September 27, 2000

Mr. Garry L. Randolph
Vice President and Chief Nuclear Officer
Union Electric Company
Post Office Box 620
Fulton, MO 65251

SUBJECT: CALLAWAY PLANT, UNIT 1 - ISSUANCE OF AMENDMENT RE: REANALYSIS OF MAIN STEAM LINE BREAK AND STEAM GENERATOR TUBE RUPTURE ACCIDENTS (TAC NO. MA6482)

Dear Mr. Randolph:

The Commission has issued the enclosed Amendment No. 139 to Facility Operating License No. NPF-30 for the Callaway Plant, Unit 1 (Callaway). The amendment consists of changes to the Callaway Final Safety Analysis Report (FSAR) in response to the unreviewed safety question per 10 CFR 50.59 that was submitted in your application dated September 8, 1999 (ULNRC-04103). There are no changes to the Callaway Technical Specifications.

The amendment authorizes revisions to the descriptions of the steam generator tube rupture and main steam line break accidents in the FSAR to reflect increases in the radiological dose consequences calculated by your staff for these accidents. The revisions shall be incorporated in the next update of the FSAR, in accordance with 10 CFR 50.71(e).

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

Sincerely,
/RA/
Jack N. Donohew, Senior Project Manager, Section 2
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosures: 1. Amendment No. 139 to NPF-30
2. Safety Evaluation

cc w/encls: See next page

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ADAMS Accession No. ML00373

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

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 139
License No. NPF-30

1. The Nuclear Regulatory Commission (the Commission) has found that:

   A. The application for amendment by Union Electric Company (UE, the licensee) dated September 8, 1999, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act) and the Commission's regulations set forth in 10 CFR Chapter I;

   B. The facility will operate in conformity with the application, the provisions of the Act, and the rules and regulations of the Commission;

   C. There is reasonable assurance (i) that the activities authorized by this amendment can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the Commission's regulations;

   D. The issuance of this amendment will not be inimical to the common defense and security or to the health and safety of the public; and

   E. The issuance of this amendment is in accordance with 10 CFR Part 51 of the Commission's regulations and all applicable requirements have been satisfied.

2. Accordingly, by Amendment No. 139 , the license is amended to authorize revision of the Final Safety Analysis Report (FSAR) as set forth in the application for amendment by Union Electric Company dated September 9, 1999. Union Electric Company shall update the FSAR to reflect the revised licensing basis authorized by this amendment in accordance with 10 CFR 50.71(e).

3. This license amendment is effective as of its date of issuance and shall be implemented in the next periodic update to the FSAR in accordance with 10 CFR 50.71(e). Implementation of the amendment is the incorporation into the FSAR the changes to the description of the facility as described in the licensee's application dated September 8, 1999, and evaluated in the staff's Safety Evaluation attached to this amendment.

FOR THE NUCLEAR REGULATORY COMMISSION

L Raghavan

for Stephen Dembek, Chief, Section 2
Project Directorate IV & Decommissioning
Division of Licensing Project Management
Office of Nuclear Reactor Regulation

Date of Issuance: September 27, 2000

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

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 139 TO FACILITY OPERATING LICENSE NO. NPF-30

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

1.0 INTRODUCTION

By application dated September 8, 1999, Union Electric Company (the licensee) submitted an unreviewed safety question related to increases in the potential radiological dose consequences in the Callaway Final Safety Analysis Report (FSAR) for the steam generator tube rupture (SGTR) and main steam line break (MSLB) accidents, which were calculated by the licensee. The amendment request would authorize revisions to the FSAR that describes the SGTR and MSLB accidents to reflect the increase in the potential dose consequences, and would not change the Callaway Technical Specifications (TS, Appendix A to Facility Operating License No. NPF-30). The proposed revision to the FSAR is given in Attachment 4 to the September 8, 1999, application.

The licensee identified errors in its analyses of the SGTR and MSLB accidents, and reanalyzed the two accidents to correct these errors. The changes to these analyses yielded potential dose consequences for the accidents slightly higher than those reported in the FSAR and were identified as unreviewed safety questions in accordance with 10 CFR 50.59. The licensee submitted revisions to the FSAR analysis descriptions and to TS Bases 3.4.16 to reflect the analyses changes.

