



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 Request for Additional Information (RAI) Regarding Accident Dose Analysis Basis

- References:
1. NRC E-mail to TVA dated November 29, 2010, "RAIs for FSAR Section 15.5"
 2. TVA letter to NRC dated December 10, 2010, "Watts Bar Nuclear Plant (WBN) Unit 2 – Final Safety Analysis Report (FSAR) – Response to Requests for Additional Information"

This letter provides an updated response to the Reference 1 request to provide additional information on site meteorology used for accident dose calculations.

Enclosure 1 provides X/Q values for the exclusion area boundary and the low population zone. Information to develop control room X/Q values is also provided. Hourly meteorology data for the 20 year period from 1991 to 2010 will be provided separately. New commitments are provided in Enclosure 2

I declare under penalty of perjury that the foregoing is true and correct. Executed on the 27th day of June, 2011.

Respectfully,

David Stinson
Watts Bar Unit 2 Vice President

DOBO
MRR

Enclosures:

1. Response to NRC Question on Meteorological Data Used for Accident Dose Analysis
2. Commitment

Attachments:

- 1 Calculated 1-Hour Average Atmospheric Dispersion Factors (X/Q) at Minimum Distance (1100 Meters) Between Release Zone (100 m Radius) and Exclusion Area Boundary (1200 m Radius) for Watts Bar Nuclear Plant
- 2 Calculated 1-Hour Average and Annual Average Atmospheric Dispersion Factors (X/Q) at Low Population Zone Distance (4828 Meters) for Watts Bar Nuclear Plant
- 3 Values of 5th Percentile Overall Site 8-Hour, 16-Hour, 3-Day, and 26-Day Atmospheric Dispersion Factors (X/Q) at Low Population Zone Distance (4828 Meters) for Watts Bar Nuclear Plant
- 4 0.5th Percentile Sector Values of 8-Hour, 16-Hour, 3-Day, and 26-Day Atmospheric Dispersion Factors (X/Q) at Low Population Zone Outer Boundary Distance (4828 Meters) for Watts Bar Nuclear Plant
- 5 Atmospheric Dispersion Factors (X/Q), sec/m^3 , for Design Basis Accident Analyses Based on Onsite Meteorological Data for Watts Bar Nuclear Plant
- 6 Dispersion Meteorology - Onsite 10-Meter Wind Data - 5th Percentile Values of Inverse Wind Speed (1/u) Distributions for Post-LOCA Control Bay Dose Calculations for Watts Bar Nuclear Plant

cc (Enclosures):

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Enclosure 1

Response to NRC Question on Meteorological Data Used for Accident Dose Analysis

Reference 1 noted that the meteorology data used to license Unit 1 was based on a time period of 18 years from 1974 to 1993. NUREG-0800, Standard Review Plan 2.3.3, "On-site Meteorological Measurements Programs," (July 1981) states that at least two consecutive annual cycles, including the most recent one year period should be provided for the operating licensing review. TVA was requested to show that the Unit 1 data was still representative of recent atmospheric dispersion conditions at Watts Bar and appropriate for use in the accident dose assessments provided in Section 15.5 of the Watts Bar FSAR. TVA provided a response in Reference 2 that concluded that no new X/Q calculations were needed as wind conditions in 2008 – 2009 were similar.

Meteorological conditions were reviewed as part of the TVA work on the normal releases discussed in FSAR Chapter 11. Based on that review, TVA concluded that a more detailed review of the meteorological data was needed and that X/Q's should be recalculated. Attachments 1 through 6 provide the atmospheric dispersion factors for the Watts Bar Site as functions of time, distance and direction for the Exclusion Area Boundary and Low Population Zone. In addition, information necessary to develop control room X/Qs using ARCON96 is provided. These values are based on a twenty year period from 1991 to 2010 and Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants."

The control room and offsite dose analyses described in FSAR Section 15.5 are being revised using the updated X/Q information presented in this letter. Section 15.5 will be updated to reflect the results of the analyses in a future amendment.

Enclosure 1

Response to NRC Question on Meteorological Data Used for Accident Dose Analysis

Attachment 1

Calculated 1-Hour Average Atmospheric Dispersion Factors (X/Q) at Minimum Distance (1100 Meters) Between Release Zone (100 m Radius) and Exclusion Area Boundary (1200 m Radius) for Watts Bar Nuclear Plant

