



L-2011-371
10 CFR 52.3

September 8, 2011

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555-0001

Re: Florida Power & Light Company
Proposed Turkey Point Units 6 and 7
Docket Nos. 52-040 and 52-041
Response to NRC Request for Additional Information Letter No. 032
(eRAI 5889) Standard Review Plan Section 19 - Probabilistic Risk
Assessment and Severe Accident Evaluation

Reference:

1. NRC Letter to FPL dated July 20, 2011, Request for Additional Information Letter No.032 Related to SRP Section 19 - Probabilistic Risk Assessment and Severe Accident Evaluation for the Turkey Point Nuclear Plant Units 6 and 7 Combined License Application
2. FPL Letter to NRC dated August 19, 2011 Schedule for Response to NRC Request for Additional Information Letter No. 032 (eRAI 5889) - Standard Review Plan Section 19 Probabilistic Risk Assessment and Severe Accident Evaluation

Florida Power & Light Company (FPL) provides, as attachments to this letter, its responses to the Nuclear Regulatory Commission's (NRC) Request for Additional Information (RAI) 19-1 and 19-2 provided in Reference 1. FPL provided a schedule for the responses to RAI 19-1 and 19-2 in Reference 2. The attachment identifies changes that will be made in a future revision of the Turkey Point Units 6 and 7 Combined License Application (if applicable).

If you have any questions, or need additional information, please contact me at 561-691-7490.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on September 8, 2011

Sincerely,

William Maher
Senior Licensing Director – New Nuclear Projects

WDM/RFB

Florida Power & Light Company

700 Universe Boulevard, Juno Beach, FL 33408

DO97
NRD

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Attachment 1: FPL Response to NRC RAI No. 19-1 (eRAI 5889)

Attachment 2: FPL Response to NRC RAI No. 19-2 (eRAI 5889)

cc:

PTN 6 & 7 Project Manager, AP1000 Projects Branch 1, USNRC DNRL/NRO
Regional Administrator, Region II, USNRC
Senior Resident Inspector, USNRC, Turkey Point Plant 3 & 4

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NRC RAI Letter No. PTN-RAI-LTR-032

SRP Section: 19-Probabilistic Risk Assessment and Severe Accident Evaluation

Question for PRA and Severe Accidents Branch (SPRA)

NRC RAI Number: 19-1 (eRAI 5889)

Part of AP1000 DCD COL Information Item 19.59.10-2 calls for the following action by COL applicants:

The Combined License applicant will confirm that the High Winds, Floods, and Other External Events analysis documented in Section 19.58 is applicable to the COL site. Further evaluation will be required if the COL site is shown to be outside of the bounds of the High Winds, Floods, and Other External Events analysis documented in Section 19.58.

To address the above, TPN COL 19.59.10-2 states:

It has been confirmed that the High Winds, Floods, and Other External Events analysis documented in Section 19.58 is applicable to the site...

Please provide supporting information or appropriate references that ensure that all of the key site-related assumptions, including, but not limited to external floods, and aviation, marine, pipeline, railroad, truck and nearby facility accidents, in the Section 19.58 External Events analyses are valid for the TPN site.

If external events have been screened from further evaluation, please (1) include a discussion of the external events screening approach used and the results of the approach, and (2) discuss why the expected core damage frequency and large release frequency of the screened events is insignificant compared to the quantitative results from other initiators. In addition, the following areas should be addressed:

- a. The criteria used to screen each event should be clearly identified. An example is the Westinghouse approach of screening at an initiating event frequency less than 1×10^{-7} per year or an associated core damage frequency (CDF) of less than 1×10^{-8} per year. These criteria should be consistent with the guidance in Standard Review Plan Section 19.0 to the effect that results of the PRA should indicate that the design represents a reduction in risk compared to operating plants.
- b. The screening should address a broad set of potential site-specific contributors, not only the events identified in APP-GW-GLR-101 (for an example, see nonmandatory Appendix 4-A of ASME RA-S). Additional events may include biological effects, temperature and drought effects on the ultimate heat sink, and turbine missiles. Any screening should be documented in the FSAR.
- c. The basis for the numerical values generated as part of the screening process should be discussed.

FPL RESPONSE:

An external event frequency screening analysis for Turkey Point Units 6 & 7 was conducted using a broad set of potential site-specific contributors. The criteria used to screen each external event, along with an explanation and basis for the numerical values generated as part of the screening evaluation, will be documented in a future revision to the COLA. (See Associated COLA Revisions Section, Table 19.58-202).

External events are not applicable to the Turkey Point Units 6 & 7 site if the external event frequency is less than $1.0\text{E-}07$ per year (or if the quantitative consequence evaluation performed in the FSAR has demonstrated that the event will not adversely impact the safe operation of the Turkey Point Units 6 & 7). If the external event frequency is greater than $1.0\text{E-}07$ per year, external events are screened from further evaluation by demonstrating that the external event frequencies are bounded by the limiting initiating event frequencies given in Table 3.0-1 of APP-GW-GLR-101 (Reference 1) or that the calculated core damage frequency (CDF) is less than $1.0\text{E-}08$.

