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November 22, 1982

Mr. Paul O'Connor
Project Manager
Operating Reactors Branch No. 5
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Subject: Dresden 2
SEP Topic: III-2, Wind and Tornado Loadings

Reference: (a) T.J. Rausch letter to D.M. Crutchfield dated 2/22/82
(b) T.J. Rausch letter to P.W. O'Connor dated 8/2/82; Subject: III-7.B, Design codes, Design criteria, and loading combinations.

NRC Docket 50-237

Dear Mr. O'Connor:

10CFR50 (GD2), as implemented by SRP Sections 3.3.1 and 3.3.2 and Regulatory Guides 1.76 and 1.1117, requires that the plant be designed to withstand the effects of natural phenomena and establish the ability of Class I structures to safely withstand a high wind or tornado strike.

The specific areas of concern along with a response is provided as follows:

Item 1: Components not enclosed in qualified structures

The staff's analysis did not include the systems and components important to safety that are located outside qualified structures. It is the staff's position that the licensee identify those components and ensure that they are designed to withstand the postulated tornado loading, or that their loss of function will not adversely affect safe operation of the plant.

Response: The condensate storage tanks serve as one water source for the HPCI system and the isolation condenser. These tanks are not safety-related, and therefore are not protected from tornado loadings. However, HPCI can also take suction from the suppression pool (torus), which is located inside the reactor building.

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Also, if condensate storage tanks are unavailable for Isolation Condenser make-up, water can be supplied by the fire water system header by either the service water pumps or the emergency diesel fire water pumps which are located in two separate crib houses approximately 300 feet apart.

The wind load capacities of the exterior intake supports, the exhaust pipe supports, and the exhaust silencer supports of the Diesel Generator for Units 2 and 3 have been reviewed. The maximum wind velocities that the existing supports can withstand and the probabilities of exceeding these wind speeds are as follows:

	Support Type	Allowable Tornado Wind Velocity (0.95Fy Stress)	Probability of Exceeding Allowable Wind Velocity (based on 95% confidence limits)
Unit 2&3	Exhaust Silencer (Vertical)	105 mph	9.0×10^{-5}
Unit 2/3	Swing Diesel Exterior Intake	170 mph	2.0×10^{-5}
Unit 2/3	Swing Diesel Exhaust Silencer (Horizontal)	200 mph	0.9×10^{-5}

Item 2: Ventilation Stack

The stack capacities provided to the staff by the licensee are lower (300-mph windspeed) than those required by the site-specific tornado-imposed loads. Failure of the stack could affect the integrity of seismic Category I structures because the stack is in close proximity to these structures. The licensee should verify the capacity of the stack or provide an evaluation of tornado (or high-wind) induced stack failure and its consequences.

Response: The original report (Reference a) and conclusion were based on evaluating the vent stack using the ACI ultimate strength method. A further analysis showed that the approach using the ultimate strength of the steel would yield a higher capacity of the vent stack to tornado wind loads. This higher capacity would, of course, yield to a lower probability of damage.

The analysis using the ACI ultimate strength requirements based on the yield strengths of the reinforcing steel shows that the chimney will "fail" if it is subjected to tornado wind speeds greater than 210 mph. Additional analysis using an approach based on the ultimate strength of the reinforcing steel shows that the chimney is expected to fail at a tornado wind speed of 255 mph at an elevation of 577'-0" (60 ft. above grade or higher). The foundation will sustain this wind load. As shown in the tornado wind probability curve (Figure 1), the probability of tornado wind speeds exceeding a value of 255 mph is approximately 2.35×10^{-6}.

A conservative assumption can be made that the falling vent stack and associated secondary structural failures would impact an area within an angle of approximately 36° out of 360°. The probability of the falling vent stack damaging buildings or equipemnt within any 36° section would, therefore, be 2.35×10^{-7} per year.

Item 3: Roof Decks on Category I structures

Roof decks consisting of built-up roofing as opposed to structural roof slabs made of concrete were not investigated by the staff. It is expected that such roofs will have minimal resistance to differential pressure. Therefore, it is the staff's position that the licensee provide an evaluation of demonstrate that failure of roof decks will not adversely affect safe plant operation or result in unacceptable offsite dose consequences.

Response: The reactor building roof consists of built-up roofing material on rigid insulation over precast concrete slabs. The Tornado Wind and Normal Wind allowable loads and the ultimate capacity of the precast roof slabs was evaluated for the Reactor Building and the Turbine building. The results are as follows for a closed building assumption.

Wind Type	Allowable Uplift			Ultimate Uplift		
	Press.	Wind Velocity	Probaility of Exceeding Allowable Wind Velocity	Press.	Wind Velocity	Probability of Exceeding Allowable Wind Velocity
Tornado Wind	118 psf	250 mph	1.7×10^{-6}	130 psf	270 mph	1.0×10^{-6}
Normal Wind	73 psf	200 mph	0.9×10^{-5}			

This assumption is based on the siding not being removed and slab flexure governing. The wind loads do not take into account local wind effects and are for a closed building.

Since the theoretical wind velocity capacity of the metal wall siding panels around the reactor building is less than the ultimate uplift capacity of the roof panels, we have considered an open building for the evaluation of the roof panel capacity. The ultimate capacity of the precast roof slabs for uplift is 130 psf. The tornado windspeed required to produce this uplift is 320 mph. The NRC staff evaluation of Topic II-2.A, "Severe Weather Phenomena", included a probability analysis of tornado windspeeds. The mean probability of exceeding a tornado windspeed of 320 mph is approximately 2×10^{-7} per year (figure 1).

