Enclosure 1

MFN 14-075

GEH Response to RAI 02-1

NRC Request for Additional Information 02-1:

Nuclear plants must be designed so that they remain in a safe condition under extreme meteorological events, including those that could result in the most extreme wind events (tornadoes and hurricanes) that could reasonably be predicted to occur.

10 CFR Part 50, Appendix A, General Design Criteria (GDC) 2, "Design bases for protection against natural phenomena," (1997) requires SSCs important to safety to be designed to withstand the effects of natural phenomena such as tornadoes and hurricanes without loss of capability to perform their safety function. GDC 4, "Environmental and dynamic effects design bases," (1997) requires SSCs important to safety to be appropriately protected against the effects of missiles that may result from events and conditions outside the nuclear power unit. The regulations concerning the content of a DC application (Subpart B to 10 CFR Part 52) state that DC applications must include the site parameters postulated for the design and an analysis and evaluation of the design in terms of those site parameters (10 CFR 52.47(a)(1)) (1997).

Prior to 2007, the general engineering assumption was that tornado phenomena controlled design with respect to wind loads and wind generated missiles and that tornadoes bounded hurricane wind loads and hurricane missiles. Revision 1 to Regulatory Guide (RG) 1.76, "Design-Basis Tornado and Tornado Missiles for Nuclear Power Plants," which was released in March 2007, resulted in a decrease in tornado wind speeds due to the adoption of the Enhanced Fujita scale for classifying tornado intensity. Since design-basis tornado wind speeds were decreased as a result of the analysis performed to update RG 1.76, it was no longer clear that the revised tornado design-basis wind speed would bound design-basis hurricane wind speeds in all areas of the United States. This prompted an investigation into extreme wind gusts during hurricanes and their relations to design-basis hurricane wind and missiles, which resulted in the issuance of RG 1.221, "Design-Basis Hurricane and Hurricane Missiles for Nuclear Power Plants," in October 2011. The study of extreme wind gusts during hurricanes concluded that it is possible that the wind speeds from the design-basis tornado may not be bounding for certain locations along the United States Gulf Coast and the southern Atlantic Coast. The study of missile speeds during hurricanes concluded that, because of assumed differences between the tornado and hurricane wind fields, airborne missiles can fly faster in a hurricane wind field having the same 3-second gust wind speed at 10 meters (33 feet) above ground as a tornado wind field. Missiles in a hurricane wind field may have higher maximum velocities than in a tornado wind field because hurricane missiles are subject to high wind speeds throughout their trajectory. Additional information on the Staff's review of DC renewal applications with respect to hurricane wind and hurricane missile site parameters can be found in the final interim staff guidance (ISG), DC/COL-ISG-024, "Implementation of Regulatory Guide 1.221 on Design-Basis Hurricane and Hurricane Missiles," issued May 2013 (ADAMS Accession No. ML13015A693).

If a nuclear power plant using the ABWR certified design is located at a site where the hurricane loads and/or the hurricane-generated missile spectra are not bounded by tornado loads and tornado missile spectra, then safety-related structures may not be able to withstand hurricane loads and hurricane-generated missiles as required. Therefore, the nuclear power plant would not be in compliance with GDC 2 and GDC 4, and adequate protection to public health and safety against hurricanes of credible intensity would not be demonstrated.

Therefore, in accordance with 10 CFR 52.59(a) and (b) (2014); 10 CFR 52.47(a)(1) (1997); and 10 CFR Part 50, Appendix A, GDC 2 and GDC 4 (1997):

1) *Add hurricane wind speed (e.g., 3-second gust at 10 m above ground in open terrain) and hurricane missile spectra (including missile dimensions, mass, and velocity) to the list of site parameter values presented in Tier 1, Section 5.0, and Tier 2, Section 2.0 of the GE-Hitachi ABWR Design Control Document.*

