UNITED STATES
NUCLEAR REGULATORY COMMISSION
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SAFETY EVALUATION

AMENDMENT NO. 32 TO NPF-10

AMENDMENT NO. 21 TO NPF-15

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 & 3

DOCKET NOS. 50-361 AND 50-362

1.0 INTRODUCTION

Southern California Edison Company (SCE), on behalf of itself and the other licensees, San Diego Gas and Electric Company, the City of Riverside, California, and The City of Anaheim, California has submitted several applications for license amendments for San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS 2 and 3).

A number of these are associated with Cycle 2 operation of Units 2 and 3. San Onofre Unit 2 is currently shut down for reloading in preparation for Cycle 2 operation. The following is the NRC staff's evaluation of the licensees' description of their proposed Cycle 2 operation for San Onofre Unit 2, and the technical specification changes related to Cycle 2 operation for both Units 2 and 3.

By letter dated September 28, 1984, Southern California Edison Company (SCE) submitted a request to reload and operate Unit 2 of the San Onofre Nuclear Generating Station for Cycle 2 (Ref. 1). In support of the request the licensee submitted a reload safety analysis report (Ref. 2) and Part 1 of the Statistical Combination of Uncertainties (SCU) report (Ref. 3) applicable to SONGS Units 2 and 3. Parts 2 and 3 of the SCU report (Refs. 4 and 5) were submitted by letter from SCE dated November 7, 1984 (Ref. 6). By letter dated November 15, 1984 (Ref. 7), the licensee also submitted a report on CPC/CEAC software modification (Ref. 8), CPC/CEAC data base listing (Ref. 9), and phases I and II software verification test reports (Refs. 10, 11).

The NRC staff has reviewed the application and the supporting documents and has prepared the following evaluation of the fuel design, nuclear design, and thermal-hydraulic design of the core as well as an evaluation of those plant transients which were reanalyzed for Cycle 2. In addition, a summary and evaluation of the Technical Specification changes, the Core Protection Calculator (CPC) and Control Element Assembly Calculator (CEAC) system modifications, and the SCU methodology reports reviewed are also presented.

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2.0 FUEL DESIGN

2.1 Mechanical Design

The Cycle 2 core consists of 145 Batch A, B and C fuel assemblies irradiated during the first cycle in addition to 72 fresh (unirradiated) Batch D assemblies. Except for the design features listed below, the mechanical design of the Batch D assemblies is identical to that of the Cycle 1 fuel assemblies. The changes are:

a. The lowest spacer grid (Inconel) has a redesigned perimeter strip with lead-in tabs that are now similar to those on the Zircaloy grids (HID-1 and HID-2). This change is merely an evolutionary one which brings the Inconel grid perimeter strip in line with the current HID-1 and HID-2 grid perimeter strip profile and is, therefore, acceptable.

b. The fuel rod overall length has been reduced by 0.15 inches by shortening the fuel rod end plenum length. This results in additional shoulder gap clearance. The licensee has analyzed the fuel rod internal pressure due to the shorter plenum length with the fuel performance code, FATES3A (Refs. 12 and 13) which has been approved by the staff. The calculations have shown that the maximum internal pressure remains below the reactor coolant system (RCS) pressure throughout Cycle 2 even with an allowance for the change in fuel rod length. Therefore, we conclude that the effect of the shorter plenum length on Batch D rod internal pressure satisfies the NRC fuel rod pressure criterion.

c. In order to increase the margin to the Technical Specification limit on control element assembly (CEA) insertion time an additional cooling hole (for the four outer guide tubes) has been drilled at the same elevation as that of the existing cooling hole. This will increase the bypass flow fraction from 2.6% to 2.8%. This change is reflected in the Cycle 2 thermal hydraulic design calculations as a decrease in the coolant flow through the core. Since the thermal hydraulic design calculations show that all safety limits and other criteria are still met, we find this change to be acceptable.

Therefore, based on our evaluation of these new design features, we conclude that the Batch D fuel assemblies are acceptable for use during Cycle 2.

The licensee has stated that the cladding creep collapse time for any fuel that will be irradiated during Cycle 2 was conservatively determined to be greater than its maximum projected residence time. The creep collapse analysis was performed by Combustion Engineering (CE) using the CEPAN computer code (Ref. 14) which has been approved by the NRC for licensing applications. We conclude that the cladding collapse has been appropriately considered and will not occur for Cycle 2 operation.

During the first refueling outage, fuel will be inspected to provide verification of adequate shoulder gap on fuel which will be reinserted in Cycle 2. In addition, in accordance with Ref. 15, a report has been provided to the NRC by SCE (Reference 33) to demonstrate that the Cycle 2 fuel will have sufficient available shoulder gap clearance for its total planned exposure. This report is currently under staff review.

2.2 Thermal Design

The thermal performance of Cycle 2 fuel was performed by analyzing a composite fuel pin that envelopes the peak pins of the various fuel assemblies (fuel Batches A, B, C and D) in the Cycle 2 core using the NRC approved fuel performance code FATES3A. The NRC imposed grain size restriction (Ref. 16) was included and a power history that envelopes the power and burnup levels representative of the peak pin at each burnup interval from beginning-of-cycle (BOC) to end-of-cycle (EOC) was used. The maximum peak pin burnup analyzed for Cycle 2 was 32,600 MWD/MTU which bounds the expected EOC maximum fuel rod burnup. License Condition 6 in the SONGS 2 operating license requires that SCE provide analyses using fission gas release models acceptable to the NRC prior to the cycle of operation that will result in peak burnups greater than 20,000 MWD/MTU. Therefore, we find the above presented analysis meets the requirements of this license condition and demonstrates acceptable operating conditions for the design lifetime of the fuel.* Based on this analysis, the internal pressure in the most limiting hot rod will not reach the nominal RCS pressure of 2250 psia. Since this satisfies the fuel rod internal gas pressure requirement of Standard Review Plan (SRP) 4.2, Section II.S.1(f), we find it acceptable and conclude that the fuel rod internal pressure limits have been adequately considered for Cycle 2 operation.

3.0 NUCLEAR DESIGN

3.1 Fuel Management

The SONGS Unit 2 Cycle 2 core consists of 217 fuel assemblies, each having a 16 by 16 fuel rod array. All but one of the 73 Batch A assemblies initially loaded in Cycle 1 will be removed and replaced by 56 zone - enriched Batch D assemblies (3.65*and 2.78 weight percent U-235 enrichment) and 16 zone - enriched Batch D assemblies (2.78 and 1.92 weight percent U-235 enrichment). The SONGS Unit 2 fuel storage facility has been approved for storage of fuel of maximum U-235 enrichment of 3.7 weight percent.

The Cycle 2 core will minimize power peaking by loading the fresh fuel assemblies (Batch D) predominantly on the core periphery and shuffling the Cycle 1 peripheral assemblies to the interior of the core. With this loading and a Cycle 1 endpoint of 14,000 MWD/MTU, the Cycle 2 reactivity lifetime for full power operation is expected to be 10,000 MWD/MTU. The analyses presented by the licensee will accommodate a Cycle 2 length up to 11,000 MWD/MTU and is applicable for Cycle 1 termination burnups of between 13,800 and 14,200 MWD/MTU.

