

December 18, 2006

Mr. Charles D. Naslund
Senior 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: REVISION
TO REACTOR COOLANT SYSTEM-SPECIFIC ACTIVITY (TAC NO. MD1814)

Dear Mr. Naslund:

The U.S. Nuclear Regulatory Commission (NRC) has issued the enclosed Amendment No. 178 to Facility Operating License No. NPF-30 for the Callaway Plant, Unit 1. The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated May 9, 2006 (ULNRC-05281).

The amendment revises TSs 1.1, "Definitions," and 3.4.16, "RCS [Reactor Coolant System] Specific Activity." The revisions replace the current Limiting Condition for Operation (LCO) 3.4.16 limit on RCS gross-specific activity with limits on RCS Dose Equivalent I-131 and Dose Equivalent Xe-133 (DEX). The conditions and required actions for LCO 3.4.16 not being met, as well as surveillance requirements for LCO 3.4.16, are revised. The modes of applicability for LCO 3.4.16 are extended. The current definition of \bar{E} - Average Disintegration Energy in TS 1.1 is replaced by the definition of DEX. In addition, the current definition of Dose Equivalent I-131 in TS 1.1 is revised to allow alternate NRC-approved thyroid dose conversion factors.

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 Donohew, Senior Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-483

Enclosures: 1. Amendment No. 178 to NPF-30
2. Safety Evaluation

cc w/encls: See next page

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DATE	12/6/06	12/12/06	10/23/06	12/7/06	12/12/06

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UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

AMENDMENT TO FACILITY OPERATING LICENSE

Amendment No. 178
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 May 9, 2006, 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, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment and paragraph 2.C.(2) of Facility Operating License No. NPF-30 is hereby amended to read as follows:

(2) Technical Specifications and Environmental Protection Plan

The Technical Specifications contained in Appendix A, as revised through Amendment No. 178 and the Environmental Protection Plan contained in Appendix B, are hereby incorporated in the license. The licensee shall operate the facility in accordance with the Technical Specifications and the Environmental Protection Plan.

3. This amendment is effective as of its date of issuance, and shall be implemented within 90 days of the date of issuance.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

David Terao, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment: Changes to the Facility
Operating License and
Technical Specifications

Date of Issuance: December 18, 2006

ATTACHMENT TO LICENSE AMENDMENT NO. 178

FACILITY OPERATING LICENSE NO. NPF-30

DOCKET NO. 50-483

Replace the following pages of the Facility Operating License and the Appendix A Technical Specifications (TSs) with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

REMOVE

INSERT

License

License

- 3 -

- 3 -

TSs

TSs

2 (Table of Contents)

2 (Table of Contents)

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SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 178 TO

FACILITY OPERATING LICENSE NO. NPF-30

UNION ELECTRIC COMPANY

CALLAWAY PLANT, UNIT 1

DOCKET NO. 50-483

1.0 INTRODUCTION

By application dated May 9, 2006 (Agencywide Documents Access and Management System Accession No. ML061430309), Union Electric Company (the licensee) requested changes to Facility Operating License No. NPF-30 for the Callaway Plant, Unit 1 (Callaway). The licensee is proposing to revise Technical Specifications (TSs) 1.1, "Definitions," and 3.4.16, "RCS [Reactor Coolant System] Specific Activity." The revisions would replace the current Limiting Condition for Operation (LCO) 3.4.16 limit on RCS gross-specific activity with limits on RCS Dose Equivalent I-131 and Dose Equivalent Xe-133 (DEX). The conditions and required actions for LCO 3.4.16 not being met, as well as surveillance requirements (SRs) for LCO 3.4.16, are being revised. The modes of applicability for LCO 3.4.16 would be extended. The current definition of \bar{E} - Average Disintegration Energy in TS 1.1 would be replaced by the definition of DEX. In addition, the current definition of Dose Equivalent I-131 in TS 1.1 would be revised to allow alternate, NRC-approved thyroid dose conversion factors.

2.0 REGULATORY EVALUATION

Section 182a of the Atomic Energy Act requires applicants for nuclear power plant operating licenses to include TSs as part of the license. The TSs ensure the operational capability of structures, systems, and components that are required to protect the health and safety of the public. The NRC's regulatory requirements related to the content of the TSs are contained in Section 50.36 of Title 10 of the *Code of Federal Regulations* (10 CFR 50.36), which requires that the TSs include items in the following categories: (1) safety limits, limiting safety systems settings, and limiting control settings; (2) LCOs; (3) SRs; (4) design features; and (5) administrative controls. In accordance with paragraph 50.36(c)(3) of Title 10 of the *Code of Federal Regulations* (10 CFR), surveillance requirements are "requirements relating to tests, calibration, or inspection to assure that the necessary quality of the systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met."

As stated in 10 CFR 50.36(c)(2)(i), LCOs "are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a[n] [LCO] of a nuclear

reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specification..." The remedial actions in the TSs are specified in terms of LCO conditions, required actions, and completion times (CTs) to complete the required actions. When an LCO is not being met, the CTs specified in the TSs are the time allowed in the TSs for completing the specified required actions. The conditions and required actions specified in the TSs must be acceptable remedial actions for the LCO not being met, and the CTs must be a reasonable time for completing the required actions.

