



X Energy, LLC
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20 July 2023
Project No. 99902071

2023-XE-NRC-022

U.S. Nuclear Regulatory Commission
ATTN: Document Control Desk
Washington, DC 20555-0001

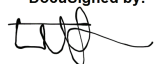
Re: Technical Specifications Presentation Materials

This letter provides the X Energy, LLC presentation material for the upcoming "Technical Specifications" U.S. Nuclear Regulatory Commission pre-application engagement meeting (Enclosures 1, 2, and 3) scheduled for 02 August 2023. The presentation material contains proprietary information; as such, it is requested that Enclosure 3 be withheld from public disclosure per 10 CFR 2.390, "Public inspections, exemptions, requests for withholding." An affidavit certifying the basis for the request to withhold Enclosure 3 from public disclosure is included as Enclosure 1. Proprietary information has been omitted from the presentation materials provided in Enclosure 2.

This letter and enclosures make no new or revised regulatory commitments.

Should you have any questions regarding this submittal, please contact Brandon Hartle at bhartle@x-energy.com.

Sincerely,

DocuSigned by:


F053E736949E4C3...
Travis A. Chapman
Director, Reactor Licensing & Regulatory Affairs
X Energy, LLC

Enclosures:

- 1) Affidavit Supporting Request for Withholding from Public Disclosure (10 CFR 2.390)
- 2) "Technical Specifications" Presentation Material – Open Meeting – Non-Proprietary (Public)
- 3) "Technical Specifications" Presentation Material – Closed Meeting – Proprietary (Non-Public)

cc: David Bannister, X Energy, LLC
Bobby Kunkle, X Energy, LLC
Brandon Hartle, X Energy, LLC
Adrian Muniz, U.S. Nuclear Regulatory Commission
Andrew Proffitt, U.S. Nuclear Regulatory Commission
Jorge Hernandez, U.S. Nuclear Regulatory Commission
Zachary Stone, U.S. Nuclear Regulatory Commission



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Enclosure 1

**X Energy, LLC Affidavit and Request for Withholding from Public Disclosure
(10 CFR 2.390)**



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Affidavit Supporting Request for Withholding from Public Disclosure (10 CFR 2.390)

I, Travis Chapman, Director, Reactor Licensing & Regulatory Affairs, Xe-100 Program, of X Energy, LLC (X-energy) do hereby affirm and state:

1. I am authorized to execute this affidavit on behalf of X-energy. I am further authorized to review information submitted to or discussed with the U.S. Nuclear Regulatory Commission (NRC) and apply for the withholding of information from disclosure. The purpose of this affidavit is to provide the information required by 10 CFR 2.390(b) in support of X-energy's request for proprietary treatment of certain commercial information submitted in Enclosure 3 to X-energy's letter 2023-XE-NRC-022 from myself to the NRC which provides "Technical Specifications" Presentation Material – Closed Meeting – Proprietary (Non-Public).
2. I have knowledge of the criteria used by X-energy in designating information as sensitive, proprietary, confidential, and export-controlled.
3. Pursuant to the provision of paragraph (b)(4) of 10 CFR 2.390, the following is furnished for consideration by the NRC in determining whether the information sought to be withheld from public disclosure should be withheld.
 - a. The information sought to be withheld from public disclosure in Enclosure 3 is owned by X-energy. This information was prepared with the explicit understanding that the information itself would be treated as proprietary and confidential and has been held in confidence by X-energy.
 - b. The information sought to be protected in Enclosure 3 is not available to the public.
 - c. The information contained in Enclosure 3 is of the type that is customarily held in confidence by X-energy, and there is a rational basis for doing so. The information X-energy is requesting to be withheld from public disclosure includes technical information related to the design, analysis, and operations associated with our Xe-100 high-temperature, gas-cooled, pebble bed advanced reactor design that directly impacts our business development and commercialization efforts. X-energy limits access to this proprietary and confidential information in order to maintain confidentiality.
 - d. Enclosure 3 contains information about the planned activities of X-energy related to the development of the Xe-100 design bases, TRISO-X fuel design bases, forecast design development timeframes, and relate to the commercialization strategy for our Xe-100 advanced reactor. Public disclosure of the information contained in Enclosure 3 would create substantial harm to X-energy because it would reveal valuable technical information regarding X-energy's design development, competitive expectations, assumptions, current position, and strategy. Its use by a competitor could substantially improve the competitor's position in the design, manufacture, licensing, construction, and operation of a similar competing product.



