GE Nuclear Energy

General Electric Company
175 Curtner Avenue, San Jose, CA 95125

May 19, 1993

Docket No. STN 52-001

Chet Poslusny, Senior Project Manager
Standardization Project Directorate
Associate Directorate for Advanced Reactors
and License Renewal
Office of the Nuclear Reactor Regulation

Subject: Submittal Supporting Accelerated ABWR Review Schedule - **Audit Item 2**

Dear Chet:

Enclosed is a SSAR markup addressing Audit Item 2 associated with wind loading.

Please provide a copy of this transmittal to Tom Cheng.

Sincerely,

Jack Fox

Jack Fox
Advanced Reactor Programs

cc: Gary Ehlert (GE)
Norman Fletcher (DOE)
Ting-Yu Lo (LLNL)

JF93-162

210015

3.3 WIND AND TORNADO LOADINGS

ABWR Standard Plant structures which are Seismic Category I are designed for tornado and extreme wind phenomena.

3.3.1 Wind Loadings

3.3.1.1 Design Wind Velocity

Seismic Category I structures are designed to withstand a design wind velocity of 130 mph at an elevation of 33 feet above grade with a recurrence interval of 100 years. See Subsection 3.3.3.1 for interface requirement.

3.3.1.2 Determination of Applied Forces

The design wind velocity is converted to velocity pressure in accordance with Reference 1 using the formula:

$$q_z = 0.00256\, K_z\, (IV)^2$$

where K_z = the velocity pressure exposure coefficient which depends upon the type of exposure and height (z) above ground per Table 6 of Reference 1.

I = the importance factor which depends on the type of exposure; appropriate values of I are listed in Table 3.3-1,

V = design wind velocity of 130 mph, and

q_z = velocity pressure in psf

The velocity pressure (q_z) distribution with height for exposure types C and D of Reference 1 are given in Table 3.3-2.

The design wind pressures and forces for buildings, components and cladding, and other structures at various heights above the ground are obtained, in accordance with Table 4 of Reference 1 by multiplying the velocity pressure by the appropriate pressure coefficients and gust factors. Gust factors are in accordance with Table 8 of Reference 1. Appropriate pressure coefficients are in accordance with Figures 2, 3a, 3b, 4, and Tables 9 and 11 through 16 of Reference 1. Reference 2 is used to obtain the effective wind pressures for cases which Reference 1 does not cover. Since the Seismic Category I structures are not slender or flexible, vortex-shedding analysis is not required and the above wind loading is applied as a static load.

3.3.2 Tornado Loadings

3.3.2.1 Applicable Design Parameters

The design basis tornado is described by the following parameters:

(1) A maximum tornado wind speed of 300 mph at a radius of 150 feet from the center of the tornado;

(2) A maximum translational velocity of 60 mph;

(3) A maximum tangential velocity of 240 mph, based on the translational velocity of 60 mph;

(4) A maximum atmospheric pressure drop of 2.00 psi with a rate of the pressure change of 1.2 psi per second; and

(5) The spectrum of tornado-generated missiles and their pertinent characteristics as given in Subsection 3.5.1.4.

See Subsection 3.3.3.2 for COL license information.

3.3.2.2 Determination of Forces on Structures

The procedures of transforming the tornado loading into effective loads and the distribution across the structures are in accordance with Reference 4. The procedure for transforming the tornado-generated missile impact into an effective or equivalent static load on structures is given in Subsection 3.5.3.1. The loading combinations of the individual tornado load ing components and the load factors are in accordance with Reference 4.

The reactor building and control building are not vented structures. The exposed exterior roofs and walls of these structures are designed for the 2.00 psi pressure drop. Tornado dampers are provided on all air intake and exhaust openings. These dampers are designed to withstand a negative ~~1.46~~ 2.0 psi pressure.

3.3.2.3 Effect of Failure of Structures or Components Not Designed for Tornado Loads

All safety-related system and components are protected within tornado-resistant structures.

See Subsection 3.3.3.3 for COL license information requirements.