The Nuclear Regulatory Commission (NRC) staff evaluated the impact of the proposed changes as it relates to the radiological consequences of affected design-basis accidents (DBAs) that use the RCS inventory as the source term. The source term assumed in radiological analyses should be based on the activity associated with the projected fuel damage or the maximum TS RCS values, whichever maximizes the radiological consequences. The limits on RCS-specific activity ensure that the offsite doses are appropriately limited for accidents that are based on releases from the RCS with no significant amount of fuel damage.

The steam generator tube rupture (SGTR) accident and the main steamline break (MSLB) accident typically do not result in fuel damage; therefore, the radiological consequence analyses are based on the release of primary coolant activity at maximum TS limits. For accidents that result in fuel damage, the additional dose contribution from the initial activity in the RCS is not normally evaluated and is considered to be insignificant in relation to the dose resulting from the release of fission products from the damaged fuel.

The requirements for acceptable dose consequences for DBAs are listed in 10 CFR Part 100, "Reactor Site Criteria."

For licensees that incorporate the source term as defined in Technical Information Document (TID)-14844, U.S. Atomic Energy Commission (AEC), 1962, "Calculation of Distance Factors for Power and Test Reactors Sites," in their dose consequence analyses, the staff uses the regulatory guidance provided in NUREG-0800, "Standard Review Plan [SRP] for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 15.1.5, "Steam System Piping Failures Inside and Outside of Containment (PWR)," Appendix A, "Radiological Consequences of Main Steam Line Failures Outside Containment," Revision 2, for the evaluation of MSLB accident analyses, and NUREG-0800, SRP Section 15.6.3, "Radiological Consequences of Steam Generator Tube Failure (PWR)," Revision 2, for evaluating SGTR accidents analyses. In addition, the staff uses the guidance from Regulatory Guide (RG) 1.195, "Methods and Assumptions for Evaluating Radiological Consequences of Design Basis Accidents at Light-Water Nuclear Power Reactors," May 2003, for those licensees that choose to use the NRC staff's guidance for dose consequence analyses using the TID-14844 source term.

The applicable dose criteria for the evaluation of DBAs depend on the source term incorporated in the dose consequence analyses. For licensees using the TID-14844 source term, the maximum dose criteria to the whole body and the thyroid that an individual at the exclusion area boundary can receive for the first 2 hours following an accident, and at the low population zone outer boundary for the duration of the radiological release, are specified in 10 CFR 100.11.

These criteria are 25 roentgen equivalent man (rem) total whole body dose and 300 rem thyroid dose from iodine exposure. The accident dose criteria in 10 CFR 100.11 are supplemented by accident dose acceptance criteria in SRP 15.1.5, Appendix A; SRP 15.6.3; or Table 4 of RG 1.195.

For control room dose consequence analyses that use the TID-14844 source term, the regulatory requirement on which the NRC staff bases its acceptance is General Design Criterion (GDC) 19 of Appendix A to 10 CFR Part 50, "Control room." GDC 19 requires that adequate radiation protection be provided to permit access and occupancy of the control room under accident conditions without personnel receiving radiation exposures in excess of 5 rem whole body, or its equivalent to any part of the body, for the duration of the accident. NUREG-0800, SRP Section 6.4, "Control Room Habitability System," Revision 2, July 1981, provides guidelines defining the dose equivalency of 5 rem whole body as 30 rem for both the thyroid and skin dose. For licensees adopting the guidance from RG 1.196, "Control Room Habitability at Light-Water Nuclear Power Reactors," May 2003, Section C.4.5 of RG 1.195, May 2003, states that in lieu of the dose equivalency guidelines from Section 6.4 of NUREG-0800, the 10 CFR 20.1201 annual organ dose limit of 50 rem can be used for both the thyroid and skin dose equivalent of 5 rem whole body.

3.0 TECHNICAL EVALUATION

In its application, the licensee proposed the following changes to TSs 1.1 and 3.4.16:

TS 1.1 - Definitions

1. Revise the definition of Dose Equivalent I-131 (DEI) to allow the determination of DEI to be performed using thyroid dose conversion factors from the following additional references:
 - 1) Table E-7 of Regulatory Guide 1.109, Revision 1, NRC, 1977, or
 - 2) Table 2.1 of EPA [Environmental Protection Agency] Federal Guidance Report No. 11, EPA-520/1-88-020, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," 1988.

The new definition for DEI would read as follows:

DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries per gram) that alone would produce the same dose when inhaled as the combined activities of iodine isotopes I-131, I-132, I-133, I-134, and I-135 actually present. The determination of DOSE EQUIVALENT I-131 shall be performed using thyroid dose conversion factors from:

- 1) Table III of TID-14844, AEC, 1962, "Calculation of Distance Factors for Power and Test Reactor Sites," or
- 2) Table E-7 of Regulatory Guide 1.109, Revision 1, NRC, 1977, or

- 3) International Commission on Radiological Protection (ICRP) Publication 30, "Limits for Intakes of Radionuclides by Workers," Supplement to Part 1, pages 192-212, Table titled, "Committed Dose Equivalent in Target Organs or Tissues per Intake of Unit Activity," 1979, or
- 4) Table 2.1 of EPA Federal Guidance Report No. 11, EPA-520/1-88-020, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion," 1988.