2.0 BACKGROUND

The SGTR is the postulated rupture of a single tube in a steam generator and the release of primary coolant to the secondary side of the steam generator. The MSLB is the postulated break of a main steam line from a steam generator outside the primary containment and upstream of the main steam isolation valve between the steam generator and the turbine.

The MSLB and SGTR accidents are addressed in Sections 15.1 and 15.6, respectively, of the FSAR. For the MSLB accident, the analysis parameters are given in Table 15.1-3, the analysis assumptions are given in Section 15.1.5.3.1.2, and the estimated dose consequences of the MSLB are given in Table 15.1-4. For the SGTR accident, the analysis parameters are given in Table 15.6-4, the assumptions are given in Section 15.6.3.2, and the estimated dose consequences of the SGTR are given in Table 15.6-5. Additional information is provided in Appendix 15A of the FSAR.

In its submittal, the licensee addressed the nonconservatisms in its calculation of the offsite dose consequences for the MSLB and the SGTR accidents, that when corrected, were higher than the dose consequences currently reported in the FSAR. The changes to the analyses are the following:

- An increase in the initial steady-state letdown flow rate from 75 to 140 gpm. This flow rate is an input to the iodine appearance rate calculation. The iodine appearance rates are used in determining the radioactivity releases for both the MSLB and SGTR accidents.

- An increase in the letdown cleanup resin efficiency from 90 percent to 100 percent. The resin efficiency is an input to the iodine spiking appearance rate calculation. The iodine spike appearance rates are used in determining the radioactivity releases for both the MSLB and SGTR accidents.

- A revision in assumptions regarding the initial steady-state relative concentrations of radioiodines present in the reactor coolant system (RCS) and in the steam generators (SGs). These concentrations are used in determining the radioactivity releases for both the MSLB and SGTR accidents.

- An increase in the duration of SGTR radioactivity releases via the flashing pathway. This change corrected an inconsistency between the current FSAR analysis and the original licensing submittal for the Callaway SGTR methodology.

The licensee stated that the increased offsite doses resulting from the revised reanalysis of the MSLB and SGTR continue to satisfy the acceptance criteria in the Standard Review Plan (SRP) Section 15.1.5 Appendix A (for the MSLB) and Section 15.6.3 (for the SGTR) for both the preaccident and accident initiated iodine spike cases. The licensee further stated that Sections 6.4.4, 12.3.2.2.6, and 15A.3 of the FSAR provide that the post-loss-of-accident coolant radiological consequences are bounding for the design basis accidents analyzed in FSAR Chapter 15 for showing compliance with 10 CFR Part 50, Appendix A, General Design Criterion 19 on control room habitability, and that this conclusion is unchanged by this license amendment application.

3.0 EVALUATION

The staff reviewed the licensee's proposed changes to the MSLB and SGTR accidents in the context of the current FSAR analyses, regulatory guidance, and staff experience in reviewing similar analyses. Each of the proposed changes and the impact of these changes on control room habitability is discussed in the following section. The staff performed independent calculations to confirm offsite and control room dose conclusions made by the licensee. Nonetheless, the staff's acceptance of this license amendment request is based primarily on the licensee's docketed analysis descriptions and not on the analyses performed by the staff.

3.1 Proposed Change in Letdown Flow Rate and Resin Cleanup Efficiency

The changes in the letdown flow rate and the resin cleanup efficiency addresses nonconservatisms in the licensee's calculation of the iodine spike appearance rate. During normal steady-state operation, iodine fission products collect in the fuel rods and a minor amount of this activity is released to the RCS via small defects in the fuel cladding. The RCS letdown system continuously cleans up impurities in the RCS. At equilibrium, the iodine activity in the RCS is a function of the balance of the iodine release rate into the RCS through the fuel clad, and the iodine removal that occurs in the RCS letdown systems and via radioactive decay. Maximizing the letdown flow rate and the cleanup resin efficiency in the analysis maximizes the apparent iodine appearance rate from the fuel clad, a conservative situation.

During certain plant transients, the iodine appearance rate may increase resulting in an increase in the RCS radioactivity available for release to the environment in an accident. This increase in the iodine concentration is known as an iodine spike and the staff considers two iodine spike cases in accident analyses. In the first case, a preincident iodine spike occurs immediately prior to the accident such that the RCS iodine concentration is at the maximum transient value (beyond which the plant would be required by the TS to shutdown) when the accident occurs. In the second case, an iodine spike is initiated by the accident and the RCS activity builds up during the accident until a new equilibrium is reached. The staff conservatively assumes that the rate of iodine release from the fuel is 500 times the steady-state iodine appearance rate. Only the second spike case is affected by the proposed changes to the accidents.

