



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D.C. 20555-0001

February 7, 2024

Mr. Steve Vaughn
Licensing Manager, Project Long Mott
X Energy, LLC
801 Thompson Avenue
Rockville, MD 20852

SUBJECT: PREAPPLICATION READINESS ASSESSMENT REPORT OF THE
X-ENERGY, LLC XE-100 PRELIMINARY SAFETY ANALYSIS REPORT

Dear Mr. Vaughn:

On December 14, 2023, the U.S. Nuclear Regulatory Commission (NRC) staff completed a preapplication readiness assessment (hereinafter "readiness assessment") of the draft preliminary safety analysis report (PSAR) for the X-energy, LLC (X-energy) and Dow Chemical Company (Dow) planned construction permit (CP) application in support of the Advanced Reactor Demonstration Program (ARDP) project to build a 4-unit Xe-100 nuclear power facility at the Dow Seadrift Site in Calhoun County, Texas. The readiness assessment, as requested by X-energy (Agencywide Documents Access and Management System (ADAMS) Accession No. ML23195A107), was limited to the draft PSAR content (with the exception of Chapter 2, "Site Characteristics") of a CP application, and therefore, excluded the environmental report. X-energy requested the readiness assessment in order for the NRC staff to: (1) identify information gaps between the draft PSAR and the technical content required for the final application submitted to the NRC staff, as set forth in Title 10 of the *Code of Federal Regulations* (10 CFR) Section 50.34, "Contents of applications; general information," (2) identify technical or regulatory issues that may complicate the acceptance or technical reviews of the application, and (3) become familiar with the PSAR, particularly in areas where Dow and X-energy are proposing new concepts or novel design features. The NRC staff's readiness assessment plan used to conduct the review of X-energy's PSAR can be found in ADAMS (ML23243B065).

The NRC staff conducted the readiness assessment via X-energy's Electronic Reading Room in accordance with NRC's Office Instruction LIC-116, "Pre-application Readiness Assessment" (ML20104B698). The readiness assessment is not part of the NRC's acceptance review process and is not intended to determine whether the associated construction permit will be acceptable for docketing, as would be required by 10 CFR Part 2, "Agency Rules of Practice and Procedure."

The NRC staff found that X-energy's draft PSAR structure is in alignment with Nuclear Energy Institute (NEI) 21-07, "Technology Inclusive Guidance for Non-Light-Water Reactors, Safety Analysis Report Content for Applicants Using the NEI 18-04 Methodology." However, there are key areas where additional information will need to be included for a finalized application to be accepted and docketed for NRC review. The enclosed table (ML24010A225) provides further

details and specific NRC staff observations on the draft PSAR. The staff categorized each of the observations to assist X-energy and Dow in understanding the potential impact of the observation. Each observation was assigned one of three possible categories. Category A (PSAR Gap) includes information that the NRC staff expects will be required to meet the information requirements in 10 CFR 50.34(a), but was not provided in the draft preliminary PSAR. Category B (Items Requiring Additional Information) includes staff observations on items provided in the draft PSAR, but for which further justification or additional information will be needed to support a regulatory finding. Lastly, Category C (Other) includes other observations that should be addressed or considered by X-energy to support the development of a quality application.

The following examples of each category illustrate the rationale used:

Category A

Observation ID #121: Multiple chapters and sections of the draft PSAR for various safety-related (SR) and non-safety-related with special treatment (NSRST) structures, systems, and components (SSCs) refer to this section as the SSCs' environmental qualification program special treatment. However, Section 8.5, "Environmental Qualification Program," does not include a discussion on the environmental qualification program for these safety-significant SSCs. In addition, Chapter 6 and 7 sections for SR and NSRST SSCs should be reviewed to ensure that their reference to Section 8.5, as special treatment is consistently applied. Some sections do not refer to Section 8.5, although the reference appears to be needed. The NRC staff expects that Section 8.5 discusses the environmental qualification program for all safety-significant (SR and NSRST) SSCs, thus this information needs to be provided in the PSAR.

Category B

Observation ID #39: PSAR Section 3.4, "Design Basis Events," states that "due to the complex nature of the models, the evaluations are computationally limited to being used only for the first few hours of these events." This "plant transient phase" terminates in some cases where the transient is not stable or decreasing (e.g., SD-004), and then passes off to a "long-term plant response" phase, described at a high level in PSAR Section 3.4.15, "Long Term Plant Response to AOOs, DBEs, and BDBEs," which is not complete at this stage.