There are event frequencies which exceed the $1.0\text{E-}07$ events per year criteria in two site-specific categories, High Winds and Transportation and Nearby Facility Accidents. Within the High Winds category, EF0 through EF5 tornadoes, Category 1 through Category 5 hurricanes, and extratropical storms events are considered. For each tornado event category where the event frequency exceeds $1.0\text{E-}07$ (EF0, EF1, EF2, and EF3 tornadoes), the external event frequencies are bounded by the limiting initiating event frequencies provided in Table 3.0-1 of APP-GW-GLR-101. The remaining events in the High Winds category (Category 1 through Category 5 hurricanes, and extratropical storms) and Aviation events in the Transportation and Nearby Facility Accidents category exceed both the external event frequency $1.0\text{E-}07$ criteria and the associated limiting initiating event frequencies; however, the calculated core damage frequency (CDF) is less than $1.0\text{E-}08$. A detailed explanation of the calculated CDFs will be documented in a future revision to the COLA. (See Associated COLA Revisions Section, Subsections 19.58.2.1 and 19.58.2.3.1 and Tables 19.58-201, 19.58-202 [new], and 19.58-203 [new]).

This response is PLANT SPECIFIC.

References:

1. APP-GW-GLR-101, "AP1000 Probabilistic Risk Assessment Site-Specific Considerations," Revision 1.

ASSOCIATED COLA REVISIONS:

A new FSAR Subsection 19.58.1 will be added in a future COLA revision as follows:

19.58.1 Introduction

Add the following text to the end of DCD Subsection 19.58.1:

A summary of the risk evaluations of the various external events is provided in Table 19.58-202.

A new Table 19.58-202 will be added in a future COLA revision as follows:

Table 19.58-202
External Event Frequencies for Turkey Point Units 6 & 7 (Sheet 1 of 5)

Category	Event	Evaluation Criteria (See Notes)	Applicable to Site? (Y/N) ¹	Explanation of Applicability Evaluation	Event Frequency (Events/yr)
High Winds	EF0 Tornado	A, C	Y	Turkey Point tornado activity is provided in Subsection 2.3.1.3.2. The event frequency was determined for the 2-degree square area including all or portions of six counties (Broward, Collier, Hendry, Miami-Dade, Monroe, and Palm Beach). There were 297 tornadoes from the six counties that occurred in the 2-degree square in the 58.58 years (1/1/1950 to 7/31/2008) of data examined. Average areas were calculated for each EF scale tornado and assigned to all storms, even if damage path data was not included in a record. Area was normalized by the land area of the 2-degree square. There were no EF Category 4 or 5 events in the 2-degree area during the period of record.	2.39E-05
	EF1 Tornado	A, C	Y		1.81E-05
	EF2 Tornado	A, C	Y		4.30E-05
	EF3 Tornado	A, C	Y		1.64E-05
	EF4 Tornado	B	N		No Recorded Events
	EF5 Tornado	B	N	The tornado event frequency for each category is bounded by the associated limiting initiating event frequency given in Table 3.0-1 of APP-GW-GLR-101. However, because event frequencies related to hurricanes are not bounded by Table 3.0-1 of APP-GW-GLR-101, a screening CDF evaluation for high winds was performed (Subsection 19.58.2.1), and the results documented in Table 19.58-201. Based on this analysis, a more detailed PRA is not necessary for Turkey Point Units 6 & 7.	No Recorded Events
	Cat. 1 Hurricane	C	Y	The National Oceanic and Atmospheric Administration's Coastal Services Center provides a comprehensive historical database, extending from 1851 through 2007, of tropical cyclone tracks based on information compiled by the National Hurricane Center. Subsection 2.3.1.3.3 summarizes the occurrence of the various categories of hurricanes that have tracked within 100-nautical miles from Turkey Point Units 6 & 7. This data was used to analyze the event frequency of hurricane activity.	1.02E-01
	Cat. 2 Hurricane	C	Y		5.10E-02
	Cat. 3 Hurricane	C	Y		8.30E-02
	Cat. 4 Hurricane	C	Y		6.40E-02
	Cat. 5 Hurricane	C	Y		1.9E-02
	Extratropical Cyclones	A,C	Y	As documented in Table 2.0-201, the Turkey Point Units 6 & 7 site characteristic tornado wind loadings (200 mph) are less than the AP1000 DCD site characteristic tornado wind loadings (300 mph). However, the Turkey Point Units 6 & 7 site characteristic operating basis wind speed (150 mph—3 second gust, 50 year return) exceeds the DCD site characteristic operating wind speed of 145 mph (PTN DEP 2.0-1). Based on the screening CDF evaluation presented in Subsection 19.58.2.1 and the results documented in Table 19.58-201, a more detailed PRA is not necessary for Turkey Point Units 6 & 7.	1.9E-02

Table 19.58-202
External Event Frequencies for Turkey Point Units 6 & 7 (Sheet 2 of 5)

