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

December 17, 2009

Mr. Ross T. Ridenoure
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 - TEMPORARY EXEMPTION FROM THE REQUIREMENTS OF 10 CFR PART 50, SECTION 50.46 AND APPENDIX K FOR LEAD FUEL ASSEMBLIES (TAC NOS. ME0602 AND ME0603)

Dear Mr. Ridenoure:

The Nuclear Regulatory Commission has approved the enclosed temporary exemption from specific requirements of Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50, Section 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and Appendix K, "ECCS Evaluation Models," for the San Onofre Nuclear Generating Station, Unit 2 and Unit 3 (SONGS 2 and 3). This action is in response to your letter dated January 30, 2009, as supplemented by letters dated March 16 and September 29, 2009. The temporary exemption allows up to 16 lead fuel assemblies (LFAs) with M5 alloy cladding manufactured by AREVA NP to be inserted into the SONGS 2 reactor core, or into the SONGS 3 reactor core. Currently, eight AREVA LFAs are scheduled to be loaded into the SONGS 2 reactor core for Cycle 16. The exemption allows the LFAs to be used for up to three operating cycles (Cycles 16, 17, and 18).

A copy of the enclosed temporary exemption has been forwarded to the Office of the Federal Register for publication.

Sincerely,

James R. Hall

James R. Hall, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket Nos. 50-361 and 50-362

Enclosure:
Temporary Exemption

cc w/encl: Distribution via Listserv

7590-01-P

UNITED STATES OF AMERICA

NUCLEAR REGULATORY COMMISSION

SOUTHERN CALIFORNIA EDISON

SAN ONOFRE NUCLEAR GENERATING STATION, UNIT 2 AND UNIT 3

DOCKET NOS. 50-361 AND 50-362

TEMPORARY EXEMPTION

1.0 BACKGROUND

Southern California Edison (SCE, the licensee) is the holder of the Facility Operating License Nos. NPF-10 and NPF-15, which authorize operation of the San Onofre Nuclear Generating Station, Units 2 and 3 (SONGS 2 and 3), respectively. The licenses provide, among other things, that the facility is subject to all rules, regulations, and orders of the Nuclear Regulatory Commission (NRC or the Commission) now or hereafter in effect.

The facility consists of two pressurized-water reactors (PWRs) located in San Diego County, California.

2.0 REQUEST/ACTION

Pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Section 50.12, "Specific exemptions," SCE has, by letter dated January 30, 2009, as supplemented by letters dated March 16 and September 29, 2009 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML090360738, ML090780251, and ML092740310, respectively), requested a temporary exemption from 10 CFR 50.46, "Acceptance criteria for emergency core cooling systems for light-water nuclear power reactors," and Appendix K to 10 CFR 50, "ECCS [emergency core cooling system] Evaluation Models" (Appendix K). The regulation in 10 CFR 50.46 contains acceptance criteria for the ECCS for light-water nuclear

power reactors fueled with uranium oxide pellets within cylindrical zircaloy or ZIRLO™ cladding. In addition, Appendix K to 10 CFR Part 50 requires that the Baker-Just equation be used to predict the rates of energy release, hydrogen concentration, and cladding oxidation from the metal-water reaction in the development and application of an acceptable ECCS model. The temporary exemption request relates solely to the specific types of cladding material specified in these regulations. As written, the regulations require the use of zircaloy or ZIRLO™ fuel rod cladding. Thus, SCE needs an exemption from the requirements of 10 CFR 50.46, and Appendix K in order to use (irradiate) lead fuel assemblies (LFAs) with a different cladding material, M5 alloy, at SONGS 2 and 3. The scope of the staff's review of this temporary exemption request is limited to the current burnup limits (i.e., 60 gigawatt-days per metric ton of uranium (GWD/MTU)). Extending the burnup of these LFAs above 60 GWD/MTU will require further NRC staff review and is beyond the scope of this exemption request.

The temporary exemption requested by the licensee would allow up to 16 LFAs with M5 alloy cladding manufactured by AREVA NP to be inserted into the SONGS 2 reactor core or the SONGS 3 reactor core. Currently, eight AREVA NP LFAs are scheduled for loading into the SONGS 2 reactor core for Cycle 16. The exemption would allow the LFAs to be used for up to three operating cycles (Cycles 16, 17, and 18). The use of M5 alloy LFAs will allow SCE to evaluate cladding performance for future fuel assemblies that need to be of a more robust design than the current fuel assemblies, to allow for possible higher duty or extended burnup.

