase in the TS 3.8.1 AOTs that limit the time that combinations of an EDG and offsite power source can be inoperable for a single continuous time period. The staff determined these AOT extensions were consistent with the extension of the EDG AOT to 14 days and determined to be acceptable.

The staff evaluated the net contribution of the change to overall plant risk in the Section 3.3.

3.3 Probabilistic Risk Assessment (PRA) Review

The staff used a three-tiered approach to gain risk insights and to evaluate the risk associated with the proposed amendment. The first tier evaluated the PRA model and the impact of the change on plant operational risk. The second tier addressed the need to preclude potentially high risk configurations if additional equipment will be taken out of service simultaneously or other risk significant operational factors such as the potential for concurrent system or equipment testing. The third tier evaluated the licensee's configuration risk management program to ensure that equipment removed from service prior to or during the proposed AOT will be appropriately assessed from a risk perspective. Each tier and associated findings are discussed in the following.

3.3.1 Tier 1: PRA Evaluation of AOT Extensions

SONGS had originally requested an EDG AOT extension on the basis that the at-power risk impact of the proposed change is small in terms of total core damage frequency (CDF) and large early release frequency (LERF). However, due to an issue associated with the design basis aspects regarding a proposed new cross-tie to cross-connect available EDGs of the same train from the other unit, the staff requested the licensee to perform risk evaluations based on conditions of either no cross-tie or the existing manual cross-tie modeled in the PRA model. In response, the licensee provided additional analyses to include shutdown risk analysis as part of the basis for the proposed change in the new submittal. This new submittal, dated July 22, 1998, concluded that the proposed EDG AOT extension would result in a net risk decrease regardless of whether the cross-tie was credited.

The staff determined that the licensee actively uses PRA on a daily basis during at-power operation when making safety decisions on various plant activities. Also, the shutdown PRA model has been used during past refueling outages to schedule maintenance activities and manage risk during refueling. In addition, the licensee's PRA staff has demonstrated a strong level of knowledge and high degree of confidence in their PRA model for this and other previous risk-informed applications.

The Tier 1 staff review of the licensee's PRA involved two aspects: (1) evaluation of the PRA model and its application to the proposed AOT extension, and (2) evaluation of PRA results and insights stemming from the application. The review did not warrant an assessment of any unconventional PRA practices or unique features that could impact the reasonableness of PRA findings and conclusions.

(1) Evaluation of PRA Model and Application to the AOT Extension.

The staff's review focused on the capability of the licensee's PRA model to analyze the AOT risk stemming from the modified AOTs for EDGs. This activity, however, did not involve an in-depth review of the licensee's PRA to the extent necessary to validate the licensee's overall quantitative estimates. The staff's review consisted of an initial screening process that examined the attributes of the licensee's PRA, i.e., scope and level of detail that consider recent site experience of loss of offsite power (LOOP) and EDG reliability and availability, and plant-specific features such as EDG configurations, cross-ties, battery capacity, offsite sources, and other systems critical for mitigation of a LOOP/SBO event.

The licensee used its "living" PRA model as the basis for the calculations to support the proposed changes. The licensee's submittal uses a PRA that includes both at-power and shutdown risks stemming from a set of both internal and external initiating events. The licensee's current internal events PRA model has been updated since the development of the Individual Plant Examination (IPE), and the external events PRA model has been revised since the development of the IPEEE (Individual Plant Examination for External Events). The current PRA model has undergone internal and external peer reviews, and the licensee utilizes a proceduralized change process to control modification of the PRA to reflect the as-built, as-operated plant condition.

The licensee's at-power PRA consists of a Level 1 and Level 2 analysis of accident sequences due to both internal and external events. The development of the PRA is based on the small event tree and large fault tree methodology using the fault tree linking technique, and the set of event trees are consistent with those in PRAs of other Combustion Engineering designed plants. The licensee quantified at-power PRA calculations for the proposed change using the on-line Safety Monitor Version 5.26. The licensee modeled the support system dependencies in the linked fault trees. The licensee used both generic and plant-specific data of basic event failure rates and unavailabilities for PRA analysis. The licensee used the β -factor method for common cause failure analysis along with generic data. The set of accident initiators considered in the PRA, which include both generic and plant-specific types, are consistent with those found in other PRAs.