2. Replace the following current definition of \bar{E} - Average Disintegration Energy:

\bar{E} shall be the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration (in MeV [million electron volts] for [radio]isotopes, other than iodines, with half lives > 15 minutes, making up at least 95% of the total noniodine activity in the coolant.

with the following definition for Dose Equivalent Xe-133 (DEX):

DOSE EQUIVALENT XE-133 shall be that concentration of Xe-133 (microcuries per gram) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides Kr-85m, Kr-87, Kr-88, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 actually present. If a specific noble gas nuclide is not detected, it should be assumed to be present at the minimum detectable activity. The determination of DOSE EQUIVALENT XE-133 shall be performed using the effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12, EPA-402-R-93-081, "External Exposure to Radionuclides in Air, Water, and Soil," 1993.

TS 3.4.16 - RCS Specific Activity

1. Replace the current LCO 3.4.16, which states "The specific activity of the reactor coolant shall be within limits," with the following statement: "RCS DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 specific activity shall be within limits."
2. Extend the applicability of LCO 3.4.16 from Mode 3 with RCS average temperature $\geq 500^{\circ}\text{F}$ to the entirety of Modes 3 and 4, with the applicability in Modes 1 and 2 remaining unchanged.
3. Replace current Condition A, which states "DOSE EQUIVALENT I-131 > 1.0 $\mu\text{Ci/gm}$," with the following new statement: "DOSE EQUIVALENT I-131 not within limit."
4. Replace current Required Action A.1, which states "Verify DOSE EQUIVALENT I-131 within the acceptable region of Figure 3.4.16-1," with the following statement: "Verify

DOSE EQUIVALENT I-131 \leq 60 $\mu\text{Ci/gm}$." TS Figure 3.4.16-1 would be removed from the TSs. The CT of once per 4 hours for this required action is not being changed.

5. Replace current Condition B, which states "Gross specific activity of the reactor coolant $> 100/\bar{E}$ $\mu\text{Ci/gm}$," with the following statement: "DOSE EQUIVALENT XE-133 not within limit."
6. Replace current Required Action B.1, which states "Be in Mode 3 with $T_{\text{avg}} < 500^\circ\text{F}$," with the following statement: "Restore DOSE EQUIVALENT XE-133 to within limit."
7. Add the note stating "LCO 3.0.4.c is applicable" to the new Required Action B.1.
8. The CT for Required Action B.1 is changed from 6 hours to 48 hours.
9. Revise Condition C (the changes are in **bold**) to state the following: "Required Action and associated Completion Time of Condition A **or B** not met OR DOSE EQUIVALENT I-131 **$> 60 \mu\text{Ci/gm}$** ."
10. Delete the phrase "with $T_{\text{avg}} < 500^\circ\text{F}$ " from current Required Action C.1 so that it simply states "Be in Mode 3." The CT of 6 hours is not being changed.
11. Add the logical connector "AND" and new Required Action C.2, which states "Be in Mode 5," with a CT of 36 hours.
12. Replace current SR 3.4.16.1, which states "Verify reactor coolant gross specific activity $\leq 100/\bar{E}$ $\mu\text{Ci/gm}$," with the following statement: "Verify reactor coolant DOSE EQUIVALENT XE-133 specific activity $\leq 225 \mu\text{Ci/gm}$."
13. Add the note to SR 3.4.16.1 to state that the surveillance is only required to be performed in Mode 1.
14. Delete SR 3.4.16.3, which states that \bar{E} is determined from a sample in Mode 1 every 184 days.

The following are not being changed by this proposed amendment to TS 3.4.16:

1. The note for Required Actions A.1 and A.2 stating "LCO 3.0.4.c is applicable," Required Action A.2, and the CTs for Required Actions A.1 and A.2 are not being changed.
2. The CT for Required Action C.1 is not being changed.
3. The frequency for SR 3.4.16.1, SR 3.4.16.2, and the DEI limit of 1.0 $\mu\text{Ci/gm}$ are not being changed.

The \bar{E} given above is referred to as E-bar in the NRC staff evaluation of the licensee's application that is in Section 3.2 of this Safety Evaluation (SE).

3.1 Background

The RCS-specific activity level is used in DBA analyses to determine the radiological consequences of accidents that involve the release of primary coolant activity with no substantial amount of fuel damage. For events that also include significant amounts of fuel damage, the contribution from the initial activity in the primary coolant is considered insignificant and is not normally evaluated.

The maximum allowable RCS-specific activity is governed by TS 3.4.16. Due to the importance of iodine in the dose consequence analyses, a separate limit is specified for the iodine radioisotopes. This limit is specified in units of DEI, which is the normalized quantity of I-131 that would result in the same dose consequence as the combination of the major radioisotopes of iodine present in the primary coolant. The TS for DEI includes both an equilibrium long-term limit as well as a higher maximum allowable short-term limit to account for iodine spiking. Typically, the TSs for pressurized-water reactors (PWRs), such as Callaway, allow for increases in the maximum allowable spiking limit as a linear function of decreasing power level from 80 to 20 percent of rated thermal power (RTP). A typical short-term DEI limit of 60 microcuries per gram ($\mu\text{Ci/gm}$) would be constant from 100 down to 80 percent RTP but allowed to increase to as high as 300 $\mu\text{Ci/gm}$ at 20 percent RTP. The dose consequence analyses typically do not consider these allowable increases in DEI values at lower power levels. For Callaway, this is shown in TS Figure 3.4.16-1.