3.0 DISCUSSION

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50, when (1) the exemptions are authorized by law, will not present an undue risk to public health and safety, and are consistent with the common defense and security; and (2) special

circumstances are present. Under 10 CFR 50.12(a)(2), special circumstances include, among other things, when application of the specific regulation in the particular circumstance would not serve, or is not necessary to achieve, the underlying purpose of the rule.

Authorized by Law

This temporary exemption would allow the licensee to use a limited number of M5 alloy LFAs to evaluate cladding performance for the design of future fuel assemblies, which may need to be more robust than current fuel assemblies, to account for possible higher duty or extended burnup conditions. The regulations specify standards and acceptance criteria only for fuel rods clad with zircaloy or ZIRLO™. Thus, a temporary exemption is required to allow the licensee to use fuel rods clad with an advanced alloy that is not zircaloy or ZIRLO™. As stated above, 10 CFR 50.12 explicitly authorizes the NRC to grant exemptions from the requirements of 10 CFR Part 50. The NRC staff has determined that granting of the licensee's proposed temporary exemption will not result in a violation of the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

No Undue Risk to Public Health and Safety

In regard to the fuel mechanical design, the temporary exemption request for SONGS 2 and 3 relates solely to the types of cladding material specified in the regulations. No new or altered design limits for purposes of 10 CFR 50, Appendix A, General Design Criterion 10, "Reactor Design," need to be applied or are required for the licensee's LFA program. In its exemption request, SCE committed to perform additional analyses of the LFAs to verify LFA performance and compatibility with existing fuel assemblies. These analyses will use approved methods, in compliance with the existing Technical Specifications (TS) and consistent with the Updated Final Safety Analysis Report (UFSAR) for SONGS 2 and 3, and will address the core physics, core thermal hydraulics, fuel thermal-mechanical design, and other safety analysis

aspects of the LFAs. The LFAs will be placed in non-limiting core locations, in accordance with TS 4.2.1, "Fuel Assemblies," where the peak integrated radial power peaking factor in the LFAs will be 0.95 or less of the core maximum integrated radial power peaking factor at all times in life. SCE further committed to perform poolside examinations of the LFAs after each cycle of operation to evaluate their performance and acceptability for continued use.

The underlying purpose of 10 CFR 50.46 is to establish acceptance criteria for ECCS performance. The staff's review and approval of topical report BAW-10227P-A, "Evaluation of Advanced Cladding and Structural Material (M5) in PWR Reactor Fuel," dated February 4, 2000 (ADAMS Accession Nos. ML003681479 and ML003681490), addressed all of the important aspects of M5 cladding with respect to ECCS performance requirements: (1) applicability of 10 CFR 50.46(b) fuel acceptance criteria, (2) M5 material properties including fuel rod ballooning and rupture strains, and (3) steam oxidation kinetics and applicability of the Baker-Just weight gain correlation. A subsequent NRC-approved topical report, BAW-10240P-A, "Incorporation of M5 Properties in Framatome ANP Approved Methods," dated May 5, 2004 (ADAMS Accession No. ML041260560), further addressed M5 material properties with respect to loss-of-coolant accident (LOCA) applications.

Based on an ongoing LOCA research program at Argonne National Laboratory (ANL), and NRC Research Information Letter 0801, "Technical Basis for Revision of Embrittlement Criteria in 10 CFR 50.46," dated May 30, 2008 (ADAMS Accession No. ML081350225), cladding corrosion (and associated hydrogen pickup) has a significant impact on post-quench ductility. Pre-test characterization of irradiated M5 fuel cladding segments at ANL provides further evidence of favorable corrosion and hydrogen pickup characteristics of M5 as compared with standard Zircaloy-4. Hence, the M5 fuel rods would be less susceptible to the detrimental effects of hydrogen uptake during normal operation and their impact on post-quench ductility.

Furthermore, ANL post-quench ductility tests on un-irradiated and irradiated M5 cladding segments demonstrate that the 10 CFR 50.46(b) fuel criteria (i.e., 2200 degrees Fahrenheit and 17 percent equivalent cladding reacted) remain conservative up to current burnup limits.

