

## Vogle PEmails

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**From:** Hoellman, Jordan  
**Sent:** Monday, August 31, 2015 2:13 PM  
**To:** Vogle PEmails  
**Subject:** AP1000 Auxiliary Building Wall 11 Tornado Missile Protection Public Meeting 9/3/15  
**Attachments:** AP1000 Auxiliary Building Wall 11 Tornado Missile Protection Public Meeting September 3 2015.pdf

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**Hearing Identifier:** Vogtle\_COL\_Docs\_Public  
**Email Number:** 2

**Mail Envelope Properties** (a3c1b02b849f4ea58d60ff444836ac5f)

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9/3/15  
**Sent Date:** 8/31/2015 2:12:53 PM  
**Received Date:** 8/31/2015 2:12:54 PM  
**From:** Hoellman, Jordan

**Created By:** Jordan.Hoellman2@nrc.gov

**Recipients:**  
"Vogtle PEmails" <Vogtle.PEmails@nrc.gov>  
Tracking Status: None

**Post Office:** HQPWMSMRS03.nrc.gov

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MESSAGE	237	8/31/2015 2:12:54 PM
AP1000 Auxiliary Building Wall 11 Tornado Missile Protection Public Meeting September 3 2015.pdf		
1041384		

**Options**  
**Priority:** Standard  
**Return Notification:** No  
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DOCUMENT NO. APP-GW-GLY-077	REVISION 0	PAGE 1 of 52	OPEN ITEMS N
DOCUMENT STATUS: <b>DES</b>		AP1000 SAFETY CLASS: <b>NA</b>	
LICENSING REVIEW STATUS: Not Required			Westinghouse Acceptance of <b>AP1000</b> Design Partner Document by:
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ALTERNATE DOCUMENT NUMBER: N/A

ORIGINATING ORGANIZATION: WESTINGHOUSE ELECTRIC COMPANY

TITLE: AP1000 Auxiliary Building Wall 11 Tornado Missile Protection Public Meeting September 3, 2015

DCP/DCA/SUPPLEMENTS/EDCR # INCORPORATED IN THIS DOCUMENT REVISION:

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# AP1000 Auxiliary Building Wall 11 Tornado Missile Protection Public Meeting

September 3, 2015



# LAR-30 Scope & Meeting Purpose

LAR-30 consists of the following changes:

- Reconfiguring Wall 11 reinforcement bar:
  - Close the openings in Aux Building Wall 11 at Elevation 148'-9" to the Main Steam Isolation Valve (MSIV) compartments with reinforced concrete consistent with the surrounding wall.
  - Modify the Wall 11 reinforcement design in the vicinity of the main steam line penetration.
- Protecting Wall 11
  - Credit the Turbine Building Wall 11.2 for providing protection from a postulated high energy line break in the turbine building
  - Credit the Turbine Building First Bay for providing limited tornado missile protection for openings in the Auxiliary Building Wall 11