The current standard TS definition of DEI is based on thyroid dose conversion factors (DCFs) and reflects a licensing model in which the radiological consequences of iodine releases for accidents are reported as thyroid and whole body doses. The numerical determination of DEI is dependent on the relative quantities of the radioisotopes of iodine present in the RCS and on the DCFs used in the calculation. The TS definition of DEI typically lists acceptable sources for the thyroid DCFs to be used in the determination of DEI. It is incumbent on the licensee to ensure that the DCFs used in the determination of DEI are consistent with the DCFs used in the dose consequence analyses.

A second limit is used to govern the non-iodine radioisotopes in the RCS. This limit has traditionally been based on an evaluation of the average beta and gamma disintegration energy of the total non-iodine activity in the RCS, which is referred to as E-bar. The standard TSs defines E-bar as the average (weighted in proportion to the concentration of each radionuclide in the reactor coolant at the time of sampling) of the sum of the average beta and gamma energies per disintegration for radioisotopes, other than iodines, with half-lives greater than 15 minutes, making up at least 95 percent of the total non-iodine activity in the coolant. The RCS non-iodine-specific activity limit is then expressed as the quantity 100 divided by E-bar expressed in units of $\mu\text{Ci/gm}$. In DBA dose consequence analyses based on releases from the RCS with no significant fuel damage, the concentration of noble gas activity in the coolant is assumed to be that level associated with 1 percent fuel clad defects. Operating experience has indicated that, depending on the radioisotopes used to calculate E-bar and the actual degree of fuel clad defects, the routinely calculated value of E-bar may not be an effective indicator of the level of noble gas activity relative to the levels used in the DBA dose consequence analyses on which the limit is based.

3.2 NRC Technical Evaluation of Proposed TS Changes

3.2.1 Revision to Definition of DEI

The licensee is (1) revising the definition of DEI by removing the word "thyroid" in phrase "would produce the same thyroid dose" from the current definition and (2) expanding the list of acceptable DCFs for use in the determination of DEI to include several additional sources, all of which are approved for use by the NRC. As stated by the licensee in its application, the removal of the word "thyroid" from "thyroid dose" is only an editorial change and does not change any requirement in the TSs.

For the NRC staff, the list of acceptable sources for DCFs is as follows:

1. Table III of TID-14844, AEC, 1962, "Calculation of Distance Factors for Power and Test Reactor Sites."
2. Table E-7 of RG 1.109, Revision 1, NRC, 1977.
3. International Commission on Radiological Protection (ICRP) 30, 1979, page 192-212, Table titled, "Committed Dose Equivalent in Target Organs or Tissues per Intake of Unit Activity."
4. Table 2.1 of Environmental Protection Agency Federal Guidance Report No. 11, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose Conversion Factors for Inhalation, Submersion, and Ingestion."

The two new sources of DCFs proposed by the licensee to be used in the determination of DEI that are being added to the definition of DEI in this amendment are the second and fourth references listed above.

As previously stated, it is incumbent on the licensee to ensure that the DCFs used in the determination of DEI are consistent with the DCFs used in the applicable DBA dose consequence analyses. This proposed change will allow the licensee to calculate DEI using the same DCFs as are used in the dose consequence analyses. Based on this, the NRC staff concludes that these DCFs, including the new references to RG 1.109 and EPA Report No. 11, are acceptable from a radiological dose perspective and, therefore, that the proposed new definition of DEI is acceptable.

3.2.2 Replace Definition of E-Bar with New Definition for DEX

The licensee has proposed to eliminate the term E-Bar and to govern the non-iodine RCS activity by incorporating a new term referred to as Dose Equivalent Xe-133, or DEX. The determination of DEX will be performed in a similar manner to that currently used in determining the DEI, except that the calculation of DEX is based on the acute dose to the whole body and considers the noble gases Kr-85m, Kr-87, Kr-88, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 which are significant in terms of contribution to the whole body dose. The whole body dose is primarily dependent on the noble gas activity, not the non-gaseous activity currently captured in the E-bar definition and limited by the current TS 3.4.16 Condition B. The licensee

determined that these radioisotopes account for approximately 98 percent of the whole body dose from noble gases in the accident analysis. If a specified noble gas nuclide is not detected, the new definition states that it should be assumed the nuclide is present at the minimum detectable activity, which will result in a conservative calculation of DEX.

The licensee asserts, and the NRC staff agrees, that when E-bar is determined using a design-basis approach in which it is assumed that 1 percent of the RTP is being generated by fuel rods having cladding defects and it is also assumed that there is no removal of fission gases from the letdown flow, the value of E-bar is dominated by Xe-133. The other nuclides have relatively small contributions. However, during normal plant operation, there are typically only a small amount of fuel clad defects and the radioactive nuclide inventory can become dominated by tritium and corrosion and/or activation products, resulting in the determination of a value of E-bar that is very different than would be calculated using the design-basis approach. Because of this difference, the accident dose analyses become disconnected from plant operation and the LCO becomes essentially meaningless and results in a TS limit that can vary during operation as different values for E-bar are determined.