3.3.3 COL License Information

3.3.3.1 Site-Specific Design Basis Wind

The site-specific design basis wind shall not exceed the design basis wind given in Table 2.0-1 (See Subsection 2.2.1).

3.3.3.2 Site-Specific Design Basis Tornado

The site-specific design basis tornado shall not exceed the design basis tornado given in Table 2.0-1 (See Subsection 2.2.1).

3.3.3.3 Effect of Remainder of Plant Structures, Systems, and Components not Designed for Tornado Loads

All remainder of plant structures, systems, and components not designed for tornado loads shall be analyzed for the site-specific loadings to ensure that their mode of failure will not effect the ability of the Seismic Category I ABWR Standard Plant structures, systems, and components to perform their intended safety functions. (See Subsection 3.3.2.3)

3.3.4 References

1. ANSI/ASCE 7-88 ~~ANSI Standard A58.1~~, *Minimum Design Loads for Buildings and Other Structures*, ~~Committee A. 58.1, American National Standards Institute.~~ November 27, 1990.

2. ASCE Paper No. 3269, *Wind Forces on Structures*, Transactions of the American Society of Civil Engineers, Vol. 126, Part II.

3. Deleted

4. Bechtel Topical Report BC-TOP-3-A, Revision 3, *Tornado and Extreme Wind Design Criteria for Nuclear Power Plants.*

Table 3.3-1

Importance Factor (I) for Wind Loads

Nonsafety - Related ~~EXPOSURE C~~	Safety - Related ~~EXPOSURE D~~
1.00	~~1.04~~ 1.11

NOTES:

1. These values of (I) are based on Table 5 of Reference 1 ~~but are modified to reflect the 100 year return period of the design wind velocity versus the 50 year return period basis of Reference 1.~~

2. Exposure categories are as defined in Section 6.5.3 of Reference 1.

Table 3.3-2

VELOCITY PRESSURE DISTRIBUTION AND GUST FACTORS AT VARIOUS HEIGHTS

EXPOSURE TYPE C

Height Zone z (ft)	q_z (ft/sec)	G_h	Windward Wall Pressure $0.8G_hq_z$ (lb/ft^2)	Side Wall Suction $0.7G_hq_h$ (lb/ft^2)	Roof Suction $0.7G_hq_h$ (lb/ft^2)	Leeward Wall Suction $0.5G_hq_h$ (lb/ft^2)
0-15	34.6	1.32	37	58	58	42
20	37.6	1.29	39	57	57	41
25	40.2	1.27	41	56	56	40
30	42.4	1.26	43	56	56	40
40	45.9	1.23	45	54	54	39
50	48.9	1.21	47	54	54	38
60	51.5	1.20	49	53	53	38
70	53.6	1.19	51	53	53	38
80	55.8	1.18	53	52	52	37
90	58.0	1.17	54	52	52	37
100	59.7	1.16	55	51	51	37
120	62.7	1.15	58	51	51	36
140	65.8	1.14	60	50	50	36
160	68.4	1.13	62	50	50	36

EXPOSURE TYPE D

Height Zone z (ft)	q_z (ft/sec)	G_a	Windward Wall Pressure $0.8G_hq_z$ (lb/ft^2)	Side Wall Suction $0.7G_hq_h$ (lb/ft^2)	Roof Suction $0.7G_hq_h$ (lb/ft^2)	Leeward Wall Suction $0.5G_hq_h$ (lb/ft^2)
0-15	56.2	1.15	52	58	58	42
20	59.4	1.14	54	58	58	41
25	61.8	1.13	56	57	57	41
30	64.1	1.12	57	57	57	41
40	68.3	1.11	61	56	56	40
50	71.1	1.10	63	56	56	40
60	73.9	1.09	64	55	55	39
70	76.3	1.08	66	55	55	39
80	78.1	1.08	67	55	55	39
90	80.0	1.07	68	54	54	39
100	81.9	1.07	70	54	54	39
120	84.7	1.06	72	54	54	38
140	87.5	1.05	74	53	53	38
160	89.8	1.05	75	53	53	38

$q_h = q_z$ @ $z = 123.69$ ft (roof height above grade) for the reactor building

DELETE