



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

March 18, 2010

Vice President, Operations
Arkansas Nuclear One
Entergy Operations, Inc.
1448 S.R. 333
Russellville, AR 72802

SUBJECT: ARKANSAS NUCLEAR ONE, UNIT NO. 1 - ISSUANCE OF AMENDMENT RE:
DELETION OF E BAR DEFINITION AND REVISION TO REACTOR COOLANT
SYSTEM SPECIFIC ACTIVITY TECHNICAL SPECIFICATION
(TAC NO. MD8311)

Dear Sir or Madam:

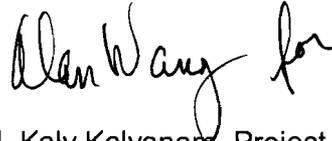
The Nuclear Regulatory Commission (NRC) has issued the enclosed Amendment No. 243 to Renewed Facility Operating License No. DPR-51 for Arkansas Nuclear One, Unit No. 1 (ANO-1). The amendment consists of changes to the Technical Specifications (TSs) in response to your application dated March 13, 2008, as supplemented by letter dated February 28, 2010.

The amendment replaces the current ANO-1 TS 3.4.12, "RCS [Reactor Coolant System] Specific Activity," limit on RCS gross specific activity with a new limit on RCS noble gas specific activity. The noble gas specific activity limit would be based on a new dose equivalent Xe-133 definition that would replace the current E Bar average disintegration energy definition. In addition, the current dose equivalent I-131 definition would be revised to allow the use of additional thyroid dose conversion factors.

The changes are consistent with NRC-approved Industry Technical Specification Task Force (TSTF) Standard Technical Specification Change Traveler, TSTF-490, Revision 0, "Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec." The availability of this TS improvement was announced in the *Federal Register* on March 15, 2007 (72 FR 12217), as part of the consolidated line item improvement process.

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

Sincerely,

A handwritten signature in black ink that reads "Alan Wang for". The signature is written in a cursive style.

N. Kaly Kalyanam, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-313

Enclosures:

1. Amendment No. 243 to DPR-51
2. Safety Evaluation

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

ENTERGY OPERATIONS, INC.

DOCKET NO. 50-313

ARKANSAS NUCLEAR ONE, UNIT NO. 1

AMENDMENT TO RENEWED FACILITY OPERATING LICENSE

Amendment No. 243
Renewed License No. DPR-51

1. The Nuclear Regulatory Commission (the Commission) has found that:
 - A. The application for amendment by Entergy Operations, Inc. (the licensee), dated March 13, 2008, as supplemented by letter dated February 28, 2010, complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and 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 license 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.

Enclosure 1

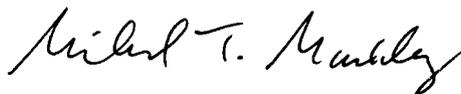
2. Accordingly, the license is amended by changes to the Technical Specifications as indicated in the attachment to this license amendment, and Paragraph 2.C.(2) of Renewed Facility Operating License No. DPR-51 is hereby amended to read as follows:

- (2) Technical Specifications

- The Technical Specifications contained in Appendix A, as revised through Amendment No. 243, are hereby incorporated in the renewed license. EOI shall operate the facility in accordance with the Technical Specifications.

3. The license amendment is effective as of its date of issuance and shall be implemented within 90 days from the date of the issuance.

FOR THE NUCLEAR REGULATORY COMMISSION



Michael T. Markley, Chief
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Attachment:
Changes to the Renewed Facility
Operating License No. DPR-51
and Technical Specifications

Date of Issuance: March 18, 2010

ATTACHMENT TO LICENSE AMENDMENT NO. 243
RENEWED FACILITY OPERATING LICENSE NO. DPR-51
DOCKET NO. 50-313

Replace the following pages of the Renewed Facility Operating License No. DPR-51 and Appendix A Technical Specifications with the attached revised pages. The revised pages are identified by amendment number and contain marginal lines indicating the areas of change.