3.2 Power Distributions

Hot full power (HFP) fuel assembly relative power densities are given in Reference 2 for beginning-of-cycle (BOC), middle-of-cycle (MOC), and end-of-cycle (EOC) unrodded configurations. Radial power distributions at BOC and EOC are also given for rodded configurations allowed by the power dependent insertion limit (PDIL) at full power. These rodded configurations consist of part length CEAs (PLCEAs), Bank 6, and Bank 6 plus the PLCEAs. The largest radial power peak occurs at BOC for both the rodded and unrodded configurations. These expected values are based on ROCS code calculations with neutron cross sections generated by the DIT code (Ref. 17). Also, the use of ROCS and DIT with the MC fine-mesh module explicitly accounts for the higher power peaking which is characteristic of fuel rods adjacent to water holes. These methods have been approved by the NRC and, therefore, the calculated power distributions are acceptable.

3.3 Control Requirements

The value of the required shutdown margin varies throughout core life with the most restrictive value occurring at EOC hot zero power (HZP) conditions. This minimum shutdown margin of 5.15% is required to control the reactivity transient resulting from the reactor coolant system (RCS) cooldown associated with a steam line break accident at these conditions. For operating temperatures below 200°F, the reactivity transients resulting from inadvertent boron dilution events have established a 3.0% shutdown margin requirement. Sufficient boration capability and net available CEA worth, including a maximum worth stuck CEA and appropriate calculational uncertainties, exist to meet these shutdown margin requirements. These results were derived by approved methods and incorporate appropriate assumptions and are, therefore, acceptable.

3.4 Safety Related Data

Physics characteristics used in the Cycle 2 safety analyses include the maximum reactivity worths and planar radial power peaks associated with an ejected CEA event as well as the limiting reactivity worth and maximum increase in radial peaking factor for a dropped CEA event. These were derived using approved methods and appropriate assumptions and are, therefore, acceptable.

4.0 THERMAL-HYDRAULIC DESIGN

Steady-state thermal-hydraulic analysis for Cycle 2 is performed using the approved thermal-hydraulic code TORC (Ref. 18) and the CE-1 critical heat flux (CHF) correlation (Ref. 19). The core and hot channel are modeled with the approved method described in Ref. 20. The design thermal margin analysis is performed with the fast running variation of the TORC code, CETOP-D (Ref. 21). The licensee has shown that the CETOP-D model predicts minimum departure from nucleate boiling ratio (DNBR) conservatively relative to TORC (Ref. 21).

The uncertainties associated with the system parameters are combined statistically using the approved statistical combination of uncertainties (SCU) methodology described in Refs. 3, 4, and 5. Using this SCU methodology, the engineering hot channel factors for heat flux, heat input, fuel rod pitch, and cladding diameter are combined statistically with other uncertainty factors to arrive at an equivalent DNBR limit of 1.31 at a 95/95 probability/confidence level. The fuel rod bow penalty is incorporated directly in the DNBR limit. It has been calculated using the approved method described in Ref. 22. The value used for this analysis, 1.75% DNBR, is valid for bundle burnups up to 30,000 MWD/MTU. For those assemblies with average burnup in excess of 30,000 MWD/MTU, sufficient margin exists to offset rod bow penalties.

5.0 SAFETY ANALYSES

The design basis events (DBEs) considered in the safety analyses are categorized into two groups: anticipated operational occurrences (AOOs) and postulated accidents. All events were reviewed by the licensee to assess the need for reanalysis as a result of the new core configuration for Cycle 2. Those events for which results were not bounded by the FSAR were reanalyzed by the licensee to assure that the applicable criteria are met. The AOOs were analyzed to assure that specified acceptable fuel design limits (SAFDLs) on DNBR and fuel centerline to melt (CTM) are not exceeded. This may require either reactor protection system (RPS) trips or RPS trips and/or sufficient initial steady state margin to prevent exceeding the SAFDLs.

Plant response to the DBEs was simulated using the same methods and computer programs which were used and approved for Cycle 1 analyses or which were approved by the staff after Cycle 1 analyses. These include the CESEC III and STRIKIN II computer programs. For some of the reanalyzed DBEs, certain initial core parameters such as CEA trip worth and moderator temperature coefficient (MTC) were assumed to be more limiting than the actual calculated Cycle 2 values. All of the events reanalyzed have results which are within NRC acceptance criteria and, therefore, are acceptable.

5.1 Increased Main Steam Flow

The increased main steam flow event was reanalyzed due to the smaller CEA trip worth, the more negative MTC, and a more adverse pin census for Cycle 2 compared to the reference cycle. For the increased main steam flow event without a single failure, the DNBR and CTM limits are not exceeded. For transients coupled with a concurrent single failure, the most limiting event with respect to DNBR is the increase in main steam flow with loss of AC power. This event resulted in a low DNBR trip and a minimum DNBR of 1.10 compared to the design limit of 1.31. The licensee originally calculated that approximately 1.5% of the fuel pins experienced DNB. However, this was based on the use of a statistical convolution to calculate the number of failed pins. For this event, the staff considers any pin which has a DNBR below 1.31 to have failed. Based on this criterion, the licensee has determined that approximately 4% of the fuel pins would fail, resulting in offsite doses of approximately 67 rem thyroid and a whole body dose of 2.7 rem. These are well within 10 CFR 100 values and are, therefore, acceptable. A maximum allowable linear heat rate (LHR) of 16.0 kW/ft could exist before the transient begins without causing the CTM of 21.0 kW/ft to be exceeded. This amount of margin is assured by setting the LHR limiting condition for operation (LCO) based on the more limiting loss of coolant accident (LOCA) limit of 13.9 kW/ft. The staff, therefore, finds the results of the licensee's analysis to be acceptable.

5.2 Steam System Piping Failures Inside and Outside of Containment

Steam line breaks (SLBs) inside containment may have break areas up to the cross section of the largest main steam pipe (7.41 ft²). The licensee performed a parametric analysis in both MTC and break area and the limiting inside containment SLB event was found to be the break having an effective flow area of 1.5 ft² with an effective MTC of $-1.5x10^{-4}$ /°F. Since inside containment SLBs may cause environmental degradation of sensor input to the core protection calculators (CPCs) and pressure measurement systems, no credit is taken for CPC action. Therefore, the trips credited are the low steam generator pressure, high linear power level or high containment pressure trips. A loss of AC power was also postulated to accompany the SLB event. The results indicate that the number of fuel pins predicted to fail is less than 3% and thus a coolable geometry is maintained.

Break areas for outside containment SLBs are limited to the area of the flow restrictors (4.13 ft²) located upstream of the containment penetrations. The outside containment SLBs, however, are not subject to the same environmental effects on the RPS as the inside containment breaks and the full array of RPS trips, including the CPC low DNBR trip, can be credited. Therefore, the outside containment breaks are bounded by the reference Cycle 1 analysis.