2) *Revise and provide markups of affected sections of the GE-Hitachi ABWR Design Control Document to show how structures, systems, and components important to safety are protected from the effects of hurricane winds and missiles.*

GEH Response to RAI 02-1:

1) The tornado wind speeds based on the new Enhanced-Fujida scale are lower than values based on the earlier scale, and the design-basis tornado wind speeds may no longer bound the design-basis hurricane speeds in certain hurricane-prone areas of the US. To address this issue, in the GE-Hitachi ABWR Design Control Document (DCD) Tier 1, Section 5.0, the following parameters are added to Table 5.0, ABWR Site Parameters:

Hurricane:	-- Maximum hurricane wind speed(8):	286.5 km/h
	-- Maximum Pressure Drop:	0 kPaD
	-- Missile Spectra:	Spectrum I

Note (4) to the table is modified as:

"Spectrum I missiles consist of a massive high kinetic energy missile which deforms on impact, a rigid missile to test penetration resistance, and a small rigid missile of a size sufficient to just pass through any openings in protective barriers. These missiles consists of an 1810 kg automobile, a 130 kg, 20 cm diameter armor piercing artillery shell, and a 2.54 cm diameter solid steel sphere, all impacting at 35% of the maximum horizontal wind speed of the design basis tornado, or at 59% of the maximum horizontal wind speed of the design basis hurricane. The first two missiles are assumed to impact at normal incidence, the last to impinge upon openings in the most damaging directions."

Note (8) below is added to the table:

"(8) Maximum hurricane wind speed is the nominal 3-second gust wind speed measured at 10 m above ground over open terrain."

In DCD Tier 2, Section 2.0, the following parameters are added to Table 2.0-1, Envelope of ABWR Standard Plant Site Design Parameters:

Hurricane:	-- Maximum hurricane wind speed***:	286.5 km/h
	-- Maximum Rotational Speed:	261.5 km/h
	-- Translational Velocity:	25 km/h
	-- Radius:	1500 m
	-- Maximum Pressure Drop:	0 kPaD
	-- Missile Spectra:	Spectrum I

Note f to the table is modified as:

"Spectrum I missiles consist of a massive high kinetic energy missile which deforms on impact, a rigid missile to test penetration resistance, and a small rigid missile of a size sufficient to just pass through any openings in protective barriers. These missiles consists of an 1810 kg automobile, a 130 kg, 20 cm diameter armor piercing artillery shell, and a 2.54 cm diameter solid steel sphere, all impacting at 35% of the maximum horizontal wind speed of the design basis tornado or at 59% of the maximum horizontal wind speed of the design basis hurricane. The first two missiles are assumed to impact at normal incidence, the last to impinge upon openings in the most damaging directions."

Note *** below is added to the table:
"***Maximum hurricane wind speed is the nominal 3-second gust wind speed measured at 10 m above ground over open terrain."

2) Related sections of the GE-Hitachi ABWR Design Control Document Tier 2 are revised to show how structures, systems, and components important to safety are protected from the effects of hurricane winds and missiles.

Impact on DCD:

The following ABWR DCD text, tables, and figure are revised as shown on the markups in Enclosure 2:

- Tier 1, Section 2, Figures 2.15.5a, 2.15.5b, 2.15.5c, 2.15.5d, 2.15.5f, 2.15.5g, 2.15.5h, and 2.15.5i
- Tier 1, Sections 2.15.10, 2.15.12, and 2.15.13
- Tier 1, Section 5.0, Table 5.0
- Tier 2, Section 1.0, Table 1.8-20
- Tier 2, Section 2.0, Table 2.0-1
- T Tier 2, Section 3.0, Table of Contents, Sections 3.3, 3.3.1, 3.3.2, 3.5.1, 3.5.2, 3.5.3, 3.5.4, 3.7.2, 3.8.4, Table 3.8-7, and Appendix 3H
- Tier 2, Sections 9.2, 9.4, and 9.5.