In its application, the licensee stated, and the NRC staff agrees, that this change will implement an LCO that is consistent with the whole body radiological consequence analyses, which are sensitive to the noble gas activity in the primary coolant but not to other, non-gaseous radioactivity currently captured in the E-bar definition. The current LCO 3.4.16 requires that the RCS-specific activity be within limits, and the current Condition B and SR 3.4.16.1 specify that the limit for RCS gross-specific activity is $100/E\text{-bar } \mu\text{Ci/gm}$.

The current E-bar definition includes radioisotopes that decay by the emission of both gamma and beta radiation. The licensee stated, and the NRC staff agrees, that the current Condition B would rarely, if ever, be entered for exceeding $100/E\text{-bar}$ since the calculated value is very high (i.e., the denominator E-bar is very low) if beta emitters such as tritium (H-3) are included in the determination, as required by the E-bar definition.

The licensee proposes to replace the TS definition for \bar{E} - Average Disintegration Energy, which is E-bar, with a new definition for DEX which states the following: "DOSE EQUIVALENT XE-133 shall be that concentration of Xe-133 (microcuries per gram) that alone would produce the same acute dose to the whole body as the combined activities of noble gas nuclides Kr-85m, Kr-87, Kr-88, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 actually present. If a specific noble gas nuclide is not detected, it should be assumed to be present at the minimum detectable activity. The determination of DOSE EQUIVALENT XE-133 shall be performed using effective dose conversion factors for air submersion listed in Table III.1 of EPA Federal Guidance Report No. 12, EPA-402-R-93-081, 'External Exposure to Radionuclides in Air, Water, and Soil,' 1993."

Because the proposed change to add the newly-defined quantity DEX will result in an LCO that more closely relates the non-iodine RCS activity limits to the dose consequence analyses which form their bases, the NRC staff concludes that the DEX definition is acceptable from a radiological dose perspective. This TS change ensures that the DCFs used in the determination of DEI and the newly defined DEX are consistent with the DCFs used in the applicable DBA dose consequence analyses.

Based on the above evaluation, the NRC staff concludes that the proposed definition of DEX and the change from the RCS gross-specific activity in terms of E-bar to the activity in terms of DEX is acceptable.

3.2.3 Revision of LCO 3.4.16

The LCO 3.4.16 limits on RCS-specific activity are to ensure that DBA dose consequences will be within acceptable values, and the associated conditions, as proposed Condition B, are to limit the time when the RCS-specific activity is above the limits. The licensee proposes to modify LCO 3.4.16 to state that the iodine-specific activity DEI and the noble gas-specific activity DEX shall be within limits.

The proposed LCO 3.4.16 states "RCS DOSE EQUIVALENT 1-131 and DOSE EQUIVALENT XE-133 specific activity will be within limits."

The change is to replace (1) the DEI with a revised definition and (2) the RCS gross-specific activity in terms of E-bar with the RCS-specific activity in terms of DEX. These changes are addressed in Sections 3.2.1 and 3.2.2 of this SE, respectively. Currently, the activity limits are not given in the LCO, but are defined as follows: (1) in current Condition A and SR 3.4.16.2 for iodine-specific activity and (2) in current Condition B and SR 3.4.16.1 for gross non-iodine-specific activity. The DEI limit of 1.0 $\mu\text{Ci/gm}$ is not being changed, but it will only be listed in the TSs in SR 3.4.16.2. The proposed DEX limit of 225 $\mu\text{Ci/gm}$ is new and will only be stated in SR 3.4.16.1.

Based on the acceptance of the revised definition of DEI and the replacement of the definition of E-bar with the new definition for DEX for the RCS gross-specific activity, as discussed above in Sections 3.2.1 and 3.2.2 of this SE, the NRC staff concludes that the proposed revision of LCO 3.4.16 is acceptable.

The licensee stated that the DEI limit of 1.0 $\mu\text{Ci/gm}$ is retained because the limit is consistent with the current SGTR and MSLB radiological consequence analyses, and the DEX limit of 225 $\mu\text{Ci/gm}$ is more limiting than the value in the current SGTR and MSLB radiological consequences analyses.

The NRC staff performed an independent calculation of DEX based on the isotopic values provided by the licensee as used in the applicable dose consequence analyses. The results of the evaluation confirm the licensee's assertion that the proposed DEX limit of 225 $\mu\text{Ci/gm}$ is bounded by the RCS-specific activity values used in the applicable dose consequence analyses.

The licensee is only changing the non-iodine activity limit for the reactor coolant. Because the proposed DEX limit of 225 $\mu\text{Ci/gm}$ is more limiting than the value in the current SGTR and MSLB radiological consequences analyses, the NRC staff concludes that this limit is acceptable.