The licensee has also performed analyses of the SLB event to determine the potential for a post-trip return to power. The results of the most limiting event, that from hot full power (HFP) with a concurrent loss of AC power, show that there is no significant return to power and sufficient shutdown margin exists to terminate the event. In addition, there is no predicted fuel failure and a coolable geometry is maintained.

The staff concludes that the consequences of postulated SLB events meet the requirements of General Design Criteria (GDC) 27 and 28 by demonstrating that any resultant fuel damage is limited such that CEA insertability would be maintained and that no loss of core cooling capability results. The requirements of GDC 31 and 35 demonstrating the integrity of the primary system and the adequacy of the emergency core cooling system (ECCS) have also been met. The parameters used as input were reviewed and found to be conservative and the model used has been previously reviewed and found acceptable by the staff. The staff, therefore, concludes that the licensee has demonstrated conformance with the acceptance criteria stipulated in SRP Section 15.1.5. As such, the staff concludes that Cycle 2 operation is acceptable with respect to accidents resulting in breaks in the steam line.

5.3 Feedwater System Pipe Break Event

The feedwater system pipe break event with a loss of AC power at time of trip was analyzed to demonstrate that the reduction of CEA trip worth in Cycle 2 will not cause violation of the RCS pressure criterion. The initial RCS pressure and initial steam generator inventory were selected such that the low steam generator water level trip and the high pressurizer pressure trip occur simultaneously, resulting in the maximum peak RCS pressure after trip. The RCS pressure increases to 2930 psia compared to the reference cycle value of 2870 psia. Since the staff considers a feedwater line break with a concurrent loss of non-emergency AC power to be a very low probability event, SRP 15.2.8 requires that the RCS pressure should be maintained below 120% of the design pressure (3000 psia). This criterion is met and the feedwater line break, which is the limiting event with respect to RCS pressure, results in acceptable consequences during Cycle 2.

5.4 Total Loss of Forced Reactor Coolant Flow

The loss of coolant flow (LOF) event was reanalyzed by the licensee due to the reduction in CEA worth at trip, the change in the DNBR SAFDL, and a change in the CPC protection. In Cycle 1 the event was analyzed assuming a CPC low DNBR trip. For Cycle 2, the total loss of coolant flow event was analyzed with a CPC trip based on low reactor coolant pump (RCP) shaft speed, initiated when the shaft speed drops to 95% of its initial speed. According to the licensee, this new CPC trip methodology helps to avoid unnecessary trips due to underfrequency transients. The results show that this event initiated from the Technical Specification LCOs in conjunction with the low RCP shaft speed trip will not exceed the DNBR limit and is, therefore, acceptable.

5.5 CEA Misoperation Event

The single full length CEA drop was reanalyzed since it yields the maximum initial margin which must be maintained by the LCOs to assure that the DNBR and CTM limits are not violated. For single CEA downward deviations, the CEA position related penalty factors in the control element assembly calculators (CEACs) have been eliminated. This requires the core operating limit supervisory system (COLSS) in conjunction with the LCOs to contain sufficient thermal margin to compensate for the penalty factor removal. The licensee has stated that this change will reduce unnecessary trips due to spurious CEA position indications. The event is analyzed assuming a 9.2% increase in the three-dimensional power peak with no resultant trip. A minimum DNBR of 1.37 is obtained after 900 seconds at which time the operator would reduce power in accordance with Fig. 3.1-1A of the Technical Specifications if the dropped CEA has not been realigned. Operating at the LOCA LHR LCO limit assures that the CTM limit of 21.0 kW/ft is not violated. Therefore, the staff finds the results of this event acceptable.

5.6 Inadvertent Boron Dilution

This event was reanalyzed due to the Cycle 2 increase in critical boron concentrations and decrease in inverse boron worth. For power operation (Modes 1 and 2), an inadvertent boron dilution event will be terminated by the CPC trip system. For subcritical modes (Modes 3 through 6), the time required to achieve criticality due to boron dilution depends on the initial and critical boron concentrations as well as the inverse boron worth and the rate of dilution. Because of the Cycle 2 increase in critical boron concentrations, the minimum required shutdown margin during cold shutdown (Mode 5) has increased from 2.0% k/k to 3.0% k/k. In addition, the analysis for Mode 5 with the RCS partially drained assumes that only one charging pump is operable. The results show that, with the alarms which were installed before Cycle 1 startup, sufficient time exists to alert the operator of a boron dilution event at least 15 minutes before criticality (30 minutes during refueling) during all modes of Cycle 2 operation. The staff concludes that SONGS-2 Cycle 2 meets the requirements of SRP Section 15.4.6 and is acceptable.

5.7 Asymmetric Steam Generator Events

The four events which affect a single steam generator are:

(a) loss of load to one steam generator (LL/1SG)
(b) excess load to one steam generator (EL/1SG)
(c) loss of feedwater to one steam generator (LF/1SG)
(d) excess feedwater to one steam generator (EF/1SG)

Of these, the LL/1SG event is the limiting asymmetric event. This event is initiated by the inadvertent closure of a single main steam isolation valve (MSIV), which results in a loss of load to the affected steam generator. The CPC high differential cold leg temperature trip serves as the primary means of mitigating this transient with the steam generator low level trip providing additional protection. The minimum transient DNBR calculated was greater than the DNBR SAFDL limit of 1.31. A maximum allowable LHR of 17.0 kW/ft could exist as an initial condition without exceeding the fuel CTM SAFDL of 21.0 kW/ft during the transient. This amount of margin is assured by setting the LHR LCO based on the more limiting allowable LHR for LOCA of 13.9 kW/ft. The staff concludes that the calculations contain sufficient conservatism to assure that fuel damage will not result from any asymmetric steam generator event during Cycle 2 operation.

5.8 Loss of Coolant Accident (LOCA)

The ECCS performance evaluation for both the large break and the small break LOCA must show conformance with the acceptance criteria required by 10 CFR 50.46. Based on the Cycle 1 results, a comparison of the two limiting LOCA events demonstrated that the large break LOCA ECCS performance is more limiting than the small break LOCA performance results. The calculations were made using approved computer programs and models which meet the requirements of Appendix K to 10 CFR 50. The blowdown and reflood calculations used in the reference cycle still apply to Cycle 2 since only fuel pin operating conditions have changed between the two cycles. The analysis accounts for an assumed amount of steam generator tube plugging of up to 100 average length tubes per steam generator.

For the large break analysis, the licensee analyzed both the 1.0 and 0.8 double-ended guillotine at pump discharge (DEG/PD) breaks. The 1.0 DEG/PD break resulted in the highest peak clad temperature (2015°F) and the highest core wide clad oxidation percentage (0.68%) while the local clad oxidation percentage (10.46%) was only slightly lower than the 10.48% calculated for the 0.8 DEG/PD break. Based on these results, the 1.0 DEG/PD break was assumed to be the most limiting for Cycle 2. Since the results meet the acceptance criteria for peak clad temperature (2200°F), peak local clad oxidation percentage (17.0%), and core wide clad oxidation percentage (1.0%), we conclude that operation of SONGS-2 with a peak linear heat generation rate (PLHGR) of 13.9 kW/ft is acceptable for Cycle 2.