Category	Event	Evaluation Criteria (See Notes)	Applicable to Site? (Y/N) ¹	Explanation of Applicability Evaluation	Event Frequency (Events/yr)
External Flood	External Flood	D	N	<p>Potential flooding events and the determination of the design basis flood elevation that may affect Turkey Point Units 6 & 7 safety-related facilities are described in Subsection 2.4.2. The design basis flooding elevation for Turkey Point Units 6 & 7 is determined by considering a number of different flooding scenarios. The potential flooding scenarios applicable and investigated for Turkey Point Units 6 & 7 include the following: probable maximum flood (PMF) on streams and rivers, potential dam failures, probable maximum surge and seiche flooding, probable maximum tsunami, flooding due to ice effects, and potential flooding caused by channel diversions. The flooding scenarios were investigated in conjunction with other flooding and meteorological events, such as wind-generated waves and tidal levels, as recommended in the guidelines presented in ANSI/ANS-2.8-1992.</p> <p><u>PMF on streams and rivers:</u> Flooding due to the PMF on streams and rivers is assessed and described in Subsection 2.4.3. The PMF on streams and rivers is defined by the probable maximum precipitation (PMP) storm event over the stream or river watershed. As addressed in Subsection 2.4.3, flood levels at Turkey Point Units 6 & 7 during severe storms, such as the PMP event, would be controlled by storm tides in the Biscayne Bay because Turkey Point Units 6 & 7 are located on the Biscayne Bay shoreline and there are no major streams or rivers nearby. As a result, a detailed modeling analysis to determine the flood levels from PMF on streams and rivers was not performed for Turkey Point Units 6 & 7.</p> <p><u>Potential dam failures:</u> There are no dams located upstream or downstream of Turkey Point Units 6 & 7. The makeup water reservoir, located south of the power block, is constructed of a concrete basin with a top of basin wall at 24 feet NAVD 88, which is 2 feet below the design grade of 26 feet NAVD 88 for the safety-related structures. It is concluded in Subsection 2.4.4 that a postulated breach of the reservoir wall would not pose a flooding risk to the safety-related facilities of the plant.</p> <p><u>Probable maximum surge and seiche flooding:</u> Probable maximum surge and seiche flooding as a result of the probable maximum hurricane (PMH) is presented in Subsection 2.4.5. The maximum water surface elevation including wave run-up at the plant area during the postulated passage of the PMH is estimated to be 24.8 feet NAVD 88. This flood level also constitutes the design basis flood elevation for the site, and is below the design grade including the elevation of floor entrances and openings of all safety-related facilities at 26 feet (7.9 meters) NAVD 88. Thus, the safety functions of the plant are not impacted by the PMH-induced flooding.</p>	N/A

Table 19.58-202
External Event Frequencies for Turkey Point Units 6 & 7 (Sheet 3 of 5)

Category	Event	Evaluation Criteria (See Notes)	Applicable to Site? (Y/N) ¹	Explanation of Applicability Evaluation	Event Frequency (Events/yr)
External Flood (Continued)				<p><u>Probable maximum tsunami:</u> Subsection 2.4.6 describes the estimation of flood levels associated with the probable maximum tsunami (PMT). The maximum water level associated with the PMT at Turkey Point Units 6 & 7 is conservatively estimated to be 16.7 feet NAVD 88. Therefore, the PMT does not pose a flood risk to the safety-related facilities for Turkey Point Units 6 & 7.</p> <p><u>Flooding due to ice effects:</u> Based on the historical data assessed in Subsection 2.4.7, it is unlikely that ice effects would pose any flood risk to Turkey Point Units 6 & 7.</p> <p><u>Potential flooding caused by channel diversions:</u> Subsection 2.4.9 describes the effects of channel diversions, and it is determined that channel diversion would not pose any flood risk to Turkey Point Units 6 & 7. The maximum water level at Turkey Point Units 6 & 7 due to a local PMP storm event is estimated and described in Subsection 2.4.2.3.</p> <p>Because the design plant grade (26.0 feet NAVD 88), including the elevation of the openings and entrances to the Turkey Point Units 6 & 7 safety-related buildings, is located above the design basis flood elevation (24.8 feet NAVD 88), as described in Subsection 2.4.2, the safety-related functions of the plant will not be adversely impacted by flooding events. Subsection 2.4.10 describes the flooding protection requirements for Turkey Point Units 6 & 7.</p>	
Transportation and Nearby Facility Accidents	Aviation (general/commercial/military)	C	Y	<p>As discussed in Subsection 2.2.2.7.2, a calculation to determine the probability of an aircraft accident into the plant and its impact frequency was performed following NUREG-0800 and DOE-STD-3014-96 methodology to determine whether the accident probability rate (external event frequency) is less than an order of magnitude of 1.0E-07 events per year. This assessment led to a total impact frequency of 3.86E-06 per year when considering both the airport and non-airport operations, which is greater than an order of magnitude of 1.0E-07 per year.</p> <p>Because the total impact frequency (external event frequency) is greater than 1.0E-07 events per year, a determination was made to ascertain whether the external event frequencies are bounded by the limiting event frequency criterion given in APP-GW-GLR-101. The event frequency numbers were compared to the limiting event frequency numbers, 1.21E-06 and 1.0E-07, for small and large aircraft, respectively, given in APP-GW-GLR-101. (Note, commercial air carrier aircraft, commercial air taxi aircraft, military small aircraft, and military large aircraft are included in the large aircraft category.) The determined impact frequency also exceeded the limiting event frequency of 1.21E-06 events per year for small aircraft in APP-GW-GLR-101. However, based on the screening CDF evaluation presented</p>	<p><u>General Aviation:</u> 3.70E-06</p> <p><u>Commercial Aviation Carrier:</u> 1.72E-08</p> <p><u>Commercial Aviation Air Taxi:</u> 3.86E-08</p> <p><u>Military Aviation-Large:</u> 2.38E-08</p> <p><u>Military Aviation-Small:</u> 8.66E-08</p> <p><u>Total:</u> 3.86E-06</p>

