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SCHWENCER,A. Licensing Branch 2

SUBJECT: Provides justification for adequacy of present design re tornado missile protection for diesel generator exhausts. New SRP requirement should not be imposed.Removal of item from SER outstanding issue list requested.Rept encl.

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May 14, 1982
G02-82-446
SS-L-02-PLP-82-031

Docket No. 50-397

Mr. A. Schwencer, Chief
Licensing Branch No. 2
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Schwencer:

Subject: NUCLEAR PROJECT NO. 2
WNP-2 TORNADO MISSILE PROTECTION
FOR DIESEL GENERATOR EXHAUSTS

On April 26-27, 1982, members of our staff met with R. Auluck, J. Ridgely, and R. Lobel of the NRC staff to discuss, among other things, tornado missile protection for the WNP-2 diesel generator exhausts. The Supply System position on this issue is presently being evaluated by the NRC staff, but discussions have indicated that NRC management attention may be warranted.

In summary, the NRC staff has advised the Supply System that the WNP-2 design must take into consideration protection against tornado missiles for up to 30 feet above the highest grade elevation within 1/2 mile of the plant site, in accordance wth the new Standard Review Plan (SRP). As you are aware, WNP-2 received its construction permit in 1973 (CPPR-93). WNP-2 is designed and constructed in accordance with Regulatory Guide 1.70 and takes into account protection against tornado missiles up to 30 feet above <u>plant grade</u>. Thus, the plant area that is subject to the backfit proposed by the staff is that area between 30 feet above grade and the new level prescribed in the SRP (approximately 60 feet above grade). The issue raised by the staff is the probability that a utility pole could damage or block the diesel generator exhaust. A detailed discussion of the matter is provided in the enclosure of this letter.

We are raising this matter with you to assure that you are aware of it and can take any management action you may deem necessary. In this regard, we invite your attention to the following points:

- WNP-2 was designed and constructed in accordance with Regulatory Guide 1.70;
- The new SRP should not be considered a binding legal requirement on WNP-2 at this stage of the review process.

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WNP-2 Tornado Missile Protection for Diesel Generator Exhausts:

- The staff's attempt to impose the new SRP for WNP-2 design involves a change in design basis and constitutes a backfit;
- The staff has made no finding in accordance with 10CFR 50.109.

In any event, tornados of sufficient velocity to generate a missile of the type under consideration are unprecedented in the vicinity of the site. The probability of occurrence of such a tornado in the WNP-2 site vicinity has been estimated to be less than 10^{-8} per year (NUREG-0722). Of course, the probability that any missile generated by a tornado would strike the exhaust port for the diesel generator is even lower. In these circumstances, we have concluded that no substantial additional protection would be afforded by the backfit, and that the backfit cannot be justified on a cost-benefit basis due to the extremely low probability of the event.

Because the SRP is a guidance document, and because no finding has been made by the staff in accordance with 10CFR 50.109, we submit that the staff has no justification for imposing the backfit. Further, we believe that the enclosure to this letter provides ample technical justification for the adequacy of the present design. Accordingly, we request that the NRC remove this item from the Safety Evaluation Report Outstanding Issues list.

Please contact me if you have further questions.

Very truly yours,

GD Bouchey

G. D. Bouchey
Deputy Director, Safety and Security

GCS/jca

cc: R Auluck - NRC
WS Chin - BPA
R Feil - NRC Site
H Denton - NRC
W Dircks - NRC
V Stello - NRC
DG Eisenhutt - NRC
RL Tedesco - NRC

ATTACHMENT 1

Washington Public Power Supply System
Position On Tornado Missile Protection
for Diesel Generator Exhausts, WNP-2

March 23, 1982

The Power Systems Branch of the Nuclear Regulatory Commission (NRC) has indicated in the Safety Evaluation Report (SER) for WNP-2 that there is a concern that adequate protection against tornado missiles has not been provided for the diesel generator exhausts. The NRC postulates that a utility pole may be blown into the diesel exhaust of one of the divisions or into the structure around the exhaust, possibly collapsing part of the exhaust system. Because of the partial blockage of the exhaust area, the diesel performance of that division may be degraded, and the generators may not produce enough power to provide for safe shutdown of the plant. Concurrent with this event is the loss of offsite power (because of the tornado) and the non-starting of the diesels in the other diesel generator division.