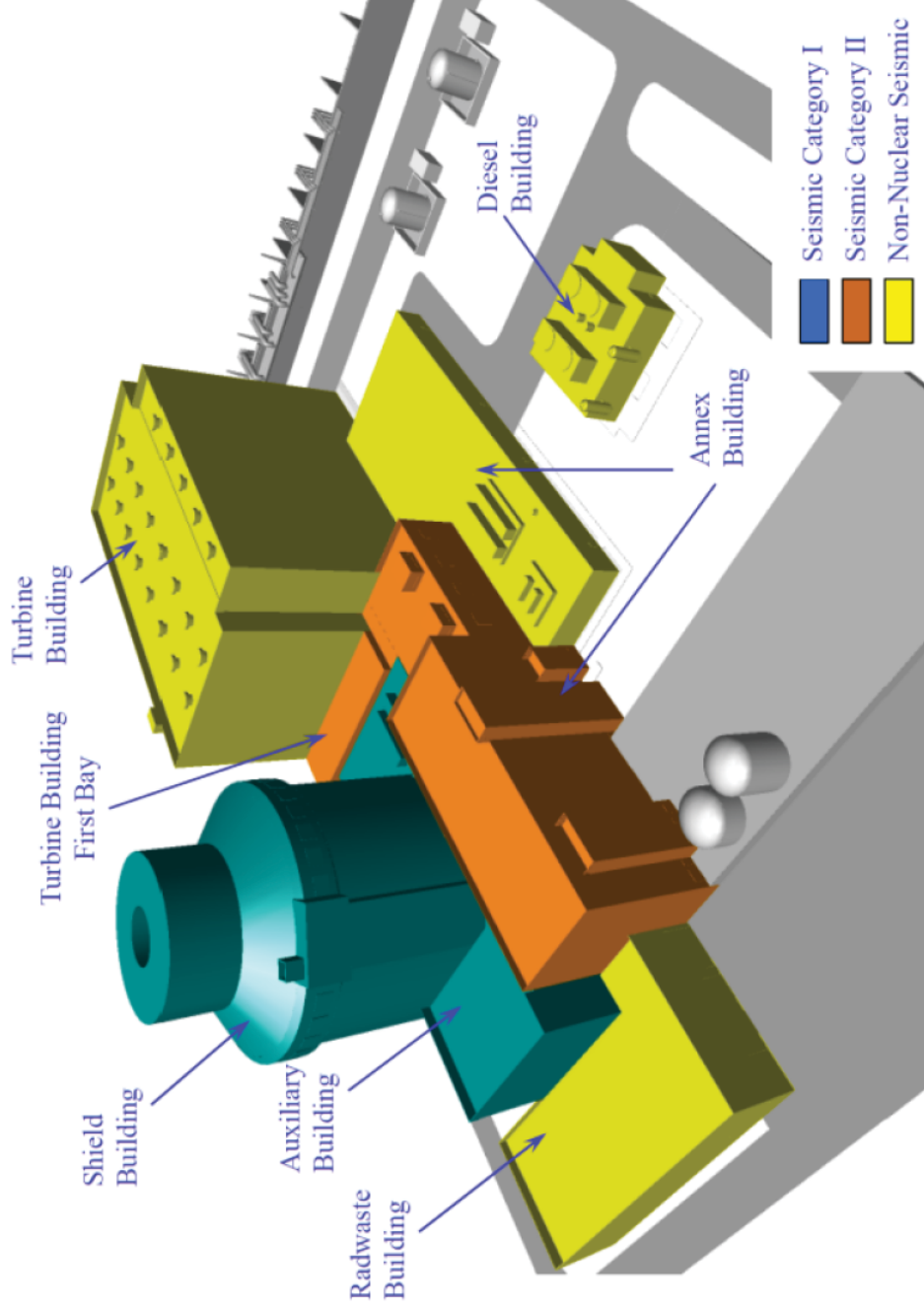


The purpose of this meeting is to discuss tornado missile protection

# Summary of the Proposed Change

- The Auxiliary Building concrete structure protects the nuclear island from all design basis tornado missiles
- Openings through the Auxiliary Building concrete structure are to be evaluated for tornado missiles on a case-by-case basis
  - As discussed with the NRC staff during design certification, the Annex Building provides protection for openings in the East Auxiliary Building Wall (Wall I)
    - The intent of the AP1000 DCD was to allow nonsafety-related SCII structures to provide tornado missile protection
    - However, the tornado missile protection for openings in the Auxiliary Building structure is not clearly described in the licensing basis
  - Similar to Wall I, NRC approval will be requested to credit the Turbine Building First Bay for protecting openings in the North Auxiliary Building Wall (Wall 11)
    - LAR-30 will include changes to specify that an adjacent seismic category II non-safety related building may provide limited tornado missile protection on a case-by-case basis for openings in the nuclear island
  - The tornado missile protection change is involved with the Tier 2\* LAR-30 reinforcement bar changes because if the tornado missile protection proposal were not approved, Wall 11 rebar redesign could be needed

# Turbine Building First Bay Location



# Auxiliary Building Wall 11 Design

- North Wall of the Auxiliary Building
  - contains penetrations for the main steam and main feedwater lines
- Protects safety-related equipment in the nuclear island
- Seismic Category I Structure
- Designed, analyzed, and constructed to ACI 349
- Critical Section described in UFSAR Section 3H.5.1.4 and shown in UFSAR Figure 3H.5-5



# Design Basis Tornado Missiles

- Tornado missiles are defined in UFSAR Section 3.5.1.4:
  - A massive 4000 pound automobile high-kinetic-energy missile, which deforms on impact.
  - A rigid 275 pound eight inch armor-piercing artillery shell to test penetration resistance
  - A small 1” solid steel sphere missile to pass through any openings in protective barriers.



**Wall 11 Concrete Structure is capable of stopping all design basis missiles.**

# Summary: Evaluation of Auxiliary Building Wall 11 Openings

- 5 doors and 2 vents in Wall 11 are evaluated for the following tornado missiles with a horizontal velocity of 105 mph, as described in the UFSAR Section 3.5.1.4