6.0 CPC/CEAC SOFTWARE MODIFICATIONS

The SONGS Units 2 and 3 Core Protection Calculator/CEA Calculator System is provided by the reactor vendor Combustion Engineering. The CPC/CEAC software algorithm for Cycle 2 operation is an updated version of CE CPC/CEAC which has been approved for use in CESSAR 80 plants (Ref. 23) such as Palo Verde Nuclear Generation System Units 1, 2 and 3. By letters dated July 20 (Ref. 24) and November 15, 1984, the licensee submitted CEN-284(s)-P, "Safety Analysis and CPC Methodology Changes for SONGS Units 2 and 3" (Ref. 25), and CEN-281(s)-P, Revision 01-P, "CPC/CEAC Software Modifications" which describe additional CPC/CEAC software modifications to be applied to the SONGS Cycle 2 operation. These modifications and their evaluation are as follows:

6.1 Temperature Shadowing Factor Algorithm Modification

The temperature shadowing factor (TSF) is a moderator temperature-dependent multiplier applied to the neutron power calculation in the CPC to correct the excore detector response to the decalibration effects due to changes in inlet coolant density. The current CPC calculates TSF as a simple function of the change in moderator temperature slope which is determined in start up testing. The modification is made in the calculation of TSF so that TSF is a function of inlet moderator temperature consistent with the off-line TSF data. The method of TSF data calculation is described in a response to a staff question (Ref. 26). The slope of the correction for temperature is chosen to bound all expected TSF data including uncertainties associated with the calculational model, measurement configuration and non-linear response of the excore detector as coolant temperature changes. Therefore, the TSF uncertainty is included directly in the TSF itself. There is no need to further incorporate the TSF uncertainty in the overall uncertainty factors used in the CPC DNBR and LHR calculations. In addition, since the TSF algorithm is changed, an addressable constant, TCREF, defined as the reference cold leg temperature, is added to and the TSF correction multiplier, CORR1, is removed from the CPC addressable constants. The staff has reviewed the modified algorithm and find it acceptable.

6.2 CPC Core Power Bias Algorithm Modifications

Power measurement uncertainties are conservatively added to the thermal and neutron powers in the CPC core power calculation. These uncertainties include the CPC neutron flux synthesis error, the secondary calorimetric power measurement error, the secondary calorimetric power to the CPC power calibration allowance, and the thermal power transient offset. These uncertainties are treated as bias terms and are added together to be applied to CPC through the addressable constants, BERR0 and BERR2, which are the overall uncertainty biases for thermal and neutron power, respectively. Since the secondary calorimetric power measurement has a higher measurement uncertainty at lower power conditions due to higher instrumentation error (such as main feedwater flow transmitter error) and noise level, the revised CPC software incorporates an algorithm to calculate the power-dependent measurement uncertainty for the secondary calorimetric power. In response to staff questions (Ref. 26), the licensee provided a description of the determination of the secondary calorimetric power uncertainty as a function of power level. The algorithm used in CPC is a function chosen to bound the error calculated in the measurement of secondary calorimetric power. Since the secondary calorimetric power measurement error is dependent on the power level at which the calorimetric measurement is performed, an addressable constant PCALIB is added to the CPC for the determination of uncertainty. PCALIB is defined as the calorimetric power at the time the latest calibration was performed. The staff has reviewed the modified CPC algorithm and find it to be correct and acceptable. In addition, since the secondary calorimetric power measurement error is directly incorporated in the CPC core thermal and neutron power calculations, this error component is removed from BERR0 and BERR2. This is also acceptable.

6.3 Improvement to UPDATE Algorithm

The CPC detailed DNBR calculation is performed in the STATIC algorithm routine. Since the STATIC calculation is performed only once every two seconds, the DNBR is updated every 0.1 seconds within the two second interval in the UPDATE routine using the STATIC-calculated DNBR and the change in the state parameters, such as hot channel mass flow, heat flux and quality at the minimum DNBR node. Presently, the CPC UPDATE algorithm applies a penalty to the updated DNBR at all times. This algorithm is modified so that the penalty factor is applied only when the updated-DNBR differs significantly from the STATIC-DNBR. This modification thus eliminates an unnecessary penalty for steady state operation. The penalty factors applied to the updated-DNBR depend on the magnitude of the deviation between the updated and STATIC DNBRs. These penalty factors are determined from the off-line CPC simulator calculation by using the maximum possible change in the operating parameters within the two second interval. The penalty factors are cycle-dependent and the values used in Cycle 2 must be shown to bound the necessary values or must be modified for the future cycles through cycle-dependent analysis.

The staff reviewed the modified algorithm and finds the change to be acceptable.

6.4 Modification of Heat Flux Distribution Extrapolation in STATIC

The hot-pin axial power distribution is calculated in the STATIC algorithm by an extrapolation from a 20-node representation to a 21-node representation. For certain CEA configurations, this extrapolation may result in negative values of heat flux in the top node. The heat flux extrapolation algorithm is modified by adding a flux value check to prevent a non-physical zero or negative nodal heat flux value. The staff has reviewed the modified algorithm and finds it acceptable.

6.5 Modification of ASGT Penalty in UPDATE

In the CPC UPDATE routine, a DNBR penalty factor is computed based on the temperature difference between opposing cold legs. This cold leg temperature difference is compensated for by the effects of the sensor time constant. The algorithm is modified by adding an additional test to check for the small value of the compensated cold leg temperature difference to clarify the underflow condition. The staff has reviewed the algorithm and finds it acceptable.

6.6 Pump Speed Trip for Loss of Flow Event

Section 4.2 of CEN-284(s)-P, "Safety Analysis and CPC Methodology Changes for San Onofre Nuclear Generating Station Units No. 2 and 3", identifies a change in the CPC trip logic for protection against the loss of flow event. Rather than using the projected DNBR, the revised trip logic is based on pump speed with the minimum pump speed setpoint set at 95% of the rated pump speed, i.e., a CPC trip will be initiated when the speed of one or more pumps falls below 95 percent of rated pump speed. This trip logic change does not affect the DNBR trip for other transients and does not require any change in the existing CPC algorithm, but only changes in the flow projection constants in the FLOW algorithm and the pump-dependent parameters used for flow projection calculations. As a result of the changes in the values of these constants, the flow projection is no longer projecting the minimum DNBR based on a decrease in core flow. This causes a different time-to-trip during a LOF event. In response to a staff question (Ref. 26), the licensee stated that the change in time-to-trip resulting from the setpoint change is accommodated by a change in the COLSS underflow fraction (UFF). The COLSS UFF is based on the LOF analysis and is the fraction of the initial core flow at the time of minimum DNBR. COLSS uses the UFF to reduce the core flow used in the calculation of DNBR power operating limit. Thus when COLSS is used to monitor the limiting conditions for operation, sufficient margin exists to avoid violation of the DNBR limit when a trip is initiated in the LOF event.

