

JUN 09 1993

PI-22  
50-390

Craig S. Wingo  
Assistant Associate Director  
Office of Technological Hazards  
Federal Emergency Management Agency  
500 C Street, S.W.  
Washington, D.C. 20472

Dear Mr. Wingo:

In a letter of April 22, 1993, the Federal Emergency Management Agency (FEMA) requested that the U.S. Nuclear Regulatory Commission (NRC) analyze the evacuation time estimates (ETE) for the Watts Bar Nuclear Power Station and provide FEMA with a determination on the acceptability of this information with regard to the criteria contained in Appendix 4 of NUREG-0654/FEMA-REP-1, Revision 1. An initial review of the ETEs has been completed by NRC's technical consultant, Dr. Thomas Urbanik. Dr Urbanik's report is enclosed.

In the report, it is concluded that the material contained in the State of Tennessee emergency plan for Watts Bar suggests that the evacuation time estimate may be based on a series of undocumented assumptions, that when added together, produce a relatively long evacuation time estimate. Additional explanation of the methodology used will be required before a determination can be made that the ETE is reasonable. Other additional items mentioned in the enclosed report will also need to be resolved.

If you or your staff have any questions concerning the enclosed ETE review, Ed Fox (301-504-2908) is our point of contact regarding emergency planning matters at Watts Bar.

Sincerely,

Original signed by Frank J. Congel

Frank J. Congel, Director  
Division of Radiation Safety  
and Safeguards  
Office of Nuclear Reactor Regulation

Enclosure:  
Review of Watts Bar ETE (May 23, 1993)

DISTRIBUTION

Central Files	PMcKee
NRC & Local PDRs	PEPB Staff
PEPB R/F	FHebdon
FCongel	PTam
EButcher	KBarr, RII
LJCunningham	

ACRS-1

OFC	PEPB:NRR	SCCE:PEPB:NRR	C:PEPB:NRR	D:DRSS:NRR	
NAME	EFox	FKantor	RAEricsson	FJCongel	
DATE	6/8/93	6/8/93	6/8/93	6/9/93	

OFFICIAL RECORD COPY  
DISK/DOCUMENT NAME: A:WATTSBAR.ETE

6/11/93

NRC FILE CENTER COPY

QFO 1/11

9306150373 930609  
PDR ADOCK 05000390  
P PDR

## REVIEW OF WATTS BAR EVACUATION TIME ESTIMATES (March 1993)

by

Thomas Urbanik II, Ph.D., P.E.

May 23, 1993

My review is based on the material contained in "THE STATE OF TENNESSEE MULTI-JURISDICTIONAL RADIOLOGICAL EMERGENCY RESPONSE PLAN FOR THE WATTS BAR NUCLEAR PLANT, VOLUME I." The review was based on the requirements of NUREG-0654, FEMA-REP-1, Rev. 1.

The Watts Bar estimates appear to be predicated on the notion of a conservative time estimate (See, for example page H-13). Nowhere within NUREG 0654, or elsewhere is the concept of a conservative estimate advocated. Everything in NUREG-0654 is based on the best possible estimate. My concern appears to be reinforced by a relatively high, nearly 8 hour, evacuation time estimate, for a relatively low population, 25,227 permanent residents plus transients. The following are specific concerns on the actual evacuation time estimate process in the order they appear in Appendix 1, Annex II.

No basis is provided for the 2.5 person per vehicle occupancy. The vehicle occupancy should be selected based on characteristics of the Watts Bar EPZ.

It is not clear where the roadway segments are located, so it is not possible to determine if the roadway capacities were appropriately selected. It is also not clear how the capacities of intersections of two evacuation routes, such as Highway 30 and Highway 58 were computed. The text would suggest that only the non-intersection capacities were used.

Paragraph III.C.2, page H-13, indicates that a 2-second headway is added to a 6 mile per hour speed. This is difficult to understand conceptually, and needs to be better explained.

It is assumed that the reference to "... Par. II, 1 and 2 ..." in Paragraph IV.B should be to Paragraph III.1 and III.2. Nevertheless, it is difficult to determine the methodology used in Paragraph IV. It is not at all clear how the number of vehicles is related to the roadway capacity. A specific example using one of the evacuation routes should be provided.

