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Director, Nuclear Regulatory Affairs and
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January 21, 2013

10 CFR 50.4

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

Subject: **Docket No. 50-361**
Response to Request for Additional Information (RAI 11)
Regarding Confirmatory Action Letter Response
(TAC No. ME 9727)
San Onofre Nuclear Generating Station, Unit 2

References:
1. Letter from Mr. Elmo E. Collins (USNRC) to Mr. Peter T. Dietrich (SCE), dated March 27, 2012, Confirmatory Action Letter 4-12-001, San Onofre Nuclear Generating Station, Units 2 and 3, Commitments to Address Steam Generator Tube Degradation
2. Letter from Mr. Peter T. Dietrich (SCE) to Mr. Elmo E. Collins (USNRC), dated October 3, 2012, Confirmatory Action Letter – Actions to Address Steam Generator Tube Degradation, San Onofre Nuclear Generating Station, Unit 2
3. Letter from Mr. James R. Hall (USNRC) to Mr. Peter T. Dietrich (SCE), dated December 26, 2012, Request for Additional Information Regarding Response to Confirmatory Action Letter, San Onofre Nuclear Generating Station, Unit 2

Dear Sir or Madam,

On March 27, 2012, the Nuclear Regulatory Commission (NRC) issued a Confirmatory Action Letter (CAL) (Reference 1) to Southern California Edison (SCE) describing actions that the NRC and SCE agreed would be completed to address issues identified in the steam generator tubes of San Onofre Nuclear Generating Station (SONGS) Units 2 and 3. In a letter to the NRC dated October 3, 2012 (Reference 2), SCE reported completion of the Unit 2 CAL actions and included a Return to Service Report (RTSR) that provided details of their completion.

By letter dated December 26, 2012 (Reference 3), the NRC issued Requests for Additional Information (RAIs) regarding the CAL response. Enclosure 1 of this letter provides the response to RAI 11.

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IE36
NRR

There are no new regulatory commitments contained in this letter. If you have any questions or require additional information, please call me at (949) 368-6240.

Sincerely,

Enclosures:

1. Response to RAI 11

cc: E. E. Collins, Regional Administrator, NRC Region IV
J. R. Hall, NRC Project Manager, SONGS Units 2 and 3
G. G. Warnick, NRC Senior Resident Inspector, SONGS Units 2 and 3
R. E. Lantz, Branch Chief, Division of Reactor Projects, NRC Region IV

ENCLOSURE 1

SOUTHERN CALIFORNIA EDISON

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

REGARDING RESPONSE TO CONFIRMATORY ACTION LETTER

DOCKET NO. 50-361

TAC NO. ME 9727

Response to RAI 11

RAI 11

Please submit an operational impact assessment for operation at 70% power. The assessment should focus on the cycle safety analysis and establish whether operation at 70% power is within the scope of SCE's safety analysis methodology, and that analyses and evaluations have been performed to conclude operation at 70% power for an extended period of time is safe. The evaluation should also demonstrate that the existing Technical Specifications, including limiting conditions for operation and surveillance requirements, are applicable for extended operation at 70% power.

RESPONSE

Note: This response includes information requested in RAI 14 associated with the operational impact assessment for operation at 70% power. RAI 14 states: "Provide a summary disposition of the U2C17 calculations relative to the planned reduction in power operation."

SCE has evaluated the extended reduced power operation for its impacts on the Unit 2 Cycle 17 reload core design and safety analysis. The power levels evaluated range from 50% to 100% rated thermal power, which bounds the planned operation at the 70% power level. The assessments were performed in accordance with NRC approved SONGS reload methodology and topical reports referenced in the UFSAR and Technical Specification (TS) 5.7.1.5, and the SONGS Core Reload Analyses and Activities Checklist procedure.

The impacts of extended reduced power operation on Unit 2 Cycle 17 core design and reload analyses, including UFSAR Chapter 15 safety analyses are summarized in Table 1, the impact assessment table. The impact assessment table is organized consistent with the SONGS Core Reload Analyses and Activities Checklist procedure. For each analysis, the Reload Checklist item number is listed in the second column from the left; when applicable, the second column also lists the UFSAR Chapter 15 safety analysis section number. The determination of impact for each analysis is summarized in the right column of the table.

Safety Analysis Methodology

The NRC approved safety analysis methods, as described in TS 5.7.1.5, are used to establish the core operating limits specified in the Core Operating Limits Report (COLR) which encompass from Mode 6 up to Mode 1 operation at the rated thermal power. Therefore, operating at the 70% power level is within the scope of SCE safety analysis methodology. No change to the safety analysis methodology is required for extended reduced power operation.

Safety Analysis

The reload and safety analyses determined to be impacted by extended reduced power operation were re-analyzed. The conclusions of the reload analyses, including safety analyses, for extended reduced power operation are as follows: (1) All safety analyses results meet the established acceptance criteria, and (2) The radiological dose consequences for all safety analyses remain bounded by the dose consequences reported in the UFSAR.

Technical Specifications

The existing TS, including limiting conditions for operation (LCO) and surveillance requirements, are applicable for extended operation at 70% power. The impact assessment for TS surveillance requirements is described in the following section.