The staff examined the data values for a number of basic events which are important for LOOP/SBO event sequences modeled in the licensee's PRA for the proposed application. For example, the staff evaluated estimates for the LOOP initiating event frequency, EDG failure probability, turbine-driven auxiliary feedwater pump failure probability, cross-tie failure probability, and non-recovery probability of offsite power. Even though the SONGS PRA uses less conservative values in some cases than those indicated by generic industry data sources, the staff finds that the licensee has provided reasonable justification based on actual plant-specific operational history and design characteristics to support the use of the estimated values in the database. Battery capacity can be extended up to four hours for A and B batteries with proceduralized load shedding, and C and D batteries have an eight-hour capacity. AC power supply can be cross-connected from the other unit at the 480 V bus level, and the cross-connection can allow depleted batteries to be recharged; however, the licensee did not credit this feature in the PRA. The staff did not identify inappropriate methods in the data estimation process and quality data used in the LOOP/SBO risk analysis.

CEOG submitted report CE NPSD-996, "Joint Applications Report for Extending EDG AOTs," dated May 1995 to the staff for review. In this report the CEOG provided detailed comparisons among CE plants of data, modeling assumptions, and results to validate the PRA application to the EDG AOT extension. This comparison process provided the staff with insights associated with the reasonableness of the SONGS analysis relative to the other Combustion Engineering (CE) plants. The staff finds that the licensee's PRA analysis is not an outlier in terms of major assumptions, the set of important data, and results. The staff's independent review of the major SBO modeling assumptions used in the PRA analysis and evaluation of the dominant cutsets did not identify any unusual findings that could impact the staff's overall conclusion.

The staff examined the risk impact of system interaction and dependencies of shared systems and components between units. SONGS Units 2 and 3 share several structures, systems, and components that include the emergency chillers, nuclear service water system, instrument air system, and intake structure. The staff finds that these shared systems were explicitly credited in the SONGS PRA model. The licensee evaluated accident initiators affecting dual-unit risk as part of the IPE work and determined that these dual-unit initiators have low likelihood and, thus, do not contribute significantly to plant risk. The licensee also indicated that dual-unit initiators were considered in the EDG AOT extension analysis and this concern was found to be an insignificant factor for the application.

The licensee included in the current PRA model the potential for a reactor coolant pump (RCP) seal loss-of-coolant accident (LOCA) even if the RCPs are tripped within 30 minutes. The staff concluded that the RCP seal failure probabilities used are reasonable based on the performance history.

For external events, the licensee included consideration of earthquakes for the proposed change, while other types of external events such as fire, high winds and external flooding were not included. The licensee indicated that the overall risk contribution was dominated by seismic event risk and seismically induced LOOP events would be the largest contributor to risk impact of the proposed change.

The shutdown risk model SONGS used to assess the risk for the EDG AOT extension is based on the SONGS Level 1 shutdown risk model. This shutdown risk model did not include offsite consequences. The licensee developed the shutdown risk model from the SONGS IPE, and used the small event tree and large fault tree approach. The licensee modified the fault trees for modeling initiating events in the IPE that are applicable for initiating events during shutdown. The licensee then used these modified fault trees for the shutdown PRA model. The licensee created two new fault trees for the shutdown PRA to model the spent fuel pool cooling system and spent fuel pool inventory makeup. Therefore, the staff concluded that the shutdown PRA has sufficient detail for analyzing shutdown risk. The licensee used the shutdown risk model in two prior shutdown outages to evaluate risk implications of outage schedule and manage outage risk.

In the shutdown risk model, the licensee partitioned the refueling outage into discrete configurations for individual evaluation, and developed event trees for each configuration. The licensee revised IPE fault tree models for the systems needed during shutdown, and modified the failure data to be applicable during shutdown. Finally, the licensee quantified the shutdown risk model using the Reliability Engineering Building-Block Environment of Computer Analysis (REBECA) PRA computer code. The licensee used a truncation limit of $1 \times 10^{-12}/\text{day}$ or $1 \times 10^{-9}/\text{yr}$ in solving the event trees. The staff considers the truncation value reasonable because it was at least four orders of magnitude below the baseline core damage frequency (CDF). The staff determined that the discrete outage configurations, also called plant operating states (POSs), which are based on equipment availability, system alignment, modes of operation, and decay heat, are generally consistent with the Surry Low Power/Shutdown Risk Study (NUREG/CR-6144). The licensee further characterized each configuration by operating equipment, standby equipment, and maintenance activities.