The actual structural behavior would be between the totally open and totally closed building. In any event, the tornado wind load capacity is acceptable. Because of the low probability of exceeding a tornado windspeed sufficient to fail the roof slabs, the rapid dispersion of any postulated radiological release due to the turbulent nature of tornado winds, Commonwealth Edison concludes that upgrading of the roof to withstand higher tornado windspeeds is not warranted.

Item 4: Load Combination

As a result of the topic review, the staff was unable to determine if straight wind loads (not tornado loads) were combined with other loads (i.e., operating pipe reaction loads and thermal loads).

The licensee should determine if these loads were considered in the original design. If not, the effect of combining the loads should be addressed.

Response: Under SEP Topic III-7.B (Reference b), pipe reaction loads and thermal loads were considered in combination with wind loads, therefore overstress is not of concern.

Please address any questions you may have concerning this matter to this office.

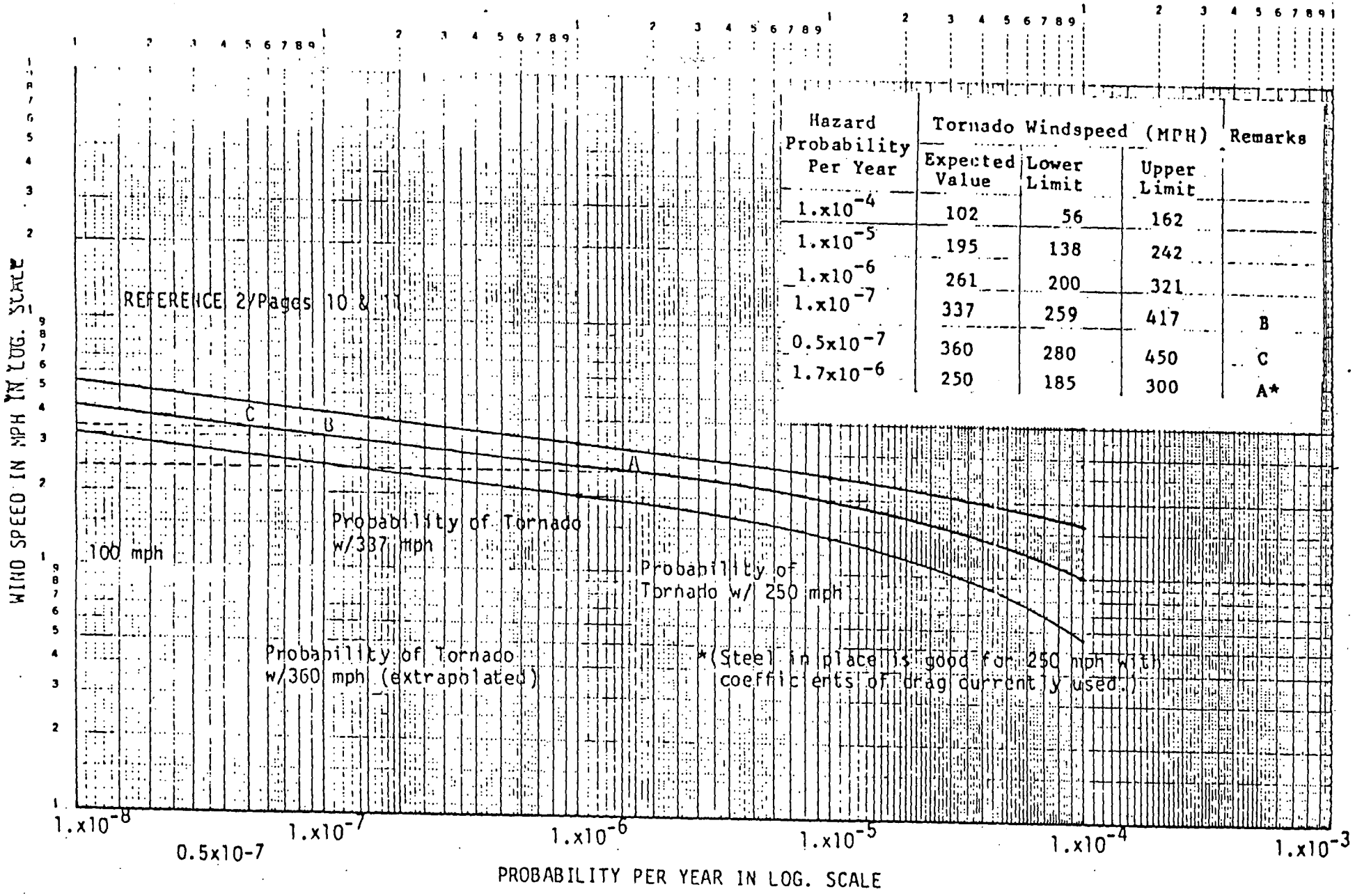
One (1) signed original and thirty-nine (39) copies of this transmittal have been provided for your use.

Very truly yours,

Thomas J. Rausch

Thomas J. Rausch
Nuclear Licensing Administrator
Boiling Water Reactors

SPPJ/rmr
2382D
cc: RIII Resident Inspector, Dresden
Gregg Cwalina, SEP Integrated Assessment Project Manager



Hazard Probability Per Year	Tornado Windspeed (MPH) Expected Value	Lower Limit	Upper Limit	Remarks
$1.\times10^{-4}$	102	56	162	
$1.\times10^{-5}$	195	138	242	
$1.\times10^{-6}$	261	200	321	
$1.\times10^{-7}$	337	259	417	B
0.5×10^{-7}	360	280	450	C
1.7×10^{-6}	250	185	300	A*

FIGURE 1 TORNADO HAZARD PROBABILITY MODEL FOR DRESDEN
(With 95% Confidence Limits)