PSNH

Public Service of New Hampshire

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March 29, 1983

SBN-495
T.F. B7.1.2

United States Nuclear Regulatory Commission
Washington, D. C. 20555

Attention: Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing

Reference: (a) Construction Permits CPPR-135 and CPPR-136, Docket Nos. 50-443 and 50-444

Subject: Response to SER Outstanding Issue #1 (SER Section 2.3.1; Meteorological and Effluent Treatment Systems Branch)

Dear Sir:

We have enclosed a response to SER Outstanding Issue #1 which is addressed in SER Section 2.3.1.

The enclosed response is in the form of a revision to our response to your Request for Additional Information (#451.11) which will be incorporated in OL Application Amendment 49.

Very truly yours,

YANKEE ATOMIC ELECTRIC COMPANY

John DeVincentis

John DeVincentis
Project Manager

B001

ALL/dsm

cc: Atomic Safety and Licensing Board Service List

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451.11 a. Identify meteorological conditions (including extreme temperatures, pressure, humidity, and windspeeds) considered in the design of auxiliary systems and components (e.g., the diesel generator combustion air intake and exhaust system discussed in Section 9.5.8).

b. Provide the bases for the selected values (including the magnitude and duration).

c. Compare the selected values with severe or extreme meteorological conditions observed in the region through 1981 (through January 1982 for extreme minimum temperatures).

d. Compare the selected values with those presented in Section 2.3.1.2 for tornadoes and hurricanes, extreme winds (e.g., 100-year recurrence), extreme temperatures (100-year recurrence; see NUREG/CR-1390, "Probability Estimates of Temperature Extremes for the Contiguous United States"), and other extreme conditions for atmospheric moisture and precipitation.

RESPONSE: a. Meteorological conditions considered in the design of auxiliary systems and components, exclusive of the diesel generator air intake and exhaust system, are summarized below; the environmental conditions for the diesel generator air intake and exhaust system are addressed in RAI 430.130.

Extreme Outdoor Temperatures

Maximum 88°F

Minimum 0°F

Relative Outdoor Humidity

Maximum 100%

Minimum 10%

The above temperature and humidity extremes were utilized in the design of the HVAC systems for all safety-related buildings. The HVAC systems are intended to maintain temperature and humidity environments within the buildings as specified in FSAR Figure 3.11(B)-1 (Service Environment Chart) under the outdoor conditions specified above.

Seismic Category I structures and certain non-Seismic Category I structures, as listed in Subsection 3.8.4.1, were designed for wind velocities as follows:

Severe Environmental Load:

A wind speed of 110 mph at 30 feet above ground for a 100-year return.

Extreme Environmental Load:

A total maximum tornado wind velocity (translational plus rotational of 360 mph).

Seismic Category I structures and certain non-Seismic Category I structures were designed for the following atmospheric pressure change accompanying the design basis tornado:

Total pressure change due to passage of tornado: 3 psi
Rate of pressure change: 2 psi per second

b. The bases for specification of temperature extremes are actual measured regional temperature distributions for Massachusetts presented in "ASHRAE Handbook of Fundamentals", Chapter 22, Table 1, page 380, 1967 Edition. The 2-1/2 % values (Summer) and 97-1/2% values (Winter) of the distributions were used.

The bases for the selection of the humidity range is the assumption that relative humidities at or near 100% occur during fog, dew formation and precipitation which are frequently observed in this climate. Relative humidities less than 10% are not observed under the climatic conditions affecting this site.

The bases for the design wind velocities and atmospheric pressures for Seismic Category I structures and certain non-Seismic Category I structures (listed in Subsection 3.8.4.1) are discussed in Subsection 2.3.1.2.

c. Extreme wind speed and ambient temperature conditions observed in the Seabrook Station site region through December 1978 were reported in Seabrook FSAR Tables 2.3-4, 2.3-11 and 2.3-12. Seabrook FSAR Table 2.3-4 shows that the fastest mile wind speed recorded was 87 mph (Boston, September 1938); SB FSAR Tables 2.3-11 and 2.3-12 show that the maximum and minimum ambient temperatures observed were 104°F (Boston, July 1911) and -39°F (Portland, February 1943), respectively. None of these extreme environmental conditions have been exceeded at their respective stations as of January 1982.

Extreme temperatures which are more representative of the site were determined through an analysis of the Pease AFB (Portsmouth, N.H.) temperature data for the period April 1956 through June 1982. The pertinent results of this analysis are contained in our response to part (d) below.