Table 19.58-202
External Event Frequencies for Turkey Point Units 6 & 7 (Sheet 4 of 5)

Category	Event	Evaluation Criteria (See Notes)	Applicable to Site? (Y/N) ¹	Explanation of Applicability Evaluation	Event Frequency (Events/yr)
Transportation and Nearby Facility Accidents (Continued)				in Subsection 19.58.2.3.1 and the results documented in Table 19.58-203, the second criterion, the CDF is not greater than 1.0E-08, is met and a further detailed PRA is not necessary for Turkey Point Units 6 & 7.	
	Marine (ship/barge)	D	N	As described Subsection 2.2.2.4, Turkey Point Units 6 & 7 are located on the western shore of south Biscayne Bay. Biscayne Bay is a shallow coastal lagoon located on the lower southeast coast of Florida. The Biscayne Bay contains the Miami to Key West, Florida Intracoastal Waterway. The only commodity transported on the Miami to Key West, Florida Intracoastal Waterway is residual fuel oil. In 2005, there were 611,000 short tons of residual fuel oil transported, and the entirety of this commodity was delivered to the Turkey Point Units 1-5 site. Because the storage of residual fuel oil at the Turkey Point Units 1-5 site exceeds the quantity transported by a barge, the storage tanks present a greater hazard and, as such, the analysis of residual fuel oil located in the storage tanks is bounding and no further analysis of the residual fuel oil transported by the barge is warranted.	N/A
	Pipeline (gas/oil)	D	N	As described in Subsection 2.2.2.3, there are two natural gas transmission pipelines operated by Florida Gas Transmission Company within 5 miles of the plant. The Florida Gas Transmission Company owns and operates a high-pressure natural gas pipeline system that serves FPL and other customers in south Florida. Two of the pipelines, the Turkey Point Lateral and the Homestead Lateral, are located within 5 miles of Turkey Point Units 6 & 7. As discussed in Subsections 2.2.3.1.1.7, 2.2.3.1.2.7, and 2.2.3.1.3.5, the postulated scenarios resulting from a release of the bounding natural gas pipeline within 5 miles of the Turkey Point Unit 6 & 7 site do not pose a credible hazard to the site.	N/A
	Railroad	D	N	As discussed in Subsection 2.2.2.6, there are no railroads in the vicinity (5 miles) of Turkey Point Units 6 & 7. Thus, the safety functions of the plant are not impacted by the hazards from this source.	N/A
	Truck	D	N	A description of the highways in the vicinity of Turkey Point Units 6 & 7 is presented in Subsection 2.2.2.5. The only identified chemicals whose transportation route may approach closer than 5 miles to Turkey Point Units 6 & 7 are those chemicals transported onto the Turkey Point plant property. Of these chemicals, gasoline was the only identified roadway transportation event that is not bounded. As discussed in Subsections 2.2.3.1.1.6, 2.2.3.1.2.6, and 2.2.3.1.3.4, the potential hazards resulting from the truck transport of gasoline concluded that there were no adverse impacts to the site.	N/A
	Nearby Facility Accidents	D	N	As detailed in Subsections 2.2.2.2.1, and 2.2.2.2.2, two nearby facilities were evaluated, Turkey Point Units 1-5, and the Homestead Air Reserve Base. Based on the discussions in Subsections, 2.2.3.1.1.3, 2.2.3.1.2.3, and 2.2.3.1.3.1 (Turkey Point Units 1-5) and Subsections 2.2.3.1.1.5, 2.2.3.1.2.5, and 2.2.3.1.3.3 (Homestead Air Reserve Base), the effects of explosions, flammable vapor clouds and toxic chemicals at Turkey Point Units 1-5 and the Homestead Air Reserve Base were evaluated	N/A

Table 19.58-202
External Event Frequencies for Turkey Point Units 6 & 7 (Sheet 5 of 5)