To determine a transient is over from a consequence perspective, figures of merit should be in a stable condition, with none degrading or undergoing transitory behavior. In cases where a transient spans two models, a justification should be provided for any handoff in calculation of consequence. Lacking additional information at this stage, the NRC staff expects this subject to be an area of focus during the CP application review.

Category C

Observation ID #113: The discussion of "Assumption 1" introduces the term "Fire Protection Analysis (FPA)" as distinct from Fire Hazards Analysis, Fire PRA, and Fire Safe Shutdown Analysis. The term is not defined or described, and it is unclear what it is intended to mean. A clear definition should be provided in the PSAR.

X-energy should consider the entirety of the NRC staff observations when finalizing the PSAR to support development of a high-quality application. In addition to the detailed observations provided in the table, the NRC staff identified two overarching observations that could substantially impact the ability of the NRC to accept and docket an application for review and establish a review schedule.

1. X-energy excluded Chapter 2 of the PSAR from the scope of the readiness assessment. Therefore, the NRC staff considers PSAR Chapter 2, in its entirety, as an information gap. Furthermore, during a meeting held on December 7, 2023 (ML23333A056 and ML23325A241), X-energy indicated that only some information in the initial submittal of the PSAR Chapter 2 will be based on site-specific data. Data from nearby locations, as well as bounding or other analyses, will be provided in lieu of site-specific information. X-energy stated that the information in the initial submittal would be supplemented with additional site-specific information at a later date. This approach presents a risk to the acceptability of the application, and X-energy should ensure that the bases for the applicability of any regional data or surrogate analyses are well defined and supported. Further, X-energy should consider how the schedule for submission of supplemental information would support an efficient and effective review of the application.
2. X-energy identified areas throughout the PSAR as “placeholders” to note that the pertinent information was not yet available, was not yet of sufficient detail for the NRC staff’s assessment, or was preliminary in nature and required further validation. The scope of the “placeholders” encompasses substantive portions of the PSAR that should be completed and validated in advance of the CP application.

The NRC staff remains committed to working with X-energy and Dow in ongoing and future preapplication engagement activities. X-energy and Dow are encouraged to engage the NRC staff if additional clarity is needed on any of the NRC staff’s observations. Based on the nature of the readiness assessment, additional items may be identified during the acceptance review of the anticipated CP application that were not identified during the readiness assessment.

S. Vaughn

- 4 -

Enclosed are two Observation reports – non-proprietary version (Enclosure 1) and proprietary version (Enclosure 2). The complete ADAMS package can be found under ML24011A071.

If you have any questions, please contact Adrian Muñoz, Senior Project Manager, at 301-415-4039 or via email at Adrian.Muniz@nrc.gov.

Sincerely,

Mohamed Shams, Director
Division of Advanced Reactors and Non-Power
Production and Utilization Facilities
Office of Nuclear Reactor Regulation

Project No.: 99902117

cc: Distribution via X-Energy Xe-100 (Except Enclosure 2)

S. Vaughn

- 3 -

SUBJECT: PREAPPLICATION READINESS ASSESSMENT REPORT OF THE
X-ENERGY, LLC XE-100 PRELIMINARY SAFETY ANALYSIS REPORT
REVISION 2 DATED: FEBRUARY 7, 2024

DISTRIBUTION:

PUBLIC
UAL2 R/F
RidsNrrDanu Resource
RidsNrrDanuUar12 Resource
RidsNrrDanuUtb1 Resource
RidsNrrLACSmith Resource
RidsAcrcMailCenter
RidsOGCMailCenter
RidsEdoMailCenter
MWentzel, NRR
GOberson, NRR
AMuniz, NRR
IJung, NRR
JHernandez, NRR
ODukes, NRR

Mstaiger@x-energy.com

ADAMS Accession Nos.:

Package: ML24011A071

Letter: ML24011A222

Enclosure 1: ML24037A296

Enclosure 2: ML24011A225

NRR-106

OFFICE	NRR/DANU/UAL2:PM	NRR/DANU/UAL2:LA	NRR/DANU/UTB1:BC
NAME	AMuñiz	CSmith	GOberson
DATE	01/08/2024	01/31/2024	01/10/2024
OFFICE	NRR/DANU/UAL2:PM	NRR/DANU/UAL2:BC	NRR/DANU:DD
NAME	JHernandez	MWentzel	MShams
DATE	01/08/2024	01/10/2024	02/07/2024

OFFICIAL RECORD COPY