Impact Assessment for Technical Specification Surveillance Requirements

The TS surveillance requirements were evaluated for the impacts of reduced power operation. The evaluation concluded all TS surveillance requirements under the reactor core design and monitoring program that would have been performed at approximately 82% power or at full power will be performed with the plant operating at approximately 70% power. The evaluation is summarized in Table 2.

Two surveillance procedures related to monitoring Reactor Coolant System (RCS) flow were revised to (1) reduce the minimum power required to perform the surveillances from 85% to 68% power, and to (2) account for the slightly increased RCS flow uncertainty at reduced power operation. No other surveillances were identified to be impacted by plant operation at 70% power.

Conclusions

Extended reduced power operation at 70% power has been evaluated and determined to be acceptable with respect to Unit 2 Cycle 17 reload core design and safety analysis. Reload analyses needed to support reactor startup and operation at 70% power have been completed. All TS LCO and surveillance requirements under the reactor core design and monitoring program normally performed at or above 70% power will be performed with the plant operating at approximately 70% power. The above evaluations demonstrate that the existing TSs, including limiting conditions for operation and surveillance requirements, are applicable for extended operation at 70% power.

Table 1
SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses

ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
1	0.1	Reload Ground Rules (RGR) Review	No change to analysis is required. No change to Rated Thermal Power (RTP). RGR still addresses 0% to 100% RTP operation. RGR addresses the full range of power independent and power dependent operating parameters, including those applicable at reduced power. The RGR Analysis Value defines the maximum or minimum value which must be bounded in the safety analysis. The number is not necessarily equivalent to the value used in an analysis (or Technical Specification) but will be conservative with respect to that value. The RGR Analysis Value includes applicable uncertainties and margins for which the safety analyses must be bounding.
2	1.1.3	Design Models and Depletions	Re-analysis was performed to determine impact, and all results were acceptable. Calculation revised to document depletion at 50% power from Beginning of Cycle (BOC) to End of Cycle (EOC) and comparison to 100% power. SONGS Unit 2 Cycle 17 (S2C17) at 50% power results in radial power distributions (at the same power level and burnup) essentially identical to depleting the core at 100% power. As the radial power distributions and distortion factors have been determined to be valid, no downstream analyses are impacted. Impact of extended reduced power operation on generic axial shapes and scram curves is addressed in Item 10 (1-D HERMITE model.)
3	1.1.4	Design Parameters and F_R Versus Power	No change to analysis is required. Radial power distributions and generic axial shapes remain applicable. Individual Control Element Assembly (CEA) worth, CEA bank worth, scram worth, peaking factors, distortion factors that are strongly dependent on the radial power distribution remain applicable. Extended reduced power operation results in less Pu-239 inventory. As such, generic bounding parameters (i.e., Fuel Temperature Coefficient (FTC), Moderator Temperature Coefficient (MTC), kinetics parameters) remain applicable. Critical Boron Concentrations (CBC) at Beginning of Cycle (BOC) are not affected. CBC at End of Cycle (EOC) is similar. Therefore, bounding boron concentration requirements and Inverse Boron Worths (IBW) are not impacted. Representative design parameter and Fr values for Reload Analysis Report (RAR) are not impacted.

Table 1 SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses			
ITEM #	**CHECKLIST ITEM (UFSAR SECTION)**	**DESCRIPTION**	**SUMMARY OF IMPACT ASSESSMENT**
4	1.1.5	Physics Input to LOCA, TORC, and FATES Analysis (including Pin Census)	No change to analysis is required for the physics inputs to LOCA analysis and TORC code analysis. BOC, limiting boron concentration, reactivity are not affected. Radial power distribution and peaking data remain applicable. Generic LOCA and TORC input parameters remain applicable. Re-analysis was performed for the physics input to Fuel Performance Analysis (FATES) code analysis. Radial fall-off curves, Fr, and fast flux data were regenerated for reduced power operation. Generic axial shapes remain applicable.
5	1.1.6	Physics Input to Fuel Mechanical Design	Re-analysis was performed to determine impact, and all results were acceptable. Calculation revised to provide power history data for AREVA Lead Fuel Assembly (LFA) mechanical design analysis. Also updated maximum core residence time for Westinghouse analysis. Other generic parameters for Westinghouse mechanical design analysis remain applicable due to similar radial power distribution.
6	1.1.7	Physics Input to ASGT	No change to analysis is required. Physics Input to Asymmetric Steam Generator Transient (ASGT) is performed at EOC with most negative Technical Specification MTC. Calculations performed at multiple power levels (90%, 70%, 50%, and 20%). Due to similar power distributions, results remain applicable.
7	1.1.8	Physics Input to Post-Trip Steam Line Break Analysis	No change to analysis is required. Analysis performed at EOC. Radial power distributions (at the same power level and burnup) are essentially identical. The MTC is tuned to the most negative Tech Spec value (-3.7E-4 $\Delta k/k/^{o}F$). Cooling down adds reactivity. More reactivity is added cooling from 100% power (higher T-fuel and T-mod) than reduced power to lower temperatures (e.g., 545°F, 300°F, 200°F, 68°F)
8	1.1.9	Physics Input to CEA Ejection Analysis	No change to analysis is required. Physics data in this analysis were generated at multiple power levels and the reduced power operating range is covered. Since the reduced power operation results in power distributions essentially identical to those from 100% power operation, the data generated from the original analysis are applicable to reduced power operation.
9	1.1.10	Physics Input to CEA Withdrawal	No change to analysis is required. Calculations performed at multiple power levels. Radial power distributions (at the same power level and burnup) are essential identical. CEA worth remains applicable since it is strongly dependent on power distribution. Limiting axial power shapes from axial shape index (ASI) search remain applicable.