Category	Event	Evaluation Criteria (See Notes)	Applicable to Site? (Y/N) ¹	Explanation of Applicability Evaluation	Event Frequency (Events/yr)
				and determined to meet the safe distance requirements and toxicity limits of Regulatory Guides 1.91 and 1.78. Therefore, because no significant consequences were identified for these events, the potential safety effect from nearby facilities to the site is insignificant.	
Other Events	External Fires	D	N	<p>External fires in the vicinity of the Turkey Point Units 6 & 7 site that could lead to high heat fluxes or smoke and nonflammable gas or chemical-bearing clouds from the release of materials as a consequence of fires have been addressed in Subsection 2.2.3.1.4. Fires in adjacent industrial plants and storage facilities—chemical, oil and gas pipelines; brush and forest fires; and fires from transportation accidents—were evaluated as events that could lead to high heat fluxes or to the formation of such clouds. Based on the above, it is demonstrated that there are no external fire events that adversely affect Turkey Point Units 6 & 7. Therefore, no further consideration of external fires is required in the PRA analysis.</p> <p>This event is not specifically addressed in DCD Section 19.58 or in APP-GW-GLR-101, though DCD Section 19.58 does state that the COL applicant should re-evaluate and include external fires in the site specific PRA if any site specific susceptibilities are found. As discussed above, no site specific susceptibilities have been identified for the Turkey Point Units 6 & 7 site; therefore the evaluations presented in DCD Section 19.58 and APP-GW-GLR-101 are bounding to the Turkey Point Units 6 & 7 site.</p>	N/A
	On-Site Chemical Storage	D	N	<p>Potential hazards from on-site storage tanks are addressed in Subsections 2.2.3.1.1.4, 2.2.3.1.2.4, and 2.2.3.1.3.2. Chemicals not screened from further consideration on the basis of chemical properties such as low toxicity or volatility have been specifically evaluated. Chemicals with potential explosion or flammable vapor cloud hazards have been evaluated in accordance with Regulatory Guide 1.91 as described in Subsections 2.2.3.1.1 and 2.2.3.1.2. Chemicals with potential hazards to control room personnel have been evaluated using the methodology of Regulatory Guide 1.78 as described in Subsection 2.2.3.1.3. Based upon the quantitative evaluations performed, it is concluded that these evaluations demonstrate through bounding analyses that these hazards do not adversely affect Turkey Point Units 6 & 7. Therefore, the hazard can be excluded from further consideration in the PRA analysis.</p> <p>This event is not specifically addressed in DCD Section 19.58 or in APP-GW-GLR-101. As discussed, the event screens out from further PRA considerations; therefore the evaluations presented in DCD Section 19.58 and APP-GW-GLR-101 are bounding to the Turkey Point Units 6 & 7 site.</p>	N/A

Notes:

1. An event is applicable (Y) to the Turkey Point Units 6 & 7 site if the external event frequency is greater than $1.0E-07$, or if a quantitative consequence evaluation has demonstrated that there are site specific parameters that exceed the parameters used in APP-GW-GLR-101 (Reference 201). An event is not applicable (N) to the Turkey Point Units 6 & 7 site if the external event frequency is less than $1.0E-07$ or if the quantitative consequence evaluation performed in the FSAR has demonstrated that the event will not adversely impact the safe operation of the Turkey Point Units 6 & 7.

Evaluation Criteria:

- A: The initiating event frequency (IEF) is less than the IEF in DCD Tier 2 Section 19.58 or Table 19.58-3 for the event.
- B: External Event Frequency is less than $1.0E-07$.
- C: Core Damage frequency (CDF) is less than $1.0E-08$.
- D: A specific event frequency for this event has not been determined. A deterministic quantitative consequence evaluation has been performed that has demonstrated that the event does not adversely impact the safe operation of Turkey Point Units 6 & 7. Additional details are provided in the "Explanation of Applicability Evaluation" with references to the applicable Subsections.

Paragraph 9 of Subsection 19.58.2.1 will be revised in a future COLA revision as follows:

The evaluation of the high winds hazard uses the two screening criteria established from the previous description. The first criterion is that if the high wind event category annual frequency does not exceed $1.0\text{E}-07$, the event category can be screened out from the requirement to perform further analysis. If the first criterion is not met, the second criterion is that if the annual CDF for the event category is assessed to not exceed $1.0\text{E}-08$, the event category can be screened out. As can be seen from **Table 19.58-202** ~~Table 19.58-201~~, the annual frequency of tornado and hurricane events exceeds $1.0\text{E}-07$ per year. Therefore, the screening CDF is calculated for high winds to determine if detailed analysis is required.

Existing Table 19.58-201 will be updated in a future COLA revision as follows:

Table 19.58-201
High Winds and Tornadoes Results for Units 6 & 7

Category	Event	Limiting Initiating Event Freq. (events/yr)	CDF (events/yr)		
			LOSP (Case 1) (events/yr)	LOSP with Non- Safety Systems Unavailable for Select Events (Case 2) (events/yr)	LOSP with Non- Safety Systems Unavailable for All Events (Case 3) (events/yr)
High Winds	EF0 Tornado	2.56E-06 2.39E-05	2.51E-14 2.34E-13	2.51E-14 2.34E-13	1.50E-13 1.40E-12
	EF1 Tornado	4.56E-06 1.81E-05	4.47E-14 1.78E-13	4.47E-14 1.78E-13	2.67E-13 1.06E-12
	EF2 Tornado	1.41E-05 4.30E-05	1.38E-13 4.22E-13	1.38E-13 4.22E-13	8.25E-13 2.52E-12
	EF3 Tornado	5.37E-06 1.64E-05	5.27E-14 1.61E-13	3.14E-13 9.59E-13	3.14E-13 9.59E-13
	EF4 Tornado	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EF5 Tornado	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Cat. 1 Hurricane	1.01E-01 1.02E-01	9.91E-10 1.00E-09	9.91E-10 1.00E-09	5.91E-09 5.97E-09
	Cat. 2 Hurricane	5.10E-02	5.00E-10	5.00E-10	2.98E-09
	Cat. 3A Hurricane	2.50E-02 2.57E-02	2.45E-10 2.52E-10	2.45E-10 2.52E-10	1.46E-09 1.50E-09
	Cat. 3B Hurricane	5.70E-02 5.73E-02	5.59E-10 5.62E-10	3.33E-09 3.35E-09	3.33E-09 3.35E-09
	Cat. 4 Hurricane	7.00E-02 6.40E-02	6.87E-10 6.28E-10	4.10E-09 3.74E-09	4.10E-09 3.74E-09
	Cat. 5 Hurricane	1.30E-02 1.90E-02	1.28E-10 1.86E-10	7.61E-10 1.11E-09	7.61E-10 1.11E-09
	Extratropical Cyclones	1.90E-02	1.86E-10	1.86E-10	1.11E-09
Totals			3.3E-09	1.0E-08	2.0E-08

