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 177 km/h with a recurrence interval of 50 years and 197 km/h with a recurrence interval of 100 years at an elevation of 10m above grade (see Subsection 3.3.3.1 and 3.3.3.3 for COL license information requirements).

The 177 km/h for 50 year recurrence interval and 197 km/h for 100 year recurrence interval are based on Reference 3.3-1, which is "fastest mile". Per Reference 3.3-4 Table 1609.3.1 and Equation 16-34, these correspond to a wind velocity (3 second gust) of 203 km/h with a recurrence interval of 50 years and 224 km/h with a recurrence interval of 100 years.

3.3.1.2 Determination of Applied Forces

The design wind velocity is converted to velocity pressure in accordance with Reference 3.3-1 using the formula:

$q_z = 4.94 \times 10^{-5} K_z (IV)^2$

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 3.3-1

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

V = Design wind velocity with a recurrence interval of 50 years, in km/h, and

q_z = Velocity pressure in kPa

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 3.3-1 by multiplying the velocity pressure by the appropriate pressure coefficients and gust factors. Gust factors are in accordance with Table 8 of Reference 3.3-1. Appropriate pressure coefficients are in accordance with Figures 2, 3a, 3b, 4, and Tables 9 and 11 through 16 of Reference 3.3-1. Reference 3.3-2 is used to obtain the effective wind pressures for cases which Reference 3.3-1 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.

Applied forces for the Reactor and Control Buildings are found in Appendices 3H.1 and 3H.2, respectively.

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 483 km/h at a radius of 45.7 m from the center of the tornado.

(2) A maximum translational velocity of 97 km/h.

(3) A maximum tangential velocity of 386 km/h, based on the translational velocity of 97 km/h.

(4) A maximum atmospheric pressure drop of 13.8 kPa with a rate of the pressure change of 8.3 kPa/s.

(5) The spectrum of tornado-generated missiles and their pertinent characteristics as given in Table 2.0-1.

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 3.3-3. 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 loading components and the load factors are in accordance with Reference 3.3-3.

The reactor building and control building are not vented structures. The exposed exterior roofs and walls of these structures are designed for the 13.8 kPa pressure drop. Tornado dampers are provided on all air intake and exhaust openings. These dampers are designed to withstand a negative13.8 kPa pressure.

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

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

See Subsection 3.3.3.4 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 (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 (Subsection 2.2.1).

3.3.3.3 Effect of Remainder of Plant Structures, Systems and Components Not Designed for Wind Loads

All remainder of plant structures, systems and components not designed for wind loads shall be analyzed using the 1.11 importance factor or shall be checked that their mode of failure will not effect the ability of safety-related structures, systems or components performing their intended safety functions.

3.3.3.4 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

3.3-1 ANSI/ASCE 7, "Minimum Design Loads for Buildings and Other Structures", November 27, 1990.

3.3-2 ASCE Paper No. 3269, "Wind Forces on Structures", Transactions of the American Society of Civil Engineers, Vol. 126, Part II, 1961.

3.3-3 Bechtel Topical Report BC-TOP-3-A, Revision 3, "Tornado and Extreme Wind Design Criteria for Nuclear Power Plants."

3.3-4 International Code Council, 2006 International Building Code.

Table 3.3-1 Importance Factor (I) for Wind Loads

Non-Safety-Related	Safety-Related
1.00	1.11

Notes:

(1) These values of (I) are based on Table 5 of Reference 3.3-1.