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SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses

ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
10	1.1.11	1-D HERMITE Model	Re-analysis was performed to determine impact, and all results were acceptable. Analysis is revised to establish applicability of the generic axial shapes used in the design analyses and applicability of the SCRAM curves used in the design analyses. Analysis also shows that depletion at reduced power leads to essentially the same limiting shapes from ASI search as those selected for the analyses of the design depletions.
11	1.1.12	Physics Input to Steam Line Break Return-to-Power for Cycle N-1 Configuration	No change to analysis is required. This EOC event begins at 0% power. Radial power distributions (at the same power level and burnup) are essentially identical.
12	1.1.13	F_R Versus Temperature for Cooldown Events	No change to analysis is required. Bounding distortion factors were determined based on multiple CEA configurations, temperature ranges at BOC and EOC. Radial power distributions (at the same power level and burnup) are essentially identical.
13	1.1.14	Boron Requirement for SITs and BAMU Tanks	No change to analysis is required. The case run for this calculation is performed at hot zero power (HZP). The Xenon starting condition is Hot Full Power (HFP) which is conservative.
14	1.1.15	LOCA and Non-LOCA Source Term	No change to analysis is required. This analysis tests the Cycle 17 conditions of interest against the parameters required for applicability of the LOCA and Alternative Source Term (AST) source terms. The power level is used as a maximum not to be exceeded. Running Cycle 17 at reduced power results in less "short half-life" nuclides. Increase in "long half-life" nuclides due to extended calendar time is bounded by the lower production from extended reduced power.
15	1.1.16	Tritium Production	No change to analysis is required. Reduced power results in a decrease in tritium production. The analysis at 100% power is conservative.
16	1.1.17	STAR Physics Verification	No change to analysis is required. This analysis uses BOC (HZP) conditions (Mode 3) for *an assessment for S2C17 inclusion in the Startup Test Activity Reduction* (STAR) program.
17	1.1.18	Digital Setpoints Physics Data	No change to analysis is required. The case sets encompass LCO and Limiting Safety System Settings (LSSS) ASI ranges. Power level does not impact axial shapes significantly, so reduced powers are covered by the case set.

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SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses

ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
18	1.1.19	Physics RAR Inputs	Re-analysis was performed to determine impact, and all results were acceptable. RAR has been updated to reflect actual Cycle 16 EOC burnup and Cycle 17 reduced power operation.
19	1.2.1	Fuel Performance Analysis (FATES)	Re-analysis was performed to determine impact, and all results were acceptable. Reduced power results in fuel performance data that is not bounded when compared to the Generic Fuel Performance data generated for ZIRLO™ in Cycle 14 (data used in LOCA Analysis). A revision to the Fuel Performance and Setpoints Analyses was performed to determine the appropriate penalty factors such that the Generic Fuel Performance data remained bounding.
20	1.2.2	T-H Input Summary	No change to analysis is required. Calculation is a collection of input data that are not impacted by reduced power.
21	1.2.4	T-H Limiting Assembly and CETOP Benchmarking Analysis	No change to analysis is required. Power is not an input. Calculation is a benchmark of CETOP to TORC computer codes at reference departure from nucleate boiling (DNBR) points rather than a benchmark at a given power. This benchmark is mainly driven by power distributions from physics. Physics Models & Depletions has validated the power distributions used in the original calculation.
22	1.2.5	Mechanical Design Analysis (Fuel Vendor)	Re-analysis was performed to determine impact, and all results were acceptable. Westinghouse performed calculations to determine the impact of reduced power on the fuel mechanical design. AREVA performed calculations to determine the impact of reduced power on the Lead Fuel Assembly fuel mechanical design.
23	1.2.6	Power Operating Limit Partial Derivative Verification	No change to analysis is required. The calculation is driven by a large family of axial shapes, which are not impacted by the power reduction.
24	1.2.7	Setpoints Input Summary	Re-analysis was performed to determine impact, and all results were acceptable. Calculation has been revised to address the increased reactor coolant system (RCS) flow uncertainty at reduced power.
25	1.2.8	RCS Flow Uncertainties	Re-analysis was performed to determine impact, and all results were acceptable. Has been reanalyzed. RCS flow uncertainty increases due to reduced delta-temperature and increased secondary calorimetric power uncertainty.