The licensee evaluated four initiating event classes for each shutdown configuration for the proposed EDG AOT extension: (1) loss of heat removal; (2) loss of inventory; (3) loss of offsite power due to onsite disturbances; and (4) loss of the offsite power grid. The licensee developed event trees for these four initiating events with three end states: "safe", "inventory boiling", and "fuel damage." The licensee developed a separate seismically-induced loss of offsite power event tree, and took the seismically-induced loss of offsite power frequency from the at-power seismic core damage sequence.

The staff evaluated the major assumptions associated with the shutdown PRA model and the various calculations for the proposed case. The staff also evaluated the logic of event trees and some of the dominant cutsets. For example, the staff examined the basic events associated with common cause failure of EDGs, operator failure to recover offsite power, and EDG unavailabilities due to maintenance to evaluate reasonableness and consistency in cutset results. A commercial contractor for the licensee performed an independent peer review of the shutdown PRA. A summary of the key areas in the peer review was provided, and the staff finds that the peer review was reasonably comprehensive in scope.

However, the staff identified several examples in the licensee's analysis that are considered weaknesses. The weaknesses are generally associated with the lack of the rigor and detail in the modeling, which could have removed some of the uncertainties regarding the risk impact of the proposed change. For example, the licensee based the EDG maintenance unavailability value used in the PRA model for the proposed 14 day AOT case at power not on the individual AOTs but on the maintenance department annual projection. From a PRA modeling standpoint, the staff believes the licensee's approach to be overly simplistic, which subsequently introduces uncertainties associated with the risk impact of the proposed change. Also, the licensee based the assessment of the shutdown risk impact of EDG AOT extension only on one reduced inventory configuration of -1 foot (wide range level), although there were other reduced inventory configurations of different water levels. This simplification may result in additional uncertainties of the shutdown risk impact. In addition, there are several other factors of large uncertainty affecting the overall shutdown risk impact distribution. Despite the lack of detail and some examples of insufficient rigor in the licensee's shutdown risk analysis, the staff finds that the overall approach and methodology for quantifying the shutdown risk impact of the EDG AOT extension is generally reasonable.

The SONGS shutdown risk analysis on which the proposed change is based is very plant-specific; therefore, the results and conclusions of this evaluation may not be generically applicable to other plants without a detailed plant-specific shutdown risk analysis.

In summary, the staff believes that the licensee's at-power PRA has adequate scope and detail for assessing the risk impact of the proposed change. Although there were several factors introducing uncertainties to the shutdown analysis, the staff finds that the licensee's approach and methodology for evaluating the shutdown risk impact are reasonable.

(2) Evaluation of PRA Results and Insights Associated with the Proposed Change

The current SONGS PRA credits a proceduralized manual cross-tie of the EDGs of the same train between Units 2 and 3. For the proposed EDG AOT extension, the licensee evaluated two cases: Case A - no credit for any EDG cross-tie, and Case B - credit for the manual EDG cross-tie. Risk measures in terms of CDF change, incremental conditional core damage probability (ICCDP) for a single outage, LERF change, and incremental conditional large early release probability (ICLERP) for a single outage were presented for staff evaluation. The result of the risk analysis is summarized as follows:

Case A: No Manual Cross-Tie Capability Credited

<u>Risk Parameters</u>	<u>At-Power</u>	<u>Shutdown</u>	<u>Total</u>
Baseline CDF	$9.5 \times 10^{-5}/\text{yr}$	$5.5 \times 10^{-5}/\text{yr}$	$1.5 \times 10^{-4}/\text{yr}$
Proposed CDF	$1.1 \times 10^{-4}/\text{yr}$	$2.3 \times 10^{-5}/\text{yr}$	$1.3 \times 10^{-4}/\text{yr}$
Δ CDF	$1.5 \times 10^{-5}/\text{yr}$	$-3.1 \times 10^{-5}/\text{yr}$	$-1.6 \times 10^{-5}/\text{yr}$ (Net CDF change)
ICCDP	$1.4 \times 10^{-5}/\text{yr}$	N/A	
Baseline LERF	$2.3 \times 10^{-6}/\text{yr}$	Not quantified	
Proposed LERF	$2.9 \times 10^{-6}/\text{yr}$	Not quantified	
Δ LERF	$6.0 \times 10^{-7}/\text{yr}$	Not quantified	
ICLERP	$5.8 \times 10^{-7}/\text{yr}$	N/A	

