ENCLOSURE 1 – SUMMARY REPORT FOR THE REGULATORY AUDITS OF THE LONG MOTT ENERGY, LLC LONG MOTT GENERATING STATION CONSTRUCTION PERMIT APPLICATION
(EPID NO. L-2025-CPS-0000)

APPLICANT INFORMATION

Applicant:	Long Mott Energy, LLC
Applicant Address:	530 Gaither Road, Suite 700 Rockville, MD, 20850
Facility Name:	Long Mott Generating Station
Docket No.:	05000614

1.0 BACKGROUND AND PURPOSE

By letter dated March 31, 2025 (Agencywide Documents Access and Management System (ADAMS) Package Accession No. ML25090A057), Long Mott Energy, LLC (LME) submitted a construction permit (CP) application for a reactor facility pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR) Part 50, "Domestic Licensing of Production and Utilization Facilities," to the U.S. Nuclear Regulatory Commission (NRC) for review. The facility, referred to as Long Mott Generating Station (LMGS), would be constructed in Calhoun County, Texas. By letter dated May 12, 2025, the NRC staff (the staff) accepted the CP application for detailed review (ML25115A247). The NRC staff conducted a detailed review of the LMGS CP application and engaged in regulatory audits as described below to assist the NRC staff in its review. Revision 1 of the CP application was submitted by LME on September 18, 2026.

The general audit plan was issued on June 5, 2025 (ML25128A332), the probabilistic risk assessment (PRA) audit plan was issued on June 11, 2025 (ML25156A350), and the Chapter 2 and structures audit plan was issued on June 25, 2025 (ML26048A641). The purpose of these audits was to enable the staff to gain understanding, confirm information, and/or identify information that would require docketing to support the basis for the staff's regulatory decision.

2.0 AUDIT REGULATORY BASES

The basis for the audits are the regulations in 10 CFR pertinent to the NRC staff's review of the CP application, including 10 CFR 50.34, "Contents of applications; technical information," 10 CFR 50.35, "Issuance of construction permits," 10 CFR 100.20, "Factors to be considered when evaluating sites," 10 CFR 100.21, "Non-seismic site criteria," 10 CFR 100.23, "Geologic and seismic siting criteria," and Appendix S to Part 50, "Earthquake Engineering Criteria for Nuclear Power Plants."

3.0 GENERAL AUDIT TEAM

Members of the general audit team, listed below, were selected based on their detailed knowledge of the subject. General audit team members included:

- Tracy Radel, Office of Advanced Reactors (OAR), Senior (Sr.) Nuclear Engineer, Lead Technical Reviewer

- Adrian Muñiz, OAR, Sr. Project Manager, Lead Project Manager
- Santosh Bhatt, OAR, Sr. Nuclear Engineer
- Margaret Audrain, OAR, Materials Engineer
- Kristy Bucholtz, OAR, Nuclear Engineer
- Calvin Cheung, OAR, Electronics Engineer
- Matthew Gordon, OAR, Materials Engineer
- Zachary Gran, OAR, Reactor Scientist – Severe Accidents
- Steve Jones, OAR, Sr. Reactor Systems Engineer
- John Matrachisia, OAR, Nuclear Engineer
- Robert Roche-Rivera, OAR, Sr. Civil Engineer – Structural
- Pravin Sawant, OAR, Sr. Nuclear Engineer
- Clair Song, OAR, Mechanical Engineer
- Reed Anzalone, Senior Nuclear Engineer
- Garry Armstrong, Office of the Chief Nuclear Reactor Inspector (CNRI), Reactor Operations Engineer – Human Factors
- Brad Baxter, Office of Nuclear Reactor Regulation (NRR), Security Specialist
- Jorge Cintrón-Rivera, NMSS, Electrical Engineer
- Jeff Correll, OAR, Reactor Engineer - Examiner
- Thinh Dinh, NRR, Fire Protection Engineer
- Timothy Drzewiecki, OAR, Sr. Reactor Systems Engineer
- Ondra Dukes, OAR, Project Manager
- Carol Dye, OAR, Geologist
- Amitava Ghosh, OAR, Physical Scientist – Hazards Analyst
- Vladimir Graizer, Office of Nuclear Regulatory Research (RES), Seismologist
- Ian Jung, OAR, Sr. Reliability and Risk Analyst
- Andrea Keim, CNRI, Reactor Operations Engineer – QA Inspector
- Travis Leach, OAR, Security Specialist
- Kosmas Lois, NMSS, Financial Analyst
- Denise McGovern, OAR, Sr. Project Manager
- Charles Mouton, NRR, Fire Protection Engineer
- Phil O'Bryan, OAR, Sr. Reactor Operations Engineer
- Sheila Ray, OAR, Sr. Electrical Engineer
- Richard Rivera, OAR, Project Manager
- Ryan Ruppert, NMSS, Information Security Specialist
- Michael Salay, RES, Sr. Reactor Systems Engineer
- Jenise Thompson, OAR, Geologist
- Nebiyu Tiruneh, OAR, Hydrologist
- Rosalynn Wang, OAR, Geophysicist
- Jason White, OAR, Physical Scientist – Meteorologist
- Brian Zaleski, NRR, Fitness for Duty Specialist

