Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

CNL-21-005

January 22, 2021

10 CFR 50.90

ATTN: Document Control Desk
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555-0001

Watts Bar Nuclear Plant, Units 1 and 2
Facility Operating License Nos. NPF-90 and NPF-96
NRC Docket Nos. 50-390 and 50-391

Subject: **Response to Request for Additional Information Regarding Watts Bar Nuclear Plant, Units 1 and 2, License Amendment Request to Adopt TSTF-490, "Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec" (WBN-TS-20-07) (EPID L-2020-LLA-0191)**

References:

1. TVA Letter to NRC, CNL-20-068, "Watts Bar Nuclear Plant, Units 1 and 2, License Amendment Request to Adopt TSTF-490, 'Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec' (WBN-TS-20-07)," dated August 18, 2020 (ML20234A241)

2. NRC Electronic Mail to TVA, "Request for Additional Information Regarding TVA's Request to Adopt Traveler TSTF-490 'Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec' (EPID L-2020-LLA-0191)," dated December 15, 2020 (ML20350B559)

In Reference 1, Tennessee Valley Authority (TVA) submitted a request for an amendment to Facility Operating License Nos. NPF-90 and NPF-96 for the Watts Bar Nuclear Plant (WBN), Units 1 and 2, respectively. The proposed changes would replace the current WBN Units 1 and 2 Technical Specification (TS) 3.4.16, "RCS Specific Activity," limit on reactor coolant system (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. The proposed changes ware consistent with the Nuclear Regulatory Commission (NRC) approved Technical Specification Task Force (TSTF) Traveler-TSTF-490, Revision 0, "Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec."

In Reference 2, the NRC issued a Request for Additional Information (RAI) and requested TVA respond by January 22, 2021. Enclosure 1 provides the TVA response to the RAI.

As noted in the responses to NRC STSB RAI 1, STSB RAI 2, and STSB RAI 4, Enclosure 2 provides the revised WBN Units 1 and 2 TS Bases pages marked up to show the proposed changes that will be made to match the proposed changes to the TS. Additional TS Bases changes were made for better consistency with the TSTF-490 Bases. Changes to the existing TS Bases are provided for information only and will be implemented under the TS Bases Control Program. Enclosure 2 supersedes the corresponding information provided in Attachment 3 of the Enclosure to Reference 1.

This letter does not change the no significant hazard considerations or the environmental considerations contained in Reference 1. Additionally, in accordance with 10 CFR 50.91(b)(1), TVA is sending a copy of this letter and the enclosure to the Tennessee Department of Environment and Conservation.

There are no new regulatory commitments associated with this submittal. Please address any questions regarding this request to Kimberly D. Hulvey, Senior Manager, Fleet Licensing, at (423) 751-3275.

I declare under penalty of perjury that the foregoing is true and correct. Executed on this 22nd day of January 2021.

Respectfully,

James T. Polickoski
Director, Nuclear Regulatory Affairs

Enclosures

1. Response to NRC Request for Additional Information
2. Revised TS Bases Page Changes (Mark-Ups) for WBN Units 1 and 2 (For Information Only)

cc: (with Enclosures):

NRC Regional Administrator - Region II
NRC Senior Resident Inspector - Watts Bar Nuclear Plant
NRC Project Manager - Watts Bar Nuclear Plant
Division of Radiological Health - Tennessee Department of Environment and Conservation

Response to NRC Request for Additional Information

NRC Introduction

By letter dated August 18, 2020 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML20234A241), Tennessee Valley Authority (TVA) submitted a license amendment request (LAR) for the Watts Bar Nuclear Plant (Watts Bar), Units 1 and 2. The proposed amendments would adopt 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," and replace the current Watts Bar, Units 1 and 2 Technical Specification (TS) 3.4.16, "RCS Specific Activity," limit on reactor coolant system (RCS) gross specific activity with a new limit on RCS noble gas specific activity.

The U.S. Nuclear Regulatory Commission (NRC) staff is reviewing the submittal and has identified the following need for additional information.

Section 50.36 of Title 10 of the Code of Federal Regulations (10 CFR) requires licensees to include TSs as part of its license and that a summary statement of the bases or reasons for such specifications be included in the application, but shall not become part of the technical specifications.

The requested TS changes appear to be consistent with Traveler TSTF-490, but the TSs and Bases are not consistent with each other making it difficult for the NRC staff to determine TVA's intent for the changes. The staff also identified that a figure that is deleted by the traveler has been previously deleted from, or not included in, the Watts Bar TSs; however, this was not included in the LAR as a variation from the Traveler. The staff identified some editorial errors in the TS Bases as well.

The following issues should be addressed to ensure that the NRC staff clearly understands the intent of the changes requested.

STSB RAI 1

The proposed note for Surveillance Requirement (SR) 3.4.16.1 requires the surveillance to be performed in Modes 1, 2, and 3 with Tavg > 500°F. However, the markup of the note in the TS Bases says SR 3.4.16.1 is to be performed in Mode 1 only. Clarify whether the SR is to be performed in Modes 1, 2, and 3 when Tavg is greater than 500°F or in Mode 1 only and update the TS or confirm that the appropriate changes to the TS Bases will be made to match the proposed change to the TS, as appropriate.