Operating License

REMOVE

3

INSERT

3

Technical Specifications

REMOVE

1.1-2

1.1-3

1.1-4

3.4.12-1

3.4.12-2

INSERT

1.1-2

1.1-3

1.1-4

3.4.12-1

3.4.12-2

- (5) EOI, pursuant to the Act and 10 CFR Parts 30, 40 and 70, to receive, possess and use in amounts as required any byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis byproduct, source or special nuclear material without restriction to chemical or physical form, for sample analysis or instrument calibration or associated with radioactive apparatus or components;
 - (6) EOI, pursuant to the Act and 10 CFR Parts 30 and 70, to possess, but not separate, such byproduct and special nuclear materials as may be produced by the operation of the facility.
- c. This renewed license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:
- (1) Maximum Power Level
EOI is authorized to operate the facility at steady state reactor core power levels not in excess of 2568 megawatts thermal.
 - (2) Technical Specifications
The Technical Specifications contained in Appendix A, as revised through Amendment No. 243, are hereby incorporated in the renewed license. EOI shall operate the facility in accordance with the Technical Specifications.
 - (3) Safety Analysis Report
The licensee's SAR supplement submitted pursuant to 10 CFR 54.21(d), as revised on March 14, 2001, describes certain future inspection activities to be completed before the period of extended operation. The licensee shall complete these activities no later than May 20, 2014.
 - (4) Physical Protection
EOI shall fully implement and maintain in effect all provisions of the Commission-approved physical security, training and qualification, and safeguards contingency plans, including amendments made pursuant to provisions of the Miscellaneous Amendments and Search Requirements revisions to 10 CFR 73.55 (51 FR 27817 and 27822) and to the authority of 10 CFR 50.90 and 10 CFR 50.54(p). The combined set of plans, which contains Safeguards Information protected under 10 CFR 73.21, is entitled: "Arkansas Nuclear One Physical Security Plan, Training and Qualifications Plan, and Safeguards Contingency Plan," as submitted on May 4, 2006.

1.1 Definition

CHANNEL CALIBRATION (continued)	The CHANNEL CALIBRATION may be performed by means of any series of sequential, overlapping, or total channel steps.
CHANNEL CHECK	A CHANNEL CHECK shall be the qualitative assessment, by observation, of channel behavior during operation. This determination shall include, where possible, comparison of the channel indication and status to other indications or status derived from independent instrument channels measuring the same parameter.
CHANNEL FUNCTIONAL TEST	A CHANNEL FUNCTIONAL TEST shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable to verify OPERABILITY of all devices in the channel required for channel OPERABILITY. The CHANNEL FUNCTIONAL TEST may be performed by means of any series of sequential, overlapping, or total steps.
CONTROL RODS	CONTROL RODS shall be all full length safety and regulating rods that are used to shutdown the reactor and control power level during maneuvering operations.
CORE ALTERATION	CORE ALTERATION shall be the movement of any fuel, sources, or reactivity control components, within the reactor vessel with the vessel head removed and fuel in the vessel. Suspension of CORE ALTERATIONS shall not preclude completion of movement of a component to a safe position.
CORE OPERATING LIMITS REPORT (COLR)	The COLR is the ANO-1 specific document that provides cycle specific parameter limits for the current reload cycle. These cycle specific parameter limits shall be determined for each reload cycle in accordance with Specification 5.6.5. Plant operation within these limits is addressed in individual Specifications.
DOSE EQUIVALENT I-131	DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries per gram) that alone would produce the same committed effective dose equivalent (CEDE) as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The CEDE dose conversion factors used to determine the DOSE EQUIVALENT I-131 shall be performed using Table 2.1 of EPA Federal Guidance Report No. 11, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose conversion Factors for Inhalation, Submersion, and Ingestion."

1.1 Definition (continued)

DOSE EQUIVALENT XE-133

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-85, Kr-87, Kr-88, Xe-131m, 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, 1993, "External Exposure to Radionuclides in Air, Water, and Soil."

LEAKAGE

LEAKAGE shall be:

a. Identified LEAKAGE

1. LEAKAGE, such as that from pump seals or valve packing (except RCP seal water injection or leakoff), that is captured and conducted to collection systems or a sump or collecting tank;
2. LEAKAGE into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be pressure boundary LEAKAGE; or
3. Reactor Coolant System (RCS) LEAKAGE through a steam generator to the Secondary System (primary to secondary LEAKAGE);

b. Unidentified LEAKAGE

All LEAKAGE (except RCP seal water injection and leakoff) that is not identified LEAKAGE;

c. Pressure Boundary LEAKAGE

LEAKAGE (except primary to secondary LEAKAGE) through a nonisolable fault in an RCS component body, pipe wall, or vessel wall.