Since the reactor trip is to be initiated based on pump speed for the LOF event, the trip setpoint of 95 percent is determined from the safety analysis for a total loss of reactor flow event where a CPC trip is assumed to initiate at 95 percent RC flow. In response to a staff question, the licensee stated that the 95 percent rated flow is equivalent to a 94.5 percent pump speed setpoint. With a 0.2 percent uncertainty in pump speed measurement, the 95 percent pump speed setpoint is conservative. The licensee also indicated (Ref. 27) that the time to reach 95 percent flow as calculated by the CESEC code in the safety analysis is 0.8 seconds whereas the CPC calculated time to reach 95 percent pump speed is 0.65 seconds. The staff concludes that this CPC trip setpoint change is acceptable.

6.7 CPC/CEAC Data Base Constants

By letter dated November 15, 1984, the licensee submitted CEN-266(s)-P, Revision 1, which provides the CPC/CEAC data base constants applicable to the San Onofre Unit 2 CPC/CEAC. We have reviewed the important parameters relevant to the software change and find them, in general, to be correct. However, some of the values in the data base listing are inconsistent with the values in other reports. For instance, there is an inconsistency in the values of the DNBR UPDATE uncertainty penalty factors, AA and BB, between the data base listing and the values quoted in CEN-281(s)-P, Rev. 01, "CPC/CEAC Software Modifications." In response to a staff question the licensee indicated that the values in CEN-281(s)-P are just typical values and the values in the data base listing are correct. Also, the values of BERR0, BERR1, BERR2, BERR3 and BERR4 are inconsistent with the results from Part 2 of the SCU reports. The licensee indicated that the values in the data base listing were just temporary values used for functional testing. Since the BERR's are addressable constants, correct values from the SCU report will be used during SONGS CPC operations. Also, the trip times assumed in the safety analyses bound the trip times calculated using the CPC FORTRAN simulator and the correct BERR values. The staff concludes that these explanations are acceptable.

6.8 Verification of CPC/CEAC Software Modification Implementation

The implementation of the CPC/CEAC software modifications translates the system functional requirements into modules of machine executable coding and integrates these modules into a real time software system. The overall CPC/CEAC software implementation is verfied through the Phase I and Phase II software verfication tests. By letter dated November 15, 1984, the licensee submitted SONGS-2, Cycle 2 CPC/CEAC Phase I and Phase II test reports, CEN-176(s)-P, Revision 03-P and CEN-269(s)-P, Revision 02-P (Refs. 10 and 11).

The Phase I test was performed at the CEAC Single Channel Unit on relatively small, single-entry/single-exit segments of modules. The objective was to verify the implementation of CPC/CEAC software. Sufficient test cases were chosen to exercise each functional branch in the application program and executive software system. Expected results for the application program test cases were generated by either the CPC FORTRAN Simulation Code or by hand calculations by the test engineer based on the system functional requirements. When test case input had been selected and expected results had been generated, a test tape was prepared to be read by the automated Phase I test program. Whenever the actual value differed from the expected value by more than 0.1 percent, an analysis of the error was performed to assure that the deviation was not caused by a coding error. Several branches were not exercised because the assigned constant values made it impossible to branch on certain conditions. In these cases the module was verified by inspection to assure correct implementation. The executive software was tested through the debug program, CLUB, which was used to insert test case inputs into memory, to insert breakpoints, to trace and intercept code execution and to examine results. The report indicates that the overall Phase I test was performed in accordance with the approved Phase I test procedures and that the test results show no coding error in the application program and executive software. Therefore, the implementation of CPC/CEAC software into machine executable modules has been verified correctly.

The objectives of the Phase II tests were to verify that the CPC/CEAC software modifications have been properly integrated with the CPC/CEAC software and system hardware, and that the static and dynamic operation of the integrated system is consistent with the predictions of design analyses. These objectives were achieved by comparing the response to that projected by the CPC/CEAC FORTRAN Simulation Code. The test was performed in the Single Channel CPC and the test cases were selected in accordance with the approved procedure described in CEN-39(A)P, Revision 02.

The Phase II testing consisted of Input Sweep Tests (ISTs), Dynamic Software Verification Tests (DSVTs) and Live Input Single Parameter Tests (LISPs). ISTs were utilized to determine the processing uncertainties inherent in the CPC/CEAC designs. Thousands of cases were run in the ISTs and the resulting uncertainties were factored into the acceptance criteria for the DSVT and LISP. The DSVT is a real time exercise of the CPC software to verify the dynamic response of the integrated CPC software with design analyses by determining whether the initial DNBR and LPD calculations and the trip time of each transient are within the acceptance criteria predicted by the FORTRAN Simulation Code. In contrast to the DSVT where the transient CPC input values are read from a storage device, the LISP test is a real-time exercise with transient input values generated from an external source and read through the CEAC/CPC input hardware. The LISP test is to verify that the dynamic response of the trip time of the integrated CPC/CEAC software/hardware system is consistent with the design analysis prediction during operational modes approximating plant conditions. These tests have shown that in all but two DSVT cases the CPC/CEAC calculated results are within the acceptance criteria. In the two DSVT cases not meeting the acceptance criteria, one had the local power density (LPD) 0.02 percent below the minimum acceptance value, and the other had the LPD trip time 0.08 percent above the maximum acceptance value. Since the deviations are small, they are not considered an indication of implementation error. In response to a staff question (Ref. 27), the licensee performed a thorough investigation of the causes of the deviations. For both cases, they have identified the causes of deviations as not being related to the software implementation. Therefore, the staff concludes that the CPC/CEAC software has been implemented correctly.

7.0 STATISTICAL COMBINATION OF UNCERTAINTIES (SCU)

In Cycle 1, the uncertainties of relevant parameters were treated deterministically. Starting with Cycle 2, statistical treatment of uncertainties will be used in the safety analysis, CPC and COLSS. By letters dated September 28 and November 7, 1984, the licensee submitted CEN-283(s)-P, Parts 1, 2 and 3 of the Statistical Combination of Uncertainties (Refs. 3, 4, 5).

Part 1 of SCU describes the method of statistically combining the uncertainties of the thermal hydraulic code input parameters (system parameters) to generate a new DNBR limit that accommodates the uncertainties of the system parameters. The resulting DNBR limit is applied to safety analysis, CPC trip setpoints and COLSS required overpower margin calculations.

Part 2 of SCU describes the methods used for statistically combining the uncertainties of modeling and the measured parameters relevant to the linear heat rate (LHR) and DNBR limiting safety system setting (LSSS). A stochastic simulation is used to evaluate state parameter response functions and their uncertainties in relation to LHR and DNBR LSSS. The results obtained from the stochastic simulation are used to obtain penalty factors (BERR0, BERR1, BERR2, BERR3 and BERR4) for the CPC three-dimensional peaking factor (F_q) and DNBR calculations to ensure conservative plant operation.

Part 3 of SCU describes the methods for statistically combining uncertainties of modeling and state parameters relevant to the LHR and DNBR LCO calculation. All measurement uncertainties are combined to determine the overall uncertainty factors (UNCERT and EPOLS) to be applied to the COLSS for the calculation of the core power operating limits on LHR and DNBR.