Information provided in the NRC-approved M5 alloy topical reports, as well as recent ANL LOCA research, demonstrates that the acceptance criteria within 10 CFR 50.46 remain valid for M5 alloy cladding, and thus, the underlying purpose of the rule—to maintain a degree of post-quench ductility in the fuel cladding material—is met.

Paragraph I.A.5 of Appendix K to 10 CFR Part 50 states that the rates of energy release, hydrogen generation, and cladding oxidation from the metal-water reaction shall be calculated using the Baker-Just equation. Since the Baker-Just equation presumes the use of zircaloy clad fuel, strict application of the rule would not permit use of the equation for the LFA cladding for determining acceptable fuel performance. Metal-water reaction tests performed on M5 alloy material by AREVA NP (as discussed in topical report BAW-10227P-A) demonstrate conservative reaction rates relative to the Baker-Just equation. Thus, strict application of Appendix K, Paragraph I.A.5 is not necessary to achieve the underlying purpose of the rule in these circumstances, as acceptable performance of the LFAs can be demonstrated.

In addition, SCE states that the LFAs will be placed in non-limiting core locations, which provides further margin to ECCS performance requirements and ensures that the behavior of the LFAs is bounded by the safety analyses performed for the standard fuel rods. Based upon the results of metal-water reaction testing and mechanical testing, which demonstrate that the 10 CFR 50.46 acceptance criteria and 10 CFR 50 Appendix K methods can be applied to the M5 alloy material, and the planned placement of the LFAs in non-limiting core locations, the NRC staff finds it acceptable to grant a temporary exemption from the requirements of 10 CFR

50.46 and Appendix K to 10 CFR Part 50 for the use of up to 16 AREVA NP LFAs within SONGS 2 and 3.

Based on the above, no new accident precursors are created by allowing the use of the LFAs with M5 cladding material in the SONGS 2 and/or SONGS 3 reactor cores during operating Cycles 16, 17, and 18; therefore, the probability of postulated accidents is not increased. Also, based on the above, the consequences of postulated accidents are not increased. Therefore, there is no undue risk to public health and safety in granting this temporary exemption.

Consistent with Common Defense and Security

The temporary exemption would allow up to 16 LFAs, with advanced M5 alloy cladding material, to be inserted into the SONGS 2 reactor core or potentially into the SONGS 3 reactor core. Currently, eight AREVA NP LFAs are scheduled to be loaded into the SONGS 2 core for Cycle 16, to be used for up to three operating cycles (Cycles 16, 17, and 18). This change to the reactor core configuration does not affect any existing or planned security measures. Therefore, the common defense and security is not impacted by this temporary exemption.

Special Circumstances

Special circumstances, in accordance with 10 CFR 50.12(a)(2)(ii), are present whenever application of the specific regulation in the particular circumstance would not serve, or is not necessary to achieve, the underlying purpose of the rule. The underlying purpose of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 is to establish acceptance criteria for ECCS performance. The wording of the regulations in 10 CFR 50.46 and Appendix K is not directly applicable to the M5 advanced cladding alloy, even though the evaluations discussed above show that the intent of the regulations is met. Therefore, since the underlying purposes of 10

CFR 50.46 and Appendix K are achieved with the use of the M5 advanced cladding alloy, the special circumstances required by 10 CFR 50.12(a)(2)(ii) for granting of an exemption exist.

4.0 CONCLUSION

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the temporary exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants SCE temporary exemption from the requirements of 10 CFR 50.46 and Appendix K to 10 CFR Part 50 to allow up to 16 LFAs clad with M5 alloy and manufactured by AREVA NP, to be inserted into the SONGS 2 reactor core or the SONGS 3 reactor core, in non-limiting core locations, for use for up to three operating cycles (Cycles 16, 17, and 18 for the respective units).

Pursuant to 10 CFR 51.32, the Commission has determined that the granting of this temporary exemption will not have a significant effect on the quality of the human environment (74 FR 51339; October 6, 2009). This temporary exemption is effective upon issuance.

Dated at Rockville, Maryland, this 17th day of December 2009.

FOR THE NUCLEAR REGULATORY COMMISSION

Joseph G. Giitter, Director
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

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Mr. Ross T. Ridenoure
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Sincerely,

/RA/

James R. Hall, Senior Project Manager
Plant Licensing Branch IV
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Temporary Exemption

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ADAMS Accession Nos.: PKG ML090860392; Letter ML090860415 (NRR-106), Exemption (NRR-042) ML090860429

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