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

November 30, 2012

Mr. Peter T. Dietrich
Senior Vice President and Chief Nuclear Officer
Southern California Edison Company
San Onofre Nuclear Generating Station
P.O. Box 128
San Clemente, CA 92674-0128

SUBJECT: SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3 - REGULATORY AUDIT REQUEST RE: LICENSE AMENDMENT REQUEST FOR USE OF AREVA FUEL (TAC NOS. ME6820 AND ME6821) AND REQUEST FOR PERMANENT EXEMPTION FOR USE OF AREVA FUEL (TAC NOS. ME6822 AND ME6823)

Dear Mr. Dietrich:

By application dated July 29, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML112150247), as supplemented by letters dated September 14, September 27, and November 5, 2012 (ADAMS Accession Nos. ML12263A300, ML12275A418, and ML12310A408, respectively), Southern California Edison (SCE, the licensee) submitted a request for an amendment to the Technical Specifications (TSs) for San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS). The proposed license amendment request is to support the transition to AREVA's 16x16 HTP fuel to replace the Westinghouse-Combustion Engineering 16x16 fuel currently used at SONGS. Portions of the letters dated July 29, 2011, September 14, 2012, and September 27, 2012, contain sensitive unclassified non-safeguards information and, accordingly, those portions have been withheld from public disclosure.

The scope of this application consists of:

1. A request for permanent license exemption for SONGS from the requirements of paragraph (a)(1)(i) of Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," of Title 10 of the *Code of Federal Regulations* (10 CFR), and Appendix K, "ECCS Evaluation Models," to 10 CFR Part 50, that will allow SONGS to use AREVA fuel with M5 cladding (a temporary exemption was granted to support SONGS lead test assembly program).

2. Changes to the SONGS TS 5.7.1.5, "Core Operating Limits Report (COLR)," methodology reference list to support the core design with the new AREVA fuel. The requested additions consist of: (a) AREVA's realistic large break loss-of-coolant accident (RLBLOCA) methodology (EMF-2103(P)(A)); (b) AREVA's pressurized-water reactor small break LOCA (SBLOCA) methodology (EMF-2328(P)(A)); and (c) BAW-10240(P)-A, AREVA's topical report that incorporates M5 properties in Framatome ANP-approved methods.

3. Changes to TS 4.2.1, "Fuel Assemblies," to include the description of the new fuel cladding material, M5.

4. Updates to the SONGS TS 2.1.1.2, "Reactor Safety Limits," to identify a fuel centerline melt safety limit with corresponding adjustments made to account for the burnable absorber fuel rods.

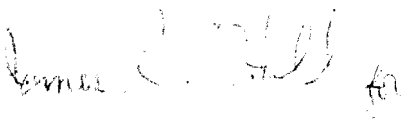
SCE provided the following documents as enclosures and attachments to its license amendment request:

- Enclosure 2, Licensee's Evaluation - Permanent Exemption Request and SONGS PCN 600 Request for Unrestricted Use of AREVA Fuel
  - Attachment A, Listing of Acronyms
  - Attachment B, Technical Specification and Bases Changes
  - Attachment C, SONGS – Summary of Impact on UFSAR Chapter 15 Events
  - Attachment D, Compilation of Calvert Cliffs RAIs – Application to SONGS and Responses
  - Attachment E, Evaluation of AREVA SER and TER Methodology Limitations
- Enclosure 3, ANP-2975(P), Revision 0, San Onofre Nuclear Generating Station Unit 2 and Unit 3 Realistic Large Break LOCA Report, June 2011.
- Enclosure 4, San Onofre Nuclear Generating Station Unit 2 and Unit 3 Small Break LOCA Report, July 2011.

The NRC staff intends to perform a regulatory audit of supporting documents in accordance with Office of Nuclear Reactor Regulation Office Instruction LIC-111, "Regulatory Audits." The audit will be scheduled once the licensee notifies the NRC that the requested enclosed information is assembled. The Enclosure lists the documents that the NRC staff intends to review during the regulatory audit. The documents listed correspond to the specified sections from the license amendment request or to the NRC staff's requests for additional information.

If you have any comments or concerns, please contact Brian Benney, Senior Project Manager, at 301-415-2767 or via e-mail at brian.benney@nrc.gov.