3.2.4 TS 3.4.16 Applicability Revision

The licensee has proposed to extend the applicability of TS 3.4.16 to include all of Mode 3 and Mode 4. The licensee stated, and the NRC staff agrees, that it is necessary for LCO 3.4.16 to apply during Modes 1 through 4 to limit the potential radiological consequences of an SGTR or MSLB that may occur during these reactor operational modes, which are defined in TS Table 1.1-1, "MODES." The licensee stated, and the NRC staff agrees, that in Modes 5 and 6, the steam generators are not used for decay heat removal, the RCS and steam generators are depressurized, and primary-to-secondary leakage is minimal and, therefore, the monitoring of RCS-specific activity during Modes 5 and 6 is not necessary. The licensee concluded that the proposed change to modify the TS 3.4.16 applicability to include all of Mode 3 and to add Mode 4 is necessary to limit the potential radiological consequences of an SGTR or MSLB that may occur during these modes. Based on this, the NRC staff concludes that this proposed change to extend the mode applicability for LCO 3.4.16 is acceptable.

3.2.5 TS 3.4.16 Condition A Revision

The licensee has proposed to revise TS 3.4.16 Condition A by replacing the DEI limit of 1.0 $\mu\text{Ci/gm}$ with the words "not within limit." The DEI limit of 1.0 $\mu\text{Ci/gm}$ is contained in SR 3.4.16.2, which is not being changed in this amendment. This change in wording in Condition A does not change the DEI limit in TS 3.4.16, or any other requirement in the TSs. Based on this, the NRC staff concludes that the proposed change to Condition A is acceptable.

3.2.6 TS 3.4.16 Required Action A.1 Revision

The licensee has proposed to revise TS 3.4.16 Required Action A.1 to replace the requirement to verify that the DEI is within the acceptable region of TS Figure 3.4.16-1, "Reactor Coolant [DEI] Specific Activity Limit Versus Percent of Rated Thermal Power," with the requirement to verify that the DEI is $\leq 60 \mu\text{Ci/gm}$. The proposed change is to specify the value of the verification limit instead of referencing the acceptable operation region in the TS figure. The figure would be removed from the TSs.

The proposed change keeps the requirement to verify that the DEI is within an acceptable limit. The licensee's radiological consequence analyses for SGTR and MSLB accidents that take into account the pre-accident iodine spike do not consider the elevated RCS iodine-specific activities permitted by current TS Figure 3.4.16-1 for operation at power levels below 80 percent RTP (i.e. DEI of 60 $\mu\text{Ci/gm}$ at 80 percent RTP increasing linearly to 225 $\mu\text{Ci/gm}$ at 25 percent RTP). Instead, the pre-accident iodine spike analyses assume a DEI concentration 60 times higher than the corresponding long-term equilibrium value, which corresponds to the 60 $\mu\text{Ci/gm}$ RCS-specific activity limit associated with 100 percent RTP operation. The licensee stated, and the NRC staff agrees, that TS 3.4.16 Required Action A.1 should be based on a limit of 60 $\mu\text{Ci/gm}$ to be consistent with the assumptions contained in the radiological consequence of the associated accident analyses. Also, because the proposed 60 $\mu\text{Ci/gm}$ verification limit is the lowest value of the acceptable operation region in TS Figure 3.4.16-1, the proposed value would require the licensee to verify that the DEI is at the lowest value of the figure, or to start shutting down the plant, and, therefore, would be a conservative change to the TSs. The NRC staff concludes that the proposed change is acceptable because the proposed 60 $\mu\text{Ci/gm}$ limit

is (1) based on maintaining the requirement to verify that the DEI is within an acceptable limit, (2) consistent with the accident analyses, and (3) conservative.

The Required Action A.2 and the CTs for both Required Actions A.1 and A.2 are not being changed by this amendment.

3.2.7 TS 3.4.16 Condition B Revision to Include Required Action for DEX Limit

The licensee has proposed to replace the current TS 3.4.16 Condition B with a new Condition B for the DEX not being within limits. This change includes changing the Required Action B.1 and its CT. These changes are proposed to be consistent with the change to the LCO 3.4.16 that requires the DEX-specific activity to be within limits, which is addressed above in Sections 3.2.2 and 3.2.3 of this SE. The DEX limit of 225 $\mu\text{Ci/gm}$ is proposed to be listed in the revised SR 3.4.16.1 and the proposed CT will be extended from 6 hours to 48 hours. Also, the licensee has proposed to add a note to the Required Action B.1 that states LCO 3.0.4.c is applicable.

Given that LCO 3.4.16 is stated partly in terms of the requirement that the DEX shall be within limits, 10 CFR 50.36 requires that there be remedial actions specified for the case when the LCO is not being met. The licensee has proposed a new Condition B, which is applicable when the DEX is not within its limit. The proposed Required Action B.1 would require that the licensee restore the DEX to within its limit within 48 hours.

The proposed Condition B and Required Action B.1 are appropriate remedial actions for the licensee to address the case of the DEX limit in LCO 3.4.16 not being met and the NRC staff concludes that this condition and required action is needed to address the case of the DEX limit not being met. Based on this, the NRC staff concludes that the proposed Condition B and Required Action B.1 meet 10 CFR 50.36 and are, therefore, acceptable.

The proposed CT for the new Required Action B.1 will require the restoration of DEX to within limit in 48 hours, or the licensee has to enter revised Condition C and start shutting down the plant. This proposed CT has the same value as the CT for the current Required Action A.2 to restore the DEI within its limit.