TVA Response to STSB RAI 1

The SR 3.4.16.1 is to be performed in Modes 1, 2, and 3 when $T_{avg} \geq 500°F$. Following an administrative mark-up error in Attachment 3 of Reference 1, the TS Bases for the WBN Units 1 and 2, SR 3.4.16.1 have been revised to be consistent with the proposed Note for WBN Units 1 and 2 SR 3.4.16.1. Enclosure 2 provides the revised WBN Units 1 and 2 TS Bases pages marked up to show the proposed changes. Changes to the existing TS Bases are provided for information only and will be implemented under the TS Bases Control Program. Enclosure 2 supersedes the corresponding information provided in Attachment 3 of the Enclosure to Reference 1. The issue has been entered in the TVA corrective action program.

STSB RAI 2

The proposed SR 3.4.16.2 deletes the Note that requires the surveillance to be performed in Mode 1; however, the proposed change to the TS Bases adds a statement that says the SR includes a note that it is to be performed in Mode 1 only. Clarify whether SR 3.4.16.2 is intended to be performed in Mode 1 only or in all Modes during which the LCO is applicable and update the TS or confirm that the appropriate changes to the TS Bases will be made to match the proposed change to the TS, as appropriate.

TVA Response to STSB RAI 2

The SR 3.4.16.2 is to be performed in all Modes during which the LCO is applicable. Following an administrative mark-up error in Attachment 3 of Reference 1, the TS Bases for WBN Units 1 and 2 SR 3.4.16.2 have been revised to delete "in MODE 1 only" in one location and the statement that says the SR includes a note that it is to be performed in Mode 1 only, matching the proposed changes to the TS. Enclosure 2 provides the revised WBN Units 1 and 2 TS Bases pages marked up to show the proposed changes. Enclosure 2 supersedes the corresponding information provided in Attachment 3 of the Enclosure to Reference 1. The issue has been entered in the TVA corrective action program.

STSB RAI 3

Traveler TSTF-490 shows Figure 3.4.16-1 being deleted. This figure was previously deleted from the Watts Bar, Unit 1 TSs and was never part of the Unit 2 TSs. Confirm that the nonexistence of this figure in each unit's TSs is a variation from the traveler.

TVA Response to STSB RAI 3

As noted in STSB RAI 3, WBN Units 1 and 2 do not contain Figure 3.4.16-1 or the references to that figure in TS 3.4.16 Required Action A.1 and Condition C, as in the Standard TS, and is therefore a variation to the traveler. The objective of this change in TSTF-490 is to replace the figure with a bounding upper limit for Dose Equivalent I-131 that is applicable at all power levels. WBN Unit 1 accomplished this previously in License Amendment 41 (Reference 2), which similarly replaced the figure with a bounding Dose Equivalent I-131 value. When WBN Unit 2 was licensed in 2015 (Reference 3), the issued TS 3.4.16 was made to be consistent with Unit 1. Accordingly, the above is an administrative variation with the traveler based on WBN Units 1 and 2 having received prior NRC approval for the figure's removal consistent with this TSTF-490 change.

STSB RAI 4

The NRC staff identified the following editorial issues in the TS Bases markup:

a. The TS Bases markup for LCO 3.4.16 includes Actions B.1 and B.2 in the heading for those Actions. However, Action B.2 is deleted in the proposed markup.

b. The TS Bases markup for Action C only includes Action C.1 in the heading. However, an Action C.2 is added in the TS markup.

c. In the TS Bases writeup for SR 3.4.16.1, it refers to SR 3.4.15.1. This appears to be an error.

Confirm that the appropriate changes to the TS Bases will be made to match the proposed changes to the TS.

TVA Response to STSB RAI 4

Following an administrative mark-up error in Attachment 3 of Reference 1, the following changes have been made to the Bases for WBN Units 1 and 2 TS 3.4.16.

a. The Bases for WBN Units 1 and 2 TS 3.4.16, Action B.1 have been revised to delete the reference to B.2 in the heading.

b. The Bases for WBN Units 1 and 2 TS 3.4.16, Action C.1 have been revised to include the reference to C.2 in the heading.

c. The proposed change to the TS Bases for SR 3.4.16.1 has been revised to correctly reference SR 3.4.16.1 instead of SR 3.4.15.1.

Enclosure 2 provides the revised WBN Units 1 and 2 TS Bases pages marked up to show the proposed changes that will be made to match the proposed changes to the TS. Enclosure 2 supersedes the corresponding information provided in Attachment 3 of the Enclosure to Reference 1. The issue has been entered in the TVA corrective action program.

ARCB RAI 1

In performing confirmatory calculations with the proposed changes to reach assurance that the doses at the exclusion area boundary(EAB) and low population zone (LPZ) remain less than 10 percent of 10 CFR Part 100 limits and that main control room (MCR) dose limits remain within the General Design Criterion 19 limit following a steam generator tube rupture accident, the NRC staff calculated doses for Unit 2 that were above the values provided in Table 15.5-19, "Doses from Steam Generator Tube Ruptures," of the Watts Bar Updated Final Safety Analysis Report (ADAMS Accession No. ML20323A316).

