



Tennessee Valley Authority, Post Office Box 2000, Spring City, Tennessee 37381-2000

September 15, 2011

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

Watts Bar Nuclear Plant, Unit 2  
NRC Docket No. 50-391

**Subject: Watts Bar Nuclear Plant (WBN) Unit 2 – Final Safety Analysis Report (FSAR) – Chapter 15.5 Design Basis Dose Analysis**

- References:
1. TVA Letter to NRC dated June 27, 2011, "Watts Bar Nuclear Plant (WBN) Unit 2 – Final Safety Analysis Report (FSAR) – Response to Request for Additional Information (RAI) Regarding Accident Dose Analysis Basis"
  2. TVA Letter to NRC dated August 5, 2011, "Watts Bar Nuclear Plant (WBN) Unit 2 – Final Safety Analysis Report (FSAR) – Chapter 15.5 Design Basis Dose Analysis"

This letter provides revised FSAR Design Basis Accident dose analysis results for the Main Steam Line Break (MSLB), Steam Generator Tube Rupture (SGTR), and Loss of AC Power accidents.

Enclosure 1 provides updated FSAR Tables for the MSLB, SGTR, and Loss of AC Power events. These results changed as a result of correcting the release elevation of the Unit 2 South Main Steam Valve Vault. The effect on the results was minimal, with the resulting dose being slightly lower than previously calculated. A discussion of the limiting release/receptor points for the Unit 2 Control Room Dose assessments for all accidents analyzed for dose is also provided.

Enclosure 2 lists the new commitments to include the revised analysis in a future FSAR amendment and to submit a revised Fuel Handling Accident and a complete FSAR Section 15.5 draft incorporating recent changes by September 30, 2011.

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I declare under penalty of perjury that the foregoing is true and correct. Executed on the 15<sup>th</sup> day of September, 2011.

Respectfully,

A handwritten signature in black ink, appearing to read 'D Stinson', with a stylized flourish at the end.

David Stinson  
Watts Bar Unit 2 Vice President

**Enclosures:**

1. WBN Unit 2 Revised FSAR Section 15.5 Dose Analysis
2. Regulatory Commitments

cc (Enclosures):

U. S. Nuclear Regulatory Commission  
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## Enclosure 1

### WBN Unit 2 Revised FSAR Section 15.5 Dose Analysis

A telephone call was held with the NRC on August 30, 2011, for a general discussion of the release points from WBN building ventilation exhausts and receptor points at the Main Control Room (MCR) air intakes used in the FSAR Chapter 15 dose analyses for Unit 2. A summary of the discussions follows.

Release points from either the Unit 1 or Unit 2 shield building stack are used for the Loss of Coolant Accident (LOCA) and Fuel Handling Accident (FHA). The South Main Steam Valve Vault is the release point for the MSLB, SGTR, and Loss of AC events. The release point for the Waste Gas Decay Tank Rupture is the normal Auxiliary Building Exhaust. The receptor points for any of these events can be either the east or west MCR intake.

The control room X/Qs were determined using ARCON96. For the LOCA and FHA, the most limiting release/receptor combination is the Unit 1 Shield Building Vent to the west Control Building Intake. The Unit 1 Shield Building Vent is a release point for Unit 2 because for a LOCA or FHA on Unit 2 due to the design of the Emergency Gas Treatment System and Auxiliary Building Gas Treatment System, the release can occur from either the Unit 1 or the Unit 2 Shield Building Stack. Of the various possible combinations, the path described above will result in the highest dose to the operators. The X/Q for the LOCA is  $1.09 \text{ E-}3$  for the 0-2 hour time period and  $9.44 \text{ E-}4$  for the 2-8 hour time period. Since all releases for the FHA are assumed to occur within 0-2 hours, only the  $1.09\text{E-}3$  X/Q is used for this accident.

For the MSLB, SGTR, and Loss of AC event, the most limiting release/receptor combination is the Unit 2 South Main Steam Valve Vault with the east Control Building Intake. The X/Q for this combination is  $2.59 \text{ E-}3$  for the time period of 0-2 hours and  $2.12 \text{ E-}3$  for 2-8 hours. The release elevation is 23 meters.