	Sphere Stopped by:	Shell Stopped by:	Car Stopped by:
Wall 11 Concrete Structure	<ul style="list-style-type: none"> <li>• Wall 11 Reinforced Concrete</li> </ul>		
Valve/Piping Room Door	<ul style="list-style-type: none"> <li>• Wall 11 Door</li> </ul>		<ul style="list-style-type: none"> <li>• First Bay Concrete,</li> <li>• Missile Barriers,</li> <li>• No LOS Through Opening</li> </ul>
Lower VBS Eq. Rm Door			
Upper VBS Eq. Rm Door			
MSIV Room A Door			
MSIV Room B Door			
MSIV Room A Vent	<ul style="list-style-type: none"> <li>• First Bay Concrete,</li> <li>• Missile Barriers,</li> <li>• No LOS Through Opening</li> </ul>		
MSIV Room B Vent			



**Westinghouse**

**Openings and Penetrations Protected  
from Design Basis Tornado Missiles**

# Turbine Building First Bay Design

- Located between the nuclear island and the turbine building
- Provides separation between the nuclear island and general portion of the Turbine Building
- Precludes structural failure during a safe shutdown earthquake or interaction with the Aux Building
- Building designed and constructed to seismic category II requirements
- Reinforced concrete walls and roof
- Designed and analyzed for the SSE using the same methods and design allowables used for seismic Category I structures:
  - ACI-349 for concrete features
  - AISC-N690 for steel features
- Designed to Category I tornado loading

# Turbine Building First Bay Design

- Constructed to ACI 318
  - ACI 318 is the general specification used for the design of reinforced concrete buildings in the United States and it provides the basis for the majority of the design information presented in ACI 349
  - ACI 318 also provides the commentary for ACI 349
  - ACI 318 does not require certified material test reports to provide documentation of traceability of materials and has less stringent requirements with respect to record keeping and inspection and testing of construction work
- Credited as a key feature for the protection of the auxiliary building from the impact of large commercial aircraft (UFSAR 19F.4.2)
- Designed for an SSE and is designed to be capable of stopping all design basis tornado missiles defined in UFSAR Section 3.5.1.4

# First Bay Missile Barrier

- Detailed design to be finalized
  - Designed per AISC N690
  - Meets UFSAR Section 3.5.3 requirements
  - Equipment Class D

# Wall I Tornado Missile Protection

AP1000 RAI COL03.05.01.04-1 Revision 2 response states that the Annex Building provides protection for openings in the external wall of the Nuclear Island.

There are no structures, systems, and components (SSCs) located on the exterior of the AP1000 standard design facilities at any elevation that require protection from tornado missiles. The systems and components required to shut down the reactor, address transient conditions, and mitigate postulated accidents are protected by the reinforced concrete walls of the shield building and auxiliary building. Openings created by doors are on the East side of the Nuclear Island. **The Annex building provides protection, and the roll-up door at the fuel handling area has no systems in the vicinity that are required for safe shutdown.**

In process of evaluating the tornado missile paths for Wall I based on finalized Annex Building layout.



**Missile protection may be performed by the Annex Building for Wall I**

# Licensing Basis – Tornado Missile Protection

The licensing basis indicates:

1. Openings through nuclear island walls are evaluated on a case-by-case basis to provide confidence that a missile passing through the opening would not prevent safe shutdown
  - UFSAR Subsection 3.5.2
2. First Bay is a C-II Structure
  - Table 3.2.2
3. Seismic Category II SSCs are designed and analyzed to the pertinent portions of Appendix B and perform no safety function
  - UFSAR Subsection 3.2.1.1.2 & RAI OI-SRP3.2.1-EMB2-03
4. Missile protection is performed by safety-related Class C equipment but may be performed by SCII structure
  - UFSAR Section 3.2.1.1.1, 3.2.2.5, & RAI COL03.05.01.04-1
5. SCII buildings are designed and analyzed to requirements of ACI 349 and AISC N690 and are constructed to requirements of ACI 318
  - UFSAR Subsection 3.2.1.1.2 & 3.3.2.3
6. Spatial separation may be used to demonstrate protection from missile hazards when it is shown that the range and trajectory of the generated missile is less than the distance to or is directed away from the potential target (i.e. Line-of-sight)
  - UFSAR Subsection 3.5



The tornado missile protection description for openings in the Auxiliary Building is not concisely described in the licensing basis

# Proposed Resolution

- NRC approval will be requested to credit the Turbine Building First Bay for protecting openings in the North Auxiliary Building Wall (Wall 11)
  - Approach is consistent with the tornado missile protection for Wall I
- The tornado missile protection approach is as follows:
  - The Auxiliary Building concrete structure is capable of stopping all design basis missiles
  - Openings in the Auxiliary Building are protected by
    - Crediting an existing adjacent nonsafety seismic category II structure on a limited case-by-case basis
    - Evaluating tornado missiles in the direct line-of-sight of the Auxiliary Building opening
    - Installing tornado missile barriers on a limited case-by-case basis
- The proposed licensing basis markups are under development and will be included in the LAR-30 pre-submittal discussion



# Questions