While the resin cleanup efficiency is a function of design and cannot be readily affected by plant controls, the letdown flow rate can be changed by plant operating personnel. Also, letdown flow is typically isolated whenever safety injection actuates, as is expected in MSLB and SGTR accidents. The staff would find a letdown flow rate assumption based on the normal system flow rate to be acceptable, provided that the system is not operated at the higher flow rate for more than a minimal portion of plant operations. The licensee stated that the letdown flow is nominally 120 gpm for current plant operation and the maximum possible resin efficiency is 100 percent. Therefore, the staff concludes that the licensee's revised assumptions of increased letdown flow and resin cleanup efficiency are conservative and acceptable.

3.2 Changes in Steady State RCS and SG Concentrations

In performing analyses of the radiological consequences of MSLB and SGTR accidents, the staff assumes that the initial radioactivity concentrations in the RCS and the SG are at the maximum steady-state equilibrium specific activity value (i.e., 1.0 μCi/gm) allowed by TS 3.4.16, "RCS Specific Activity," and TS 3.7.18, "Secondary Specific Activity," respectively. The iodine concentration limits are expressed in terms of dose equivalent I-131 (DEI-131), that is, the concentration of I-131 that alone would produce the same dose as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. Although the technical specification is expressed in terms of DEI-131, the radiological consequence analyses are performed using the individual isotopic quantities. The licensee proposes to develop the initial RCS specific activity by determining the quantities of the individual iodine isotopes corresponding to the DEI-131 technical specification. The licensee then, for the analyses,

increases the concentration of the short-lived iodine isotopes to bound plant conditions which it projects may exist in the presence of open fuel defects. The adjusted iodine mixture corresponds to a DEI-131 value greater than the TS specific activity limit of 1.0 μCi/gm. The licensee assumes that the initial SG concentrations are 10 percent of that in the RCS. This is consistent with the 10 percent difference in technical specification limits for the RCS and SG specific activities. The licensee's proposal does not affect current assumptions regarding the concentrations of noble gas radionuclides. In addition to the changes to the analyses, the licensee submitted editorial changes to the TS Bases to reflect the revised assumptions.

The staff finds the RCS and SG concentration assumptions based on the steady-state equilibrium TS specific activities acceptable without the adjustment to increase the concentrations proposed by the licensee, because plant operation would not be possible for extended periods at the higher concentrations assumed in the licensee's analyses. The TS on the maximum RCS and SG radioactivity concentrations would not allow such plant operation. Because the licensee's proposed concentrations are more conservative than the steady-state equilibrium TS specific activities, the staff concludes that they are acceptable.

3.3 Increased Duration of SGTR Releases via the Flash Pathway

The current FSAR analysis for the SGTR describes two iodine transport paths from the ruptured SG to the environment via the SG atmospheric dump valve (ADV). The analysis assumes that a fraction of the break flow from the RCS flashes to vapor and is released from the SGs. The fraction that doesn't flash mixes with the initial iodine activity in the SG bulk water and is released as the bulk water becomes steam. The licensee assumes a loss of AC power concurrent with the SGTR. Because this assumption has the effect of making the main condenser unavailable, plant cooldown is performed by dumping steam from the nonruptured SGs, and until it is isolated, the ruptured SG. The licensee appropriately assumes that the ADV on the ruptured SG sticks open, delaying isolation of the ruptured SG and increasing the radioactivity release. The current FSAR analysis assumes the plant operators close a block valve at 30.4 minutes after the tube rupture, thereby stopping the release from the two transport pathways.

The licensee is proposing for the SGTR that the release from the steaming pathway be isolated at 30.4 minutes, but that the release via the flash transport path continue after the block valve is closed until such time as the thermodynamic condition no longer supports flashing from water to steam. This assumption was submitted to the staff as part of an analysis of the SGTR in the letter dated January 8, 1986, from the Standardized Nuclear Unit Power Plant System, after the licensing of Callaway in accordance with License Condition 2.c.11 on the SGTR. The staff's evaluation and acceptance of the analysis of the SGTR submitted in this letter was issued August 6, 1990. Since this assumption is consistent with the January 8, 1986, submittal for the Callaway SGTR methodology that has previously been accepted by the staff, the staff concludes that it is acceptable for this proposed change to the FSAR for the SGTR.

