



NRC Meeting on the Development of Xe-100 Principal Design Criteria

U.S. Licensing Team

March 17, 2022



Agenda

- Introductions
- Purpose and Objectives
- General Approach to Principal Design Criteria (PDC)
- Examples:
 - MHTGR-DC 2 “Design Bases for Protection Against Natural Phenomena”
 - MHTGR-DC 10 “Reactor Design”
- Next Steps
- Questions and Closing Remarks



Purpose and Objectives

- Purpose:
 - Support the Xe-100 design and licensing basis approach regarding Principal Design Criteria (PDC)
- Objectives:
 - Describe the Xe-100 approach to developing PDC by leveraging insights from RG 1.232, NEI 18-04, and NEI 21-07
 - Receive feedback from the NRC on the Xe-100 approach
 - Determine any course corrections prior to formal submittals



General Approach to Xe-100 PDC

- Review the Modular High-Temperature Gas-cooled Reactor Design Criteria (MHTGR-DC) from Appendix C of RG 1.232 and, as applicable, describe how the:
 - Required Safety Functions (RSFs) and Required Functional Design Criteria (RFDC) or
 - PRA Safety Functions (PSFs) and Complementary Design Criteria (CDC) meet the intent of the MHTGR-DC
- In cases when the RSFs/RFDC or PSFs/CDC do not align with any of the suggested MHTGR-DC:
 - Acknowledge the addition of functional requirements beyond the set of MHTGR-DC
 - Provide justification as to why the Xe-100 design does not need to meet a particular MHTGR-DC to justify the safety case

MHTGR-DC 2 “Design Bases for Protection Against Natural Phenomena”

Changes from MHTGR-DC to Xe-100 PDC

- Split into 2 PDCs: 1) SR PDC-RFDC and 2) NSRST PDC-CDC
- SR PDC-RFDC
 - Clarifies that RFDC only apply to SSCs supporting RSFs (instead of important to safety)
 - Language remains largely unchanged from MHTGR-DC
 - Adds requirement to meet reliability and capability targets established under NEI 18-04
- NSRST PDC-CDC
 - Clarifies CDC only apply to safety significant PSFs (instead of important to safety)
 - Removes most “severe” language
 - Adds requirement to meet reliability and capability targets established under NEI 18-04



MHTGR-DC 10 “Reactor Design”

No Change from MHTGR-DC to Xe-100 PDC

- Plan to follow the guidance in MHTGR-DC 10
- Currently developing a detailed SARRDL implementation methodology for the Xe-100 design



Next Steps

- Continue to implement the overall approach until the ARDC and the current Xe-100 design criteria are dispositioned
- Draft a PDC white paper for NRC review and feedback as part of the pre-submittal engagement
- Incorporate feedback from the staff on the PDC white paper via:
 - Revisions to the draft PSAR chapters or
 - PDC Topical Report





Background Slides



ARDC 2 “Design Bases for Protection Against Natural Phenomena”

Title:	2. Design Bases for Protection Against Natural Phenomena
Xe-100 PDC-RFDC	<p>Structures, systems, and components that are required to perform RSFs shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena, (3) the importance of the safety functions to be performed and (4) the reliability and capability targets identified under the NEI 18-04 Process.</p>
RG 1.232, App C, Criterion 2:	<p>Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed</p>



ARDC 2 “Design Bases for Protection Against Natural Phenomena”

Title:	2. Design Bases for Protection Against Natural Phenomena
Xe-100 PDC-CDC	Structures, systems, and components that are required to perform NSRST PSFs shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena, (3) the importance of the safety functions to be performed and (4) the reliability and capability targets identified under the NEI 18-04 Process.
RG 1,232, App C, Criterion 2:	Structures, systems, and components important to safety shall be designed to withstand the effects of natural phenomena such as earthquakes, tornadoes, hurricanes, floods, tsunami, and seiches without loss of capability to perform their safety functions. The design bases for these structures, systems, and components shall reflect: (1) Appropriate consideration of the most severe of the natural phenomena that have been historically reported for the site and surrounding area, with sufficient margin for the limited accuracy, quantity, and period of time in which the historical data have been accumulated, (2) appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena and (3) the importance of the safety functions to be performed

No Changes from ARDC to Xe-100 PDC

Title:	10. Reactor Design
Xe-100 PDC	The reactor system and associated heat removal, control, and protection systems shall be designed with appropriate margin to ensure that specified acceptable system radionuclide release design limits (SARRDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.
RG 1.232, App C, Criterion 10:	The reactor system and associated heat removal, control, and protection systems shall be designed with appropriate margin to ensure that specified acceptable system radionuclide release design limits (SARRDLs) are not exceeded during any condition of normal operation, including the effects of anticipated operational occurrences.