The methods of SCU have previously been reviewed and approved for ANO-2 (Ref. 28) and CESSAR-80 plants (Ref. 29, 30, 31). Therefore, this review concentrated on any differences from the approved methods and on the derivation of the final results.

Part 1 of SCU is basically identical to the ANO-2 and CESSAR-80 SCU. The basic difference is that the uncertainties of inlet flow factors of the hot channel and its neighboring channels are treated deterministically in CESSAR-80 SCU, whereas they are treated statistically in both ANO-2 and SONGS SCU. During our review of the determination of the most adverse state parameters, we found that the values of MDNBR resulting from perturbations of system parameters are much higher than the CESSAR-80 results. In response to a staff question the licensee described the cause of the higher MDNBR's for SONGS. This is primarily due to the inclusion of the inlet flow factors in the set of system parameters being perturbed resulting in higher sensitivity of DNBR with respect to the system parameters. Since CESSAR-80 SCU does not include the inlet flow factors, the DNBR sensitivity factors are much smaller. The SONGS DNBR sensitivity factors are still somewhat larger than that of ANO-2. This is due to a change in the location of the hot assembly. This change resulted in inlet flow factors being perturbed in five assemblies compared to four assemblies for ANO-2. In addition, the uncertainties of the system parameters for SONGS are greater than those for ANO-2. The larger uncertainties and higher sensitivity factors result in a higher final DNBR for SONGS. We have reviewed the derivation of the final DNBR limit and find the SCU DNBR limit of 1.31, which includes a 1.75% fuel rod bow penalty up to a burnup of 30,000 MWD/MTU, to be acceptable.

Parts 2 and 3 of SCU are basically identical to the CESSAR-80 SCU Parts 2 and 3. The differences are that, in SONGS, (1) the uncertainty of the temperature shadowing factor is treated deterministically in CPC; and (2) the uncertainty of secondary calorimetric power is incorporated as a power-dependent function. In response to a staff question (Ref. 26), the licensee provided a detailed breakdown of the measurement uncertainties of state parameters. The uncertainty values and the sources of those values were also provided. The staff has also performed an audit calculation of the overall uncertainty penalty factors and confirmed that those values in the Parts 2 and 3 reports are correct and, therefore, acceptable.

8.0 TECHNICAL SPECIFICATION CHANGES

The staff has reviewed a number of proposed modifications to the San Onofre 2 and 3 Technical Specifications requested by the licensees by letters dated February 29, April 2, July 2, August 7, October 1 and October 3, 1984, and discussed in Reference 2. The staff's evaluation of each of the proposed changes included in these amenedments to the San Onofre 2 and 3 Operating Licenses is given below.

Proposed Change PCN-52:

The Technical Specification 3.2.4, "DNBR Margin", is changed to (1) add a second power operating limit line to Figure 3.2-1 for the case where both CEAC's are inoperable, (2) split Figure 3.2-2, "DNBR Margin Operating Limit based on CPC's (COLSS out of Service)", into Figures 3.2-2 and 3.2-3, respectively for higher and lower power levels, and (3) revise Action 6 of Table 3.3-1 for the case where one or both CEACs are out of service.

The staff, based on the following evaluation, has concluded that these changes are acceptable.

(1) During normal reactor operation, the Core Operating Limit Supervisory System (COLSS) continuously monitors various plant parameters from which it calculates a Power Operating Limit (POL) which is displayed in the control

room. The current Figure 3.2-1 limits the reactor operation to the acceptable operating region where the reactor power is less than or equal to the POL calculated by the COLSS. The Technical Specification change adds an additional limitation when both CEAC's are out of service. This limitation is imposed by the new POL line added to Figure 3.2-1 to reduce the space of the acceptable operation region, i.e., the reduction of the allowable reactor power. In response to a staff question (Ref. 26), the licensee provided a description of the derivation of the amount of power reduction required to accommodate the inoperability of both CEACs. Because the four-pump loss of flow (LOF) event is typically the limiting AOO, the under flow fraction (UFF) is used in the COLSS for the POL calculation. With both CEACs inoperable, the CEA subgroup drop event becomes the limiting event in the determination of required overpower margin (OPM). The margin set aside by the UFF to accommodate the loss of flow event is not sufficient to completely compensate for the required OPM for the CEA drop event. Therefore an additional bias margin is needed to accommodate the CEA drop event when both CEACs are inoperable. This bias margin is derived from the difference between the required OPM for the CEA drop event and the available OPM preserved by the COLSS for the LOF event. This bias margin is added to Figure 3.2-1 as a new POL line for the inoperability of both CEAs. At the staff's request, the licensee also expanded the Technical Specification Bases 3/4.2.4 by defining the UFF and the POL bias terms. The staff concludes that this Technical Specification change is acceptable.

(2) When COLSS is out of service, CPC is used for monitoring the DNBR LCO. Figure 3.2-2 specifies the acceptable operation region where the CPC-calculated DNBR is greater than or equal to the minimum DNBR limit line specified as a function of axial shape index (ASI). This minimum DNBR limit line provides sufficient OPM to ensure that the specified acceptable fuel design limit (SAFDL) will not be violated should an AOO occur. The required OPM on DNBR, which is dependent upon the reactor operating conditions such as ASI and power level, is determined by the off-line calculation using the CETOP-D thermal margin code with inputs simulating the core operating conditions. Since the margin requirement is dependent on power level and ASI, the existing Figure 3.2-2 is the most conservative margin requirement bounding all power levels. Replacing the existing Figure 3.2-2 with new Figures 3.2-2 and 3.2-3 for the higher and lower power levels, respectively, would reduce the unnecessary penalty of imposing the most conservative margin requirement to all power levels. The new figures also reduce the acceptable operating range for the ASI. We conclude that this Technical Specification change is acceptable.

(3) Action 6 of Table 3.3-1 provides conditions under which operation may continue with one or both CEAC's inoperable. The existing Action 6a allows operation to continue for a maximum of seven days with one CEAC inoperable whereas Action 6b allows plant operation to continue indefinitely when both CEACs are inoperable as long as the conditions set forth in the Technical Specifications are met. Therefore, the existing Action 6a specifies a more severe penalty to the inoperability of one CEAC than the inoperability of both CEACs. The Technical Specification change to Action 6a removes the more severe penalty to the inoperability of one CEAC so that continued operation is allowed provided that the actions to be taken for the inoperability of both CEACs are followed. The staff concludes this change is acceptable.

The existing Action 6b specifies an action requirement when both CEACs are inoperable. This action requirement did not separate the conditions for the operability of COLSS. The proposed change separates Action 6b for COLSS in-service and 6c for COLSS out-of-service. When both CEACs are inoperable and COLSS is in-service, the continued operation is allowed only if the requirement specified in Figure 3.2-1 is satisfied.