Case B: Manual Cross-Tie Capability Credited

<u>Risk Parameters</u>	<u>At-Power</u>	<u>Shutdown</u>	<u>Total</u>
Baseline CDF	$7.2 \times 10^{-5}/\text{yr}$	$3.2 \times 10^{-5}/\text{yr}$	$1.0 \times 10^{-4}/\text{yr}$
Proposed CDF	$8.0 \times 10^{-5}/\text{yr}$	$1.6 \times 10^{-5}/\text{yr}$	$9.6 \times 10^{-5}/\text{yr}$
Δ CDF	$8.0 \times 10^{-6}/\text{yr}$	$-1.6 \times 10^{-5}/\text{yr}$	$-8.0 \times 10^{-6}/\text{yr}$ (Net CDF change)
ICCDP	$6.7 \times 10^{-6}/\text{yr}$	N/A	
Baseline LERF	$1.3 \times 10^{-6}/\text{yr}$	Not quantified	
Proposed LERF	$1.6 \times 10^{-6}/\text{yr}$	Not quantified	
Δ LERF	$3.0 \times 10^{-7}/\text{yr}$	Not quantified	
ICLERP	$2.9 \times 10^{-7}/\text{yr}$	N/A	

As shown above, both cases result in a net risk decrease in terms of the total CDF risk impact. In the case of LERF impact, the licensee did not provide quantitative results for the shutdown cases. However, the licensee indicated that the LERF impact of EDG maintenance at shutdown is significantly greater than that at power, mainly due to various open containment penetrations and numerous containment isolation tests during refueling outages. Therefore, the licensee believes the Level 1 risk impact of the proposed change to be a bounding case since the relative risk reduction of performing on-line maintenance at shutdown conditions would be greater than the at-power risk increase compared with the baseline CDF.

Regarding the risk from SBO, the licensee indicated that the decrease in EDG unavailability in TS Modes 1 through 4 would result in an increase in the likelihood of SBO from $1.6 \times 10^{-5}/\text{yr}$ to $2.2 \times 10^{-5}/\text{yr}$ (a difference of $6.6 \times 10^{-6}/\text{yr}$). However, the risk increase would be offset by the

decrease in shutdown core damage risk due to SBO due to increased emergency AC power availability during shutdown.

In the various PRA calculations, the licensee calculated the Fussell-Vesley and risk achievement worth (RAW) importances for basic events. The staff review of part of the result from the importance analyses did not identify any unexpected outcomes. For example, the basic events associated with the manual cross-tie, EDG failures, and turbine-driven auxiliary feedwater pumps were examined for consistencies associated with the increase or decrease in basic event importance in different calculations.

The licensee provided the results of uncertainty analysis for various core damage PRA calculations. The results of the uncertainty analysis for various calculations are summarized as follows:

At-Power Calculations with Manual Cross-Tie Capability Credited

	<u>Point Estimate</u>	<u>Mean</u>	<u>Median</u>	<u>5%</u>	<u>95%</u>
Current	$7.2 \times 10^{-5}/\text{yr}$	$7.8 \times 10^{-5}/\text{yr}$	$6.7 \times 10^{-5}/\text{yr}$	$4.4 \times 10^{-5}/\text{yr}$	$1.5 \times 10^{-4}/\text{yr}$
Proposed	$8.0 \times 10^{-5}/\text{yr}$	$8.6 \times 10^{-5}/\text{yr}$	$7.2 \times 10^{-5}/\text{yr}$	$4.5 \times 10^{-5}/\text{yr}$	$1.7 \times 10^{-4}/\text{yr}$

Shutdown Calculations with Manual Cross-Tie Capability Credited

(Internal initiators and reduced inventory)

	<u>Point Estimate</u>	<u>Mean</u>	<u>Median</u>	<u>5%</u>	<u>95%</u>
1 EDG operable ^a	$2.1 \times 10^{-6}/\text{yr}$	$2.1 \times 10^{-6}/\text{yr}$	$1.1 \times 10^{-6}/\text{yr}$	$2.8 \times 10^{-7}/\text{yr}$	$7.0 \times 10^{-6}/\text{yr}$
2 EDG operable ^a	$1.1 \times 10^{-6}/\text{yr}$	$1.2 \times 10^{-6}/\text{yr}$	$5.3 \times 10^{-7}/\text{yr}$	$1.4 \times 10^{-7}/\text{yr}$	$3.6 \times 10^{-6}/\text{yr}$

^aThe average annual shutdown risk was estimated based on the number of days with either one EDG operable or two EDGs operable during reduced inventory operation. With the extended AOT, the number of days with 1 operable EDG was assumed to be zero.