1.1 Definition (continued)

MODE	A MODE shall correspond to any one inclusive combination of core reactivity condition, power level, average reactor coolant temperature, and reactor vessel head closure bolt tensioning specified in Table 1.1-1 with fuel in the reactor vessel.
OPERABLE-OPERABILITY	A system, subsystem, train, component, or device shall be OPERABLE or have OPERABILITY when it is capable of performing its specified safety function(s) and when all necessary attendant instrumentation, controls, normal or emergency electrical power, cooling and seal water, lubrication, and other auxiliary equipment that are required for the system, subsystem, train, component, or device to perform its specified safety function(s) are also capable of performing their related support function(s).
PHYSICS TESTS	<p>PHYSICS TESTS shall be those tests performed to measure the fundamental nuclear characteristics of the reactor core and related instrumentation.</p> <p>These tests are:</p> <ol style="list-style-type: none"> a. Described in the SAR; b. Authorized under the provisions of 10 CFR 50.59; or c. Otherwise approved by the Nuclear Regulatory Commission.
QUADRANT POWER TILT (QPT)	<p>QPT shall be defined by the following equation and is expressed as a percentage.</p> $QPT = 100 \left(\frac{\text{Power in any Core Quadrant}}{\text{Average Power in all Quadrants}} - 1 \right)$
RATED THERMAL POWER (RTP)	RTP shall be a total steady state reactor core heat transfer rate to the reactor coolant of 2568 MWt.

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.12 RCS Specific Activity

LCO 3.4.12 RCS DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 specific activity shall be within limits.

APPLICABILITY: MODES 1, 2, 3, and 4

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. DOSE EQUIVALENT I-131 not within limit.	<p>-----NOTE----- LCO 3.0.4.c is applicable. -----</p> <p>A.1 Verify DOSE EQUIVALENT I-131 $\leq 60 \mu\text{Ci/gm}$.</p> <p><u>AND</u></p> <p>A.2 Restore DOSE EQUIVALENT I-131 to within limit.</p>	<p>Once per 4 hours</p> <p>48 hours</p>
B. DOSE EQUIVALENT XE-133 not within limit.	<p>-----NOTE----- LCO 3.0.4.c is applicable. -----</p> <p>B.1 Restore DOSE EQUIVALENT XE-133 to within limit.</p>	48 hours
<p>C. Required Action and associated Completion Time of Condition A or B not met.</p> <p><u>OR</u></p> <p>DOSE EQUIVALENT I-131 $> 60 \mu\text{Ci/gm}$.</p>	<p>C.1 Be in MODE 3.</p> <p><u>AND</u></p> <p>C.2 Be in MODE 5</p>	<p>6 hours</p> <p>36 hours</p>

SURVEILLANCE REQUIREMENTS

SURVEILLANCE		FREQUENCY
SR 3.4.12.1	<p>-----NOTE----- Only required to be performed in MODE 1 and 2, MODE 3 with RCS average temperature ≥ 500 °F. -----</p> <p>Verify reactor coolant DOSE EQUIVALENT XE-133 specific activity ≤ 2200 $\mu\text{Ci/gm}$.</p>	7 days
SR 3.4.12.2	Verify reactor coolant DOSE EQUIVALENT I-131 specific activity ≤ 1.0 $\mu\text{Ci/gm}$.	14 days



UNITED STATES
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WASHINGTON, D.C. 20555-0001

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION

RELATED TO AMENDMENT NO. 243 TO

RENEWED FACILITY OPERATING LICENSE NO. DPR-51

ENTERGY OPERATIONS, INC.

ARKANSAS NUCLEAR ONE, UNIT NO. 1

DOCKET NO. 50-313

1.0 INTRODUCTION

By application dated March 13, 2008, as supplemented by letter dated February 28, 2010 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML080850906 and ML100610099, respectively), Entergy Operations, Inc. (Entergy, the licensee), requested changes to the Technical Specifications (TSs) for Arkansas Nuclear One, Unit No. 1 (ANO-1). The supplemental letter dated February 28, 2010, provided additional information that clarified the application, did not expand the scope of the application as originally noticed, and did not change the U.S. Nuclear Regulatory Commission (NRC) staff's original proposed no significant hazards consideration determination as published in the *Federal Register* on May 6, 2008 (73 FR 25038).

The proposed changes would replace the current ANO-1 TS 3.4.12, "RCS [Reactor Coolant System] Specific Activity," limit on RCS gross specific activity with a new limit on RCS noble gas specific activity. The noble gas specific activity limit would be based on a new dose equivalent Xe-133 (DEX) definition that would replace the current E Bar average disintegration energy definition. In addition, the current dose equivalent I-131 (DEI) definition would be revised to allow the use of additional thyroid dose conversion factors (DCFs).

