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

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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) - RESPONSE TO CHAPTER 11 REQUEST FOR ADDITIONAL INFORMATION**

References:
1. E-mail from Justin C. Poole, U.S. Nuclear Regulatory Commission to William D. Crouch, TVA dated June 13, 2011
2. E-mail from Justin C. Poole, U.S. Nuclear Regulatory Commission to William D. Crouch, TVA dated June 6, 2011
3. TVA letter to NRC dated February 25, 2011, "Watts Bar Nuclear Plant (WBN) Unit 2 – Final Safety Analysis Report (FSAR) – Response to Chapters 11 and 12 Request for Additional Information"

The purpose of this letter is to respond a request for additional information (RAIs) regarding the Unit 2 FSAR Chapter 11 provided in References 1 and 2.

Enclosure 1 provides the responses to RAIs received in Reference 1. The NRC questions and associated numbering is retained herein.

Enclosure 2 provides our response to a request for data for NRC to use in performing confirmatory calculations with the GALE computer code as requested in Reference 2.

Enclosure 3 provides the new commitment in this letter. If you have any questions, please contact Bill Crouch at (423) 365-2004.

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NRR

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 24th day of June, 2011.

Respectfully,

David Stinson
Watts Bar Unit 2 Vice President

Enclosures:

1. Response to Chapter 11 RAIs
2. GALE Computer Code Input Description
3. Regulatory Commitment

cc (Enclosures):

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ENCLOSURE 1
WATTS BAR NUCLEAR PLANT UNIT 2
FINAL SAFETY ANALYSIS REPORT
RESPONSE TO CHAPTER 11 REQUEST FOR ADDITIONAL INFORMATION

NRC Question 1

Even with the added text in this section, it is still unclear what effluent pathway is indicated by the term F - condensate demineralizer flow (and subsequently the related F/H and F/H/D terms) as used in the foot note to Table 11.2-5. As written, it seems to indicate the entire condensate flow through the condensate demineralizer (e.g., 55% of the entire condensate flow) when in service. TVA needs to clarify that the effluent path and plant operational mode of interest here is:

a. *Waste condensate that is discharged from the condensate system during operations with primary to secondary leakage sufficient to reroute the SGBD to the condensate system [If this is the case, provide the flow rate and verify that the condensate is released from the condensate demineralizer system downstream of the demineralizer, before it is recombined with the 45% of the condensate that bypasses the demineralizers]; or*
b. *Liquid effluent resulting from the regeneration of the condensate demineralizers during operations with primary to secondary leakage sufficient to reroute the SGBD to the condensate system [in which case explain how this is processed through the condensate demineralizers before being processed by the mobile demineralizer]; or*
c. *None of the above [explain].*

TVA Response

Term F is the condensate demineralizer regeneration waste stream. Based on Unit 1 operation the expectation is that term F will be zero and steam generator blowdown will be routed directly to the cooling tower basin for dilution and release. The basis for this is that condensate demineralizer system has not been used during routine Unit 1 power operation in recent years. The condensate demineralizers are placed in service in the first weeks after an outage to assist in rapidly stabilizing the secondary side chemistry. No activity is expected in the demineralizer during this period. Watts Bar Unit 2 is expected to be operated in the same manner. If there is significant secondary side activity as a result of steam generator tube leaks, steam generator blowdown and a portion of the condensate flow is routed through the condensate demineralizer system for clean up before being added back to the condensate system for continued circulation through the steam generators.

The development of the source associated with the regeneration waste stream is based on 55% of the condensate flow going to the demineralizers and the other 45% bypassing the demineralizers. The other input into the regeneration waste stream is from steam generator blowdown. The steam generator blowdown can be routed to the condensate demineralizers via the condensate system after the condensate flow has been split. After processing, the condensate and steam generator blowdown from the demineralizer path goes back into the main condensate system to make up the total 100% condensate/feedwater flow requirement. There are six condensate polishers (five plus a spare). If the activity is acceptable the regeneration waste can be released either to cooling tower blowdown or the turbine building sump. The regeneration waste can also be processed by the mobile demineralizer if conditions warrant.

Description b) of the question is correct. The total flow though the demineralizers is 8.28×10^6 lbs/hr. This number is made up of 55% of the condensate flow or 8.25×10^6 lbs/hr and a steam

generator blowdown flow of 3.3×10^4 lbs/hr. The total steam flow is 1.5×10^7 lbs/hr. The steam flow value does not include the steam generator blowdown flow since blowdown has its own piping from the steam generator.

Proposed FSAR wording is shown below. The changes to Sections 11.2.6.5.1 and 11.2.6.5.2 are underlined. The changes will be included in a future FSAR amendment. The footnotes to Table 11.2-5 are being revised to state that "F" is the condensate demineralizer regeneration waste. The changes to the text are excerpted below.