Sincerely,



Douglas A. Broaddus, Chief
SONGS Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-361 and 50-362

Enclosure:
As stated

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LIST OF SUPPORTING DOCUMENTS FOR REGULATORY AUDIT

RELATED TO LICENSE AMENDMENT REQUEST FOR

SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3

FOR USE OF AREVA FUEL AND FOR PERMANENT EXEMPTION

By application dated July 29, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML112150247), as supplemented by letters dated September 14, September 27, and November 5, 2012 (ADAMS Accession Nos. ML12263A300, ML12275A418, and ML12310A408, respectively), Southern California Edison (SCE, the licensee) submitted a request for an amendment to the Technical Specifications (TSs) for San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS). The proposed license amendment request (LAR) is to support the transition to AREVA's 16x16 HTP fuel to replace the Westinghouse (W)-Combustion Engineering (CE) 16x16 fuel currently used at SONGS.

The U.S. Nuclear Regulatory Commission (NRC) staff intends to perform a regulatory audit of supporting documents in accordance with Office of Nuclear Reactor Regulation Office Instruction LIC-111, "Regulatory Audits." The audit will be scheduled once the licensee notifies the NRC that the requested information is assembled.

During the regulatory audit, the NRC staff will focus on the following areas of the LAR:

- Documents related to fuel transition at SONGS,
- Documents related to setpoint analyses,
- Documents related to realistic large break loss-of-coolant accident (RLBLOCA) analysis, and
- Documents related to small break LOCA (SBLOCA) analysis

Below is the list of documents that the NRC staff intends to review during the audit. The sections of the LAR that correspond to the listed documents are provided in parentheses.

1. All documents related to SONGS M5 clad and fuel analyses using the CE/W code, FATES3B. The documents include the following M5 properties (Enclosure 2, Section 4.3.3):

   a. Fuel growth (axial growth) (Enclosure 2, Section 4.3.3.1.5),

   b. Creep (Section 4.3.3.1.2),

   c. Thermal conductivity (Section 4.3.3.1.5),

d. Thermal expansion coefficient (Section 4.3.3.1.6),

e. Poisson's ratio (Section 4.3.3.1.4),

f. Elastic modulus (Section 4.3.3.1.3), and

g. Validation and verification of acceptance criteria for the SONGS analyses (Section 4.3.3.2).

2. Rod bow penalty analysis calculations for Westinghouse and AREVA fuel designs (Enclosure 2, Section 4.2.2).

3. SCE's fuel rod behavior analysis and calculations that support the non-LOCA transient analyses (Enclosure 2, Section 4.3.2).

4. SCE fuel rod behavior analyses (per Reference 8.25 of Section 8 of Enclosure 2) and calculations that support SCE Setpoints analyses, specifically using FATES3B with M5 calculations (Enclosure 2, Section 4.3.2).

5. Analyses and supporting calculations for the following characteristics of the fuel where the thermal conductivity degradation (TCD) with burnup has a significant effect (Enclosure 2, Sections 4.3.3.3 and 7.3):

   a. Fuel temperature (Sections 4.3.3.3.1 and 7.3.1),

   b. Power-to-melt ratio (Sections 4.3.3.3.2 and 7.3.2),

   c. Internal hot gas pressure calculations for both CE/W and AREVA fuel designs (Sections 4.3.3.3.3 and 7.3.3),

   d. Deposited energy (fuel pin enthalpy) - STRIKIN calculations for control element assemblies (CEA) ejection analysis (Enclosure 2, Section 4.5.4.1),

   e. Calculations that generated Figures 4.3.4 through 4.3.8 (Enclosure 2, Section 4.3.3.3), and

   f. Calculations that generated Figures 7.3.1 through 7.3.7 (Enclosure 2, Section 7.3).