The changes are generally consistent with NRC-approved Industry Technical Specification Task Force (TSTF) Standard Technical Specification Change Traveler, TSTF-490, Revision 0, "Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec," with the exception of the Modes of Applicability for the DEX surveillance requirement (SR). The availability of this TS improvement was announced in the *Federal Register* on March 15, 2007 (72 FR 12217), as part of the consolidated line item improvement process.

2.0 REGULATORY EVALUATION

In Section 50.36, "Technical Specifications," of Title 10 of the *Code of Federal Regulations* (10 CFR 50.36), the Commission established its regulatory requirements related to the content

of the TSs. Pursuant to 10 CFR 50.36, TSs are required to include items in the following five specific categories related to station operation: (1) safety limits, limiting safety system settings, and limiting control settings; (2) limiting conditions for operation (LCOs); (3) SRs; (4) design features; and (5) administrative controls.

The NRC staff evaluated the impact of the proposed changes as they relate 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 RCS TS 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 Steam Line Break (MSLB) accident typically do not result in fuel damage and, 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.

By letter dated October 21, 2009 (ADAMS Accession No. ML092740035), the Commission issued Amendment No. 238 to Renewed Facility Operating License No. DPR-51 for ANO-1, to revise the TSs to incorporate a full-scope application of an alternative source term (AST) methodology in accordance with 10 CFR 50.67(b)(2). As a result of the licensee using the AST in its dose consequence analyses, the NRC staff used the regulatory guidance provided in NUREG-0800, Standard Review Plan (SRP) Section 15.0.1, "Radiological Consequence Analyses Using Alternative Source Terms," Revision 0, July 2000, and Regulatory Guide (RG) 1.183, "Alternative Radiological Source Terms for Evaluating Design Basis Accidents at Nuclear Power Reactors," July 2000, which provides the methodology and assumptions acceptable to the NRC staff for the evaluation of design basis radiological analyses using an AST. Specifically, the offsite dose criteria are 25 roentgen equivalent man (rem) total effective dose equivalent (TEDE) at the exclusion area boundary (EAB) for any 2-hour period following the onset of the postulated fission product release and 25 rem TEDE at the outer boundary of the low population zone (LPZ) for the duration of the postulated fission product release. In addition, 10 CFR 50.67(b)(2)(iii) 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 TEDE for the duration of the accident.

3.0 TECHNICAL EVALUATION

3.1 Background

The primary coolant-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 primary coolant-specific activity is governed by TSs. Due to the importance of iodine in the dose consequence analyses, a separate limit is specified for the iodine isotopes. This limit is specified in units of DEI, which is the normalized quantity of iodine 131 that would result in the same dose consequence as the combination of the major isotopes 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) 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 by TSs be constant from 100 percent 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.

The current standard TS definition of DEI is based on thyroid 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 isotopes 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 TS 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 isotopes, 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 72 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 isotopes 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 Technical Evaluation of RCS TS Changes

Formatting Change

The Standard TS (STS) for Babcock and Wilcox Plants (NUREG-1430) uses TS Section 3.4.16 for RCS Specific Activity. Entergy uses TS Section 3.4.12 for RCS Activity. Because Entergy has a customized TS, the TS sections do not correlate on a one-to-one basis to the STS. As such, LCO 3.4.12 will be reformatted to be consistent with the STS but using ANO-1's numbering system. The NRC staff reviewed the equivalent TS sections, where applicable, against the TSTF-490, Revision 0, model safety evaluation. The NRC staff concludes they are acceptable.

3.2.1 Revision to the Definition of DEI

The licensee proposes to revise the TS Section 1.1 definition for DOSE EQUIVALENT I-131 to read as follows:

DOSE EQUIVALENT I-131 shall be that concentration of I-131 (microcuries per gram) that alone would produce the same committed effective dose equivalent (CEDE) as the quantity and isotopic mixture of I-131, I-132, I-133, I-134, and I-135 actually present. The CEDE dose conversion factors used to determine the DOSE EQUIVALENT I-131 shall be performed using Table 2.1 of EPA Federal Guidance Report No. 11, 1988, "Limiting Values of Radionuclide Intake and Air Concentration and Dose conversion Factors for Inhalation, Submersion, and Ingestion."

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 dose consequence analyses. This change will allow the licensee to calculate DEI using the same DCFs as are used in the dose consequence analyses and is, therefore, acceptable.