Based on Regulatory Guide 1.145 and Meteorological Data for 1991 through 2010*

| Plume Sector Direction | 0.5th Percentile X/Q Value (sec/m ³) | 5th Percentile X/Q Value (sec/m ³) |
|-------------------------|--|--|
| N | 3.681E-04 | 3.460E-05 |
| NNE | 4.601E-04 | 6.261E-05 |
| NE | 5.285E-04 | 6.777E-05 |
| ENE | 6.276E-04 | 1.005E-04 |
| E | <u>6.382E-04</u> | 1.386E-04 |
| ESE | 6.309E-04 | 8.259E-05 |
| SE | 6.103E-04 | 4.620E-05 |
| SSE | 4.509E-04 | 2.383E-05 |
| S | 3.044E-04 | 2.664E-05 |
| SSW | 2.463E-04 | 2.498E-05 |
| SW | 3.080E-04 | 9.021E-06 |
| WSW | 3.244E-04 | ** |
| W | 2.437E-04 | ** |
| WNW | 1.471E-04 | ** |
| NW | 1.640E-04 | ** |
| NNW | 2.278E-04 | ** |
| All Directions Combined | 9.297E-04 | <u>5.486E-04</u> |

* Meteorological facility located 0.8 km SSW of reactor site. Temperature instruments are 9.51 and 45.63 meters above ground. Wind speed and direction is measured at 9.72-meter level. Joint percent valid data in data base = 96.9.

** Less than 5% of the hours had non-zero X/Q values.

Enclosure 1

Response to NRC Question on Meteorological Data Used for Accident Dose Analysis

Attachment 2

Calculated 1-Hour Average and Annual Average Atmospheric Dispersion Factors (X/Q) at Low Population Zone Distance (4828 Meters) for Watts Bar Nuclear Plant

Based on Regulatory Guide 1.145 and Meteorological Data for 1991 through 2010*

| Plume Sector Direction | 0.5th Percentile X/Q Value (sec/m ³) | 5th Percentile X/Q Value (sec/m ³) | Annual Average X/Q Value (sec/m ³) |
|---------------------------|---|---|---|
| N | 8.003E-05 | 4.982E-06 | 8.135E-07 |
| NNE | 1.175E-04 | 1.139E-05 | 1.640E-06 |
| NE | 1.428E-04 | 1.178E-05 | 2.220E-06 |
| ENE | 1.698E-04 | 1.824E-05 | 2.255E-06 |
| E | <u>1.784E-04</u> | 2.669E-05 | 2.541E-06 |
| ESE | 1.703E-04 | 1.464E-05 | <u>2.640E-06</u> |
| SE | 1.554E-04 | 7.360E-06 | 1.568E-06 |
| SSE | 1.159E-04 | 2.844E-06 | 9.011E-07 |
| S | 6.924E-05 | 3.330E-06 | 7.804E-07 |
| SSW | 5.744E-05 | 2.958E-06 | 6.690E-07 |
| SW | 6.975E-05 | 5.074E-07 | 7.880E-07 |
| WSW | 7.696E-05 | ** | 6.594E-07 |
| W | 5.371E-05 | ** | 2.940E-07 |
| WNW | 2.669E-05 | ** | 2.754E-07 |
| NW | 3.036E-05 | ** | 2.080E-07 |
| NNW | 4.656E-05 | ** | 2.983E-07 |
| All Directions Combined | 2.798E-04 | 1.484E-04 | -- |

* Meteorological facility located 0.8 km SSW of reactor site. Temperature instruments are 9.51 and 45.63 meters above ground. Wind speed and direction is measured at 9.72-meter level. Joint percent valid data in data base = 96.9.

** Less than 5% of the hours had non-zero X/Q values.

Enclosure 1

Response to NRC Question on Meteorological Data Used for Accident Dose Analysis

Attachment 3

Values of 5th Percentile Overall Site 8-Hour, 16-Hour, 3-Day, and 26-Day Atmospheric
Dispersion Factors (X/Q) at Low Population Zone Distance (4828 Meters)
for Watts Bar Nuclear Plant

Based on Regulatory Guide 1.145 Method of Logarithmic Interpolation between Overall
5th Percentile 1-hour X/Q Assumed to Apply for 2-hour Period and Maximum
Sector Annual Average X/Q (underscored in Attachment 2)*

| Averaging period | 5th Percentile X/Q Value (sec/m ³) |
|------------------|---|
| 8-hour | 7.623E-05 |
| 16-hour | 5.464E-05 |
| 3-day | 2.652E-05 |
| 26-day | 9.395E-06 |

- * 1-hour and annual average X/Qs calculated from meteorological data for 1991 through 2010. Meteorological facility located 0.8 km SSW of reactor site. Temperature instruments are 9.51 and 45.63 meters above ground. Wind speed and direction is measured at 9.72-meter level. Joint percent valid data in data base = 96.9.