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ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
26	1.2.9	Fuel Mechanical Design Verification	No change to analysis is required. The objective of the fuel mechanical design verification calculation is to document the design of the fuel based on the fuel vendor Bill of Materials, Design Drawings and the design and material specifications transmitted from the fuel vendor. Reduced power operation has no impact on this analysis.
27	1.2.11	Secondary Calorimetric Power Uncertainty	No change to analysis is required. Intermediate powers were explicitly analyzed in the original calculation.
28	1.2.12	Delta-T/Turbine Power Uncertainties	No change to analysis is required. The analysis uses a reference power error of 1.3% at full power. The increase in reference power (i.e., secondary calorimetric power) associated with performing delta-t/turbine power calibrations at reduced power would increase the uncertainties. The bounding results include ~0.50% of conservatism; therefore, the analysis of record (AOR) remains bounding. Intermediate powers were explicitly analyzed in the original calculation.
29	1.2.13	Cycle Independent Data and Setpoints Assumptions List (CIDSAL)	No change to analysis is required. CIDSAL provides cycle independent values to use or to be verified in downstream analyses. Reduced power operation does not impact the requirements for downstream analysis verification. None of the calculations explicitly performed in the analysis section are dependent upon nominal plant operating conditions or the power shapes/distributions at reduced power operation.
30	1.2.16	Core Protection Calculator (CPC) Calibration Allowances	No change to analysis is required. Intermediate powers were explicitly analyzed in the original calculation. Due to less decalibration, full power bounds lower power levels.
31	1.2.17	Fuel Duty Index	No change to analysis is required. Full power bounds lower power levels.
32	1.2.18	T-H MSCU Verification	No change to analysis is required. Power is not an input. Calculation is a verification of response surface at reference DNBR points rather than a benchmark at a given power.
33	1.2.19	CEA STAR Verification	No change to analysis is required. Radial power distributions (at the same power level and burnup) are essentially identical. At reduced power the plan is to continue to operate with all rods out. The duration and depth of lead bank CEA insertion beyond the typical all-rods-out position is monitored per the core follow procedure with notification/action to review the conservative CEA life analysis when insertion exceeds an insertion assumption within the analysis.

Table 1 SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses			
ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
34	1.3.1	Summary of Transients	Re-analysis was performed to determine impact, and all results were acceptable. Calculation was revised to perform an evaluation of all Updated Final Safety Analysis Report (UFSAR) Chapter 15 events for extended reduced power operation.
35	1.3.2	CENTS Cycle Update and Action Modules	No change to analysis is required. Calculation and associated computer files already accommodate power levels from 0 to 100 percent.
36	1.3.3 (15.10.1.3.1.1)	Main Steam Line Break (MSLB) Pre-Trip	No change to analysis is required. Pre-trip SLB is analyzed @100% power (with uncertainty). The generic physics inputs remain unchanged. Since the VOPT is generated on the rate of change in power setpoint (DELSPV), the actual trip occurs at the same power rise, independent of the starting power level. As this is a Required Over Power Margin (ROPM) event, the actual initial power level chosen is not significant to the event.
37	1.3.4 (15.10.1.3.1.2)	MSLB Post-Trip	No change to analysis is required. This event is limiting at hot zero power (HZP). HZP cases show greatest return to power since there is minimum initial stored energy, decay heat and scram worth at HZP conditions. There is no impact to the HZP cases since HZP physics inputs and initial conditions do not change. A reactivity balance for reduced power showed that net reactivity change remained negative.
38	1.3.5 (15.10.4.1.4)	Chemical Volume Control System (CVCS) Malfunction - Boron Dilution	No change to analysis is required. This is a BOC event that is not analyzed in Mode 1. The reactivity addition due to a boron dilution event is less adverse than the CEA Withdrawal event at Power and therefore Mode 1 and the higher power portion of Mode 2 are not explicitly addressed.
39	1.3.6 (15.10.4.1.1)	CEA Bank Withdrawal from Subcritical (CEAW @ SC)	No change to analysis is required. Event is evaluated at subcritical conditions. Note that this event is being re-evaluated to address the extended shut down.
40	1.3.6 (15.10.4.1.1)	CEA Bank Withdrawal at Low Power (CEAW @ HZP)	No change to analysis is required. Event is evaluated at hot zero power conditions.
41	1.3.6 (15.10.4.1.2)	CEA Bank Withdrawal at Power (CEAW @ Power, 50% & 100%)	No change to analysis is required. CEAW at reduced power is enveloped by CEAW @ 50% Power and CEAW @ 100% Power; and the results are acceptable.
42	1.3.8 (15.10.1.1.3)	Increased Main Steam Flow (IMSF)	No change to analysis is required. The system response is the same as IMSF+SF.

Table 1
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ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
43	1.3.8 (15.10.1.2.3)	IMSF with Single Failure (SF)	No change to analysis is required. IMSF+SF (fast & slow) analyzed @100% power. The generic physics inputs remain unchanged. The fast case credits the VOPT which is generated on the rate of change in power (DELSPV) setpoint, as such the actual trip occurs at the same power rise, independent of the starting power level. Since the fast case is a Required Over Power Margin (ROPM) event, the actual initial power level chosen is not significant to the event. The limiting event is the slow trip, which is initiated from a Power Operating Limit. As such, the actual initial power level chosen is not significant to the event.
44	1.3.9 (15.10.4.3.2)	CEA Ejection	Re-analysis was performed to determine impact, and all results were acceptable. The event is normally analyzed at multiple power levels. It was reanalyzed to address reduced power data from the fuel performance analysis.
45	1.3.10 (15.10.3.3.1)	Reactor Coolant Pump Shaft Seizure	No change to analysis is required. Bounded by Reactor Coolant Pump Sheared Shaft (RCPSS).
46	1.3.10 (15.10.3.3.2)	Reactor Coolant Pump Sheared Shaft (RCPSS)	No change to analysis is required. This is a margin/ fuel failure calculation event. The thermal margin loss for this event is initiated by the loss of flow from one pump (either seized rotor or sheared shaft). The reduction of thermal margin due to the loss of flow from one pump is not a function of the initial power (i.e., is constant at any power level). In addition, at reduced power, the initial thermal margin is larger than at the 100% power condition. Therefore, the analysis at full power is bounding.
47	1.3.11 (15.10.2.1.3)	Loss of Condenser Vacuum (LOCV)	No change to analysis is required. Bounded by LOCV+SF
48	1.3.11 (15.10.2.2.3)	LOCV with Single Failure	No change to analysis is required. This event is driven by plant response and not by detailed core physics. There are two criteria (peak RCS pressure and peak secondary pressure). At lower powers, there is less internal energy in the reactor core, which translates into a slower RCS pressure transient that is more rapidly mitigated by main steam safety valves (MSSVs). The peak secondary pressure event is evaluated at multiple power levels to establish the allowed power level as a function of the number of gagged MSSVs (Tech Spec 3.7.1).
49	1.3.12 (15.10.6.3.2)	Steam Generator Tube Rupture (SGTR)	No change to analysis is required. The SGTR is a slow event and not sensitive to initial power. Furthermore, at lower powers there is a higher secondary pressure that translates to lower primary-to-secondary rupture flow (i.e., lower activity release).