3.2.2 Deletion of the Definition of E-Bar and the Addition of a New Definition for Dose Equivalent Xe-133

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 new definition for DEX is similar to the definition for DEI. The determination of DEX will be performed in a similar manner to that currently used in determining 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-85, Kr-87, Kr-88, Xe-131m, Xe-133m, Xe-133, Xe-135m, Xe-135, and Xe-138 which are significant in terms of contribution to whole-body dose. The licensee has determined that these isotopes 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. This will result in a conservative calculation of DEX.

The licensee stated that when E-Bar is determined using a design-basis approach in which it is assumed that 1.0 percent of the power 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 NRC concludes this is acceptable. The other nuclides have relatively small contributions. However, during normal plant operation, there are typically only a small number 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. It also results in a TS limit that can vary during operation as different values for E-Bar are determined.

The licensee stated that this change will implement an LCO that is consistent with the whole-body radiological consequence analyses that are sensitive to the noble gas activity in the

primary coolant but not to other, non-gaseous activity currently captured in the E-Bar definition. The NRC concludes this is acceptable. LCO 3.4.12.b specifies the limit for primary coolant gross-specific activity as 72/E-Bar $\mu\text{Ci}/\text{gm}$. The current E-Bar definition includes radioisotopes that decay by the emission of both gamma and beta radiation. The licensee stated that the current LCO 3.4.12.b, Condition A of LCO 3.4.12 would rarely, if ever, be entered for exceeding 72/E-Bar since the calculated value is very high (the denominator is very low) if beta emitters such as tritium are included in the determination, as required by the E-Bar definition. The NRC concludes this is acceptable.

The licensee proposes to delete the TS Section 1.1 definition for E - AVERAGE DISINTEGRATION ENERGY (E-Bar) and replace it with a new definition for DEX which states:

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-85, Kr-87, Kr-88, Xe-131m, 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, 1993, "External Exposure to Radionuclides in Air, Water, and Soil."

The NRC concludes that the proposed change incorporating the newly defined quantity DEX is acceptable since it will result in an LCO that more closely relates the non-iodine RCS activity limits to the dose consequence analyses that form their bases. It is incumbent on the licensee to ensure that the DCFs used in the determination of DEI and the newly defined DEX are consistent with the DCFs used in the applicable dose consequence analyses.

3.2.3 Revision of TS 3.4.12 LCO RCS-Specific Activity

The licensee proposes to modify LCO 3.4.12 to specify that iodine-specific activity in terms of DEI and noble gas-specific activity in terms of DEX shall be within limits. Currently, the limit indicators are explicitly identified and defined in the LCO and in current SR 3.4.12.1 for gross non-iodine-specific activity and in current SR 3.4.12.2 for iodine-specific activity. The proposed changes will remove the limit definitions a and b from LCO 3.4.12 and the new limit definitions will be maintained in the SRs. The proposed LCO 3.4.12 will state "RCS DOSE EQUIVALENT 1-131 and DOSE EQUIVALENT XE-133 specific activity shall be within limits."

The DEI limit of $\leq 1.0 \mu\text{Ci}/\text{gm}$ as contained in current SR 3.4.12.2 is consistent with the revised STS 3.4.16 LCO format in the TSTF. The licensee states that the limit of $\leq 1.0 \mu\text{Ci}/\text{gm}$ is consistent with the current SGTR and MSLB radiological consequence analyses. By e-mail dated December 22, 2009 (ADAMS Accession No. ML093560104), the NRC staff requested Entergy to provide the information necessary for the NRC staff to verify the site-specific DEX limit of $\leq 2,200 \mu\text{Ci}/\text{gm}$. The licensee states that the proposed DEX limit of $\leq 2,200 \mu\text{Ci}/\text{gm}$ as contained in the revised SR 3.4.12.1 is more limiting than the value in the current SGTR and MSLB radiological consequences. The NRC staff performed an independent calculation of DEX based on the isotopic values provided in the ANO-1 final safety analysis report (FSAR) Update

Table 14-50, "Noble Gas-specific Activities in the Reactor Coolant Based on 1% Fuel Defects - SGTR Analysis." The results of the evaluation confirm the licensee's assertion that the proposed DEX limit of $\leq 2,200$ $\mu\text{Ci/gm}$ is bounded by the specific activity values used in the applicable dose consequence analyses and is, therefore, acceptable.

