OCT 5 1981

MEMORANDUM FOR: Samuel J. Chilk, Secretary

FROM: William J. Dircks, Executive Director for Operations

SUBJECT: SECY-81-453 - DIRECTOR'S DENIAL OF 2.206 RELIEF (IN THE MATTER OF TENNESSEE VALLEY AUTHORITY)

Reference is made to your memorandum to me of August 27, 1981 on the above subject wherein you requested the staff to provide the basis for its estimates of the tornado strike probability at the Browns Ferry site.

Enclosed is a description of how the tornado strike probability was calculated by the Accident Evaluation Branch. The tornado strike probabilities calculated by the staff are a factor of 4 to 10 lower than cited in WASH-1300 because of the much larger data base now available and the research on severe storms that has been accomplished during recent years as a result of funding by NRC and other Federal agencies.

(Signed) William J. Dircks

William J. Dircks
Executive Director for Operations

Enclosure:
As stated

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*See attached sheet for previous concurrence

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ESTIMATES OF TORNADO STRIKE PROBABILITIES AT BROWNS FERRY, ALABAMA SITE

The tornado strike probability for the Browns Ferry, Alabama s te was estimated to be about 2 X 10^{-4}/yr, irrespective of windspeed. Utilizing Eqn (1) from WASH-1300,

$$P_s = \frac{N\bar{a}}{YA}$$

Where P_s = Tornado strike probability $\left[\text{yr}^{-1}\right]$

N = Number of tornadoes occurring in area A in Y years

$\bar{a}$ = Mean area per tornado, considering N tornadoes.

Basing our calculation on the National Severe Storms Forecast Center (NOAA) tornado data, for a 125 mile radius centered at the Browns Ferry site for the period 1950-1980, the resulting tornado strike probability is

$$P_s = \frac{N\,\bar{a}}{Y\,A} = \frac{(666)\ (0.38)_2}{(31)\ \pi\ (125)^2} = 1.7 \times 10^{-4}\ /\ \text{yr}$$

For comparison, the tornado strike probability was also estimated by assessing the available tornado data from the Oak Ridge and Memphis, Tennessee areas. Two data sets which did not exist at the time of the preparation of WASH-1300 were used, one maintained by the National Severe Storms Forecast Center, NOAA, Kansas City, Missouri, and the other maintained by the University of Chicago. The latter data set was developed for the NRC for tornado hazard probability applications. NSSFC data for the period 1950-1975 yields the following results for Oak Ridge,

$$P_s = \frac{(236)\ (.35)_2}{26\ \pi\ (125)^2} = 6.5 \times 10^{-5}/\text{yr}$$

For Memphis,

$$P_s = \frac{(596)(.43)_2}{26\ \pi\ (125)^2} = 2 \times 10^{-4}/\text{yr}$$

The University of Chicago data for the period 1950-1978 for a 4^0 square around Oak Ridge yields

$$P_s = \frac{(343)\ (.5)}{(29)(61,874)} = 9.6 \times 10^{-5}/yr$$

The $\bar{a} = .5\ mi^2$ was conservately estimated by the staff from the NSSFC data of $.36 - .43\ mi^2$. WASH-1300 considered only data from 1955-1967 which has been superseded by later data compilations and conservatively assumed $\bar{a}$ to be $2.82\ mi^2$. This value has been shown to be about a factor of 4-10 too large considering all tornadoes.[1]

The newer probabilities are generally consistent with more recently published papers on this subject. Kelly, et al (1978)[2] computed the tornado frequency for the Browns Ferry area to be about 3.5 tornadoes per 10,000 mi^2 per year (1950-1976). This compares favorably with the strike probability cited earlier of 2×10^{-4}/yr if one assumes $\bar{a} = 0.5\ mi^2$. Schaefer, Kelly and Abbey (1980)[1] support these findings using data from 10,826 tornadoes that occurred in the period 1950-1977.

The comparison values for the same general region tend to support a tornado strike probability of about 2×10^{-4}/yr for the Browns Ferry site. The above calculations do not compute probability of windspeed, but only probability of occurrence of a tornado at a particular location within area A.

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[1] Schaefer, J. T., et al; 1980: "Tornado Track Characteristics and Hazard Probabilities," Wind Engineering, edited by J. E. Cermark, Pergamon Press, Oxford, England, 95-109

[2] Kelly, D. L., et al; 1978: "An Augmented Tornado Climatology, "Monthly Weather Review," 106, 1177-1183.