Table 1
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ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
50	1.3.13 (15.10.1.1.4)	Inadvertent Opening of a Steam Generator Safety or an Atmospheric Dump Valve (IOSGADV)	No change to analysis is required. See IOSGADV+SF
51	1.3.14 (15.10.1.2.4)	IOSGADV with Single Failure	No change to analysis is required. The IOSGADV+SF is analyzed at a power level of 1 MWt.
52	1.3.15 (15.10.9.1.1)	Asymmetric Steam Generator Transient (ASGT)	No change to analysis is required. The ASGT event was analyzed in the AOR at multiple power levels (90%, 70%, 50%, and 20%).
53	1.3.16 (15.10.1.1.1)	Decrease in Feedwater Temp (DFWT)	No change to analysis is required. Since feedwater heating is reduced at reduced power, the potential loss in feedwater heating is also reduced. Impact at reduced power is also mitigated by increased mass in RCS and Steam Generators (SGs) and increased recirculation in SGs at lower power.
54	1.3.17 (15.10.1.2.1)	DFWT with Single Failure	No change to analysis is required. Since feedwater heating is reduced at reduced power, the potential loss in feedwater heating is also reduced. Impact at reduced power is also mitigated by increased mass in RCS and Steam Generators and increased recirculation in SGs at lower power.
55	1.3.18 (15.10.1.1.2)	Increase in Feedwater Flow (IFF)	No change to analysis is required. Primary to secondary heat transfer is dominated by heat of vaporization (Hfg) which is considerably greater than steam generator enthalpy rise resulting from sensible heat. Consequently, cool downs resulting from Increases in Feedwater Flow events are limited by Increases in Main Steam Flow events. Further, Increases in Steam Flow events occur more rapidly as changes in Feed Water are mitigated by the liquid mass and recirculation flow in the steam generators. Further factors that mitigate Increasing Feedwater Flow events at reduced power include greater RCS / SG mass, increased recirculation flow in the steam generators, greater steam generator pressure and earlier reactor trip from increased feedwater flow - steam flow mismatch.
56	1.3.18 (15.10.1.2.2)	IFF with Single Failure	No change to analysis is required. The most adverse single failure postulated for IFF is the opening of all Steam Bypass Control System (SBCS) valves. Because the Increase in Main Steam Flow (IMSF) event postulates the opening of all SBCS valves and assumes that Main Feedwater flow increases to match steam flow, the IFF with Single Failure is the essentially the same event as the IMSF event. Therefore, conclusions regarding IMSF are applicable to IFF with Single Failure.

Table 1
SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses

ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
57	1.3.19 (15.10.2.1.1)	Loss of External Load (LOL)	No change to analysis is required. The system response to the Loss of External Load, Turbine Trip, and the Loss of Condenser Vacuum are essentially the same. Therefore, the relationship between the events will remain the same at reduced power. As such these events remain bounded by LOCV.
58	1.3.19 (15.10.2.2.1)	LOL with Single Failure	No change to analysis is required. The system response to the Loss of External Load with single failure, Turbine Trip with single failure, and the Loss of Condenser Vacuum with single failure are essentially the same. Therefore, the relationship between the events will remain the same at reduced power. As such these events remain bounded by LOCV+SF.
59	1.3.19 (15.10.2.1.2)	Turbine Trip (TT)	No change to analysis is required. The system response to the Loss of External Load, Turbine Trip, and the Loss of Condenser Vacuum are essentially the same. Therefore, the relationship between the events will remain the same at reduced power. As such these events remain bounded by LOCV.
60	1.3.19 (15.10.2.2.2)	TT with Single Failure	No change to analysis is required. The system response to the Loss of External Load with single failure, Turbine Trip with single failure, and the Loss of Condenser Vacuum with single failure are essentially the same. Therefore, the relationship between the events will remain the same at reduced power. As such these events remain bounded by LOCV+SF.
61	1.3.20 (15.10.2.1.4)	Loss of Normal AC Power (LONAC)	No change to analysis is required. See LONAC+SF
62	1.3.20 (15.10.2.2.4)	LONAC with Single Failure	No change to analysis is required. Operation at lower power level is less challenging with respect to maintaining an adequate heat sink.
63	1.3.21 (15.10.2.2.5)	Loss of Normal Feedwater (LONF or LOFW)	No change to analysis is required. See LOFW+SF
64	1.3.21 (15.10.2.3.2)	LOFW with Single Failure	No change to analysis is required. Operation at lower power level is less challenging with respect to maintaining an adequate heat sink.