3.4 Control Room Habitability

The licensee stated that it had considered the impact of the increased releases on control room habitability doses. The licensee stated that it performed these evaluations by comparing the

relative magnitude of the postulated releases for the revised MSLB and SGTR analyses with the previously postulated LOCA releases and considered differences in control room isolation response for the different accidents. Based on these comparative evaluations, the licensee concluded that the LOCA doses would remain bounding. The staff performed independent calculations and confirmed this conclusion.

The staff is currently working towards resolution of generic issues related to control room habitability, including the validity of control room infiltration rates assumed by the licensees in analyses of control room habitability. Recent testing by 20 percent of current operating plants has shown that, in all cases, the measured infiltration rates exceeded the values assumed in the design basis analyses. While in each case the affected licensees were able either to reduce the excessive infiltration or show the acceptability of the observed infiltration, the collective experience has caused concerns regarding those facilities that have not performed the enhanced testing.

The staff is currently participating in an industry-NRC initiative to resolve these concerns. This initiative is expected to produce a staff-endorsed industry guidance document for individual utilities to resolve the habitability concerns. Because the bounding dose consequences for the control room in Table 15.6-8 of the FSAR are within the acceptance criteria of GDC-19, the staff concludes that there is reasonable assurance that the Callaway control room would be habitable during MSLB and SGTR accidents and that this amendment may be approved before the resolution of the generic issues. The staff bases this determination on the (1) enhanced mixing and dilution afforded by the configuration of the control building and control room ventilation systems during accidents at Callaway, (2) the large margin between the postulated control room doses for the MSLB and SGTR and the GDC-19 criteria, (3) the reasonableness of the assumed 300 cfm infiltration, and (4) the proposed amendment is not changing the design or operation of the control room. However, the approval of this amendment does not exempt Union Electric Company from regulatory actions that may be imposed in the future as this generic issue is resolved.

3.5 Conclusion

The licensee provided the revised potential dose consequences at the exclusion area boundary around the plant site and at the low population zone for the SGTR and MSLB accidents in Attachment 4 to its application, and the bounding control room doses for the LOCA are given in Table 15.6-8 of the FSAR. The reported dose consequences are below the acceptance criteria of Standard Review Plan (SRP) Sections 15.1.5 ("Steam System Piping Failures Inside and Outside of Containment") and 15.6.3 ("Steam Generator Tube Rupture") of NUREG-0800 (NRC Standard Review Plan for Nuclear Power Plants) for dose consequences at the exclusion area boundary and low population zone, and in GDC-19 and SRP 6.4 for control room exposures. Because the reported dose consequences are within the acceptance criteria and the proposed changes to the SGTR and MSLB analyses are conservative or have been previously found acceptable by the staff, the staff concludes that the proposed changes to the SGTR and MSLB analyses are acceptable and the licensee is authorized to revise the descriptions of the accidents in the FSAR as shown in Attachment 4 to the licensee's application. The changes to the FSAR may be made at the next scheduled update of the FSAR in accordance with 10 CFR 50.71(e).

4.0 STATE CONSULTATION

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

5.0 ENVIRONMENTAL CONSIDERATION

The amendment changes a requirement with respect to the installation or use of a facility component located within the restricted area as defined in 10 CFR Part 20. The NRC staff has determined that the amendment involves no significant increase in the amounts, and no significant change in the types, of any effluents that may be released offsite, and that there is no significant increase in individual or cumulative occupational radiation exposure. The Commission has previously issued a proposed finding that the amendment involves no significant hazards consideration and there has been no public comment on such finding (64 FR 54383). Accordingly, the amendment meets the eligibility criteria for categorical exclusion set forth in 10 CFR 51.22(c)(9). Pursuant to 10 CFR 51.22(b) no environmental impact statement or environmental assessment need be prepared in connection with the issuance of the amendment.

6.0 CONCLUSION

The Commission has concluded, based on the considerations discussed above, that: (1) there is reasonable assurance that the health and safety of the public will not be endangered by operation in the proposed manner, (2) such activities will be conducted in compliance with the Commission's regulations, and (3) the issuance of the amendment will not be inimical to the common defense and security or to the health and safety of the public.

Principal Contributor: S. LaVie

Date: September 27, 2000