The transient population estimate needs more explanation. Reference is made to some hard data, a July traffic count, and estimates of 300/500 persons per mile. It is not clear if the estimates are based on the traffic count. If they are, the method used should be given; if they are not, the basis of the estimate is needed.

The additional time for adverse weather appear to be without justification.

Tab A, Appendix 1, Annex II is a traffic re-route map for which there is no explanation.

The method for dealing with traffic attempting to pass through the EPZ needs to be provided.

Evacuation traffic from Highway 27 and Highway 30 appear to merge in Dayton. No account of this potential problem appears to have been taken in the analysis. The analysis must go sufficiently beyond the EPZ to account for any possible impediments to evacuation.

Enclosure 1, Tab B, Appendix 1, Annex H indicates one location with "38 minutes delay". No indication is given where this occurs, if traffic control is needed or to be provided, or means exist to reduce the delay.

In conclusion, the material available suggests that the evacuation time estimate may be based on a series of undocumented assumptions, that when added together, produce a relatively long evacuation time estimate. It is also not clear how the distribution curves were actually used to compute evacuation times. Additional explanation of the methodology used will be required before a determination can be made that the ETE is reasonable. The items mentioned above will also need to be resolved.

REVIEW OF WATTS BAR EVACUATION TIME ESTIMATES (March 1993)

by

Thomas Urbanik II, Ph.D., P.E.

May 23, 1993

My review is based on the material contained in "THE STATE OF TENNESSEE MULTI-JURISDICTIONAL RADIOLOGICAL EMERGENCY RESPONSE PLAN FOR THE WATTS BAR NUCLEAR PLANT, VOLUME I." The review was based on the requirements of NUREG-0654, FEMA-REP-1, Rev. 1.

The Watts Bar estimates appear to be predicated on the notion of a conservative time estimate (See, for example page H-13). Nowhere within NUREG 0654, or elsewhere is the concept of a conservative estimate advocated. Everything in NUREG-0654 is based on the best possible estimate. My concern appears to be reinforced by a relatively high, nearly 8 hour, evacuation time estimate, for a relatively low population, 25,227 permanent residents plus transients. The following are specific concerns on the actual evacuation time estimate process in the order they appear in Appendix 1, Annex II.

No basis is provided for the 2.5 person per vehicle occupancy. The vehicle occupancy should be selected based on characteristics of the Watts Bar EPZ.

It is not clear where the roadway segments are located, so it is not possible to determine if the roadway capacities were appropriately selected. It is also not clear how the capacities of intersections of two evacuation routes, such as Highway 30 and Highway 58 were computed. The text would suggest that only the non-intersection capacities were used.

Paragraph III.C.2, page H-13, indicates that a 2-second headway is added to a 6 mile per hour speed. This is difficult to understand conceptually, and needs to be better explained.

It is assumed that the reference to "... Par. II, 1 and 2 ..." in Paragraph IV.B should be to Paragraph III.1 and III.2. Nevertheless, it is difficult to determine the methodology used in Paragraph IV. It is not at all clear how the number of vehicles is related to the roadway capacity. A specific example using one of the evacuation routes should be provided.

The transient population estimate needs more explanation. Reference is made to some hard data, a July traffic count, and estimates of 300/500 persons per mile. It is not clear if the estimates are based on the traffic count. If they are, the method used should be given; if they are not, the basis of the estimate is needed.

The additional time for adverse weather appear to be without justification.

Tab A, Appendix 1, Annex II is a traffic re-route map for which there is no explanation.

The method for dealing with traffic attempting to pass through the EPZ needs to be provided.

Evacuation traffic from Highway 27 and Highway 30 appear to merge in Dayton. No account of this potential problem appears to have been taken in the analysis. The analysis must go sufficiently beyond the EPZ to account for any possible impediments to evacuation.

Enclosure 1, Tab B, Appendix J, Annex H indicates one location with "38 minutes delay". No indication is given where this occurs, if traffic control is needed or to be provided, or means exist to reduce the delay.

In conclusion, the material available suggests that the evacuation time estimate may be based on a series of undocumented assumptions, that when added together, produce a relatively long evacuation time estimate. It is also not clear how the distribution curves were actually used to compute evacuation times. Additional explanation of the methodology used will be required before a determination can be made that the ETE is reasonable. The items mentioned above will also need to be resolved.

- 
-