Table 1
SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses

ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
65	1.3.22 (15.10.2.3.1)	Feedwater System Pipe Breaks (FSPB or FWLB)	No change to analysis is required. Peak primary and secondary pressure events were analyzed at the least negative MTC value and main feedwater enthalpy corresponding to full power. The slightly higher MTC corresponding to reduced power is offset by the lower main feedwater enthalpy at reduced power. Operation at lower power level is less challenging with respect to maintaining an adequate heat sink. The energy in the plant is less at reduced power relative to full power, and therefore pressurizer overfill is bounded by the full power response.
66	1.3.23 (15.10.5.1.1)	CVCS Malfunction	No change to analysis is required. See CVCS Malfunction+SF.
67	1.3.23 (15.10.5.2.1)	CVCS Malfunction with Single Failure	No change to analysis is required. The energy in the plant is less at reduced power relative to full power, and therefore pressurizer overfill is bounded by the full power response. Operation at lower power level is less challenging with respect to maintaining an adequate heat sink.
68	1.3.24	Pressurizer Spray Malfunction	No change to analysis is required. See Core Protection Calculator (CPC) Dynamic Filter Analysis.
69	1.3.25 (15.10.4.1.5)	Reactor Coolant Pump (RCP) - Start Up of an Inactive Loop	No change to analysis is required. Modes 1 and 2 were not analyzed because operation in these Modes is only allowed with all 4 RCPs running.
70	1.3.27 (15.10.4.3.2)	CEA Ejection (peak pressure analysis)	No change to analysis is required. The event is limiting at hot zero power (HZP).
71	1.4 (15.10.6.3.3)	Emergency Core Cooling System (ECCS) Analyses including LBLOCA, SBLOCA and LTC	Re-analysis was performed to determine impact, and all results were acceptable. Impact assessment addressed in analyses performed by Fuel Vendors.
72	(15.10.5.1.2)	Inadvertent Operation of ECCS at Power (IOECCS)	No change to analysis is required. The system response to the IOECCS and CVCS malfunction events are essentially the same. Therefore, the relationship between the events will remain the same at reduced power. As such this event continues to be bounded by CVCS malfunction event.
73	(15.10.5.2.2)	IOECCS with Single Failure	No change to analysis is required. The system response to the IOECCS with single failure and CVCS malfunction with single failure events are essentially the same. Therefore, the relationship between the events will remain the same at reduced power. As such this event continues to be bounded by CVCS malfunction event with single failure.

Table 1
SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses

ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
74	(15.10.6.3.1)	Primary Sample or Instrument Line Break (PSILB)	No change to analysis is required. Mass releases are driven by energy in the primary system which is highest following operation at HFP. The event does not fail fuel, and there is no ROPM requirement.
75	(15.10.6.3.4)	Inadvertent Opening of a PSV (IOPSV)	No change to analysis is required. The IOPSV event is bounded by small break LOCA.
76	1.5.1	Applicability Evaluation of Source Terms in Dose Analyses	No change to analysis is required. There is no change to core activity inventory source term.
77	1.5.2	Cycle Specific Dose Analysis	No change to analysis is required. No Cycle 17 event-specific dose analysis was performed, therefore no impact for reduced power.
78	1.5.4	Applicability Evaluation of Dose Analyses	Re-analysis was performed to determine impact, and all results were acceptable. Revised to document that the currently modeled radial peaking factors are conservatively greater than the increased radial peaking factors at reduced power. The transient analyses and mass release analyses are evaluated at the current 8% steam generator (SG) tube plugging limit. The dose calculation uses mass release data per the transient analyses and their assumed 8% SG tube plugging models. The calculation is revised with discretionary conservatism to model 20% SG tube plugging in the calculation of the RCS dilution volume and mass considered for non-LOCA events which have clad damage. Evaluated RCS dilution mass at RCS temperatures for both 50% and 100% power, which envelopes powers between 50% and 100%. The mass release calculations are evaluated for a core inlet temperature (Tcold) of 560F, which maximizes core average temperature (Tave). Currently modeled mass release values in the Summary of Transients (SOT) correspond to full power operation. The SOT did not identify an increase in the amount of steam released from the secondary side because it remains more limiting compared to operation at lower power level due to lower sensible heat in the RCS and lower post trip decay heat.