Upon further review of the input parameters listed in Table 15.5-18, "Parameters Used in Steam Generator Tube Rupture Analysis," the NRC staff confirmed that most parameters were similar between each unit except for those pertaining to the listed values for the "Primary Coolant Mass Release (Flashed)." Specifically, Table 15.5-18 indicates that while Unit 1 has a total primary coolant mass release of 166,200 pound-mass (lbm) and of that total a flashed mass release of 9,189 lbm, Unit 2 has a total primary coolant mass release of 191,400 lbm and a flashed mass release of 190,772 lbm.

The NRC staff notes that although the total primary coolant mass release value affects the amount of noble gases released, the portion that is flashed impacts the amount of iodines released, which greatly impacts the total dose. The amount that is flashed in Unit 2 is extraordinarily greater than the amount that is assumed to flash in Unit 1. Additionally, the staff's preliminary confirmatory calculations for the steam generator tube rupture accident show that doses at the EAB, LPZ, and MCR for Unit 2 are significantly larger than the doses for Unit 1. Although the units have different steam generators, it is unclear to the staff why there is such a large difference in the primary coolant mass release amounts that flash directly to steam between the two units.

Explain why TVA assumes that almost the entire primary coolant mass released during a steam generator tube rupture in Unit 2 flashes directly to steam. If there is an error in the UFSAR,

provide the correct values for Table 15.5-18 with references to the appropriate analyses of record.

TVA Response to ARCB RAI 1

The reference to a flashed mass release of 190,772 lbm for WBN Unit 2 in Table 15.5-18 of the WBN dual-unit Updated Final Safety Analysis Report (UFSAR) is an administrative error introduced when the WBN Unit 2 FSAR was upgraded to the UFSAR following initial licensing in 2015. The correct value is 10,077.2 lbm as noted in Table 4.1-16 of Reference 4, Table 15.4 of Reference 5, and TVA calculation WBNTSR008, "Control Room Operator and Offsite Doses Due to a Steam Generator Tube Rupture," (see page 41 of the calculation in Reference 6).

This error has been entered into the TVA corrective action program, and Table 15.5-18 of the WBN dual-unit UFSAR will be revised in accordance with 10 CFR 50.71(e).

References

1. TVA Letter to NRC, CNL-20-068, "Watts Bar Nuclear Plant, Units 1 and 2, License Amendment Request to Adopt TSTF-490, 'Deletion of E Bar Definition and Revision to RCS Specific Activity Tech Spec' (WBN-TS-20-07)," dated August 18, 2020 (ML20234A241)

2. NRC letter to TVA, "WATTS BAR NUCLEAR PLANT, UNIT 1 — Issuance of Amendment Regarding Reactor Coolant System Specific Activity (TAC No. MB3831)," dated November 18, 2002 (ML023240483)

3. NRC letter to TVA, "Issuance of Facility Operating License No. NPF-96, Watts Bar Nuclear Plant Unit 2," dated October 22, 2015 (ML15251A587)

4. TVA letter to NRC, CNL-17-144, "Application to Revise Watts Bar Unit 2 Technical Specification 4.2.1, 'Fuel Assemblies,' and Watts Bar Units 1 and 2 Technical Specifications Related to Fuel Storage (WBN-TS-17-028)," dated December 20, 2017 (ML17354B282)

5. NUREG-0847, Supplement 25, "Safety Evaluation Report Related to the Operation of Watts Bar Nuclear Plant, Unit 2 Docket Number 50-391," dated December 2011 (ML12011A024)

6. TVA letter to NRC, CNL-15-192, "Application to Revise Technical Specification 4.2.1, 'Fuel Assemblies" (WBN-TS-15-03) (TAC No. MF6050) - Response to NRC Request for Additional Information - Radiation Protection and Consequence Branch," dated September 25, 2015 (ML15268A568)

Enclosure 2

Revised TS Bases Page Changes (Mark-Ups) for WBN Units 1 and 2 (For Information Only)

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.16 RCS Specific Activity

BASES

BACKGROUND

The maximum dose that an individual at the exclusion area boundary can receive for 2 hours following an accident, or at the low population zone outer boundary for the radiological release duration, is specified in~~The maximum dose to the whole body and the thyroid that an individual at the site boundary can receive for 2 hours during an accident is specified in~~ 10 CFR 100 (Ref. 1). The maximum dose to the whole body and the thyroid that an individual occupying the Main Control Room can receive for the accident duration is specified in ~~10~~ 10 CFR 50, Appendix A, GDC 19. The limits on specific activity ensure that the offsite and control room doses are appropriately limited during analyzed transients and accidents.~~The limits on specific activity ensure that the doses are held to a small fraction of the 10 CFR 100 limits and within the 10 CFR 50, Appendix A, GDC 19 limits during analyzed transients and accidents.~~

The RCS specific activity LCO limits the allowable concentration level of radionuclides in the reactor coolant. The LCO limits are established to minimize the offsite and Main Control Room ~~radioactivity~~ dose consequences in the event of a steam generator tube rupture (SGTR) or main steam line break (MSLB) accident.