The limiting Waste Gas Decay Tank rupture control room X/Q is  $2.56 \text{ E-}3$  for the 0-2 hour time period. This is based on a release from the Auxiliary Building Vent to the east Control Room intake. Since all releases for the Waste Gas Decay Tank rupture are assumed to occur within the 0-2 hour time period, X/Qs for other time periods are not applicable.

The operators are procedurally directed to use the MCR intake that is experiencing the lower dose rate. The analyses take credit for this action for events with a release that exceeds 8 hours. The analyses assume that the intake that maximizes the dose to the operator is used for the first 8 hours and then the intake with the lower dose rate is used thereafter. In the case of the limiting LOCA for Unit 2, the west MCR intake is used for the first 8 hours (X/Qs are  $1.09\text{E-}03$  from 0-2 hours, and  $9.44\text{E-}04$  from 2-8 hours) after which time the east intake would be used. The X/Qs for the path from the Unit 1 shield building vent to the east MCR intake are  $1.26 \text{ E-}4$ ,  $9.53 \text{ E-}5$ , and  $8.07 \text{ E-}5$  for the time periods of 8 to 24 hours, 1 to 4 days, and 4 to 30 days respectively. The dose analyses actually used  $1.56 \text{ E-}4$ ,  $1.16 \text{ E-}4$ , and  $9.59 \text{ E-}5$ . These values are conservative relative to the values that could have been used and will result in a higher calculated Control Room dose.

## Enclosure 1

### WBN Unit 2 Revised FSAR Section 15.5 Dose Analysis

The elevation of the release point for the South Main Steam Valve Vault was corrected from 20 to 23 meters. This resulted in slightly lower X/Q values and thus slightly lower Control Room doses. The following draft FSAR tables provide updated results from analyses using the corrected elevation.

**Table 15.5-2 Doses From Loss of A/C Power**

<b>Conservative Analysis (rem)</b>	<b>2 HR EAB</b>	<b>30 Day LPZ</b>	<b>Control Room</b>
<b>Gamma</b>	7.45 E-04	4.18 E-04	2.10 E-04
<b>Beta</b>	4.48 E-04	2.52 E-04	2.52 E-03
<b>Thyroid – ICRP-30</b>	4.57 E-02	2.57 E-02	2.09 E-02

  

<b>Realistic Analysis (rem)</b>	<b>2 HR EAB</b>	<b>30 Day LPZ</b>	<b>Control Room</b>
<b>Gamma</b>	1.80 E-08	1.01 E-08	5.05 E-09
<b>Beta</b>	1.66 E-05	9.29 E-06	1.79 E-04
<b>Thyroid – ICRP-30</b>	1.10 E-06	6.18 E-07	5.03 E-07

# Enclosure 1

## WBN Unit 2 Revised FSAR Section 15.5 Dose Analysis

**Table 15.5-14 Atmospheric Dilution Factors At The Control Building**

DILUTION FACTOR (sec/m3)			
Time Period (hr)	LOCA/FHA <sup>1</sup>	SGTR/MSLB/Loss of AC Power	WGDT
0-2	1.09 E-03	2.59E-03	2.56 E-03
2-8	9.44 E-04	2.12 E-03	N/A
8-24	1.56 E-04*	N/A	N/A
24-96	1.16 E-04**	N/A	N/A
96-720	9.59 E-05***	N/A	N/A

### GENERAL CONTROL ROOM PARAMETERS

Volume	257,198 cu ft
Makeup/pressurization flow	711 cfm
Recirculation flow	2889 cfm
Unfiltered intake	51 cfm
Filter efficiency	95% first pass 70% second pass 0% for noble gases, Tritium
Isolation time, T	40 seconds
Occupancy factors:	
0-24 hr	100%
1-4 days	60%
4-30 days	40%

1. All FHA releases are within 2 hours. Thus, only the 0-2 hr X/Q is applicable for the FHA.

*	Calculated value for U1 Shield Bldg Vent to East MCR Intake	1.26 E-04
**	Calculated value for U1 Shield Bldg Vent to East MCR Intake	9.53 E-05
***	Calculated value for U1 Shield Bldg Vent to East MCR Intake	8.07 E-05