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e. The Proprietary Information contained in Enclosure 3 is transmitted to the NRC in confidence and under the provisions of 10 CFR 2.390; it is to be received in confidence by the NRC. The information is properly marked.

I declare under the penalty of perjury that the foregoing is true and correct. Executed on this 20th day of July 2023.

Sincerely,

DocuSigned by:

A handwritten signature in black ink, appearing to read 'T. Chapman', enclosed within a blue DocuSign signature box.

F053E736949E4C3...
Travis Chapman

Director, Reactor Licensing & Regulatory Affairs
Xe-100 Program
X Energy, LLC



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Enclosure 2

**X Energy, LLC “Technical Specifications” Presentation Material – Open Meeting
Non-Proprietary (Public)**



Xe-100 Technical Specifications - NRC Public Meeting

Travis Chapman, Director of Xe-100 US Licensing

Brandon Hartle, Operations Licensing Engineer

Bobby Kunkle, Licensing Engineer

August 2, 2023



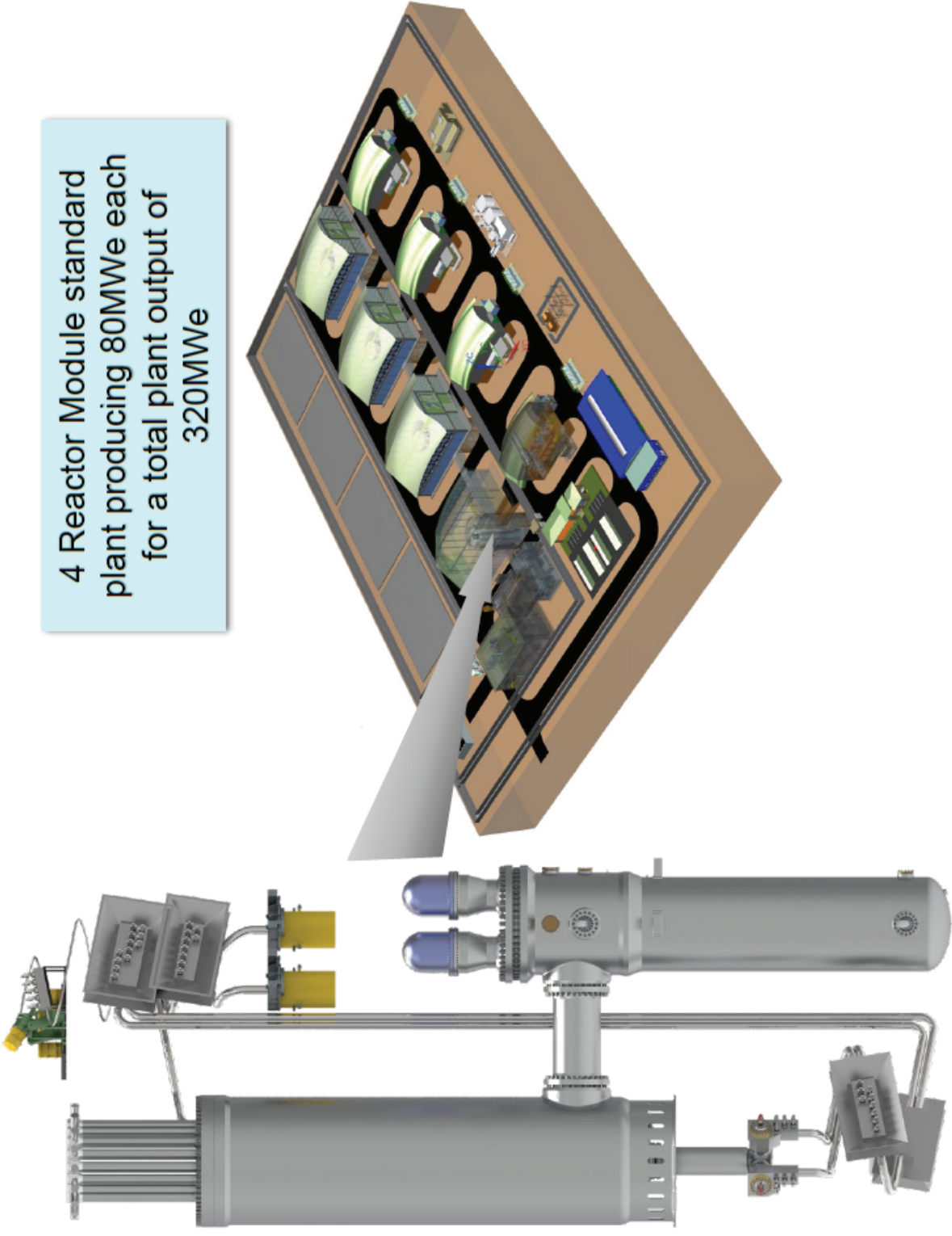
Meeting Agenda

Topic	Time (60 minutes)	Presenter
Opening Remarks	2 minutes	Travis Chapman– X-energy Tech Spec Branch Chief – NRC
Introductions and Safety Moment	3 minutes	Brandon Hartle – X-energy
Brief Technology Overview	5 minutes	Brandon Hartle
X-energy Interpretation of Advanced Reactor Content of Application (ARCAP) Guidance	5 minutes	Bobby Kunkle – X-energy
10 CFR 50.36 Exemptions	5 minutes	Bobby Kunkle
Relationship of Structures, Systems, Components (SSCs), Limiting Conditions of Operation (LCOs), Safety Limits (SLs), and Required Safety Functions (RSFs)	5 minutes	Bobby Kunkle
Xe-100 Design Features Discussion	5 minutes	Bobby Kunkle
Preliminary Safety Analysis Report (PSAR) Expected Level of Detail	5 minutes	Bobby Kunkle
NRC Questions and Feedback	20 minutes	NRC staff
Closing Remarks	5 minutes	Brandon Hartle & TS Branch Chief – NRC

Brief Technology Overview

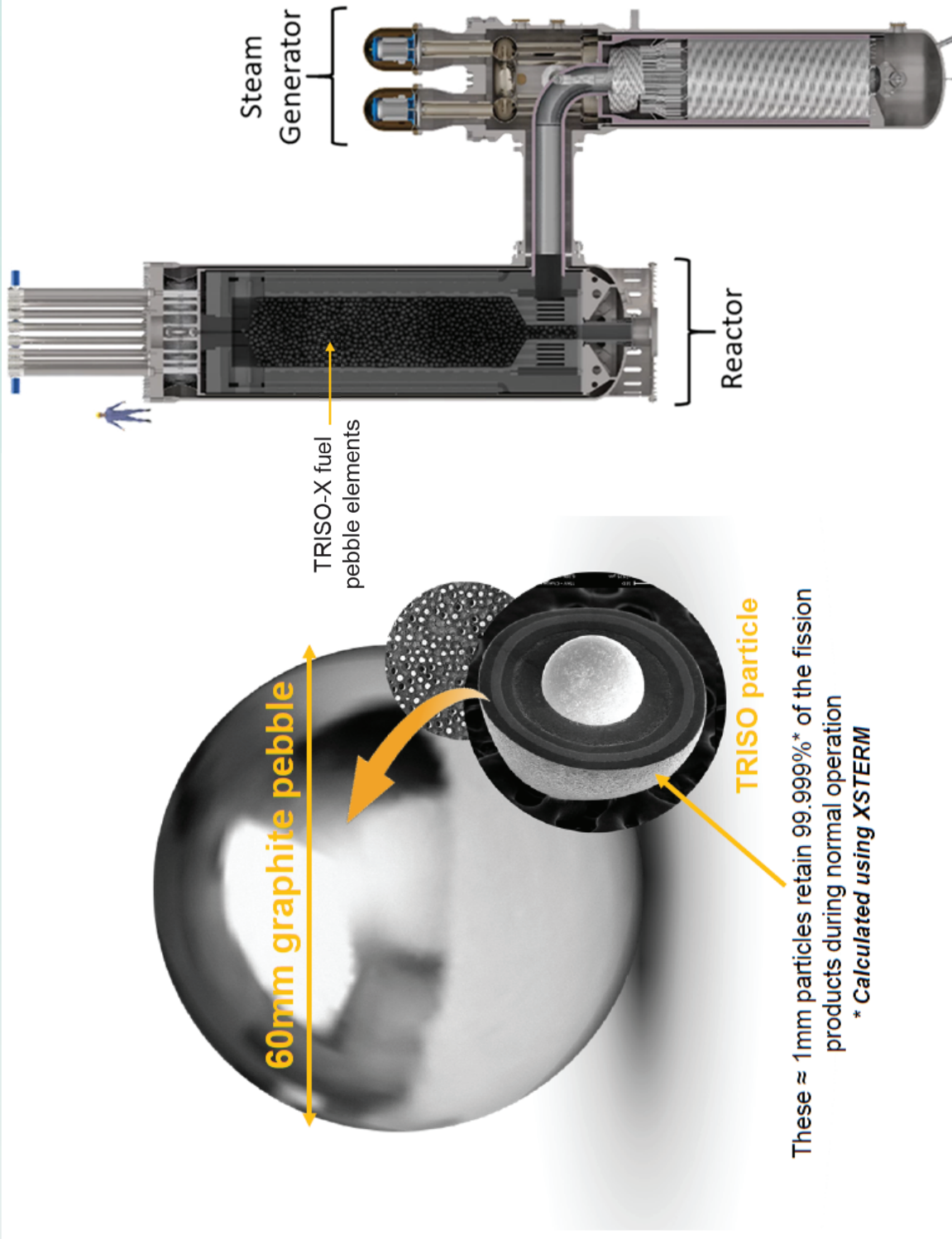
Brandon Hartle
Xe-100 Operations Licensing