The licensee stated that the whole body dose consequences for the SGTR and MSLB accidents, as documented in the Updated Safety Analysis Report Tables 15.6-5, 15.6-5A, and 15.1-4, constitute a smaller percentage of the applicable acceptance criteria (i.e., 10 CFR Part 100) than do the thyroid body doses and, therefore, the CT for restoring the noble gas-specific activity to within the DEX limit in the new Required Action B.1 should not be less than the CT for restoring the iodine-specific activity to within the DEI limit in Required Action A.2. The required Action A.2 and CT are not being changed in this amendment. Therefore, the NRC staff concludes that the proposed CT of 48 hours for the new Required Action B.1 is acceptable because it provides a reasonable time consistent with the TSs to restore the noble gas-specific activity within the DEX limit.

The licensee has also proposed to add a note to the new Required Action B.1 that states LCO 3.0.4.c is applicable. This note would allow entry into a mode or other specified condition in the LCO mode applicability when an LCO is not being met and is the same note that is currently stated for Required Actions A.1 and A.2. The proposed note would allow entry into

the applicable modes when the DEX is not within its limit; in other words, the plant could go up in the modes from Mode 4 to Mode 1 (power operation) while the DEX limit is exceeded and the DEX is being restored to within its limit. The licensee stated that this mode change allowance is acceptable because of the significant conservatism included in the limit, because of the low probability of an event occurring that is limiting because the 10 CFR Part 100 acceptance dose consequences are exceeded during the time the limit is exceeded (i.e., occurring during the proposed CT for new Required Action B.1), and because the DEX can be restored within its limit during the mode changes. The NRC staff agrees with the licensee's justification for the note and, therefore, concludes that the proposed note concerning mode change allowance for the DEX is acceptable.

3.2.8 TS 3.4.16 Condition C and Required Actions Revision

The TS 3.4.16 Condition C has two parts and both parts would be changed. The licensee has proposed to revise TS 3.4.16 Condition C to (1) include, in the first part, the new Condition B (for the DEX not within its limit) stating if the "Required Action and associated Completion Time of Condition A **or** B not met," and (2) replace, in the second part, the phrase "in the unacceptable region of Figure 3.4.6-1" with "> 60 $\mu\text{Ci/gm}$ " to state "Dose Equivalent I-131 > 60 $\mu\text{Ci/gm}$." The addition of the revised Condition B to the first part of Condition C is shown above in **bold**.

The change to the first part of the current Condition C, incorporating the reference to revised Condition B, would add the requirement on the non-iodine part of the RCS-specific activity that, when not meeting the required actions and associated CT of Condition B, the licensee shall perform the specified required actions for Condition C within the specified CTs. Because this addition is a new requirement and is consistent with what is required when not meeting the required action and associated CT for Condition A, the NRC staff concludes that this is an acceptable remedial action when not meeting the required action and CT for Condition B and, therefore, meets 10 CFR 50.36 and is acceptable.

The change to rewrite the second part of Condition C to state "DEI > 60 $\mu\text{Ci/gm}$ " replaces the limit on DEI in the deleted Figure 3.4.16-1 with a value of > 60 $\mu\text{Ci/gm}$, which is addressed in Section 3.2.6 of the SE. Because this change makes Condition C consistent with the changes made to TS 3.4.16 Required Action A.1, the NRC staff concludes that this change is also acceptable.

The proposed changes to the required actions for Condition C would (1) delete the phrase "with $T_{\text{avg}} < 500^{\circ}\text{F}$ " from Required Action C.1 and (2) add a new Required Action C.2 to "Be in Mode 5." The new Required Action C.2 is a new requirement because the licensee has proposed the new Required Action C.2 with the logical connector "And." Therefore, the licensee is proposing that if Condition C is entered, it must perform both Required Action C.1 and C.2.

The revised required actions will require the licensee to be in Mode 3 within 6 hours and in Mode 5 within 36 hours. The licensee stated that the changes are consistent with the changes made to the TS 3.4.16 mode applicability, which are addressed in Section 3.2.4 of this SE. The revised LCO applicability is extended to Modes 1 through 4 to limit the potential radiological consequences of an SGTR or MSLB that may occur during these modes. The licensee stated,

and the NRC staff agrees, that in Modes 5 and 6, the steam generators are not used for decay heat removal, the RCS and steam generators are depressurized, and primary-to-secondary leakage is minimal and, therefore, the monitoring of RCS-specific activity during Modes 5 and 6 is not necessary. The requirement to be in Mode 5 will take the plant outside the modes of applicability for TS 3.4.16. Also, the fact that the statements require entry into Mode 3 and then entry into Mode 5, without an intervening statement regarding Mode 4, is consistent with other required actions in the TSs. Based on this, the NRC staff concludes that the proposed Required Action C.2 is an appropriate remedial action for Condition C and, therefore, meets 10 CFR 50.36 and is acceptable.

The licensee has proposed a CT for the new Required Action C.2 CT of 36 hours for the plant to be in Mode 5. The licensee asserts, and the NRC staff agrees, that it is reasonable, based on operating experience, to reach Mode 5 from full power conditions in an orderly manner and without challenging plant systems. The licensee further states, and the NRC staff agrees, that the value of 36 hours is also consistent with other TSs that have a CT to reach Mode 5. Based on this, the NRC staff concludes that the proposed CT is acceptable.