A National Severe Storm Center list of tornado data for the Seabrook Station site region for the period 1950-1981 (Reference 1) indicates that the closest initial tornado touchdown point recorded was approximately 2 miles from the site on July 1, 1968. This tornado was rated 1 on the

Fujita-Pearson scale estimate of force (73-112 mph winds). The three strongest tornadoes recorded as having initially touched down within 50 miles of the site during this same 32-year period were rated 3 on the Fujita-Pearson scale estimate of force (158-206 mph winds). The estimated wind load of these three extreme tornadoes is well below the design extreme environmental tornado wind velocity of 360 mph.

NOAA Technical Report NWS 23 (Reference 2) provides a list of hurricanes with observed or estimated minimum central pressures less than 29.00 inches Hg which have occurred along the U.S. east coast during the 79-year period 1900-1978. According to NWS 23, the minimum hurricane central pressure estimated to have occurred within 150 nautical miles of the U.S. east coast during this period was 27.44 inches Hg on September 10, 1919 off the Florida coast. Minimum hurricane central pressures along the New England coast have generally been higher due primarily to decreasing water temperatures toward the north. The lowest pressure ever recorded in the site region (e.g., at either Boston, Concord or Portland NWS) was 28.40 inches Hg recorded in Portland on December 2, 1942 (Reference 3). Thus, the diesel generator air intake and exhaust design hurricane and northeastern storm pressure of 26 inches Hg as discussed in SB FSAR Section 9.5.8 and in SB RAI 430.130 is conservative when compared to the minimum pressures which have been observed in the site region.

d. The 100-year return period wind speed at 30 feet above ground is reported in FSAR Section 2.3.1.2 as 110 mph. This was the wind velocity used for the severe environmental wind load. The design basis tornado wind velocities and atmospheric pressures are those outlined for Region I in Regulatory Guide 1.76 (Reference 4). The design basis hurricane or northeastern storm pressure of 26 inches Hg more conservative than the probable maximum hurricane central pressure of 26.80 reported for the New England coastline by NWS 23 (Reference 2).

According to NUREG/CR-1390 (Reference 5), the 100-year return period maximum and minimum temperatures for the Seabrook site are approximately 106°F and -32°F, respectively. These extreme temperatures were obtained by the interpolation between isotherms shown on the maps of 100-year maximum and minimum temperatures contained in NUREG/CR-1390.

The data base used to develop these maps does not include, however, temperature data from any reporting stations near the Seabrook site and also shows a strong influence of inland stations on the isotherm maps of 100-year maximum and minimum temperatures. Thus, NUREG/CR-1390 does not, in our opinion, adequately account for the modification of extreme temperatures due to the proximity of Seabrook to the Atlantic Ocean.

Our analysis (Reference 6) of extreme temperature data collected at nearby weather stations (Portsmouth, NH (Pease AFB)), climatological stations (Rockport, MA, Sanford, ME, and Greenland, NH) and at the Seabrook site results in 100-year return period maximum and minimum hourly temperatures for the Seabrook site of 102°F and -21°F, respectively. (These values were computed following the methodology found in NUREG/CR-1390.)

Since the design of some equipment is more dependent on the maximum and minimum temperatures averaged over a period of greater than one-hour, extreme temperatures for 2, 4, 8, 12, and 24-hour averaging periods were also determined. The values are listed below:

Averaging Period	100-Year Return Period Temperature (°F) Maximum	Minimum
2-Hour	102	-21
4-Hour	101	-21
8-Hour	99	-20
12-Hour	96	-19
24-Hour	92	-16

In addition to the above hypothetical 100-year return period temperature extremes, our analysis indicated that the highest hourly temperature recorded during the period 1957 through 1981 at Pease AFB (Portsmouth, N.H.) was 101°F on July 1, 1964 (hour 13). The hottest contiguous 24-hour period containing this temperature extended from June 30 (hour 15) through July 1 (hour 14). The hourly temperature progression for this period is provided in Table 451.11-1.