The diesel exhaust piping exits the diesel generator rooms between the reactor building and the diesel generator building, rises to the roof level through a narrow, protected corridor between the two buildings, and enters a tornado missile protected penthouse atop the diesel generator building. The exhaust discharges from the penthouse at a 45° angle from the horizontal. The centerline of the exhaust (at the face of the penthouse) is at elevation 481'8½" (see Figure 1). The bottom of the exhaust opening is at 479'7". Allowing a band of concrete 16" below that to protect against a missile striking and damaging the concrete encasement below that penetration lowers the lowest point of interest to 478'3", which is 37'9" above plant grade. The finished plant grade around the diesel generator building is 440'6".

In the Preliminary Safety Analysis Report (PSAR), the Supply System committed to providing tornado missile protection against several missiles. The 35 feet long utility pole with a 14 inch butt was among these missiles. In the Final Safety Analysis Report (FSAR) for WNP-2, the Supply System committed to providing tornado missile protection against this utility pole up to thirty (30) feet <u>above plant grade</u>. (The design missile in the FSAR weighs 1600 pounds and has a velocity of 241 feet per second.)

Also in the PSAR and the FSAR the Supply System committed to providing protection against tornado winds of 360 mph (300 mph rotational and 60 mph translational).

Based upon the commitments in the PSAR, the design criteria were prepared and the drawings for the diesel generator building were released for construction in 1973. The Supply System has provided protection for the diesel generator building (and other buildings) appropriate to the commitments in the PSAR and the FSAR.

Subsequent to the release of the drawings for construction noted above, the NRC, in 1975, issued Standard Review Plan (SRP) 3.5.1.4 which called for protection against the utility pole "up to 30 feet above all grade levels within 1/2 mile of the facility structures." (Underlining added.) Thus, the current concern results from the imposition of a criterion that did not exist when the building was designed and construction was started.

The Supply System commitments listed above were made based upon the best information that was available at the time of the commitment. Since then, however, research efforts have continued and better information is now availalbe. A report by the NRC (NUREG-0722) (Ref. 1) has been published that gives a better estimate of the probability of tornado and other winds occurring at the plant site. This report was prepared for the EXXON Nuclear Company plant (eight miles south of WNP-2). Because there are no intervening terrain features, it is equally applicable to WNP-2. Figure 2 taken from that report, shows that the Supply System commitment to tornado winds of 360 mph is extremely conservative, since the greatest wind velocity shown is about 220 mph and has a probability of occurrence in any one year of P_s=1x10^{-8}. It should also be noted from Figure 2 that tornado wind speeds of 170 mph are classified as "remote" by the report. Another source (Ref. 2) supports the data in NUREG-0722 (see Table 1). The data in Figure 2 and Table 1 show that the probable maximum velocity of tornado winds falls off quite sharply while the probability of occurrence still remains very small. This clearly indicates that the occurrence of a tornado sufficient to generate large missiles is extremely remote.

There are no utility poles in the plant area at elevations within 30 feet of elevation 478'. There are some knolls above elevation 448' within one half-mile of the plant, but they are covered by grasses and sagebrush and do not have any utility poles on them. (The nearest ground at elevation 448' or higher is at least 1000 feet from the diesel generator building.)

Calculations based upon a report prepared for the U. S. Atomic Energy Commission (Ref. 3) show that a missile the size of the design utility pole cannot be made airborne with winds of 220 mph (323 fps), let alone have a velocity of 241 feet per second (FSAR commitment) and be 38 feet above plant grade.

Even assuming that a missile could be generated, the probability of the events described in the scenario is so small that additional protection is not deemed necessary for the diesel exhausts. To show this, the probability of this sequence of events will be analyzed.

Assuming that a missile were generated, the probability of it hitting any one of the four exhaust areas (a point target) is:

$$P_H = \frac{4A_H}{A_T} = \frac{4(18.98)}{(30)(200)} = 1.3x10^{-2}$$

where A_H = area of one diesel exhaust port that could result in postulated damage

= elliptical area of pipe and area of concrete that might be damaged (Figure 1)

$$= \frac{(\frac{52}{2} \times \frac{66.9}{2})\pi}{144} = 18.98 \text{ ft}^2$$

A_T = cross-sectional area of tornado

= height x diameter = 30'x200' (100' is assumed for the radius of the tornado. This is conservative for this situation. A larger radius would result in a smaller P_H.)

The probability that either diesel generator will not start when required is $P_D = 1x10^{-2}$ (including restart).

Combining these probabilities, the probability of the postulated event is $1.3x10^{-12}$.

$$P_T = P_S \times P_H \times P_D = (1x10^{-8})(1.3x10^{-2})(1x10^{-2}) = 1.3x10^{-12}.$$

This combined probability is so small as to not warrant consideration in the plant design basis. Even if one hundred poles were to be airborne in a tornado, the probability of the postulated incident occurring in any one year is $1.3x10^{-10}$, which is still too small to form the basis for the plant design.