Table 1
SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses

ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
79	n/a	Fuel Corrosion and Oxide Thickness (BOA Code) analysis	No change to analysis is required. The Westinghouse BOA code analysis for cycles 15, 16 and 17 was performed as part of the Zinc Injection project. This calculation compared predicted values for corrosion and oxide thickness, Fuel Duty Index and crud dryout to the Westinghouse Chemistry Guideline limits. Maximum values of Fuel Duty Index and Crud Dryout are driven by fresh fuel operating at high power. Operation at reduced power would be bounded by the 100% power cases run in the analysis of record (AOR). Maximum values of corrosion and oxide thickness are driven by both power level and effective full power days (EFPD). The AOR assumed a core operating strategy which would maximize corrosion and oxide; running fuel for three full cycles, a total of 1830 EFPD. Table 2-1 of the AOR showed that the maximum predicted oxide thickness for U2C17 is 28.4 microns, well below the 100 micron limit. Operation at reduced power for longer time would not significantly change the fuel rod corrosion rate, and there is substantial margin to the 100 micron limit.
80	n/a	AREVA Lead Fuel Assembly (LFA) compatibility	Re-evaluation was performed to determine impact, and all results were acceptable. Compatibility was verified by AREVA as documented in revised U2C17 Reload Analysis Report (RAR).
81	n/a	WEC Lead Fuel Assembly (LFA) compatibility	Re-evaluation was performed to determine impact, and all results were acceptable. Compatibility was verified by Westinghouse as documented in revised U2C17 RAR.
82	n/a	AREVA and WEC Chemistry concurrence	Re-evaluation was performed to determine impact, and all results were acceptable. Concurrence for reduced power operation was performed by Westinghouse and AREVA as documented in revised U2C17 RAR.
83	1.6.1	Reload Analysis Report (RAR)	Re-analysis was performed to determine impact, and all results were acceptable. Revised to address extended operation at reduced power.
84	1.6.2	Engineering Change Package (ECP) and 10CFR50.59 Review	Re-evaluation was performed to determine impact, and all results were acceptable. 10CFR50.59: New 10CFR50.59 review issued to address the extended operation at reduced power. ECP: Affected Section Change (ASC) issued to address the extended operation at reduced power.

Table 1
SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses

ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
85	2.1.2	Physics Input to FLCEA Drop Analysis and PFDTME Verification	No change to analysis is required. Power distributions at the same power level and burnup are essentially identical. Analysis performed at multiple power levels.
86	2.1.3	Physics Input to PLCEA Drop Analysis	No change to analysis is required. Power distributions at the same power level and burnup are essentially identical. Analysis performed at multiple power levels.
87	2.1.5	Physics Input to CEA Deviation Within CPC Deadband	No change to analysis is required. Power distributions at the same power level and burnup are essentially identical. Analysis performed at multiple power levels.
88	2.1.9	Refueling Boron Concentration	No change to analysis is required. Analyzed at BOC, Mode 6.
89	2.1.10	CIDSAL Physics Verification	No change to analysis is required. Radial power distributions (at the same power level and burnup) are essentially identical. T-inlet program remain unchanged.
90	2.2.1 (15.10.4.1.3)	CEA Misoperation - Deviation within Dead Band (DWDB)	No change to analysis is required. Power distributions at the same power level and burnup are essentially identical. Analysis performed at multiple power levels.
91	2.2.2 (15.10.4.1.3)	CEA Misoperation - PLR Drop - Power ≤ 50%	No change to analysis is required. Power distributions at the same power level and burnup are essentially identical. Event scenario is defined at ≤ 50% Power. Scenarios at >50% power are discussed in "CEA Misoperation - Single Part Length CEA Drop (PLR Drop) - Power > 50%."
92	2.2.3 (15.10.4.1.3)	CEA Misoperation - Single Full Length CEA Drop (FLCEA Drop)	No change to analysis is required. Power distributions at the same power level and burnup are essentially identical. Analyzed at multiple power levels.
93	2.2.3 (15.10.4.1.3)	CEA Misoperation - Single Part Length CEA Drop (PLCEA Drop) - Power > 50%	No change to analysis is required. Power distributions at the same power level and burnup are essentially identical. Analyzed at multiple power levels.
94	2.2.3 (15.10.4.1.3)	CEA Misoperation - Sub Group CEA Drop	No change to analysis is required. Power distributions at the same power level and burnup are essentially identical. Analyzed at multiple power levels.
95	2.2.4	AOPM Analysis	No change to analysis is required. Power distributions at the same power level and burnup are essentially identical. Analyzed at multiple power levels.
96	2.2.5	Transient Thermal Margin Summary	No change to analysis is required. Analyzed at multiple power levels.

Table 1
SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses

ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
97	2.2.6 (15.10.3.1.1)	Partial Loss of RCS Flow (PLOF)	No change to analysis is required. Bounded by TLOF.
98	2.2.6 (15.10.3.2.2)	PLOF with Single Failure	No change to analysis is required. Bounded by RCPSS.
99	2.2.6 (15.10.3.2.1)	Total Loss of Forced Reactor Coolant Flow (TLOF)	No change to analysis is required. The total loss of coolant flow event was analyzed for a bounding scenario at 100% power and a MTC of $+0.5\times10^{-4}$ $\Delta\rho/°F$. This scenario bounds all powers from 0 to 100%.
100	2.2.6 (15.10.3.3.3)	TLOF with Single Failure	No change to analysis is required. Bounded by RCPSS.
101	2.2.7	CPC Dynamic Filter Analysis (including the Pressurizer Spray Malfunction)	No change to analysis is required. The bounding events considered include CEA Withdrawal, Excess Load events, etc. As the system response time for these events has not changed, the dynamic filter analysis remains conservative.
102	2.3.4	MSOUA Database and Files	No change to analysis is required. The impact of RCS flow uncertainty changes has been captured in MSOUA Post-Processor.
103	2.3.5	CPC Reload Data Block (RDB) Update	No change to analysis is required. Reduced power has been implemented through CPC Type 2 addressable constants, and not CPC RDB.
104	2.3.6	MSOUA Post Processor	Re-analysis was performed to determine impact, and all results were acceptable. Calculation has been revised for RCS flow uncertainty and the change in UNCERT from the FATES fuel performance analysis.
105	2.3.7	Core Operating Limits Supervisory System (COLSS) & CPC Operating Margin Assessment	No change to analysis is required. Calculation is a prediction of operating margin at full power. Reduced power increases operating margin.
106	2.3.8	COLSS Database	No change to analysis is required. No changes are being made to the manner in which COLSS functions or responds. Therefore the cycle independent constants do not require change. The installed Primary ΔT power Block I constants were verified to be bounding. The cycle specific constants that are impacted by reduced power operation have been addressed in the COLSS As-built Database and Test Cases calculation.
107	3.1.1	Full Core Load Map	No change to analysis is required. Fuel management not changed.