3.2.4 TS 3.4.12 Applicability Revision

The licensee has proposed to modify the TS 3.4.12 Applicability to include all of Mode 3 and Mode 4. The licensee stated that it is necessary for the LCO to apply during Modes 1 through 4 to limit the potential radiological consequences of an SGTR or MSLB that may occur during these modes. The licensee also stated 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. Therefore, the monitoring of RCS-specific activity during Modes 5 and 6 is not required. The proposed change to modify the TS 3.4.12 Applicability to include all of Mode 3 and Mode 4 is necessary to limit the potential radiological consequences of an SGTR or MSLB that may occur during these modes and is, therefore, acceptable. The NRC concludes that the proposed revision is acceptable.

3.2.5 Condition A Revision

As noted above, the licensee has removed the limit definitions from the LCO 3.4.12 to the SRs. Condition A, will be revised from, "Specific activity not within limits," to "DOSE EQUIVALENT I-131 not within limits" consistent with the revised STS 3.4.16 LCO format in the TSTF. The DEI limit of ≤ 1.0 $\mu\text{Ci/gm}$ is contained in SR 3.4.12.2. This change will maintain the consistency of the proposed TS and is acceptable.

The licensee has proposed to maintain a note which permits the use of the provisions of LCO 3.0.4.c in proposed TS 3.4.12 Required Actions A.1 and A.2, and Required Action B.1. This allowance permits entry into the applicable mode(s) while relying on the actions. This allowance is acceptable due to the significant conservatism incorporated into the specific activity limit, the low probability of an event that is limiting due to exceeding this limit, and the ability to restore transient-specific activity excursions while the plant remains at, or proceeds to, power operation. The NRC concludes that the proposed revision to Condition A is acceptable.

3.2.6 TS 3.4.12 .Required Action A.1 Revision and A.2

The licensee has proposed to revise TS 3.4.12 Required Action A.1 to insert a limit of ≤ 60 $\mu\text{Ci/gm}$ for DEI and proposed a new Action A.2. New Action A.1 is consistent with the revised STS 3.4.16 LCO format in the TSTF. 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 $\mu\text{Ci/gm}$ -specific activity limit associated with 100 percent RTP operation. The NRC staff concludes that proposed TS 3.4.12 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 analyses. If Required Action A.1 is exceeded, new Required Action A.2 will require that the DEI will be restored to within limit in 48 hours. The NRC concludes the proposed revision to TS 3.4.12 Required Actions A.1 and A.2 are acceptable.

3.2.7 New Condition B DEX Limit

The licensee has proposed a new Condition B for DEX not within limits. As noted above, the licensee has removed the limit definitions a. and b. from the LCO 3.4.12 to the SRs. As discussed in Section 3.2.8 of this safety evaluation, current Condition B will be renumbered to Condition C. This new Condition B is made to be consistent with the change to the STS 3.4.16 LCO that requires the DEX-specific activity to be within limits as discussed above. The DEX limit of $\leq 2,200 \mu\text{Ci/gm}$ is contained in revised SR 3.4.12.1. The DEX limit of $2,200 \mu\text{Ci/gm}$ is established based on the maximum accident analysis RCS activity corresponding to 1 percent fuel clad defects with sufficient margin to accommodate the exclusion of those isotopes based on low concentration, short half-life, or small-dose conversion factors. The primary purpose of the TS 3.4.12 LCO on RCS-specific activity and its associated conditions is to support the dose analyses for DBAs. 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 current TS 3.4.12.b, Condition A.

The proposed Completion Time (CT) for revised TS 3.4.12 Required Action B.1 will require restoration of DEX to within limit in 48 hours. This is consistent with the proposed CT for new Required Action A.2 for DEI. The radiological consequences for the SGTR and the MSLB accidents, as documented in FSAR Update Sections 14.2.2.1 and 14.2.2.2 and FSAR Update Tables 14-21 and 14-23, respectively, demonstrate that the calculated thyroid doses are a greater percentage of the applicable acceptance criteria than the calculated whole-body doses. The NRC staff agrees with the licensee that it then follows that the CT for noble gas activity being out of specification in the revised Required Action B.1 should be at least as great as the CT for iodine-specific activity being out of specification in current Required Action A.2. Therefore, the NRC concludes that the CT of 48 hours for revised Required Action B.1 is acceptable from a radiological dose perspective.