- 200 MWt Pebble Bed High Temperature Reactor as the nuclear heat source
- UCO TRISO particle fuel embedded in a graphite matrix spherical fuel element (i.e. pebble)
- Helical coil Steam Generator for producing high quality steam (565 deg C at 16.5 Mpa)
- Standard plant has 4 reactor units that are controlled from a single control room with 3 operators
- Steam headers can be connected to steam turbines or can provide process heat directly to a plant requiring process steam or heat



Brief Technology Overview

- TRISO particle fuel has a proven pedigree – more than 30 years of operational and fuel fabrication experience
- Tested to 1800 deg C – remains safe and cannot melt even without active cooling
- Each pebble contains approximately 19,000 TRISO fuel particles
- Each particle retains ~99.999% of fission products, equivalent to each particle being its own functional containment vessel
- These particles replace the need for many complex safety systems required in the current Light Water Reactor (LWR) fleet
- Therefore, X-energy anticipates the number of Xe-100 SSCs requiring LCOs to be significantly lower than the current LWR fleet



X-energy Interpretation of ARCAP Guidance



LCO Criterion (modified for the Xe-100):

Criterion 1. Installed instrumentation used to detect, and indicate where necessary, a significant abnormal degradation of barriers necessary:

- to maintain the release of radioactive materials from the plant to within the Design Basis Event (DBE) Frequency-Consequence (F-C) Target or
- to mitigate Design Basis Accidents (DBAs)

Criterion 2. A process variable, design feature, or operating restriction:

- That is an initial condition of an Anticipated Operational Occurrence (AOO) or DBE necessary to maintain consequences to within the F-C Target
- to mitigate DBAs

Criterion 3. An SSC that performs a Required Safety Function (RSF) to:

- Mitigate the consequences of DBEs to within the F-C target
- Mitigate DBAs

10 CFR 50.36(c)(2)	TS Content Based on Corresponding NEI 18-04 Output
Limiting conditions for operation are the lowest functional capability or performance levels of equipment required for safe operation of the facility. Criterion 1. Installed instrumentation that is used to detect, and indicate in the control room, a significant abnormal degradation of the reactor coolant pressure boundary.	Limiting conditions for operation are the lowest functional capability or performance levels of equipment required for safe operation of the facility. Criterion 1. Installed instrumentation that is used to detect, and indicate where necessary, a significant abnormal degradation of barriers necessary to maintain the release of radioactive materials from the plant to within the DBE F-C Target or to mitigate DBAs that only rely on the SR SSCs to meet the dose criteria of 10 CFR 50.34 or identical criteria in 10 CFR Part 52 (i.e., 10 CFR 52.47(a)(11), 10 CFR 52.79(a)(30), and 10 CFR 52.158(f)(18).
Criterion 2. A process variable, design feature, or operating restriction that is an initial condition of a design basis accident or transient analysis that either assumes the failure of or presents a challenge to the integrity of a fission product barrier.	Criterion 2. A process variable, design feature, or operating restriction that is an initial condition of an anticipated operational occurrence (AOO) or DBE and is necessary to maintain consequences to within the F-C Target or is necessary for a SR SSC to mitigate a DBA to meet the dose criteria of 10 CFR 50.34 or identical criteria in 10 CFR Part 52.
Criterion 3. A structure, system, or component that is part of the primary success path and which functions or actuates to mitigate a design basis accident or transient	Criterion 3. An SSC that is part of the primary success path and that performs an RSF to mitigate the consequences of DBEs to within the F-C Target or to mitigate DBAs

Source: DANU-ISG-2022-08, Advanced Reactor Content of Application Project “Risk-Informed Technical Specifications” Draft Interim Staff Guidance, May 2023



Xe-100 Technical Specifications

Bobby Kunkle
Xe-100 Licensing

LCO Criterion (modified for the Xe-100):