The five hottest and five coldest contiguous 24-hour hourly temperature periods recorded at Pease AFB for the data base of 1957 through 1981 are presented by Table 451.11-2.

e. Calculations show that resulting maximum ambient temperatures experienced by equipment located in ventilated compartments of concrete structures are functions not only of the temperature extremes, but also are functions of the diurnal variations in the outside temperature and the thermal inertia of the concrete structures. Concrete walls and slabs have thermal capacitance associated with them, thus the heat transfer occurring between the structures and the ventilation air damp out the daily temperature fluctuations that would tend to occur within the ventilated areas. The benefit that is gained by accounting for this thermal inertia can be determined by calculating the room temperature as a function of time of day.

From Table 451.11-2, which shows maximum temperatures of 100°F on August 3, 1975, the hottest 24-hour average external temperature was determined as 86.6°F. Since our

analysis of temperature extremes predicts a 100-year return maximum temperature of 102°F, the hourly temperature progression data for this day was thus adjusted upward by 2°F, in order to envelope the 100-year return conditions. As a typical example of the effect that the thermal inertia of concrete structures can have, it was found that the anticipated maximum temperatures at the 21'-6" elevation of the Control Building in the Emergency Switchgear Rooms would be decreased from 118°F to 113.5°F, and in the Battery Rooms from 109°F to 103°F, refer to Table 451.11-3 for details. In other words, by accounting for the diurnal variations and the thermal inertia associated with the concrete structures, the maximum temperatures that would occur in ventilated rooms would be lowered by approximately 4.5 to 6.0°F.

Based on our probabilistic evaluation of temperature extremes using the Pease AFB meteorological data (Reference 6), the outdoor temperature exceeding the extreme design temperature of 88°F occurs during a small fraction (0.25%) of the plant life. Moreover, it can be demonstrated that considering the thermal inertia of the building structures and the diurnal variation of temperature, the maximum temperature within a ventilated room will not exceed 104°F as long as the peak temperature of a hypothetical day does not exceed 91°F. The temperature of the Control Room will not exceed 80°F. The fraction of the plant life when the temperature exceeds 91°F is less than 0.105%. Based on the above, we have determined that there will be no significant degradation of equipment within the buildings as a result of the extreme high temperature conditions.

All structures housing safety-related systems were examined for the effect of minimum temperature of -16°F for a 24-hour period. All areas of all the buildings in question are capable of being maintained at a temperature of 50°F, or greater, under those conditions, except the following:

- An area of the Secondary Containment outside the personnel hatch ---- +34°F

- Diesel Generator Building, Mechanical Equipment Rooms at Elevation 51'-6" --- -16°F

- Cooling Tower

The Secondary Containment Area in question contains no safety-related equipment and, therefore, the temperature extremes in this area will have no effect on the safe operation of the station.

The equipment in the Diesel Generator Mechanical Equipment Rooms will start and run satisfactorily under these extreme minimum conditions.

The following considerations were taken into account for the low temperature evaluation of the mechanical draft cooling tower which serves as backup to the main circulating water tunnel for cooling of the primary components heat exchangers and diesel generator heat exchangers:

1. The tower is only intended to be used as a cooling means for the service water system if a seismic event has occurred which results in a blockage of over 95% of the flow area of the intake tunnel. As stated in FSAR Sections 9.2.1 and 9.2.2, the total flow required for the performance of the heat sink function by the tower is less than 5% of the circulating water flow rate provided during normal full power operation. The likelihood of such extreme blockage occurring in this hard rock tunnel is considered extremely remote.

2. The five-year on-site and 25-year Pease AFB outdoor temperature data bases reveal that $0^{o}F$ was equalled or exceeded 0.356% of the time on-site and 0.394% of the time at Pease AFB. The probability of a major seismic event which could render the tunnel incapable of providing sufficient service water flow concurrent with temperatures below the design temperature of $0^{o}F$ is considered extremely low.

Based on the above considerations, the availability of sufficient service water is assured.

Because of the thermal inertia associated with concrete structures and the relatively short duration of time that temperatures would be below $-16^{o}F$, we do not feel the temperatures of the buildings would fall significantly below the values stated above.

Since the environmental conditions in the areas discussed above are acceptable from the personnel access and operating equipment standpoints, it is concluded that the extreme minimum 100-year return temperature would not be detrimental to plant operation.

References

1. National Severe Storms Forecast Center, Tornado Data, "Tornadoes Within 125 Miles of Seabrook", 1950-1981 (unpublished).

2. NOAA Technical Report NWS 23, "Meteorological Criteria for Standard Project Hurricane and Probable Maximum Hurricane Windfields, Gulf and East Coasts of the United States", Washington, D.C., September 1979.