The LCO contains specific activity limits for both DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133~~gross specific activity~~. The allowable levels are intended to ensure that offsite and control room doses meet the appropriate acceptance criteria in the Standard Review Plan (Ref. 2).~~The allowable levels are intended to limit the 2 hour dose at the site boundary to a small fraction of the 10 CFR 100 dose guideline limits, and ensure the Main Control Room accident dose is within the appropriate 10 CFR 50, Appendix A, GDC 19 dose guideline limits.~~

~~The evaluations showed the potential offsite and Main Control Room dose levels for a SGTR and MSLB accident were within the appropriate 10 CFR 100 and GDC 19 guideline limits.~~

APPLICABLE SAFETY ANALYSES

~~SAFETY ANALYSES~~

~~SAFETY ANALYSES~~

The LCO limits on the specific activity of the reactor coolant ensure that the resulting offsite and control room doses meet the appropriate SRP acceptance criteria following a MSLB or SGTR accident.~~The LCO limits on the specific activity of the reactor coolant ensures that the resulting 2 hour doses at the site boundary and Main Control Room accident doses will not exceed the appropriate 10 CFR 100 dose guideline limits and 10 CFR 50, Appendix A, GDC 19 dose guideline limits following a SGTR or MSLB accident.~~ The SGTR and MSLB safety analysis (Refs. 3 and 4~~2~~) assume the specific activity of the reactor coolant at the LCO limit and an existing reactor coolant steam generator (SG) tube leakage rate of 150 gallons per day (GPD).

(continued)

The safety analysis assumes the specific activity of the secondary coolant at its limit of 0.1 μCi/gm DOSE EQUIVALENT I-131 from LCO 3.7.14, "Secondary Specific Activity."

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

The analysis for the SGTR and MSLB accidents establish the acceptance limits for RCS specific activity. Reference to these analyses is used to assess changes to the unit that could affect RCS specific activity, as they relate to the acceptance limits.

The analyses are for two cases of reactor coolant specific activity. One case assumes specific activity at 0.265 μCi/gm DOSE EQUIVALENT I-131 with an iodine spike immediately after the accident that increases the iodine activity in the reactor coolant by a factor of 500 times the iodine production rate necessary to maintain a steady state iodine concentration of 0.265 μCi/gm DOSE EQUIVALENT I-131. The second case assumes the initial reactor coolant iodine activity at 14 μCi/gm DOSE EQUIVALENT I-131 due to a pre-accident iodine spike caused by an RCS transient. In both cases, the noble gas activity in the reactor coolant equals the LCO limit of 1200 ~~/ $\bar{E}$~~ μCi/gm DOSE EQUIVALENT XE-133~~for gross specific activity~~.

The analysis also assumes a loss of offsite power at the same time as the SGTR and MSLB event. The SGTR causes a reduction in reactor coolant inventory. The reduction initiates a reactor trip from a low pressurizer pressure signal or an RCS overtemperature ΔT signal. The MSLB results in a reactor trip due to low steam pressure.

For the SGTR, ~~T~~the coincident loss of offsite power causes the steam dump valves to close to protect the condenser. The rise in pressure in the ruptured SG discharges radioactively contaminated steam to the atmosphere through the SG power operated relief valves and the main steam safety valves. The unaffected SGs remove core decay heat by venting steam to the atmosphere until the cooldown ends.

~~The safety analysis shows the radiological consequences of a SGTR and MSLB accident are within the appropriate 10 CFR 100 and 10 CFR 50, Appendix A, GDC 19 dose guideline limits.~~ Operation with iodine specific activity levels greater than the LCO limit is permissible, if the activity levels do not exceed 14 μCi/gm DOSE EQUIVALENT I~~-~~-131, in the applicable specification, for more than 48 hours. The safety analysis has concurrent and pre-accident iodine spiking levels up to 14 μCi/gm DOSE EQUIVALENT I-131.

The limits on RCS specific activity are also used for establishing standardization in radiation shielding and plant personnel radiation protection practices.

RCS specific activity satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).~~Criterion 2 of the NRC Policy Statement.~~

(continued)

BASES

LCO

The specific iodine activity is limited to 0.265 μCi/gm DOSE EQUIVALENT I-131, and the noble gas~~gross~~ specific activity in the reactor coolant is limited to ~~the number of μCi/gm equal to 100 divided by $\bar{E}$ (average disintegration energy of the sum of the average beta and gamma energies of the coolant nuclides).~~1200 μCi/gm DOSE EQUIVALENT XE-133, which ensure that offsite and control room doses will meet the appropriate SRP acceptance criteria (Ref. 2).~~10 CFR 100 (Ref. 1) and GDC 19 limits.. The limit on DOSE EQUIVALENT I-131 ensures the 2 hour thyroid dose to an individual at the site boundary and accident dose to personnel in the Main Control Room during the Design Basis Accident (DBA) will be within the allowed thyroid dose. The limit on ensures the 2 hour whole body dose to an individual at the site boundary and accident dose to personnel in the Main Control Room during the DBA will be within the allowed whole body dose.~~

The MSLB and SGTR accident analyses (Refs. 3 and 4) show that the calculated doses are within acceptable limits~~The SGTR and MSLB accident analysis (Ref. 2) shows that the 2 hour site boundary dose levels and Main Control Room accident dose are within acceptable limits~~. Violation of the LCO may result in reactor coolant radioactivity levels that could, in the event of a MSLB or SGTR, lead to doses that exceed the SRP acceptance criteria (Ref. 2).~~Violation of the LCO may result in reactor coolant radioactivity levels that could, in the event of a SGTR or MSLB, lead to site boundary doses that exceed the 10 CFR 100 dose guideline limits, or Main Control Room accident dose that exceed the 10 CFR 50, Appendix A, GDC 19 dose limits.~~

