



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

ENCLOSURE

SAFETY EVALUATION BY THE OFFICE OF NUCLEAR REACTOR REGULATION
REGARDING THE EFFECTS OF ACCIDENTAL RELEASE OF HAZARDOUS CHEMICALS
TRANSPORTED BY BARGES ON CONTROL ROOM HABITABILITY
BROWNS FERRY NUCLEAR PLANT, UNITS 1, 2, AND 3
DOCKET NOS. 50-259, 50-260, AND 50-296

1.0 INTRODUCTION

By letters dated May 31, 1990 and August 16, 1990, Tennessee Valley Authority (TVA, the licensee) submitted an analysis of the effects produced by accidental release of hazardous chemicals transported by barges on the Tennessee River in the vicinity of the Browns Ferry plant. This analysis was performed in response to the staff's request stated in a letter dated December 19, 1989 which asked the licensee to provide an evaluation of accidental releases of chlorine and other toxic chemicals transported by barges. Out of the total number of transported chemicals, only six could pose a threat to the control room operators and only chlorine could exceed its toxic concentration limit in the control room in less than two minutes after its detection. The licensee used a probabilistic argument to show that the chance of incapacitating control room operators due to a chlorine release is below the value that according to the Standard Review Plan (SRP) provides an acceptable risk.

2.0 EVALUATION

Barge traffic on the Tennessee River passing by the Browns Ferry plant site consists of 427 shipments of 20 different chemicals per year. However, some of these chemicals are non-toxic and they were, therefore, excluded from further consideration. From the remaining chemicals, some were shown by the licensee as not being able to reach toxic concentrations in the control room even though they produced toxic effects. The following six chemicals were determined to be capable of producing toxic concentrations: acrylonitrile, benzene, chlorine, ethyl benzene, toluene and vinyl acetate. TVA's calculations, using the TOXGAS computer code for buildup of these chemicals in the control room after their accidental release, found that for five of them the time between detection and reaching a toxic limit was greater than two minutes giving the operators enough time to don their protective gear. These chemicals met, therefore, the requirements of Regulatory Guide (RG) 1.78. In these calculations, it was assumed that the presence of chemicals in the control room was detectable by odor. This method of detection is endorsed by RG 1.78 provided concentration in the control room increases at a slow rate due to slow air turnover. The staff has verified TVA's calculations and considers them acceptable.

The only chemical that did not meet the two-minute criterion was chlorine. For this chemical, the toxic limit in the control room was reached in less than

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15 seconds after arrival of the chlorine plume. However, TVA's usage of a probabilistic argument demonstrated that the chlorine accident need not be considered because of its very low likelihood of occurrence. Section 2.2.3 of the SRP states that a design basis event resulting from the presence of hazardous materials in the vicinity of the plant is acceptable if the occurrence rate of potential radiation exposures in excess of the 10 CFR 100 guidelines is equal to or less than approximately $1E-6$ per year and reasonable qualitative arguments exist supporting the realistic probability of this rate of occurrence.

It was TVA's rationale that an accident, occurring as a result of control room operators becoming incapacitated by toxic chemicals, that would cause radiation exposures to exceed 10 CFR 100 must occur with a lower probability than just the probability of a chemical release creating toxic concentrations in the control room. Therefore, as long as the probability of the latter remains below $1E-6$ per year, accidents due to releases of hazardous chemical need not be considered.

TVA determined the probability of chlorine gas exceeding its toxicity limit by combining probabilities of accidental release of chlorine from a damaged barge and its transport to the control room. To calculate the probability of chlorine release the licensee used a probability of $1.8E-6$ accidents per barge-mile traveled, given in WASH-1238 for barge accidents occurring on the river. This probability, when multiplied by 30 chlorine shipments per year and by 7.1 miles of river sailing line which lies within the distance from the plant for which chlorine release could produce hazardous conditions in the control room, gives the probability of occurrence of a barge accident. TVA then used the probability of $2.3E-2$ releases per accident obtained from data on barge accidents occurring on the Tennessee River system in 1984 and 1985 to arrive at the probability of a chlorine release as $8.8E-6$ per year. The probability of chlorine transfer from the damaged barge to the control room was calculated using the method described in the plant's Final Safety Analysis Report (FSAR). The value for all atmospheric stability conditions was $9.1E-2$ per release. With these probabilities for chlorine release and transport, the probability of chlorine exceeding a toxic limit in the control room was determined to be $8E-7$ per year. This value is lower than the $1E-6$ criterion of the SRP; therefore, these chlorine releases can be excluded from consideration in control room habitability analysis. The staff performed an independent verification of the TVA's probabilistic analyses and considers them to be acceptable.

3.0 CONCLUSION

The staff reviewed TVA's evaluation of the effect of accidental releases of toxic chemicals from barges passing by the plant site on habitability of the control room. Out of twenty different chemicals transported on the river in the vicinity of the plant, TVA was able to eliminate fourteen either due to their benign chemical nature or that they could not reach toxic levels of concentration in the control room. Out of the six remaining chemicals, TVA demonstrated that five will reach their toxicity limits in the control room in more than two minutes after being detected, giving sufficient time for the operators to don their protective gear. The only chemical for which the toxicity limit would be reached in less than two minutes is chlorine. However, TVA demonstrated that this is a very improbable event; hence, chlorine could also be excluded from consideration in determining habitability of the control

room. Based on these findings, the staff concludes that the chemicals transported by barges on the Tennessee River near the Browns Ferry site do not pose any significant danger to the habitability of the control room. However, the staff requests that control room personnel be given suitable training in recognizing and responding to the five hazardous chemicals (other than chlorine) whose presence could reach toxic levels in the control room.

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