6. Documents that explain how the fuel TCD due to burnup and addition of Gadolinium (Gd) for the UO2 fuel is modeled in RODEX3A. The impact of the TCD and addition of Gd on the following characteristics of the fuel must be explained (All relevant sections of ANP-2975):

   a. Fuel temperature calculations,

   b. Initial stored energy in the fuel (for LOCA),

c. Fission gas release,

d. Fuel cladding gap conductance, and

e. Supporting calculations for Section 6.1 *Thermal Conductivity Degradation – Once Burnt Fuel* of ANP-2975(P), Revision 0, *San Onofre Nuclear Generating Station Units 2 and 3 Realistic Large Break LOCA Report.*

7. SONGS has used the TORC code for thermal margin calculations by introducing AREVA NP's BHTP correlation which has not been approved by the NRC. The following documents need to be reviewed during the audit (Enclosure 2, Sections 4.2 and 7.2):

   a. Details of modified TORC thermal margin calculations,

   b. Statistical combination of uncertainties in departure from nucleate boiling (DNB) calculations,

   c. A Users Manual for the modified TORC code, and

   d. Verification and validation analyses calculations for the modified TORC results.

8. The following analyses and calculations for the mixed core:

   a. Mixed core characterization - It is customary for the licensee to perform a mixed core characterization analysis if there are geometry differences between the resident and co-resident fuel systems. The NRC staff intends to verify that a characterization evaluation was performed for the SONGS mixed transition cores.

   b. Thermal and hydraulic compatibility analyses for mixed core that shows that the AREVA 16x16 fuel is compatible with the co-resident CE 16x16 fuel. The analysis should demonstrate that the hydraulic and thermal margin performance of the core will not significantly be impacted by the introduction of the new AREVA 16x16 fuel assemblies into the SONGS core. Hydraulic compatibility should include the assessment of the impact of AREVA fuel on core flow distribution. Thermal compatibility analysis should evaluate the impact on departure from nucleate boiling ratio (DNBR) calculations due to the introduction of AREVA fuel.

      Note: Section 5.1.3 of Enclosure 2 states, "Overall, the mechanical compatibility evaluations performed for the LFA program, and the evaluations of the changes planned for the reload AREVA fuel have confirmed that the AREVA fuel assemblies are compatible with the SONGS reactor components and the co-resident fuel in the SONGS core." The NRC staff notes that the compatibility evaluations for lead fuel assemblies (LFAs) are not sufficient for the reload core, since the LFAs were limited in number and they were approved for non-limiting locations in the SONGS core.

9. AREVA fuel assembly structural response to seismic and LOCA loads (safe shutdown earthquake (SSE) + LOCA) that accounts for the SONGS-specific licensing basis (In Section 5.1.2 of Enclosure 2 of the LAR, the licensee states that the reload assemblies have two component changes to improve seismic margin.):

   a. Calculations that support AREVA fuel assembly structural response to seismic and LOCA loads. The details should include the methodology of analysis, uncertainty allowances and combination of loads from natural phenomena and accident conditions (i.e., Seismic and LOCA).

   b. Analyses that support SONGS AREVA fuel assembly structural response to externally applied forces (seismic and LOCA) and that will show how the acceptance criteria per Standard Review Plan (SRP, NUREG-0800, Chapter 4.2, Appendix A, Section IV) is satisfied.

10. Analyses documents for the following transients (Attachment C of Enclosure 2):

   a. Increase in main steam flow (IMSF),

   b. Single reactor coolant pump shaft seizure,

   c. Total loss of forced reactor coolant flow (TLOF),

   d. Single reactor coolant pump sheared shaft (RCPSS),

   e. Uncontrolled CEA withdrawal (CEAW) from a subcritical or low power condition,

   f. Uncontrolled CEA withdrawal (CEAW) at power, and

   g. Steam generator tube rupture (SGTR).

11. Documents related to the following RLBLOCA analyses/calculations (ANP-2975):

   a. Break spectrum analysis,

   b. Calculations using RODEX3A generating initial conditions for S-RELAP5,

   c. Peak cladding temperature (PCT) analysis,

   d. Long-Term Core Cooling analyses (LTC) - Section 4.6 indicates that "The current Westinghouse post-LOCA Long Term Core Cooling analyses will remain applicable for both AREVA and Westinghouse fuel." An examination of updated SONGS FSAR Section 6.3.3.4, Post-LOCA Long Term Cooling indicates that the LTC for San Onofre Units 2 and 3 was "performed using the NRC approved codes and methods documented in CENPD-254-P-A...." By letter dated August 1, 2005 (Agencywide Documents Access and Management System Accession No. ML051920310), from the NRC to John Gresham, Westinghouse, the NRC suspended its approval for use of Westinghouse Topical Report