In the above, the uncertainty spread of the shutdown calculations is much higher than that of the at-power calculations. The larger uncertainty in the shutdown calculation is due to various factors including human actions, assumptions, and data. Therefore, comparing the at-power risk versus the shutdown risk is generally not as simple as comparing the point estimate values due to this relatively large difference in uncertainty. To overcome any issue relevant to the large uncertainty distributions in the shutdown risk calculations, the staff did not focus narrowly on the details of the quantitative results; instead, more emphasis was placed on the evaluation of the reasonableness of the overall approach and methodology to quantify the results.

The licensee performed a sensitivity study to determine the risk impact when only internal initiating events, not external events, are considered. This sensitivity study indicates that the total internal event core damage risk would, again, result in a net risk decrease if the EDG AOT is extended from 3 to 14 days.

The CEOG Report CE NPSD-996, "Joint Applications Report for Extending EDG AOTs," assessed the "transition risk," the risk associated with reducing power and going to hot shutdown or cold shutdown modes. The assessment indicated that performing a 14 day corrective maintenance at power, as compared with shutting the unit down to perform maintenance, would be risk beneficial. The staff believes that the risk associated with reducing power and going to a shutdown condition to be applicable for the proposed change. However, the staff did not factor this transition risk directly into the overall quantitative results due to uncertainties associated with the licensee's assessment.

In summary, the licensee's analysis indicates that the proposed EDG AOT extension would result in a net risk decrease. The staff did not validate the accuracy of the quantitative results. The staff review of the licensee's risk analysis focused on the reasonableness of the overall approach and PRA technique used to support the proposed change in EDG AOT extension. The staff finds that there are no significant weaknesses or deficiencies associated with the approach and PRA technique used to justify the requested EDG AOT extension. The staff believes that the overall approach and PRA methodology used to support the proposed EDG AOT extension are reasonable for this application. In addition, considering other factors (listed in the conclusion section of this evaluation) contributing in favor of the proposed AOT extension, the staff concludes that the licensee's proposal has met the intent of the Tier 1 guidance in Regulatory Guides 1.174 and 1.177.

3.3.2 Tier 2: Avoidance of Risk Significant Plant Configurations

The licensee indicates that it intends to perform EDG maintenance at power in a safe and expeditious manner and it will also make every effort to minimize the concurrent maintenance on risk significant plant equipment. In addition to the current TS restrictions on allowable plant configurations, the licensee will not schedule EDG maintenance concurrently with the unavailability of the same unit's turbine-driven auxiliary feedwater pump train due to the high risk significance of the configuration. An EDG preventive maintenance outage longer than three days will be scheduled only when the remaining three EDGs are functionally tested to be operable and aligned to be available. The licensee has agreed to implement Tier 2 restrictions via use of administrative procedures and guidance documents. SONGS Work Process Procedure SO123-XX-4, "SONGS Work Scheduling and Coordination Process," and Maintenance Policy Guideline MPG-SO123-G-31, "Utilization of the Safety Monitor in Support of Work Control," provide assurance that important non-safety and safety systems are not voluntarily removed from service concurrent with EDG maintenance. All other maintenance activities will be subject to the Tier 3 assessment and the plant configuration risk management program (CRMP).

The staff finds that the SONGS's restrictions and compensatory actions while performing EDG maintenance at power adequately address the intent of the Tier 2 guidance.