When COLSS is out of service and both CEACs are inoperable, CPC must preserve the margin equivalent to that preserved by COLSS using the CEACs inoperability line of Figure 3.2-1. However, since a power penalty factor (PF_{PRD}) has been automatically applied in CPC whenever both CEACs are inoperable, this power penalty factor can be used to compensate for the margin requirement when both COLSS and CEAC are out of service. The licensee has determined the maximum margin requirement for the limiting CEA subgroup drop event when both CEACs are inoperable. The difference in the maximum required OPM and the power penalty factor for the inoperability of both CEACs used in CPC is a multiplication factor to be applied to the CPC addressable constant BERR1. Since BERR1 is a power penalty factor used in CPC power for the DNBR calculation, increasing the BERR1 value by the multiplication factor is acceptable in compensating for the required OPM. Therefore, the change in Action item 6 of Table 3.3-1 is acceptable.

For Cycles 1 and 2 operation, respectively, the licensee has submitted a separate set of Figures 3.2-1, 3.2-2 and 3.2-3 and the multiplication factor for BERR1 relevant to these Technical Specification changes. This is based on the result of cycle dependent analyses. The difference between Cycles 1 and 2 arises from the differences in the treatment of uncertainties resulting in a different DNBR limit and required OPM for the LOF event. Also, more detailed calculations for Cycle 2 of the effect of xenon distribution and radial peak distribution have resulted in the lower required OPM for the CEA drop event. Since those figures and multiplication factors are cycle-dependent, for future reload cycles, the licensee should perform cycle specific analyses to confirm or revise the Cycle 2 figures and values.

Proposed Change PCN-85:

The Technical Specification changes (1) revise a footnote on Table 3.2-2, "Reactor Protective Instrumentation Response Times", where the response time limit of the resistance temperature detectors (RTD) is changed from 6 seconds to 13 seconds; (2) add new Tables 3.3-2a, "Increase in BERRO, BERR2, BERR4 versus RTD Delay Time", and 3.3-2b, "DNBR LCO Power Operating Limit Adjustments", to be used when the RTD response time constant degrades beyond 6 seconds.

The RTDs are used to measure the cold and hot leg temperatures which are used in the CPC and COLSS for core power and DNBR calculations. The algorithms in the CPC and COLSS for the power and DNBR calculations have a built-in RTD response time constant of 6 seconds which is the maximum response time allowable in the current Technical Specifications. When the RTDs degrade to the point where the response times exceed the time constant assumed in the algorithm, the signals transmitted to the CPC channels and COLSS lag the assumed delay time.

This results in the CPC and COLSS calculating non-conservative values of the reactor coolant temperature con-ditions and, in turn, non-conservative power and DNBR for certain transients. The Technical Specification change allows continued operation with the RTD time constant degraded beyond 6 seconds provided that the CPC and COLSS calculations are adjusted with penalty factors in accordance with Tables 3.3-2a and 3.3-2b. The impact of the RTD response time on the core power and DNBR has been previously assessed for Arkansas Nuclear One, Unit 2 and described in CEN-206(A)P (Ref. 32). The same method is used by the licensee to determine the values of penalty factors with respect to RTD degradation. In response to a staff question, the licensee has provided the penalties required for various RTD response times based on the Cycle 2 analysis of limiting design basis events (DBEs), i.e., loss of load, excess load, single CEA withdrawal and asymmetric steam generator events. The penalty values in Tables 3.3-2a and 3.3-2b are the bounding values for all the affected DBEs. Therefore, the use of these two tables to compensate for the degraded RTD response time beyond 6 seconds is acceptable. For future cycles, the same type of analysis should be performed to either confirm or revise the values in Tables 3.3-2a and 3.3-2b.

None of the RTDs currently in use in the San Onofre plants have response times exceeding 6 seconds. In response to a staff question the licensee indicated that SCE does not use any material such as Neverseeze compound to degrade the heat transfer characteristics of the RTD contact surfaces and that all RTDs used to replace the failed ones are gold-plated and lapped to be custom fitted in their respective wells. Therefore the RTD response characteristics are not subject to any appreciable change. Although the Surveillance Requirement 4.3.1.3 specifies that each reactor trip function shall be demonstrated to be within limits at least once per 18 months, the RTD time constant may be degraded during the time interval prior to the next functional test. Therefore, the staff requires that the RTD time constant for the time interval prior to the next scheduled test be calculated by extrapolating the values of the previous two measurements. In no case, however, should the extrapolated value be less than the values of the previous measurements.

Proposed Change PCN-148

The Technical Specification change adds an addressable constant, PCALIB, in Table 2.2-2, "Core Protection Calculator Addressable Constants".

The addition of PCALIB as an addressable constant is related to a CPC algorithm modification where a power-dependent measurement uncertainty for the secondary calorimetric power is used in the core power calculation. PCALIB is defined as the calorimetric power at the time of the latest cali-bration. The addition of PCALIB as an addressable constant is acceptable as discussed in Section 6.2, "CPC Core Power Bias Algorithm Modification".

Proposed Change PCN-150:

The core average axial shape index (ASI) upper limits above 20% of rated thermal power have been changed from +0.50 to +0.28 with COLSS operable and from +0.50 to +0.20 with COLSS out of service.

These revised limits remain bounded by the ASI LCO extremes used in the reference cycle and Cycle 2 safety analyses. The changes are, therefore, acceptable.

Proposed Change PCN-151:

The power dependent insertion limits (PDIL) for the Cycle 2 regulating CEA groups have been modified.

These revised limits were used to calculate radial power distributions for rodded configurations and net available scram worths as well as other safety related data such as ejected CEA and dropped CEA worths. Calculations used to obtain the revised limits were performed with accepted methods, and the appropriate values were used in the safety analyses. These changes are, therefore, acceptable.

Proposed Change PCN-152:

The Technical Specification change adds an addressable constant, RPCLIM, to Table 2.2.2, "Core Protection Calculator Addressable Constants".

The SONGS Units 2 and 3 CPC software is provided by the reactor vendor, Combustion Engineering (CE). The CPC software algorithm for SONGS Cycle 2 operation is an updated version of CE CPCs. This updated CPC includes an algorithm for the Reactor Power Cutback (RPC) system designed to eliminate power imbalance without a reactor trip for the large turbine load rejection and loss of one main feedwater pump events. During the RPC mode, predetermined smaller penalty factors (PFs) for CEA deviation are used by the CPC. After the RPC mode, the CPC returns to the normal mode where larger CEA deviation PFs are used by the CPC. The licensee has determined that the RPC system is not needed for SONGS operation. Rather than eliminating the RPC system algorithm from the CPC software, the RPC mode time limit is set to 0. The Technical Specification change adds the RPC time limit, RPCLIM, as an addressable constant which is set to zero for the CPC. The staff concludes the Technical Specification change is acceptable.

Proposed Change PCN-153:

The positive limit on moderator temperature coefficient (MTC) has been changed to $+.5 \times 10^{-4}$ k/k/°F below 70% of rated thermal power and to 0 above 70% of rated thermal power.

The revised MTC positive limit is consistent with the value used in the reanalyses of any Cycle 2 transient or accident and remains bounded by the value used in the reference cycle safety analyses. The calculation of MTC has been performed with approved methods. The change is, therefore, acceptable.