Table 1 SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Reload and UFSAR Chapter 15 Safety Analyses			
ITEM #	CHECKLIST ITEM (UFSAR SECTION)	DESCRIPTION	SUMMARY OF IMPACT ASSESSMENT
108	3.1.3	As-Built Models and Depletions	Re-analysis was performed to determine impact, and all results were acceptable. Calculation was revised to address extended reduced power operation and to verify Lead Fuel Assembly (LFA) compatibility operational requirements.
109	3.1.4	CECOR Coefficients	Impacted, and all results were acceptable. Calculation was revised to address extended reduced power operation.
110	3.1.5	As-Built Mini Depletion	Re-analysis was performed to determine impact, and all results were acceptable. Calculation revised to address extended reduced power operation.
111	3.1.6	Decay Heat	No change to analysis is required. Decay heat was evaluated at end of Cycle 16 condition. The calculation specifically addresses outage times past 99 days.
112	3.1.7	Simulator Data	Re-analysis was performed to determine impact, and all results were acceptable. Calculation revised to address extended reduced power operation.
113	3.1.8	Special Nuclear Material Database Update	No change to analysis is required. The change to Cycle 17 operating power will have no effect on prior cycle spent fuel and its characteristics.
114	3.1.9	Plant Physics Data Book	Re-analysis was performed to determine impact, and all results were acceptable. Data Book has been revised to address extended reduced power operation.
115	3.1.10	Startup Physics Test Predictions	Re-analysis was performed to determine impact, and all results were acceptable. Calculation has been revised to address changes to startup testing power plateaus.
116	3.2.1	COLSS As-built Database and Test Cases	Re-analysis was performed to determine impact, and all results were acceptable. Calculation has been revised to address extended reduced power operation impact on the cycle specific COLSS reload constants for DNBR & Linear Heat Rate (LHR) penalties.
117	3.2.2	CEFAST Database Analysis	Re-analysis was performed to determine impact, and all results were acceptable. Calculation has been revised to address extended reduced power operation impact on the cycle specific CPC reload constants for DNBR & Local Power Density (LPD) penalties.

Table 2 SONGS Unit 2 Cycle 17 Reduced Power Operation – Summary of Impact Assessment of Core Design and Monitoring Technical Specification Surveillance Requirements			
Surv #	**Surveillance Topic**	**Power Applicability and Surveillance Frequency**	**Summary of Impact Assessment for Performing at 68-70% Power**
3.1.3.1	Reactivity Balance	Every 31 EFPD	Steady state power (not full power) is required
3.1.4.1	MTC within positive limit	Prior to Mode 1	Performed at Hot Zero Power and projected to BOC 70% conditions
3.1.4.2	MTC within negative limit	Within 14 EFPD of peak Boron @ RTP	Peak boron occurs at BOC, – performed at Hot Zero Power and projected to HFP EOC conditions
3.1.4.2	MTC within negative limit	Within ± 30 EFPD of 2/3 of expected core burnup	Steady state power (not full power) is required; projected to HFP EOC conditions
3.2.2.1	CPC & COLSS Fxy > measured Fxy (CECOR)	Between 40% - 85% (i.e., prior to exceeding 85%)	68%-70% is within the power range required for surveillance
3.2.2.1	CPC & COLSS Fxy > Measured Fxy (CECOR)	Every 31 EFPD	Steady state power (not full power) is required
3.2.3.3	CPC Azimuthal Tilt > Measured Tilt (CECOR)	Every 31 EFPD	Steady state power (not full power) is required
3.3.1.2	RCS Flow in CPCs < Measured RCS Flow	Every 12 hours (not required until 12 hours after power > 85% RTP)	Procedure changed to perform surveillance at ≥ 68% power
3.3.1.5	RCS Flow by calorimetric	Every 31 days (not required until 12 hours after power > 85% RTP)	Procedure changed to perform surveillance at ≥ 68% power, and to require additional margin when surveillance is performed during extended operation at < 95% power
3.3.1.11	CPC Shape Annealing Matrix (SAM) Verification	Prior to exceeding 85%	A minimum ASI change, rather than a specific power level, is required
N/A	Startup Test Activity Reduction Program Reactivity Balance HZP - HFP	Normally performed after reaching full power	Results are already adjusted from actual test conditions to RTP conditions as a part of the test method