3.2.8 TS 3.4.12 Condition C

The licensee has proposed to renumber TS 3.4.12 Condition B to Condition C. New Condition C will include Condition B (DEX not within limit) if the Required Action and associated CT of Condition B is not met. This is consistent with the changes made to Condition B, which now provides the same CT for both components of RCS-specific activity as discussed in the revision to Condition B. The proposed revision to Condition C also includes the limit on DEI $60 \mu\text{Ci/gm}$. This change makes Condition C consistent with the changes made to TS 3.4.12 Required Action A.1.

The proposed change to TS 3.4.12 Required Action C.1 requires the plant to be in Mode 3 within 6 hours and adds a new Required Action C.2 which requires the plant to be in Mode 5 within 36 hours. These changes are consistent with the changes made to the TS 3.4.12 Applicability. The revised LCO is applicable throughout all of Modes 1 through 4 to limit the potential radiological consequences of an SGTR or MSLB that may occur during these modes. The NRC staff concludes that in Modes 5 and 6, the steam generators are not used for decay heat removal, the RCS and steam generators are depressurized, and the primary-to-secondary leakage is minimal. Therefore, the monitoring of RCS-specific activity during Modes 5 and 6 is not required.

The licensee has proposed a new TS 3.4.12 Required Action C.2 CT of 36 hours for the plant to reach Mode 5. The NRC staff concludes that this CT 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 that the value of 36 hours is consistent with other TSs which have a CT to reach Mode 5. The NRC concludes that the proposed TS 3.4.12 Condition C is acceptable.

3.2.9 Surveillance Requirements

3.2.9.1 SR 3.4.12.1 Revision to Include Surveillance for DEX

The proposed change replaces the current SR 3.4.12.1 surveillance for RCS gross-specific activity with a surveillance to verify that the reactor coolant DEX-specific activity is $\leq 2,200 \mu\text{Ci/gm}$. This change provides a surveillance for the new LCO limit added to TS 3.4.12 for DEX. The revised SR 3.4.12.1 surveillance requires performing a gamma isotopic analysis as a measure of the noble gas-specific activity of the reactor coolant at least once every 7 days, which is the same frequency required under the current SR 3.4.12.1 surveillance for RCS gross-specific activity. The surveillance provides an indication of any increase in the noble gas-specific activity. The licensee stated that the results of the surveillance on DEX allow proper remedial action to be taken before reaching the LCO limit under normal operating conditions. The NRC concludes this is acceptable.

The licensee has proposed to modify SR 3.4.12.1 with a note which only requires surveillance performance in Mode 1. This allows entry into Mode 4, Mode 3, and Mode 2 prior to performing the surveillance. This allows the surveillance to be performed in any of those modes, prior to entering Mode 1, similar to the current surveillance SR 3.4.12.2 for DEI. By e-mail dated December 22, 2009 (ADAMS Accession No. ML093560104), the NRC staff requested the licensee to justify why there is an apparent disparity between the modes of applicability (MODES 1, 2, 3, and 4) and the limited mode (MODE 1) under which the surveillance is required. The licensee agreed that the footnote only requiring the SR 3.4.12.1 to be performed in Mode 1 should be deleted. However, by letter dated February 28, 2010, the licensee stated that the SR 3.4.12.1 cannot be performed in Mode 4. The licensee stated that the ANO-1 reactor coolant sample system is not designed to accommodate a total gas sample in lower Modes of operation. This is due to the total gas sample bomb being hard piped to the RCS Purification system. In lower modes of operation, the Purification system is either not in-service or there is insufficient pressure to obtain necessary sample flow from this sample point. Therefore, the licensee has proposed to only perform this surveillance in Modes 1, 2, and 3 with RCS temperature ≥ 500 degrees Fahrenheit ($^{\circ}\text{F}$). The licensee stated that in most startup and shutdown scenarios, operation in Mode 4 is usually minimal and the plant would be out of the Mode of Applicability for this TS before 7 days. However, the licensee stated it wants to maintain the flexibility to operate in Mode 4 for greater than 7 days. If the DEX surveillance were adopted for Mode 4, should the Mode 4 extend beyond 7 days, the plant would need to exit the Modes of Applicability for this TS.

In the December 22, 2009, e-mail, the NRC staff requested additional information concerning the surveillance of DEI and DEX in the lower Modes of operation. The licensee provided a response in a letter dated February 28, 2010. In that letter, the licensee stated that an MSLB and an SGTR, while possible in the lower Modes of operation, is a low likelihood event. The

NRC staff has reviewed the licensee's proposed TS changes and supplemental information provided. The proposed TS changes require the licensee to perform the surveillance for DEX in Modes 1, 2, and 3 above 500 °F and for DEI in Modes 1, 2, 3, and 4. The intent of the surveillance is to detect elevated levels of radionuclides in the RCS. Given that iodine is the dominant contributor in the dose analysis, and that the plant will now sample for it in Mode 4, the NRC staff concluded that the proposed changes are acceptable.