APPLICABILITY

In MODES 1, 2, 3, and 4, operation within the LCO limits for DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 is necessary to limit the potential consequences of a SGTR or MSLB to within the SRP acceptance criteria (Ref. 2).~~10 CFR 100.11 (Ref. 1) and GDC 19 limits (Ref. 2).~~

In MODES 5 and 6, the steam generators are not being 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 is not required.~~In MODES 1 and 2, and in MODE 3 with RCS average temperature ≥ 500°F, operation within the LCO limits for DOSE EQUIVALENT I-131 and gross specific activity are necessary to contain the potential consequences of an accident to within the acceptable Main Control Room and site boundary dose values.~~

~~For operation in MODE 3 with RCS average temperature < 500°F, and in MODES 4 and 5, the release of radioactivity in the event of a SGTR is unlikely since the saturation pressure of the reactor coolant is below the lift pressure settings of the main steam safety valves.~~

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BASES (continued)

ACTIONS

A.1 and A.2

With the DOSE EQUIVALENT I-131 greater than the LCO limit, samples at intervals of 4 hours must be taken to demonstrate that the limit of 14 μCi/gm is not exceeded. The Completion Time of 4 hours is required to obtain and analyze a sample. Sampling is done to continue to provide a trend.

The DOSE EQUIVALENT I-131 must be restored to within limits within 48 hours. The Completion Time of 48 hours is acceptable since it is expected that, if there were an iodine spike, the normal coolant iodine concentration would be restored within this time period. Also, there is a low probability of a MSLB or SGTR occurring during this time period.~~The Completion Time of 48 hours is required, if the limit violation resulted from normal iodine spiking.~~

A Note permits the use of the provisions of LCO 3.0.4.c. 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 which 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.

B.1~~ and B.2~~

With the DOSE EQUIVALENT XE-133 greater than the LCO limit, DOSE EQUIVALENT XE-133 must be restored to within limit within 48 hours. The allowed Completion Time of 48 hours is acceptable since it is expected that, if there were a noble gas spike, the normal coolant noble gas concentration would be restored within this time period. Also, there is a low probability of a MSLB or SGTR occurring during this time period.~~With the gross specific activity in excess of the allowed limit, an analysis must be performed within 4 hours to determine DOSE EQUIVALENT I-131. The Completion Time of 4 hours is required to obtain and analyze a sample.The change within 6 hours to MODE 3 and RCS average temperature < 500°F lowers the saturation pressure of the reactor coolant below the setpoints of the main steam safety valves and prevents venting the SG to the environment in an SGTR event. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 below 500°F from full power conditions in an orderly manner and without challenging plant systems.~~

A Note permits the use of the provisions of LCO 3.0.4.c. This allowance permits entry into the applicable MODES(S), relying on Required Action B.1 while the DOSE EQUIVALENT XE-133 LCO limit is not met. This allowance is acceptable due to the significant conservatism incorporated into the specific activity limit, the low probability of an event which 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.

C.1 and C.2

(continued)

BASES (continued)

If a Required Action and the associated Completion Time of Condition A or B is not met, or if the DOSE EQUIVALENT I-131 is greater than 14 μCi/gm, the reactor must be brought to MODE 3 ~~with RCS average temperature < 500°F~~ within 6 hours and MODE 5 within 36 hours. The allowed Completion Times are ~~of 6 hours is~~ reasonable, based on operating experience, to reach the required plant conditions ~~MODE 3 below 500°F~~ from full power conditions in an orderly manner and without challenging plant systems.

(continued)

BASES

SURVEILLANCE REQUIREMENTS

SR 3.4.16.1

SR 3.4.16.1 requires performing a gamma isotopic analysis as a measure of the ~~gross~~ noble gas specific activity of the reactor coolant. ~~While basically a quantitative measure of radionuclides with half lives longer than 15 minutes, excluding iodines, t~~This measurement is the sum of the degassed gamma activities and the gaseous gamma activities in the sample taken. This Surveillance provides an indication of any increase in the noble gas~~gross~~ specific activity.

Trending the results of this Surveillance allows proper remedial action to be taken before reaching the LCO limit under normal operating conditions. ~~The Surveillance is applicable in MODES 1 and 2, and in MODE 3 with T_{avg} at least 500°F.~~ The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

Due to the inherent difficulty in detecting Kr-85 in a reactor coolant sample due to masking from radioisotopes with similar decay energies, such as F-18 and 1-134, it is acceptable to include the minimum detectable activity for Kr-85 in the SR~~-~~ 3.4.16.1 calculation. If a specific noble gas nuclide listed in the definition of DOSE EQUIVALENT XE-133 is not detected, it should be assumed to be present at the minimum detectable activity. A Note modifies the SR, which requires the SR to only be performed in MODES 1, 2, and 3 with $T_{avg} \geq 500°F$.