3.3.3 Tier 3: Risk-Informed Plant Configuration Management

The staff believes that the licensee's risk-informed CRMP will allow an evaluation of the risk associated with both scheduled and unscheduled plant activities when performing the EDG

maintenance at power. The licensee indicated that it would use a PRA based matrix or on-line risk monitor to address the Tier 3 provisions. The program currently uses the on-line safety monitor to assess and manage the risk associated with the EDG maintenance activities. Risk measures in the form of both the Level 1 (CDF) and Level 2 (LERF) are used to evaluate the risk for plant configurations. The licensee uses reasonable quantitative acceptance criteria for instantaneous CDF above which senior management approval is required to enter the configuration. Procedures are in place to take necessary measures when a risk significant configuration is identified. As listed in Tier 2, the SONGS Work Process Procedure and Maintenance Policy Guideline are used for the licensee's CRMP. The licensee's Abnormal Operating Instruction SO23-13-3, "Natural Disaster/Severe Weather," requires restoration of the EDGs to operable status in the event of notification of imminent severe weather such as hurricanes, tornado, high winds, or tsunamis which could impact the plant site. Operational factors such as grid condition, external events, switchyard maintenance, and plant equipment tests are included in the on-line risk monitor and considered for scheduling work. The personnel responsible for maintaining the CRMP are trained PRA engineers and the personnel responsible for implementing the CRMP in work planning and operations are trained in the use of the safety monitor.

The licensee has already incorporated the CRMP description to the licensee's TS. TS 5.5.2.14, "Configuration Risk Management Program," was incorporated into the licensee's TS, and the staff finds it acceptable. The staff concludes that the licensee has met the intent of the Tier 3 guidance.

3.3.4 Summary of the Staff's Review of the Licensee's Probabilistic Risk Analysis Used to Support the Proposed Amendment

Based on the three-tiered approach, the staff finds the following:

- The staff did not identify any significant weaknesses or deficiencies associated with the licensee's risk analysis to support the proposed change that could impact the overall quantitative conclusion. The staff review was intended not to assess the accuracy of the licensee's quantitative results but to evaluate the reasonableness of the overall approach and methodology used to quantify the results. The staff evaluated some of the dominant cutsets, importance measures, uncertainty and sensitivity analyses to develop additional reasonable confidence in the results. Based on its review, the staff concludes there is a reasonable assurance that the licensee's risk analysis support the EDG AOT extension and the overall risk impact of the proposed change meets the intent of the criteria and guidelines used in the Regulatory Guide 1.174 and 1.177. Moreover, there were several other factors that strengthened the staffs conclusion, and these include:
 - (a) Configurational risk control processes in Tier 2 and Tier 3 would result in additional safety benefit during the proposed EDG maintenance activities;
 - (b) The licensee's active use of PRA to control risk on a daily basis with state-of-the-art PRA technology and, more importantly, the high degree of confidence and level

of knowledge demonstrated by the licensee's PRA staff provided additional assurance that the licensee's work on the proposed amendment is reasonable for the proposed application; and

- (c) Additional risk reduction, though not directly factored into the licensee's risk analysis, is expected through averted risk during transition to shutdown, flexibility in scheduled maintenance activities during shutdown conditions, and focused EDG maintenance work at power.
- The licensee will not schedule EDG maintenance coincidentally with unavailability of the same unit's turbine-driven auxiliary feedwater pump train. In addition, the licensee will not schedule an extended EDG maintenance outage longer than 3 days when any of the remaining three onsite EDGs are unavailable. The licensee's procedures and guidance provide assurance that important systems are not voluntarily taken out of service concurrent with EDG outages.
- The licensee has implemented a risk-informed CRMP to assess the risk associated with the removal of equipment from service prior to, or during, the AOT. The program provides the necessary assurances that appropriate assessments of plant risk configurations using its on-line risk monitor, or risk matrix, augmented by engineering judgment and PRA group involvement, are sufficient to support the present AOT extension request for EDGs.

Therefore, the staff concludes that the results and insights of the PRA analysis support the proposed EDG AOT extension from 3 to 14 days.

Implementation and Monitoring

The staff expects the licensee to implement these TS changes in accordance with the three-tiered approach described above. The licensee has also indicated that the maintenance scheduling practice and the tools used to implement a means of evaluating the impact of maintenance activities on plant configurations are consistent with the Maintenance Rule (10 CFR 50.65). The AOT extension will allow efficient scheduling of on-line maintenance within the boundaries established by implementing the Maintenance Rule. The licensee will monitor EDG performance in relation to the Maintenance Rule performance criteria. Therefore, application of these implementation and monitoring strategies will help to ensure that an extension of TS EDG AOT does not degrade operational safety over time and that the risk expected when an EDG is taken out of service is minimized.

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to installation and use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves 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 amendment involves no significant hazards consideration, and there has been no public comment on such finding (63 FR 40941). Accordingly, the amendment meets 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 the amendment.

6.0 CONCLUSION

The Commission 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, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

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