While the total probability of such an event occurring is extremely small, it should be considered a conservative number since no effect of pole alignment or direction of motion is considered. A factor of P_{AL}=0.5 could reasonably be assumed to represent the probability that the pole, while airborne, would be aligned in such a way that the postulated damage would occur. Also, a factor of P_{AX}=0.5 could be assumed to represent the probability that the pole would be moving axially, as opposed to sideways. The combined probability then that the pole would be properly oriented and moving in a damaging direction is P_C=0.25, which would further reduce the probability shown above.

It should also be noted that the exhaust ports are approximately 65 feet back from the vertical face of the diesel generator building. Thus, any tumbling pole or pole with a vertical or partially vertical orientation would strike the front of the diesel generator building unless all parts of the pole are at least 38' above the plant grade. This provides additional protection for the exhaust ports against being hit be the postulated missile.

In conclusion, it is the Supply System's position that adequate protection is provided for the diesel generator exhausts for the following reasons:

1. The probability of any tornado occurring is very small. If one does occur, the strongest winds to be expected are well below the design winds committed to in the PSAR and FSAR.

2. The design utility pole is not a credible missile at the elevation of the diesel exhausts.

   a. The maximum tornado wind that might be expected will not support a missile the size of the design utility pole.

3. Assuming a missile could be generated, the probability of the scenario postulated is so small (1.3×10^{-12}) that it does not warrant consideration in the plant design basis.

References:

1. NUREG-0722, "The Effects of Natural Phenomena on the EXXON Nuclear Company Mixed Oxide Fabrication Plant at Richland, Washington", U.S. Nuclear Regulatory Commission, Washington, D.C. 20555, September 1980.

2. McDonald, James R., "Assessment of Tornado and Straight Wind Risks at the Hanford Engineering Work Site", Prepared for Lawrence Livermore Laboratory, University of California by McDonald, Mehta and Minor, Consulting Engineers, Lubbock, Texas, October 1979.

3. HEDL-TME-71-35, "Review of Tornado Considerations for FFTF", prepared by D. E. Simpson of the Hanford Engineering Development Laboratory for the United States Atomic Energy Commission, Richland, Washington 99352, January 1971.