SR 3.4.16.2

This Surveillance is performed ~~in MODE 1 only~~ to ensure iodine remains within limit during normal operation and following rapid power changes when fuel failure is more apt to occur. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The Frequency, between 2 and 6 hours after a power change ≥ 15% RTP within a 1 hour period, is established because the iodine levels peak during this time following fuel failure; samples at other times would provide inaccurate results.

~~SR 3.4.16.3~~

~~A radiochemical analysis for $\bar{E}$ determination is required with the plant operating in MODE 1 equilibrium conditions. The $\bar{E}$ determination directly relates to the LCO and is required to verify plant operation within the specified gross activity LCO limit. The analysis for $\bar{E}$ is a measurement of the average energies per disintegration for isotopes with half lives longer than 15 minutes, excluding iodine. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

~~This SR has been modified by a Note that indicates sampling is required to be performed within 31 days after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for at least 48 hours. This ensures that the radioactive materials are at equilibrium~~

(continued)

BASES

~~so the analysis for $\bar{E}$ is representative and not skewed by a crud burst or other similar abnormal event.~~

(continued)

BASES

REFERENCES

1. Title 10, Code of Federal Regulations, Part 100.11, "Determination of Exclusion Area, Low Population Zone, and Population Center Distance," 1973.

2. Standard Review Plan (SRP) Section 15.1.5 Appendix A (SLB) and Section 15.6.3 (SGTR).

3. Watts Bar FSAR, Section 15.~~4~~5.4, "~~Condition IV - Limiting Faults.~~Environmental Consequences of a Postulated Main Steam Line Break"

4. Watts Bar FSAR, Section 15.5.5, "Environmental Consequences of a Postulated Steam Generator Tube Rupture"

B 3.4 REACTOR COOLANT SYSTEM (RCS)

B 3.4.16 RCS Specific Activity

BASES

BACKGROUND

The maximum dose that an individual at the exclusion area boundary can receive for 2 hours following an accident, or at the low population zone outer boundary for the radiological release duration, is specified in~~The maximum dose to the whole body and the thyroid that an individual at the site boundary can receive for 2 hours during an accident is specified in~~ 10 CFR 100 (Ref. 1). The maximum dose to the whole body and the thyroid that an individual occupying the Main Control Room can receive for the accident duration is specified in 10 CFR 50, Appendix A, GDC 19. The limits on specific activity ensure that the offsite and control room doses are appropriately limited during analyzed transients and accidents.~~The limits on specific activity ensure that the doses are held to a small fraction of the 10 CFR 100 limits and within the 10 CFR 50, Appendix A, GDC 19 limits during analyzed transients and accidents.~~

The RCS specific activity LCO limits the allowable concentration level of radionuclides in the reactor coolant. The LCO limits are established to minimize the offsite and Main Control Room ~~radioactivity~~ dose consequences in the event of a steam generator tube rupture (SGTR) or main steam line break (MSLB) accident.

The LCO contains specific activity limits for both DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133~~gross specific activity~~. The allowable levels are intended to ensure that offsite and control room doses meet the appropriate acceptance criteria in the Standard Review Plan (Ref. 2).~~The allowable levels are intended to limit the 2 hour dose at the site boundary to a small fraction of the 10 CFR 100 dose guideline limits, and ensure the Main Control Room accident dose is within the appropriate 10 CFR 50, Appendix A, GDC 19 dose guideline limits.~~

~~The evaluations showed the potential offsite and Main Control Room dose levels for a SGTR and MSLB accident were within the appropriate 10 CFR 100 and GDC 19 guideline limits.~~

(continued)

BASES (continued)

APPLICABLE SAFETY ANALYSES

The LCO limits on the specific activity of the reactor coolant ensure that the resulting offsite and control room doses meet the appropriate SRP acceptance criteria following a MSLB or SGTR accident.~~The LCO limits on the specific activity of the reactor coolant ensures that the resulting 2 hour doses at the site boundary and Main Control Room accident doses will not exceed the appropriate 10 CFR 100 dose guideline limits and 10 CFR 50, Appendix A, GDC 19 dose guideline limits following a SGTR or MSLB accident.~~ The SGTR and MSLB safety analysis (Refs. 3 and 4~~2~~) assume~~s~~ the specific activity of the reactor coolant at the LCO limit and an existing reactor coolant steam generator (SG) tube leakage rate of 150 gallons per day (GPD). The safety analysis assumes the specific activity of the secondary coolant at its limit of 0.1 μCi/gm DOSE EQUIVALENT I-131 from LCO 3.7.14, "Secondary Specific Activity."

The analysis for the SGTR and MSLB accidents establish the acceptance limits for RCS specific activity. Reference to these analyses is used to assess changes to the unit that could affect RCS specific activity, as they relate to the acceptance limits.

The analyses are for two cases of reactor coolant specific activity. One case assumes specific activity at 0.265 μCi/gm DOSE EQUIVALENT I-131 with an iodine spike immediately after the accident that increases the iodine activity in the reactor coolant by a factor of 500 times the iodine production rate necessary to maintain a steady state iodine concentration of 0.265 μCi/gm DOSE EQUIVALENT I-131. The second case assumes the initial reactor coolant iodine activity at 14 μCi/gm DOSE EQUIVALENT I-131 due to a pre-accident iodine spike caused by an RCS transient. In both cases, the noble gas activity in the reactor coolant equals the LCO limit of 1200/~~$\bar{E}$~~ μCi/gm DOSE EQUIVALENT XE-133~~for gross specific activity~~.