3. Telecon with Ms. Ettinger, Portland NWS, April 21, 1982.

4. NRC Regulatory Guide 1.76, "Design Basis Tornado for Nuclear Power Plants", April 1974.

5. Nicodemus, M. L., and N. B. Guttman, "Probability Estimates of Temperature Extremes for the Contiguous United States", NUREG/CR-1390, National Climatic Center, Asheville, NC, May 1980.

6. United Engineers and Constructors, Inc. Report, "Probability Estimate of Temperature Extremes for Seabrook New Hampshire", January 1983.

TABLE 451.11-1

HOTTEST CONTIGUOUS 24 HOURS IN ASSOCIATION WITH THE HOTTEST ONE-HOUR TEMPERATURE* OBSERVED DURING 1957 THROUGH 1981 AT PEASE AFB

Year	Date	Hour	Temperature (°F)
1964	June 30	Hr 15	89
		16	89
		17	89
		18	85
		19	81
		20	80
		21	77
		22	76
		23	76
	July 1	Hr 00	74
		1	76
		2	75
		3	75
		4	74
		5	73
		6	76
		7	80
		8	88
		9	92
		10	93
		11	96
		12	98
		13	101*
		14	100

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TABLE 451.11-2

Five Coldest and Warmest 14-Hour Periods at Seabrook Station

FIVE COLDEST 24-HOUR PERIODS

Average	-6.06	-7.12	-5.50	-2.70	-2.50
Year	1968	1957	1980	1967	1981
Period Ends	Jan 9	Jan 15	Dec 26	Feb 13	Jan 5
Hour					
00					
01					
02					
03					
04					
05			-2		-4
06			-5		-2
07			-7		-4
08			-7		-4
09			-7	0	-2
10			-7	1	-2
11	-6		-5	2	1
12	-5		-4	2	2
13	-4		-4	3	3
14	-4		-4	3	3
15	-4		-5	3	2
16	-5		-5	2	0
17	-6		-7	0	0
18	-7		-7	-1	-2
19	-8		-7	-1	-2
20	-10		-7	-2	-5
21	-10		-7	-3	-7
22	-10	-4	-6	-4	-7
23	-10	-7	-5	-5	-7
00	-10	-8	-5	-6	-5
01	-9	-10	-5	-7	-5
02	-9	-11	-5	-8	-5
03	-10	-13	-5	-8	-4
04	-9	-14	-4	-8	-4
05	-10	-15		-9	
06	-10	-15		-9	
07	-12	-16		-7	
08	-10	-14		-3	
09	-9	-12			
10	-7	-8			
11		-5			
12		-1			
13		0			
14		1			
15		0			
16		-3			
17		-4			
18		-4			
19		-4			
20		-2			
21		-2			
22					
23					

FIVE WARMEST 24-HOUR PERIODS

Average	86.62	85.87	85.23	84.25	83.91
Year	1975	1977	1964	1978	1982
Period Ends	Aug 3	Jul 21	Jul 19	Jul 22	Jul 9
Hour					
00					
01					
02					
03					
04	74				
05	77				
06	82				
07	85				
08	90				
09	92				
10	97			88	
11	99			90	
12	100		93	91	
13	100		94	93	
14	100		94	93	
15	98		94	93	
16	97	94	92	91	
17	92	92	89	86	
18	87	89	87	85	87
19	84	87	85	84	86
20	82	85	84	82	82
21	80	83	84	82	80
22	78	82	82	82	80
23	77	80	81	82	79
00	80	79	80	80	78
01	77	79	79	79	77
02	75	78	79	79	75
03	76	77	78	79	74
04.		77	77	78	75
05		77	76	78	77
06		77	78	79	79
07		80	80	81	80
08		84	84	82	82
09		87	90	85	85
10		91	92		90
11		95	94		89
12		96			93
13		96			95
14		98			94
15		98			94
16					93
17					90
18					
19					
20					
21					
22					
23					

(9)

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TABLE 451.11-3

HIGH TEMPERATURE EXTREME IN CONTROL BUILDING AT 21'-6"

COMPARTMENT	MAXIMUM TEMPERATURE (°F)
Emergency Switchgear Rooms - Train A or Train B	113.0
Rod Drive MG-Set Rooms	113.3
Battery Rooms "A," "B," "C" & "D"	103.0
Remainder of Switchgear Area	113.5°F

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