CENPD-254-P, Post-LOCA Long Term Cooling Model, due to the discovery of non-conservative modeling assumptions. The technical evaluation attached to the letter dated August 1, 2005, identified the subject areas regarding post-LOCA long-term cooling and boric acid precipitation behavior that required Westinghouse to require revision of the subject topical report (Section 4.6 and Section 5.2.3 of Enclosure 2).

e. Boric acid precipitation analysis, including a list of all of the key parameter inputs and results from the analysis.

12. Calculations related to SBLOCA analysis (ANP-2974):

a. Break spectrum calculations,

b. RODEX2-2A code calculations that generated burnup-dependent initial fuel rod conditions for the system calculations,

c. RCP trip sensitivity study calculations (ANP-2974, Section 4.3), and

d. Quantitative and qualitative evaluation of the differences in results, specifically in the PCT values of an analysis of record and the new AREVA models (ANP-2974, Section 4.5.3).

13. Documents related to the Modified Statistical Combination of Uncertainties (MSCU) analysis:

a. Calculations that lead to the conclusion that the "1.31 design DNBR limit and its associated probability distribution function (pdf) is bounding and conservative for AREVA fuel, for mixed core and full AREVA core configurations."

b. Analyses that support that there is no change to the setpoints methodology needed to account for the AREVA impact on (1) physics input, (2) T-H related input, (3) fuel behavior analyses input, and (4) the safety design analyses input to setpoints analyses.

c. Calculations that "generated specific design DNBR limit and associated pdf using AREVA fuel specifications and uncertainties for the limiting mixed core and full core configuration using approved methodology."

Section 4.2.1 of Enclosure 2 to the LAR describes the impact of the AREVA fuel design on the core thermal-hydraulic MSCU methods. This section concludes that since the engineering and systematic factor uncertainties are less for the AREVA fuel design relative to the existing Westinghouse fuel, then "the MSCU analysis for SONGS which determined the 1.31 design DNBR limit and its associated Probability Distribution Function (pdf) is bounding and conservative for AREVA fuel, for both mixed core and full AREVA core configurations." Following approved methods, provide a specific design DNBR limit and associated pdf using AREVA fuel specifications and uncertainties for the limiting

mixed core and full core configuration. The impact of differences in calculated DNBR limits and associated pdfs on operating limit supervisory system (COLSS)/core protection calculator system (CPCS) setpoint analyses (e.g., required over power margin (ROPM), EPOL2/4, BERRi) and predicted fuel rod failures should be discussed.

d. Section 4.8.1.2 of Enclosure 2 to the LAR states that the impact of the new AREVA CHF is limited to the TORC code and that the CETOP-D code and on-line algorithms will not be modified.

   i. Provide tables of CETOP-D (CE-1) to TORC (CE-1, BHTP) correction factors as a function of AXPD, temperature, pressure and flow for the COLSS narrow range, CPCS wide range, and transient analysis range of operating conditions. The tables should be accompanied by a discussion of the impact of mixed core and full core configurations on these correction factors. Also, discuss any interpolation or extrapolation of these values within the reload methods.

   ii. To demonstrate the conservatism of the proposed approach, provide a sample COLSS/CPCS MSCU evaluation using a modified CETOP-D code with the AREVA BHTP critical heat flux (CHF) correlation (along with associated DNBR pdfs and CETOP-TORC correction factors). Identify any dependence of the COLSS and CPC DNB POL uncertainty with AXPD, temperature, pressure, or flow between the two approaches.

   iii. Provide the calculation of AOPM and ROPM using CETOP-D (CE-1) for anticipated operational occurrences (AOOs) and accidents with respect to a mixed core of Westinghouse and AREVA fuel.

If you have any comments or concerns, please contact Brian Benney, Senior Project Manager, at 301-415-2767 or via e-mail at brian.benney@nrc.gov.

Sincerely,

/RA by James R. Hall for/

Douglas A. Broaddus, Chief
SONGS Special Projects Branch
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-361 and 50-362

Enclosure:
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