Proposed Change PCN-160:

The Technical Specification change revises the minimum DNBR limit from 1.20 to 1.31. This change is made to Technical Specification 2.1.1.1, "Safety Limits - Reactor Core - DNBR", 2.2.1, "Limiting Safety System Settings - Reactor Trip Setpoints" and its bases B2.2.1, and 3/4.4.1, "Reactor Coolant Loops and Coolant Circulation".

The change of the minimum DNBR limit from 1.20 to 1.31 is due to the change in the treatment of uncertainties. The 1.20 limit was imposed for the use of the CE-1 critical heat flux correlation in the SONGS fuel having both HID-1 and HID-2 spacer grids. In Cycle 2, the statistical combination of uncertainties of the system parameters is used in the safety analyses. Use of SCU results in a DNBR limit of 1.31 when the nominal values of the system parameters are used in the safety analyses. The SCU review is addressed in Section 7.0 of this SER. The staff has concluded that the SCU-DNBR limit of 1.31 is acceptable and, therefore, the Technical Specification change is acceptable.

Proposed Change PCN-162:

The Technical Specification change revises Table 2.2-2, "Core Protection Calculator Addressable Constants", by redefining the CPC addressable constant point ID No. 98 where the Temperature Shadowing Factor correction multiplier, CORR1, is replaced by the reference cold leg temperature TCREF.

This change is necessary due to the change in the CPC TSF calculational algorithm. The change is acceptable as described in Section 6.1, "Temperature Shadowing Factor Algorithm Modification", of this SER.

Proposed Change PCN-164:

This Technical Specification change revises the minimum allowable value of the addressable constant TR (azimuthal tilt allowance) from 1.02 to 1.0 in Table 2.2-2, "Core Protection Calculator Addressable Constants".

Azimuthal tilt allowance, TR, is used in CPC as a power multiplier to increase the hot pin radial peaking. Technical Specification 3/4.2.3 requires that the azimuthal power tilt be no greater than the azimuthal tilt allowance used in CPC. This limitation is to ensure that the design safety margins are maintained. Currently, COLSS uses an "arithmetic average" technique to calculate a core average azimuthal tilt value. Using this method, signal noise input is enhanced by accumulating the magnitude component without considering the directional effect. The calculation in COLSS has been modified to use a "planar vector average" technique which performs a vector sum of the individual tilt estimates at each axial plane for the calculation of the average tilt value of each plane. This planar average technique reduces the noise effects by allowing possible cancellation of some of the random components of noise.

Therefore, an appropriately low tilt value is calculated when there is no tilt in the core. This calculation has also been demonstrated to agree well with the arithmetic average method when there is a true tilt in the core. The planar vector average technique for the estimation of azimuthal power tilt is also used in the approved CECOR code. Therefore, this modification to COLSS is acceptable.

The purpose of the Technical Specification change to lower the minimum allowable value of TR is to reflect the reduced COLSS tilt estimate in the situation where there is no appreciable azimuthal power tilt in the core. However, since the minimum value of azimuthal tilt is 1.0, use of 1.0 for the TR in the CPC would result in frequent occurrences of the azimuthal tilt exceeding the TR, and therefore violating Technical Specification 3/4.2.3. This would increase the burden of the plant operators for compliance with the Action requirements specified in the Technical Specification. Therefore, the proposed Technical Specification change to reduce the minimum allowable value of the TR from 1.02 to 1.0 is not acceptable for the SONGS Units 2 and 3 Cycle 2 operation. We will review this change on a generic basis when more data on azimuthal tilt are available from operating experience of plants of CE design.

Proposed Change PCN-168:

Regulating CEA group 6 has been allowed to be inserted beyond the transient insertion limit during certain physics tests to determine temperature and power coefficients. Previously, only the center CEA was allowed to be misaligned during these tests. In addition, monitoring of DNBR margin has been added to the surveillance requirements.

This change is acceptable since the surveillance requires both the LHR and DNBR margin to be monitored continuously with the incore detector system during these tests. Power must be reduced if either the LHR or DNBR LCO is exceeded.

Proposed Change PCN-169:

The maximum weight of uranium in each fuel rod has been changed from 1807 grams to 1900 grams.

This is acceptable since variations in loading weights from cycle to cycle may occur and can be tolerated. Density variations would be accounted for in the nuclear design in order to assure that Technical Specification limits were not violated. In addition, even if all fuel rods in the core were at the upper bound, the 5% increase in fuel weight would translate into about a 2% increase in vertical load on the core support plate. This would have a negligible effect on the safety margin designed into the core support plate.

9.0 EVALUATION FINDINGS

The staff has reviewed the fuels, physics and thermal-hydraulics information presented in the SONGS Units 2 and 3 Cycle 2 reload report. The staff has also reviewed the Technical Specification revisions, the CPC/CEAC modifications, the safety reanalyses and the uncertainties derived for Cycle 2 by the SCU methodology. Based on the staff's evaluations given in the preceding sections, the proposed reload is acceptable. The staff also finds that all the proposed Technical Specifications except for change PCN-164 are acceptable. Technical Specification change PCN-164 proposes to reduce the minimum allowable value of the CPC addressable constant TR from 1.02 to 1.0. The staff has found that the use of 1.0 for TR is not reasonable and could result in frequent occurrences of the azimuthal tilt exceeding the TR. This would increase the burden of plant operators for compliance with the action requirement specified in Technical Specification 3/4.2.3. Therefore the proposed change is not acceptable for SONGS Units 2 and 3 Cycle 2 operation. The staff will review this change on a generic basis when more data on azimuthal tilt are available from operating experience of CE plants.

In addition, the acceptance of the software modifications and Technical Specification changes are based on the correctness of safety analysis, COLSS and CPC calculations and implementation. In summary, Cycle 2 operation of SONGS Units 2 and 3 is approved as described in this evaluation.

10.0 CONTACT WITH STATE OFFICIAL

The NRC staff has advised the Chief of the Radiological Health Branch, State Department of Health Services, State of California, of the proposed determinations of no significant hazards consideration. No comments were received.

11.0 ENVIRONMENTAL CONSIDERATION

These amendments invovlve changes in the installation of use of facility commponents located within the restricted area. The staff has determined that the amendments involve no significant increase in the amounts of any effluents that may be released offsite and that there is no significant increase in individual or cumlative occupation radiation exposure. The Commission has previously issued proposed findings that the amendments involve no significant hazards consideration, and there has been no public comment on such findings. Accordingly, the amendments meet the eligibility criteria for categorical exclusion set forth in 10 CFR Sec. 51.21(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need to prepared in connection with the issuance of these amendments.

12.0 CONCLUSION

Based upon the staff's evaluation of the proposed changes to the San Onofre Units 2 and 3 Technical Specifications, the staff has concluded that: there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, and such activities will be conducted in compliance with the Commission's regulations and the issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public. The staff therefore, concludes that the proposed changes are acceptable.

Dated: March 1, 1985

13.0 REFERENCES

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