Enclosure 1

Response to NRC Question on Meteorological Data Used for Accident Dose Analysis

Attachment 4

0.5th Percentile Sector Values of 8-Hour, 16-Hour, 3-Day, and 26-Day Atmospheric Dispersion Factors (X/Q) at Low Population Zone Outer Boundary Distance (4828 Meters) for Watts Bar Nuclear Plant

Based on Regulatory Guide 1.145 Method of Logarithmic Interpolation between 0.5th Percentile
1-hour X/Q for Each Sector and Annual Average X/Q for Same Sector.*

| Plume Sector Direction | Sector-Specific X/Q Value (sec/m ³) | | | |
|---------------------------|---|------------------|------------------|------------------|
| | 8-hour | 16-hour | 3-day | 26-day |
| N | 3.748E-05 | 2.565E-05 | 1.126E-05 | 3.453E-06 |
| NNE | 5.799E-05 | 4.074E-05 | 1.893E-05 | 6.302E-06 |
| NE | 7.173E-05 | 5.084E-05 | 2.409E-05 | 8.242E-06 |
| ENE | 8.312E-05 | 5.815E-05 | 2.679E-05 | 8.801E-06 |
| E | <u>8.835E-05</u> | <u>6.217E-05</u> | <u>2.900E-05</u> | 9.701E-06 |
| ESE | 8.549E-05 | 6.058E-05 | 2.869E-05 | <u>9.811E-06</u> |
| SE | 7.269E-05 | 4.971E-05 | 2.180E-05 | 6.672E-06 |
| SSE | 5.194E-05 | 3.476E-05 | 1.454E-05 | 4.163E-06 |
| S | 3.298E-05 | 2.276E-05 | 1.018E-05 | 3.207E-06 |
| SSW | 2.751E-05 | 1.904E-05 | 8.565E-06 | 2.721E-06 |
| SW | 3.324E-05 | 2.295E-05 | 1.027E-05 | 3.236E-06 |
| WSW | 3.503E-05 | 2.364E-05 | 1.006E-05 | 2.954E-06 |
| W | 2.270E-05 | 1.476E-05 | 5.800E-06 | 1.517E-06 |
| WNW | 1.253E-05 | 8.584E-06 | 3.779E-06 | 1.164E-06 |
| NW | 1.332E-05 | 8.821E-06 | 3.608E-06 | 9.999E-07 |
| NNW | 2.020E-05 | 1.331E-05 | 5.378E-06 | 1.464E-06 |

* 1-hour and annual average X/Qs calculated from meteorological data for 1991 through 2010. Meteorological facility located 0.8 km SSW of reactor site. Temperature instruments are 9.51 and 45.63 meters above ground. Wind speed and direction is measured at 9.72-meter level. Joint percent valid data in data base = 96.9.

Enclosure 1

Response to NRC Question on Meteorological Data Used for Accident Dose Analysis

Attachment 5

Atmospheric Dispersion Factors (X/Q), sec/m³, for Design Basis Accident Analyses Based on Onsite Meteorological Data for Watts Bar Nuclear Plant

Regulatory Guide 1.145 Results (maximum sector 0.5th percentile 1-hour value for 0-2 hours at exclusion area boundary and at low population zone; and 8-hour, 16-hour, 3-day, and 26-day values for 2-8, 8-24, 24-96, and 96-720 hours from logarithmic interpolation between 0.5th percentile maximum sector 1-hour value at 2 hours and corresponding sector annual average value at 8760 hours at low population zone) for 1991 through 2010 Data.*

| Period (hours) | Minimum Distance to Exclusion Boundary (1100 m)** | Low Population Zone (4828 m) |
|----------------|---|------------------------------|
| 0-2 | 6.382E-04 | 1.784E-04 |
| 2-8 | | 8.835E-05 |
| 8-24 | | 6.217E-05 |
| 24-96 | | 2.900E-05 |
| 96-720 | | 9.811E-06 |

* Hourly 10-m wind and 10- and 46-m temperature data.
Meteorological facility located 0.8 km SSW of reactor site.
Calms assigned a wind speed of 0.6 m ph.

** Travel distance from 100-m radius release zone to 1200-m exclusion area boundary distance.

Enclosure 1

Response to NRC Question on Meteorological Data Used for Accident Dose Analysis

Attachment 6

Dispersion Meteorology - Onsite 10-Meter Wind Data - 5th Percentile Values of Inverse Wind Speed (1/u) Distributions for Post-LOCA Control Bay Dose Calculations for Watts Bar Nuclear Plant

January 1991 through December 2010 Wind Speed and Direction Data*

| Plume Sectors (degrees) | Averaging Periods | | | | |
|----------------------------|-------------------|--------|---------|-------|--------|
| | 1-hour | 8-hour | 16-hour | 3-day | 26-day |
| 89.75-157.25 | 2.034 | 1.223 | 0.957 | 0.692 | 0.547 |
| 132.25-199.75 | 1.177 | 0.680 | 0.565 | 0.413 | 0.304 |
| 154.75-222.25 | 0.828 | 0.565 | 0.494 | 0.361 | 0.250 |
| 192.25-259.75 | 0.895 | 0.609 | 0.532 | 0.382 | 0.265 |

* Meteorological facility is located 0.8 km SSW of reactor site.
Calms are assumed to be 0.6 mph.

Enclosure 2

Regulatory Commitment

Revise FSAR Section 15.5 based on the results of the updated dose analyses using the 1991 to 2010 X/Q values and submit the updated FSAR Section 15.5 in a future amendment of the FSAR.