A new Subsection 19.58.2.3.1 will be added in a future COLA revision as follows:

19.58.2.3.1 Aviation Accidents

Replace the text of DCD Subsection 19.58.2.3.1 with the following:

A conservative analysis was performed to evaluate the risk to Turkey Point Units 6 & 7 due to aviation accidents. The aviation accident hazard evaluation considered airport operations and airway operations for both large and small aircraft. The approach to evaluating aviation accident hazards is similar to that discussed in Section 19.58.2.1 for severe winds and tornadoes. Two screening criteria are used to determine whether a detailed analysis is required: (1) event frequency is less than 1.0E-07 events/year and (2) CDF associated with aviation accidents is less than 1.0E-08 events/year.

As can be seen from Table 19.58-203, which uses the methodology described in Subsection 2.2.2.7.2 for determining the event frequency, the total annual aircraft accident frequency, considering all types of aircraft, is 3.86E-06, and thus exceeds the first screening criteria. Therefore, an evaluation of CDF associated with aviation accidents was performed.

Risk (CDF) due to aircraft accident hazards can be estimated using the following equation:

$$\text{CDF} = \text{IEF} * \text{CCDP}$$

where IEF is the initiating event frequency and CCDP is the conditional core damage probability.

DCD Appendix 19F includes an assessment of the effects on the plant from the beyond design basis impact of a large commercial aircraft accident. The evaluation of plant damage caused by the impact of a commercial aircraft involves phenomena associated with structural impact, shock-induced vibration and fire effects. The assessment of the aircraft impact also considers structural damage that is caused by impact/penetration of hardened components such as engine rotors and landing gear. DCD Subsection 19F.4.1 concludes that safety-related components inside containment, including the reactor pressure vessel and passive core cooling system, would remain intact and maintain their intended capabilities following the shock-induced vibrations resulting from the impact of a large commercial aircraft.

Accordingly, to establish appropriate CCDPs for the aircraft accidents, it was conservatively assumed that the crash of any aircraft causes an LOSP along with the failure of standby non-safety

systems, which are not protected by the reactor containment structures. A CCDP value of $5.85\text{E-}08$ (Reference 201), represents an LOSP along with the additional failure of standby non-safety systems and was applied to all aviation accidents in the base case.

Application of this CCDP to small aircraft accidents is conservative, as it is highly unlikely that a small aircraft would be capable of causing such extensive failures for an AP1000 plant. However, large aircraft crashes would be expected to result in more severe consequences than small aircraft crashes and it is more reasonable to assume that the crash of a large aircraft causes LOSP along with failure of the standby non-safety systems.

To make this distinction between small and large aircraft crashes in the aircraft crash hazard evaluation for Turkey Point Units 6 & 7, a sensitivity evaluation was performed where the CCDP associated with large aircraft accidents was conservatively increased by two orders of magnitude.

The results of the base and sensitivity cases are provided in Table 19.58-203. As can be seen, the resulting CDFs associated with the base case ($2.26\text{E-}13$ events/year) and sensitivity case ($1.19\text{E-}12$ events/year) are both below the screening criterion of $1.0\text{E-}08$ events/year, and further analysis is not required.

A new FSAR Table 19.58-203 will be added in a future COLA revision as follows:

Table 19.58-203
Aircraft Impact Frequency and Resulting Core Damage Frequency (CDF)

Aircraft Type	Impact Frequency (events/year)	Conditional Core Damage Probability		CDF (events/year)	
		Base	Sensitivity	Base	Sensitivity
General Aviation	$3.70\text{E-}06$	$5.85\text{E-}08$	$5.85\text{E-}08$	$2.16\text{E-}13$	$2.16\text{E-}13$
Commercial Carrier	$1.72\text{E-}08$	$5.85\text{E-}08$	$5.85\text{E-}06$	$1.01\text{E-}15$	$1.01\text{E-}13$
Commercial Air Taxi	$3.86\text{E-}08$	$5.85\text{E-}08$	$5.85\text{E-}06$	$2.26\text{E-}15$	$2.26\text{E-}13$
Military – Large	$2.38\text{E-}08$	$5.85\text{E-}08$	$5.85\text{E-}06$	$1.39\text{E-}15$	$1.39\text{E-}13$
Military – Small	$8.66\text{E-}08$	$5.85\text{E-}08$	$5.85\text{E-}06$	$5.07\text{E-}15$	$5.07\text{E-}13$
Total ¹	$3.86\text{E-}06$	—	—	$2.26\text{E-}13$	$1.19\text{E-}12$

¹The total of the impact frequencies is slightly different than the sum of the individual impact frequencies shown due to rounding.