Criterion 4. One of the following:

- An SSC classified as Safety Related (SR) that is relied on to perform an RSF to prevent the frequency of Beyond Design Basis Events (BDBEs) with consequences greater than the 10 CFR 50.34 dose limits from increasing into the DBE region and beyond the F-C Target
- An SSC classified as Non-Safety Related with Special Treatment (NSRST) and relied on to perform risk-significant functions

10 CFR 50.36(c)(2)	TS Content Based on Corresponding NEI 18-04 Output
Criterion 4. A structure, system, or component which operating experience or probabilistic risk assessment has shown to be significant to public health and safety.	Criterion 4. (a) An SR SSC relied on to perform a RSF to prevent the frequency of a BDBE with consequences greater than the 10 CFR 50.34 dose criteria or the identical criteria in Part 52 from increasing into the DBE region and beyond the F-C Target. (b) An NSRST SSC relied on to perform a risk-significant function. These risk-significant SSCs are those which perform functions that prevent or mitigate any LBE from exceeding the F-C Target or make significant contributions to the cumulative risk metrics selected for evaluating the total risk from all analyzed LBEs.

Source: DANU-ISG-2022-08, Advanced Reactor Content of Application Project “Risk-Informed Technical Specifications” Draft Interim Staff Guidance, May 2023



10 CFR 50.36 Exemptions

Bobby Kunkle
Xe-100 Licensing

- ARCAP draft guidance document, DANU-ISG-2022-08, “Risk-Informed Technical Specifications,” was released in May 2023
- This ISG provides guidance on developing TS for advanced reactors
- X-energy plans to follow this guidance to develop the Xe-100 TS
- X-energy understands the LCO screening criteria is different than what is in 10 CFR 50.36(c)
- Therefore, to comply with the current regulations in 10 CFR 50.36, X-energy understands an exemption would be needed to use the ARCAP guidance



Relationship of SSCs, LCOs, SLs, and RSFs

Bobby Kunkle
Xe-100 Licensing

- X-energy is requesting confirmation of the following interpretation of the hierarchy of advanced reactor TS following the ARCAP guidance
- RSFs – the highest functional capability
 - Ensures no radiological release to the public
- SLs – the next highest level of functional capability
 - Ensures RSFs are met, and are necessary to protect integrity of physical barriers that prevent uncontrolled release of radioactivity
- LCOs – the lowest level of functional capability
 - Ensures SLs are met
 - For the Xe-100, LCOs ensure that the Xe-100 SSCs will meet the Xe-100 SLs



Xe-100 Design Features Discussion

Bobby Kunkle
Xe-100 Licensing

- From the ARCAP guidance and 10 CFR 50.36, design features are:
 - Those features of the facility such as materials of construction and geometric arrangements if altered or modified, would have a significant effect on safety
 - Are not covered by Safety Limits, LCOs, and Surveillance Requirements.
- The Xe-100 plant has many inherent safety and design features and therefore utilizes many passive systems
 - Measuring process parameters to determine system performance is of limited value. In more extreme examples, it may not be practical or meaningful to measure process parameters for certain systems at all (e.g., graphite, fuel).
 - Therefore, X-energy anticipates more design features for the Xe-100 than the current LWR fleet



PSAR Expected Level of Detail

Bobby Kunkle
Xe-100 Licensing

- For the PSAR, X-energy plans to submit Preliminary Xe-100 TS as an Enclosure
- Xe-100 Modes defined
- Xe-100 Safety Limits:
 - Conceptually defined
 - Qualitative for PSAR process variables identified but no values given
 - Quantitative for FSAR
- Xe-100 Limiting Safety System Settings
 - Conceptually defined



PSAR Expected Level of Detail (cont.)

Bobby Kunkle
Xe-100 Licensing

- **Xe-100 LCOs:**
 - List of SSCs expected to “screen-in” with LCO Screening Criteria as a basis
 - Qualitative description of entry condition into the LCO
 - Mode(s) of applicability
 - LCO completion times and surveillances not defined for the PSAR
- **Xe-100 Design Features:**
 - Conceptually defined
 - List of expected SSCs that meet the definition of Design Features
- **Xe-100 Administrative Controls:**
 - Brief description of the programs and administrative controls
 - Examples are staffing and organization responsibilities, establishment of procedures, and other programs to operate the plant in a safe manner



Questions and Feedback



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Enclosure 3

**X Energy, LLC "Technical Specifications" Presentation Material – Closed Meeting
Proprietary (Non-Public)**