**Enclosure 1**

**WBN Unit 2 Revised FSAR Section 15.5  
Dose Analysis**

**Table 15.5-17 Doses From Main Steam Line Break**

<b>1 gpm Primary-to-Secondary Leakage (ARCON-96 X/Q)</b>	<b>2 HR EAB</b>	<b>30 Day LPZ</b>	<b>SRP Guidance for 10CFR100 Limits (rem)</b>	<b>Control Room</b>	<b>SRP Guidance for 10CFR100 Limits (rem)</b>
<b>Pre-Accident Initiated Spike Case (14 <math>\mu</math>Ci/gm maximum peak)</b>					
<b>Gamma</b>	2.74 E-02	1.11 E-02	25	4.32 E-03	5
<b>Beta</b>	8.80 E-03	4.20 E-03	300	3.96 E-02	30
<b>Thyroid – ICRP-30</b>	2.41 E+00	1.21 E+00	300	7.38 E+00	30
<b>Accident Initiated Spike Case (0.265 <math>\mu</math>Ci/gm steady state)</b>					
<b>Gamma</b>	1.04 E-01	1.25 E-01	2.5	8.00 E-03	5
<b>Beta</b>	2.54 E-02	3.02 E-02	30	6.44 E-02	30
<b>Thyroid – ICRP-30</b>	3.09 E+00	4.78 E+00	30	1.03 E+01	30

## Enclosure 1

### WBN Unit 2 Revised FSAR Section 15.5 Dose Analysis

**Table 15.5-18 Parameters Used In Steam Generator Tube Rupture Analysis**

Primary Side Activity	Technical Specification Limit
Secondary Side Activity	ANSI/ANS-18.1-1984 (Expected levels, 150 gpd/SG)
Iodine Spiking Factor	Case 1: Accident initiated spike of 500 times equilibrium iodine concentration  Case 2: Pre-accident spike of 14 $\mu\text{Ci/gm}$ I-131 dose equivalent
Iodine Partition Factor	100
Secondary Side Mass Release (Ruptured Steam Generator)	
0 - 2 hours	103,300 lbm
2 - 8 hours	32,800 lbm
Secondary Side Mass Release (Intact Steam Generator)	
0 - 2 hours	492,100 lbm
2 - 8 hours	900,200 lbm
Primary Coolant Mass Release (Total)	
0 - 2 hours	191,400 lbm
Primary Coolant Mass Release (Flashed)	
0 - 2 hours	10,077.2 lbm
Meteorology	See Table 15A-2 and 15.5-14

# Enclosure 1

## WBN Unit 2 Revised FSAR Section 15.5 Dose Analysis

**Table 15.5-19 Doses From Steam Generator Tube Rupture**

<b>Pre-Accident Initiated Spike Case (14 <math>\mu</math>Ci/gm maximum peak)</b>			
<b>(rem)</b>	<b>2 HR EAB</b>	<b>30 Day LPZ</b>	<b>Control Room</b>
<b>Gamma</b>	3.78 E-01	1.11 E-01	6.22 E-02
<b>Beta</b>	2.26 E-01	6.92 E-02	7.01 E-01
<b>Thyroid – ICRP-30</b>	1.39 E+01	3.79 E+00	1.23 E+01
<b>Accident Initiated Spike Case (0.265 <math>\mu</math>Ci/gm steady state)</b>			
<b>(rem)</b>	<b>2 HR EAB</b>	<b>30 Day LPZ</b>	<b>Control Room</b>
<b>Gamma</b>	5.46 E-01	1.60 E-01	5.71 E-02
<b>Beta</b>	2.51 E-01	7.73 E-02	6.64 E-01
<b>Thyroid – ICRP-30</b>	7.19 E+00	2.12 E+00	2.01 E+00



## **Enclosure 2**

### **Regulatory Commitments**

1. Provide a letter that includes a complete FSAR Section 15.5 draft incorporating the updated X/Qs; the revised results for the MSLB, SGTR , and Loss of AC Power; and the revised FHA results by September 30, 2011.
2. Submit revised FSAR Section 15.5 in a future amendment of the FSAR.