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Reference 201 in Subsection 19.58.4 will be revised in a future COLA revision as follows:

201. APP-GW-GLR-101, "AP1000 Probabilistic Risk Assessment Site-Specific Considerations," Revision 1, ~~Section 3.0, High Winds Evaluation.~~

ASSOCIATED ENCLOSURES:

None

NRC RAI Letter No. PTN-RAI-LTR-032

SRP Section: 19-Probabilistic Risk Assessment and Severe Accident Evaluation

Question for PRA and Severe Accidents Branch (SPRA)

NRC RAI Number: 19-2 (eRAI 5889)

Table 19.58-201 provides the high winds and tornadoes PRA results. Please expand your risk results discussion for severe winds and tornadoes, including how the initiating event frequencies were calculated, related PRA assumptions, and the basis for concluding that a sufficient number of events have been observed over a large enough area to provide a representative sample.

FPL RESPONSE:

Calculation of Tornado Event Frequency

The tornado event frequency is a strike probability, which considers the total number of tornadoes, the period over which the tornadoes were recorded for the area, the average expected area, and the total area of the 2-degree box (consistent with the information in Regulatory Guide 1.76 and NUREG/CR-4461, Revision 2). The following equation was used to calculate the strike probability:

$$P_p = \frac{A_t}{NA_r} \quad (1)$$

Where,

P_p = Strike Probability

A_t = Total area impacted by tornadoes in the region in N years (product of the number of tornadoes and their average expected areas)

N = Number of years of record

A_r = total area of the region (2-degree box)

The total area of the 2-degree box was calculated; however, a sizeable fraction of this area is ocean surface, for which tornado reports are not available. The land area (area enclosed by coastline) is 14,629 km², which represents 32.8% of the total area (44,574 km²).

As indicated in Subsection 2.3.1, 297 tornadoes, ranging in intensity from EF0 to EF3 on the Enhanced Fujita-Pearson scale, have been tracked within a 2-degree latitude-longitude area around the Turkey Point Units 6 & 7 site, in the 58.58 years that the National Climatic Data Center has been compiling storm data. No tornadoes with an EF4 or EF5 intensity have been recorded.

Strike probability was delineated by F-scale ratings. The average expected area of tornadoes in the region was calculated by averaging the lengths and widths of tornadoes recorded, with the total number of tornadoes that have length and width data in each F-scale rating.

Using equation (1) and information provided above, the strike probabilities of tornadoes within the 2-degree box surrounding the site are as follows:

Table 1
Tornado Event Frequency

Wind Speed Classification	Avg. Expected Area (km ²)	Number of Tornadoes	Event Frequency (Strike Probability) in yr ⁻¹
EF0	0.097	211	2.39E-05
EF1	0.239	65	1.81E-05
EF2	2.167	17	4.30E-05
EF3	3.518	4	1.64E-05
EF4	NR	0	—
EF5	NR	0	—

NR = None recorded

Calculation of Tropical Cyclone Event Frequency

As indicated in Subsection 2.3.1, a total of 53 tropical cyclone centers or storm tracks were recorded within a 100 nautical mile radius of the Turkey Point Units 6 & 7 site during the past 157 years (1851 through 2007). This total includes 3 storms labeled as “extratropical,” each having wind speeds below that of a Category 1 hurricane. For the purposes of calculating frequency, only hurricane data during the period of time in which the storms are within 100 nautical miles of the site area are reported. To tabulate the number of storms based on their intensity, each storm was assumed to be at its maximum intensity. The event frequency is determined by dividing the total number of hurricanes per category by the period of record resulting in events/year.

Table 2
Tropical Cyclone Event Frequency

Category	Number of Storms	Event Frequency in yr ⁻¹
1 (74 to 95 mph)	16	0.102
2 (96 to 100 mph)	8	0.051
3 (111 to 130 mph)	13	0.083
4 (131 to 155 mph)	10	0.064
5 (>155 mph)	3	0.019
Extratropical	3	0.019

Note that the results in Table 2 above (and in new Table 19.58-202, provided in the COLA markup in response to RAI 19-1) reflect a reanalysis of the data for Hurricane Andrew that did not appear in the Coastal Service Center data used to perform the previous evaluation and has resulted in an upgrading of the intensity at landfall which occurred between the regular observation periods previously reported.

PRA Assumptions

The plant is designed against 300 mph winds, and the operating basis of the plant is for winds up to 145 mph. This means that the safety structures are protected against winds up to 300 mph and non-safety system structures are protected against winds up to 145 mph. No tornadoes are expected to exceed 300 mph; however F3, F4, and F5 tornadoes do exceed the plant operating basis. Per the Saffir-Simpson Scale, no hurricanes are expected to reach 300 mph winds; however, Category 3, Category 4 and Category 5 hurricane winds may exceed the operating basis of the plant.