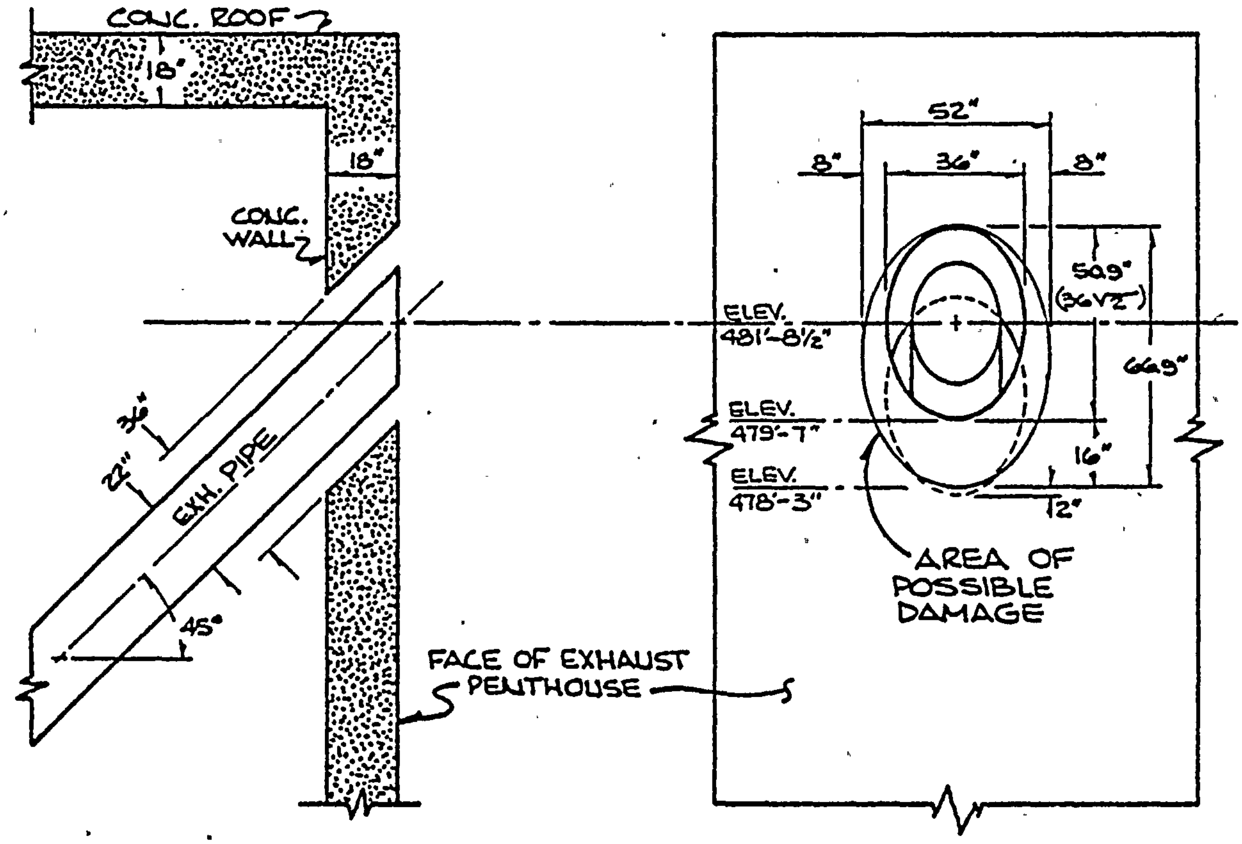

FIGURE 1

THE AREA THAT COULD BE CONSIDERED SUSCEPTIBLE TO DAMAGE IS ROUGHLY ELLIPTICAL IN SHAPE WITH A MAJOR DIMENSION OF 66.9" (36"√2 + 16") & A MINOR DIMENSION OF 52" (36" + 2×8").

Windspeeds of Design-Basis Storms as a Function of Probability of Occurrence at the Site. (Probability per year of 10^{-3} is regarded as high, 10^{-6} as low, and 10^{-7} as remote. Straight-line winds dominate the high- and low-probability cases; tornadoes dominate the remote-probability case. The use of curves B and D combined is recommended.) (100 mph = 45 m/s.)

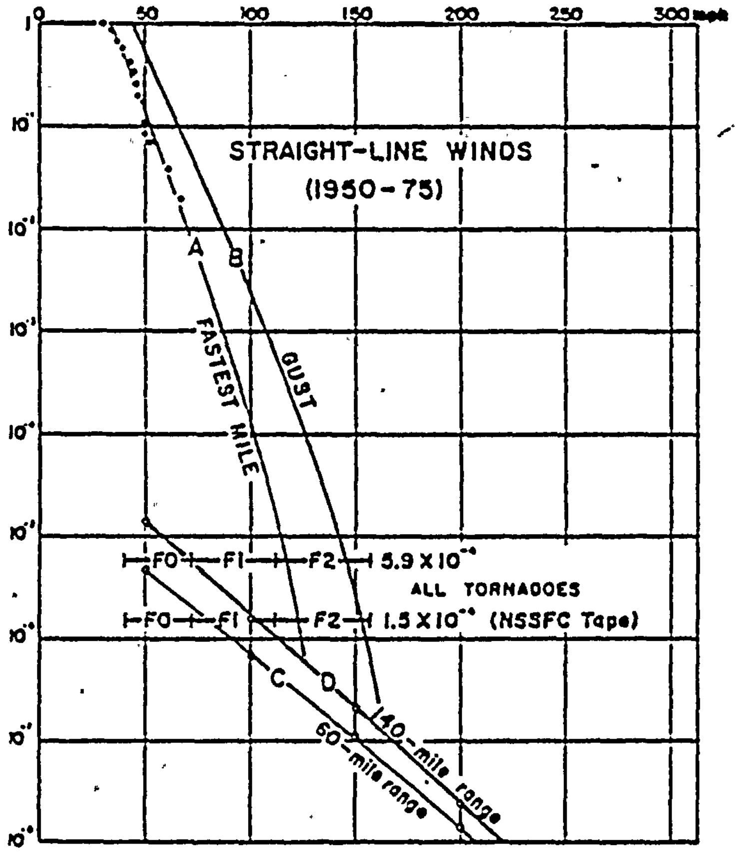

FIGURE 2

SUMMARY OF TORNADO RISKS

Windspeed mph	Mean Recurrence Interval, Yr	Expected Probability*
40	38,500	2.60×10^{-5}
73	110,000	9.07×10^{-6}
113	350,000	2.86×10^{-6}
158	3,570,000	2.80×10^{-7}
207	55,900,000	1.79×10^{-8}
251	1,471,000,000	6.80×10^{-10}

*Probability of exceeding threshold windspeed in one year.

TABLE 1