11.2.6.5.1 Expected Normal Plant Operation

The expected plant alignment and resultant releases are as follows:

- CVCS letdown waste processed by the CVCS demineralizers and then by the mobile demineralizer.
- The reactor coolant drain tank, the tritiated drain collector tank, and the floor drain collector tank discharges and processed using the mobile demineralizer
- Liquid releases from the Laundry and Hot Shower Drain Tank and the Turbine Building drains can be released without processing by mobile demineralizer.
- Steam Generator Blowdown is released without processing.
- <u>The condensate demineralizers are bypassed. Thus there is no condensate demineralizer regeneration waste to be processed.</u>

11.2.6.5.2 Other Plant Alignment Evaluations

The values in Table 11.2-5 Column 4 assume the following:

- CVCS letdown waste processed by the CVCS demineralizers and then by the mobile demineralizer.
- The reactor coolant drain tank, the tritiated drain collector tank, and the floor drain collector tank discharges and processed using the mobile demineralizer
- <u>Activity from Condensate Demineralizer waste due to the processing of condensate and steam generator blowdown is routed directly to the Cooling Tower Blowdown or the turbine building sump.</u>
- Liquid releases from the Laundry and Hot Shower Drain Tank and the Turbine Building drains were released without processing by mobile demineralizer.

The values in Table 11.2-5 Column 5 assume the following:

- CVCS letdown waste processed by the CVCS demineralizers and then by the mobile demineralizer.
- The reactor coolant drain tank, the tritiated drain collector tank, and the floor drain collector tank discharges and processed using the mobile demineralizer.
- <u>Condensate demineralizer regeneration waste is processed by the mobile demineralizer.</u>
- Liquid releases from the Laundry and Hot Shower Drain Tank and the Turbine Building drains were released without processing by mobile demineralizer.

Footnote F of FSAR Table 11.2-5 will be revised as follows:

F (Ci/yr) = Activity from Condensate Demineralizer regeneration waste = Activity from 6 days of processing of condensate and steam generator blowdown flow by the condensate demineralizer.

With this change the foot notes for column 4 and 5 will change as follows:
Column 4: ((A+B/C)/D) + E + F + G
Column 5: ((A+B/C)/D) + E + F/D + G

NRC Question 2

The second issue is that it is not clear how the design basis source term (based on 1% failed fuel and the maximum SGBD activity) listed in column 5 of Table 11.2-5d is derived. Verify that the values listed in this column is the result of adding the SGBD value in column 3 to the product of columns 2 and 4 for each isotope. If this is incorrect explain.

TVA Response:

We confirm that the NRC's understanding is correct.

NRC Question 3

On a June 7, 2011 phone call the NRC noted that the value for the volume of containment atmosphere released via the continuous containment vent on an annual basis provided in Reference 3 is not correct for the flow rate specified.

TVA Response

As identified by the NRC, the value of 7.15 $x10^{11}$ cc is not correct. The correct value is 1.48 $x10^{12}$ cc/yr for a continuous vent flow of 100 cfm. The values used in the calculations that generated the source term and dose were reviewed and found to be correct and thus there is no impact on the reported results.

ENCLOSURE 2
WATTS BAR NUCLEAR PLANT UNIT 2
FINAL SAFETY ANALYSIS REPORT
RESPONSE TO CHAPTER 11 REQUEST FOR ADDITIONAL INFORMATION
GALE COMPUTER CODE INPUT DESCRIPTION

The input listing provided below assumes a continuous containment vent of 100 cfm. The list also provides the values assuming operation of the condensate demineralizer system. As noted in the FSAR and in various communications with the NRC staff, the condensate demineralizer system has not been used during routine power operation during the 15 years of Unit 1 operation. The condensate demineralizers have been placed in service in the first few days after an outage to assist in rapidly stabilizing the secondary side chemistry. No activity is expected in the demineralizer during this period. Watts Bar Unit 2 is expected to be operated in the same manner.

GALE input for the expected plant operation would have values on cards 11, 24 and 27 set at zero. Regeneration of the condensate demineralizer shown as six days on cards 10 and 29 would not occur. The time would be life of plant.

ENCLOSURE 2
WATTS BAR NUCLEAR PLANT UNIT 2
FINAL SAFETY ANALYSIS REPORT
RESPONSE TO CHAPTER 11 REQUEST FOR ADDITIONAL INFORMATION
GALE COMPUTER CODE INPUT DESCRIPTION