As indicated in Section 19.58.2.1, high wind events may result in a Loss of Offsite Power (LOSP) because the site switchyard is not designed to withstand hurricane and tornado winds speeds. For maximum wind speeds less than the operating basis wind speed, an LOSP is assumed; however, for maximum wind speeds greater than the operating basis wind speed, additional structures, systems, and components (SSCs) may also be damaged. When only an LOSP is assumed, a conditional core damage frequency of $9.81\text{E-}09$ is assigned, and when an LOSP is assumed with a loss of all non-safety systems, a conditional core damage frequency of $5.85\text{E-}08$ is assigned.

Three cases were evaluated, using the process described in Section 3.0 of APP-GW-GLR-101 (Reference 1). These cases are as follows:

- Case 1: For each storm category, an LOSP induced by high wind is assumed with all plant equipment available. All tornadoes and hurricanes are considered in Case 1 as they may challenge the switchyard. Extratropical cyclones are normal storms and thunderstorms that typically have wind speeds below operating basis, but they can, however, regain winds of hurricane or tropical storm force and are also included in Case 1. The conditional core damage probability (CCDP) is assumed to be $9.81\text{E-}09$ for all storms.
- Case 2: Case 1 is modified to apply a CCDP of $5.85\text{E-}08$ to events that could expose the plant to wind speeds greater than the operating basis wind speed, resulting in an LOSP and a loss of all non-safety systems. Category 2 and lower hurricanes and EF0, EF1, and EF2 tornadoes are assumed to result only in an LOSP and thus are assigned a CCDP of $9.81\text{E-}09$.

Although the range of sustained winds for Category 3 storms (111 mph to 130 mph) is less than the operating basis wind speed, wind gusts can exceed the operating basis wind speed. Hurricanes labeled as "Category 3" had a maximum wind speed that was within the Category 3 range but some storms were below the Category 3 level for some of the time. To more appropriately represent the effect of Category 3 hurricanes in this case study, the Category 3 hurricane data were subdivided on the basis of the fraction of time, while within the 100 nautical mile radius of the site, the storms were at or below

Category 3. If the storm intensity decayed below the Category 3 level, then even wind gusts from the storm would not generate wind speeds that exceed operating basis wind speed and for this fraction of time that Category 3 hurricanes resided in the 100 nautical mile radius of interest, they would not pose a threat to AP1000 non-safety systems. For the 13 documented Category 3 hurricanes, there are a total of 42 data points reported. Of these 42 data points, 13 indicate that the storm was below Category 3 hurricane intensity. On this basis, 13/42, or 31 percent of the Category 3 event frequency will have a CCDF of 9.81E-09 applied and 69 percent of the Category 3 event frequency will have a CCDF of 5.85E-08 applied.

Category 4 and higher hurricanes and EF3, EF4, and EF5 tornadoes were assigned a CCDF of 5.85E-08.

Case 3: All high wind events are assumed to result in an LOSP and a loss of all non-safety systems. The CCDF is assumed to be 5.85E-08 for all events.

The results of the evaluations for each of the three cases are provided in Table 3, as follows.

Table 3
High Winds and Tornadoes Results for Units 6 & 7

Category	Event	Limiting Initiating Event Freq. (events/yr)	CDF (events/yr)		
			LOSP (Case 1) (events/yr)	LOSP with Non-Safety Systems Unavailable for Select Events (Case 2) (events/yr)	LOSP with Non-Safety Systems Unavailable for All Events (Case 3) (events/yr)
High Winds	EF0 Tornado	2.39E-05	2.34E-13	2.34E-13	1.40E-12
	EF1 Tornado	1.81E-05	1.78E-13	1.78E-13	1.06E-12
	EF2 Tornado	4.30E-05	4.22E-13	4.22E-13	2.52E-12
	EF3 Tornado	1.64E-05	1.61E-13	9.59E-13	9.59E-13
	EF4 Tornado	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	EF5 Tornado	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	Cat. 1 Hurricane	1.02E-01	1.00E-09	1.00E-09	5.97E-09
	Cat. 2 Hurricane	5.10E-02	5.00E-10	5.00E-10	2.98E-09
	Cat. 3A Hurricane	2.57E-02	2.52E-10	2.52E-10	1.50E-09
	Cat. 3B Hurricane	5.73E-02	5.62E-10	3.35E-09	3.35E-09
	Cat. 4 Hurricane	6.40E-02	6.28E-10	3.74E-09	3.74E-09
	Cat. 5 Hurricane	1.90E-02	1.86E-10	1.11E-09	1.11E-09
	Extratropical Cyclones	1.90E-02	1.86E-10	1.86E-10	1.11E-09
Totals			3.3E-09	1.0E-08	2.0E-08

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This response is PLANT SPECIFIC.

References:

1. APP-GW-GLR-101, "AP1000 Probabilistic Risk Assessment Site-Specific Considerations," Revision 1.

ASSOCIATED COLA REVISIONS:

None

ASSOCIATED ENCLOSURES:

None