3.2.9.2 SR 3.4.12.2 Revision to DEI Surveillance

SR 3.4.12.2 currently has a note which only requires surveillance performance in Mode 1. This allows entry into Mode 4, Mode 3, and Mode 2 prior to performing the surveillance. This allows the surveillance to be performed in any of those modes, prior to entering Mode 1, similar to the current surveillance SR 3.4.12.2 for DEI. By e-mail dated December 22, 2009 (ADAMS Accession No. ML093560104), the NRC staff requested the licensee to justify why there is an apparent disparity between the modes of applicability (MODES 1, 2, 3, and 4) and the limited mode (MODE 1) under which the surveillance is required. The licensee agreed that the footnote only requiring the SR 3.4.12.1 to be performed in Mode 1 should be deleted. The licensee has revised SR 3.4.12.2 to remove this footnote.

3.2.10 SR 3.4.12.3 Deletion

As previously discussed, the licensee has proposed to delete the current SR 3.4.12.3 which required the determination of E-Bar. The proposed TS 3.4.12 LCO on RCS-specific activity supports the dose analyses for DBAs, in which the whole-body dose is primarily dependent on the noble gas concentration, not the non-gaseous activity currently captured in the E-Bar definition. The NRC staff agrees with the licensee that with the elimination of the limit for RCS gross-specific activity and the addition of the new LCO limit for noble gas-specific activity, this SR to determine E-Bar is no longer required.

3.3 Precedent

The TSs developed for the Westinghouse AP600 and AP1000 advanced reactor designs incorporate an LCO for RCS DEX activity in place of the LCO on gross-specific activity based on E-Bar. This approach was approved by the NRC for the AP600 in NUREG-1512, "Final Safety Evaluation Report Related to the Certification of the AP600 Standard Design, Docket No. 52-003," dated August 1998 (ADAMS Accession No. ML081160453), and for the AP1000 in the NRC letter to Westinghouse Electric Company dated September 13, 2004 (ADAMS Accession No. ML042540268). In addition, the curve describing the maximum allowable iodine concentration during the 48-hour period of elevated activity as a function of power level was not included in the TSs approved for the AP600 and AP1000 advanced reactor designs.

3.4 Conclusions

The NRC staff has reviewed the proposed amendment to revise the definition of DEI, delete the definition of E-Bar, add a new definition for DEX, revise TS 3.4.12 to specify a limit on DEI, add a new limit to TS 3.4.12 for DEX, increase the CT of Required Action A.2, and revise the TS 3.4.12 Conditions and Required Actions accordingly. In addition, the NRC staff has reviewed the change in the Applicability of LCO 3.4.12 to reflect the modes during which the

SGTR and MSLB accidents could be postulated to occur, the revision of SR 3.4.12.1 to verify DEX is within the prescribed limit in Modes 1, 2, and 3 with RCS temperature ≥ 500 °F, the revision of SR 3.4.12.2 to verify DEI is within the prescribed limit in Modes 1-4, and the deletion of SR 3.4.12.3.

The NRC staff has concluded that the proposed changes will not impact the dose consequences of the applicable DBAs because the proposed changes will limit the RCS noble gas-specific activity to ensure consistency with the values assumed in the radiological consequence analyses. In addition, the changes will also limit the potential RCS iodine concentration excursion to the value currently associated with full-power operation, which is more restrictive on plant operation than the existing allowable RCS iodine-specific activity at lower power levels. Based on the above, and as the licensee has proposed a more conservative TS, the NRC staff concludes that the proposed TS changes are acceptable.

4.0 STATE CONSULTATION

In accordance with the Commission's regulations, the Arkansas 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 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 published in the Federal Register on May 6, 2008 (73 FR 25038). 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 Contributors: W. Rautzen
A. Wang

Date: March 18, 2010

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

Sincerely,

/RA by Alan Wang for/

N. Kaly Kalyanam, Project Manager
Plant Licensing Branch IV
Division of Operating Reactor Licensing
Office of Nuclear Reactor Regulation

Docket No. 50-313

Enclosures:

1. Amendment No. 243 to DPR-51
2. Safety Evaluation

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