	Item		Reference
1.	Name/type	WBN2/PWR	
2.	Power	3582 MWt	1
3.	Mass RCS	5.4E+05 lb	1
4.	Letdown flow rate	75 gpm	1
5.	Letdown Demin flow rate	75 gpm	1,7
6.	No of Steam Generators	4	
7.	Steam flow	1.5E+07 lb/hr	2
8.	Mass fluid in each Steam Gen	104625 lb	1
9.	Steam Gen Blowdown[l]	32776 lb/hr	8
10.	Cond demin regen time	6 days	2
11.	Cond. Demin flow fraction[b]	0.55	2
12.	CVCS	2431.7 gal/day-PCA=1	2
13.	DFI=50, DFCS=2, DFH3=1, DFO=50[a]		2
14.	1 day, 365 day, 100%		2
15.	Reactor Coolant Pump Seal-	20 gal/day- 0.1 PCA	2
	Other leaks/Drains	10 gal/day- 1.67 PCA	2
16.	DFI=1000, DFCS=1000, DFH3=1, DFO=1000		2
17.	1 day, 365 day, 100%[j]		2
18.	Primary Coolant Equip Drains	80 gal/day- 1.0 PCA	2
	Spent fuel Pit Liner Drains	700 gal/day- 0.001 PCA	2
	Reactor Coolant Sampling	200 gal/day- 0.05 PCA	2
19.	DFI=1000, DFCS=1000, DFH3=1, DFO=1000		2
20.	1 day, 365 day, 100%[j]		2
21.	TB Floor Drains[d]	7200 gal/day- 1 PCA (of SSC)	2
	Reactor Containment Cool. Sys	500 gal/day- 0.001 PCA	2
	Aux Bldg floor Drains	200 gal/day- 0.1 PCA	2
	Secondary System Sampling	1400 gal/day- 1 PCA (of SSC)	2
22.	DFI=1000, DFCS=1000, DFH3=1, DFO=1000		2
23.	1 day, 365 day, 100%[j]		2
24.	Blowdown fraction processed[b]	1	2
25.	DFI=1, DFCS=1, DFH3=1, DF0=1		2
26.	0 days, 365 days, 100%[j]		2
27.	Regenerant flow[b]	3400 gal/day	4
28.	DFI=10, DFCS=2, DFH3=0, DF0=10		2
29.	6 days, 365 days, 100%[j]		2
30.	Stripping of letdown	1	6
31.	XE Holdup time[k]	60 days	3
32.	KR Holdup time[k]	60 days	3
33.	Decay Tank fill time[c]	24.8 days	3,4,6
34.	Gas system HEPA	99	3
35.	Fuel Handling Bldg[f]	Charcoal=0, HEPA=0	3
36.	Aux Bldg[g, h]	Charcoal=0, HEPA=0	3
37.	Containment Vol.	Lower 383100 ft^3	5
		Upper 647000 ft^3	5
		Inst room 19432 ft^3	5

38.	Cont Atmos Clean up	Charcoal=0, HEPA=0, RATE=NA	3
39.	Containment High Vol Purge	NA	3
40.	Containment Low Vol Purge	Char. =70, HEPA=99, CFM=100[i]	3
41.	Blowdown flash tank partition factor	0.05	3,4
42.	Percent I removed-Air Ejector	0	3
43.	Detergent waste PF[e]	1.0	2

Notes:

a. The CVCS is treated again by the Mobile Demineralizer with DFs in item 16.
b. The Condensate Demineralizers are not normally used at WBN to treat the condensate and steam generator blowdown. **Thus, this value is normally set to 0.** The value of 3400 gal/day is taken from NUREG-0017. The TVA analysis of the regeneration release from the condensate demineralizers, assuming they are in service, is performed as follows: The activity is calculated assuming six days of processing and collection based on the supplied decontamination factors. This value is multiplied by 365 days/6 day per regeneration cycle to develop an equivalent annual continuous release.
c. Decay tank fill time is based on input of 173 ft^3/day @ STP, Vol = 600 ft^3 and Pressure= 7 atmospheres. From NUREG 0017, fill time = 7*600ft^3/173ft^3/day = 24.3 days
d. Turbine Building drains are released untreated. Thus, the DFs listed for this item do not apply.
e. Laundry & Hot Shower Drain Tank releases are taken directly from NUREG-0017, Table 2-27.
f. Refueling area Iodine releases are based on 1.85 Ci/yr per uCi/gm of RCS for 300 days and 0.3 Ci/yr per uCi/gm for 65 days.
g. Aux Building ventilation noble gas source terms are based on a 160 lb/day release of RCS coolant activity into the Aux Bldg atmosphere.
h. Aux Building iodine releases are based on 1.85 Ci/yr per uCi/gm of RCS for 300 days and 6.8 Ci/yr per uCi/gm for 65 days.
i. Continuous Containment Vent.
j. This release is continuous.
k. NUREG-0017 allows for a 90 day holdup time. 60 days is conservatively used in the TVA analysis.
l. The listed value is used for the steam generator waste flow stream. 30,000 lbs/hr was conservatively used in establishing the initial ANSI-18.1 WBN adjusted secondary side source term.

REFERENCES

1. TVA Calculation WBNNAL3-003, R4
2. TVA Calculation WBNTSR-093, R9
3. TVA Calculation TI-534, R8
4. NUREG-0017, R1
5. TVA Calculation TI-535, R3
6. TVA WBN System Description N3-77A-4001, R8, Gaseous Waste Disposal System
7. TVA WBN System Description N3-62-4001, R32, Chemical Volume and Control System
8. TVA WBN System Description N3-15-4001, R 15, Steam Generator Blowdown System

ENCLOSURE 3
REGULATORY COMMITMENT

FSAR Section 11.2 will be revised in a future FSAR amendment