The analysis also assumes a loss of offsite power at the same time as the SGTR and MSLB event. The SGTR causes a reduction in reactor coolant inventory. The reduction initiates a reactor trip from a low pressurizer pressure signal or an RCS overtemperature ΔT signal. The MSLB results in a reactor trip due to low steam pressure.

For the SGTR, ~~T~~the coincident loss of offsite power causes the steam dump valves to close to protect the condenser. The rise in pressure in the ruptured SG discharges radioactively contaminated steam to the atmosphere through the SG power operated relief valves and the main steam safety valves. The unaffected SGs remove core decay heat by venting steam to the atmosphere until the cooldown ends.

(continued)

BASES

APPLICABLE SAFETY ANALYSES (continued)

~~The safety analysis shows the radiological consequences of an SGTR and MSLB accident are within the appropriate 10 CFR 100 and 10 CFR 50, Appendix A, GDC 19 dose guideline limits.~~ Operation with iodine specific activity levels greater than the LCO limit is permissible, if the activity levels do not exceed 14 μCi/gm DOSE EQUIVALENT I-131, in the applicable specification, for more than 48 hours. The safety analysis has concurrent and pre-accident iodine spiking levels up to 14 μCi/gm DOSE EQUIVALENT I-131.

The limits on RCS specific activity are also used for establishing standardization in radiation shielding and plant personnel radiation protection practices.

RCS specific activity satisfies Criterion 2 of 10 CFR 50.36(c)(2)(ii).

LCO

The specific iodine activity is limited to 0.265 μCi/gm DOSE EQUIVALENT I-131, and the noble gas~~gross~~ specific activity in the reactor coolant is limited to 1200 μCi/gm DOSE EQUIVALENT XE-133, which ensure that offsite and control room doses will meet the appropriate SRP acceptance criteria (Ref. 2).~~the 10 CFR 100 (Ref. 1) and GDC 19 limitsthe number of μCi/gm equal to 100 divided by $\bar{E}$ (average disintegration energy of the sum of the average beta and gamma energies of the coolant nuclides). The limit on DOSE EQUIVALENT I-131 ensures the 2 hour thyroid dose to an individual at the site boundary and accident dose to personnel in the Main Control Room during the Design Basis Accident (DBA) will be within the allowed thyroid dose. The limit on gross specific activity ensures the 2 hour whole body dose to an individual at the site boundary and accident dose to personnel in the Main Control Room during the DBA will be within the allowed whole body dose.~~

The MSLB and SGTR accident analyses (Refs. 3 and 4) show that the calculated doses are within acceptable limits~~The SGTR and MSLB accident analysis (Ref. 2) shows that the 2 hour site boundary dose levels and Main Control Room accident dose are within acceptable limits~~. Violation of the LCO may result in reactor coolant radioactivity levels that could, in the event of a MSLB or SGTR, lead to doses that exceed the SRP acceptance criteria (Ref. 2).~~Violation of the LCO may result in reactor coolant radioactivity levels that could, in the event of a SGTR or MSLB, lead to site boundary doses that exceed the 10 CFR 100 dose guideline limits, or Main Control Room accident dose that exceed the 10 CFR 50, Appendix A, GDC 19 dose limits.~~

(continued)

BASES (continued)

APPLICABILITY

In MODES 1, 2, 3, and 4, operation within the LCO limits for DOSE EQUIVALENT I-131 and DOSE EQUIVALENT XE-133 is necessary to limit the potential consequences of a SGTR or MSLB to within the SRP acceptance criteria (Ref. 2).~~the 10 CFR 100.11 (Ref. 1) and GDC 19 limits (Ref. 2).~~

In MODES 5 and 6, the steam generators are not being 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 is not required.~~In MODES 1 and 2, and in MODE 3 with RCS average temperature ≥ 500°F, operation within the LCO limits for DOSE EQUIVALENT I-131 and gross specific activity are necessary to contain the potential consequences of an accident to within the acceptable Main Control Room and site boundary dose values.~~

~~For operation in MODE 3 with RCS average temperature < 500°F, and in MODES 4 and 5, the release of radioactivity in the event of a SGTR is unlikely since the saturation pressure of the reactor coolant is below the lift pressure settings of the main steam safety valves.~~

ACTIONS

A.1 and A.2

With the DOSE EQUIVALENT I-131 greater than the LCO limit, samples at intervals of 4 hours must be taken to demonstrate that the limit of 14 μCi/gm is not exceeded. The Completion Time of 4 hours is required to obtain and analyze a sample. Sampling is done to continue to provide a trend.

The DOSE EQUIVALENT I-131 must be restored to within limits within 48 hours. The Completion Time of 48 hours is acceptable since it is expected that, if there were an iodine spike, the normal coolant iodine concentration would be restored within this time period. Also, there is a low probability of a MSLB or SGTR occurring during this time period.~~The Completion Time of 48 hours is required, if the limit violation resulted from normal iodine spiking.~~

A Note permits the use of the provisions of LCO 3.0.4.c. 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 which 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.