3.2.9 SR 3.4.16.1 Revision to Include DEX Limit

The proposed change replaces the current RCS gross-specific activity limit of E-bar with the new DEX limit. The requirement to verify that the reactor coolant meets the LCO limit for RCS gross-specific activity (i.e., the non-iodine activity) is not being changed. The change is to specify the DEX limit in the SR and to state that the licensee is to verify that the reactor coolant DEX limit of $\leq 225 \mu\text{Ci/gm}$ is being met, and the reasonableness of this limit is addressed in Section 3.2.3 of this SE. The surveillance test interval of 7 days for the surveillance is not being changed.

The licensee has also proposed to modify SR 3.4.16.1 by the inclusion of a note that states that the surveillance is only required to be performed in Mode 1. The note is explained in Example 1.4-5 in Section 1.4, "Frequency," of NRC NUREG-1431, "Standard Technical Specifications Westinghouse Plants," Revision 2, dated April 2001. The Callaway TSs are based on the standard TSs in NUREG-1431. The note modifies the required performance of the surveillance and, therefore, is considered part of the "specified frequency," which in this case is 7 days and is not being changed by the amendment. It is stated in NUREG-1431 that should the 7-day interval be exceeded while operation is not in Mode 1, the note will allow entry into Modes 2 through 4 (the proposed modes of applicability for TS 3.4.16) to perform the surveillance; however, the surveillance is required to be performed before entry into Mode 1. The surveillance is also considered to be performed within the specified frequency if it is completed prior to entering Mode 1.

Therefore, the proposed note allows the licensee to enter Modes 2 through 4 without performing the surveillance, but requires the licensee to perform the surveillance prior to entry into Mode 1. This is the same note for the specified frequency of SR 3.4.16.2, which requires the periodic verification that the DEI is within its limit.

Because the surveillance is required to be performed before entry into Mode 1 and high-power operation (> 5 percent RTP), the NRC staff concludes that the proposed note is acceptable as the specified frequency for SR 3.4.16.1.

3.2.10 SR 3.4.16.3 Deletion

The licensee has proposed to delete SR 3.4.16.3, which required the periodic determination of E-bar for the RCS coolant. This change is consistent with the proposed changes to LCO 3.4.16 and Condition B to replace the limit of the RCS gross-specific coolant activity in terms of E-bar with the limit in terms of DEX. These changes are addressed in Sections 3.2.2, 3.2.3, and 3.2.5 of this SE. The licensee stated that SR 3.4.16.3 is no longer required because E-bar is being eliminated from TS 3.4.16. Because E-bar is being removed from LCO 3.4.16 and Condition A, the NRC staff concludes that SR 3.4.16.3 is no longer necessary to ensure that any limit in an LCO, specifically in this case LCO 3.4.16, is being met, which in accordance with 10 CFR 50.36 is the reason for SRs in the TSs. Based on this, the NRC staff concludes that the elimination of SR 3.4.16.3 meets 10 CFR 50.36 and is, therefore, acceptable.

3.2.11 Sufficiency of SRs 3.4.16.1 and 3.4.16.2

In accordance with 10 CFR 50.36(c)(3), SRs are "requirements relating to tests, calibration, or inspection to assure that the necessary quality of the systems and components is maintained, that facility operation will be within safety limits, and that the limiting conditions for operation will be met." In light of the proposed changes to LCO 3.4.16, the NRC staff reviewed SRs 3.4.16.1 and 3.4.16.2 to determine if these SRs were sufficient to assure that LCO 3.4.16 will be met. Since SR 3.4.16.1 ensures that the DEX is within its limit and SR 3.4.16.2 ensures that the DEI is within its limit, and LCO 3.4.16 is that the DEI and DEX are within limits, the NRC staff concludes that these SRs are sufficient to ensure the LCO is being met and no other SR is needed.

3.3 Conclusion

Based on its evaluation of the proposed amendment, as discussed in Sections 3.1 through 3.2 of this SE, the NRC staff concludes that the amendment as proposed in the licensee's application dated May 9, 2006, meets 10 CFR 50.36 and is, therefore, acceptable.

In the proposed changes to TS 3.4.16 on RCS-specific activity, the licensee proposed changes that removed two pages from TS 3.4.16. These changes are the deletion of SR 3.4.16.3 and Figure 3.4.16-1. Since the TS Table of Contents (TOC) lists TS 3.4.17, "Steam Generator (SG) Tube Integrity," the page number in the TOC for TS 3.4.17 and the 3 pages of TS 3.4.17 in Section 3.4, "Reactor Coolant System (RCS)," of the TSs must be changed to account for the removal of the two pages from TS 3.4.16. These renumbering changes are an editorial change, and no requirements in the TSs are being changed. Based on this, the NRC staff concludes that the page number change to the Table of Contents is acceptable.

In Attachments 4 and 5 to its application, the licensee identified changes to the TS Bases and Final Safety Analysis Report (FSAR) for Callaway. The NRC staff reviewed these identified changes and had no comments. The licensee's changes to the TS Bases and the FSAR are controlled by TS 5.5.14, "Technical Specification (TS) Bases Control Program," and 10 CFR 50.59, respectively.

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 and changes surveillance requirements. 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 (71 FR 35461, published June 20, 2006). 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.

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