(continued)

BASES

ACTIONS (continued)

B.1 ~~and B.2~~

With the DOSE EQUIVALENT XE-133 greater than the LCO limit, DOSE EQUIVALENT XE-133 must be restored to within limit within 48 hours. The allowed Completion Time of 48 hours is acceptable since it is expected that, if there were a noble gas spike, the normal coolant noble gas concentration would be restored within this time period. Also, there is a low probability of a MSLB or SGTR occurring during this time period.

A Note permits the use of the provisions of LCO 3.0.4.c. This allowance permits entry into the applicable MODES(S), relying on Required Action B.1 while the DOSE EQUIVALENT XE-133 LCO limit is not met. This allowance is acceptable due to the significant conservatism incorporated into the specific activity limit, the low probability of an event which 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.~~With the gross specific activity in excess of the allowed limit, an analysis must be performed within 4 hours to determine DOSE EQUIVALENT I-131. The Completion Time of 4 hours is required to obtain and analyze a sample.~~

~~The change within 6 hours to MODE 3 and RCS average temperature < 500°F lowers the saturation pressure of the reactor coolant below the setpoints of the main steam safety valves and prevents venting the SG to the environment in an SGTR event. The allowed Completion Time of 6 hours is reasonable, based on operating experience, to reach MODE 3 below 500°F from full power conditions in an orderly manner and without challenging plant systems.~~

C.1 and C.2

If a Required Action and the associated Completion Time of Condition A or B is not met, or if the DOSE EQUIVALENT I-131 is greater than 14 μCi/gm, the reactor must be brought to MODE 3 ~~with RCS average temperature < 500°F~~ within 6 hours and MODE 5 within 36 hours. The allowed Completion Times are ~~of 6 hours is~~ reasonable, based on operating experience, to reach the required plant conditions~~MODE 3 below 500°F~~ from full power conditions in an orderly manner and without challenging plant systems.

SURVEILLANCE REQUIREMENTS

SR 3.4.16.1

SR 3.4.16.1 requires performing a gamma isotopic analysis as a measure of the noble gas~~gross~~ specific activity of the reactor coolant. ~~While~~

(continued)

BASES

~~basically a quantitative measure of radionuclides with half lives longer than 15 minutes, excluding iodines, th~~This measurement is the sum of the degassed gamma activities and the gaseous gamma activities in the sample taken. This Surveillance provides an indication of any increase in the noble gas~~gross~~ specific activity.

Trending the results of this Surveillance allows proper remedial action to be taken before reaching the LCO limit under normal operating conditions. ~~The Surveillance is applicable in MODES 1 and 2, and in MODE 3 with T_{avg} at least 500°F.~~ The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.

Due to the inherent difficulty in detecting Kr-85 in a reactor coolant sample due to masking from radioisotopes with similar decay energies, such as F-18 and 1-134, it is acceptable to include the minimum

(continued)

BASES

SURVEILLANCE REQUIREMENTS (continued)

SR 3.4.16.1 (continued)

detectable activity for Kr-85 in the SR 3.4.16.1 calculation. If a specific noble gas nuclide listed in the definition of DOSE EQUIVALENT XE-133 is not detected, it should be assumed to be present at the minimum detectable activity. A Note modifies the SR, which requires the SR to only be performed in MODES 1, 2, and 3 with $T_{avg} \geq 500°F$.

SR 3.4.16.2

This Surveillance is performed ~~in MODE 1 only~~ to ensure iodine remains within limit during normal operation and following rapid power changes when fuel failure is more apt to occur. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program. The Frequency, between 2 hours and 6 hours after a power change ≥ 15% RTP within a 1 hour period, is established because the iodine levels peak during this time following fuel failure; samples at other times would provide inaccurate results.

~~SR 3.4.16.3~~

~~A radiochemical analysis for $\bar{E}$ determination is required with the plant operating in MODE 1 equilibrium conditions. The $\bar{E}$ determination directly relates to the LCO and is required to verify plant operation within the specified gross activity LCO limit. The analysis for $\bar{E}$ is a measurement of the average energies per disintegration for isotopes with half lives longer than 15 minutes, excluding iodines. The Surveillance Frequency is controlled under the Surveillance Frequency Control Program.~~

~~This SR has been modified by a Note that indicates sampling is required to be performed within 31 days after a minimum of 2 effective full power days and 20 days of MODE 1 operation have elapsed since the reactor was last subcritical for at least 48 hours. This ensures that the radioactive materials are at equilibrium so the analysis for $\bar{E}$ is representative and not skewed by a crud burst or other similar abnormal event.~~

REFERENCES

1. Title 10, Code of Federal Regulations, Part 100.11, “Determination of Exclusion Area, Low Population Zone, and Population Center Distance,” 1973.

2. Standard Review Plan (SRP) Section 15.1.5 Appendix A (SLB) and Section 15.6.3 (SGTR).~~Watts Bar FSAR, Section 15.4, “Condition~~

BASES

~~IV - Limiting Faults."~~

3. Watts Bar FSAR, Section 15.5.4, "Environmental Consequences of a Postulated Main Steam Line Break"

4. Watts Bar FSAR, Section 15.5.5, "Environmental Consequences of a Postulated Steam Generator Tube Rupture"