3.1 CHAPTER 2 AND STRUCTURES AUDIT TEAM

Members of the Chapter 2 and structures audit team, listed below, were selected based on their detailed knowledge of the subject. Chapter 2 and structures audit team members included:

- Nebiyu Tiruneh, OAR, Hydrologist

- Robert Roche-Rivera, OAR, Sr. Civil Engineer – Structural
- Amitava Ghosh, OAR, Physical Scientist – Hazards Analyst
- Carol Dye, OAR, Geologist
- Rosalynn Wang, OAR, Geophysicist
- Jason White, OAR, Physical Scientist - Meteorologist
- Richard Rivera, OAR, Project Manager
- Tracy Radel, OAR, Sr. Nuclear Engineer, Lead Technical Reviewer
- Adrian Muñiz, OAR, Sr. Project Manager, Lead Project Manager
- Hosung Ahn, OAR, Hydrologist
- Santosh Bhatt, OAR, Sr. Nuclear Engineer
- Ondra Dukes, OAR, Project Manager
- Vladimir Grizer, RES, Seismologist
- Ian Jung, OAR, Sr. Reliability and Risk Analyst
- Denise McGovern, OAR, Sr. Project Manager
- Jenise Thompson, OAR, Geologist

3.2 PROBABILISTIC RISK ASSESSMENT (PRA) AUDIT TEAM

Members of the PRA audit team, listed below, were selected based on their detailed knowledge of the subject. PRA audit team members included:

- Kristy Bucholtz, OAR, Nuclear Engineer
- Denise McGovern, Sr. Project Manager
- Tracy Radel, OAR, Sr. Nuclear Engineer, Lead Technical Reviewer
- Adrian Muñiz, Sr. Project Manager, Lead Project Manager
- Santosh Bhatt, OAR, Sr. Nuclear Engineer
- Zachary Gran, OAR, Reactor Scientist – Severe Accidents
- Ian Jung, OAR, Sr. Reliability and Risk Analyst

4.0 AUDIT PROCESS

The audits were primarily conducted remotely via the LME electronic reading room (eRR) and video teleconferences. In addition, in-person meetings were held at NRC Headquarters in Rockville, Maryland and X-Energy Offices in Rockville, Maryland. The general audit, PRA audit, and chapter 2 and structures audit began on Jun 5, 2025, June 11, 2025, and June 25, 2025, respectively, and all audits ended on October 23, 2026. The NRC staff conducted the audits in accordance with the Office of Nuclear Reactor Regulation (NRR) Office Instruction LIC-111, Revision 1, “Regulatory Audits,” (ML19226A274).

The NRC staff’s audits focused on supporting documents and information associated with the topics identified in the audit plans. Through the NRC external SharePoint site, the NRC staff transmitted audit questions, including document requests, to clearly identify the information needed to support the NRC staff’s review. Enclosure 5 of this audit report contains a list of documents that were placed in the eRR by LME. The NRC staff audited information provided by LME in the eRR and held discussions with LME staff to understand the LMGS preliminary design and resolve questions. In many cases, LME updated the preliminary safety analysis report (PSAR) to resolve items discussed in the audit.

5.0 AUDIT ACTIVITIES AND RESULTS

Some of the important topic areas that were discussed during the audit include:

- **Principal Design Criteria (PDCs)**

  The NRC staff discussed the limited PDC LBE scope (i.e., AOO for CDC, DBE/DBA for RFDC) with LME. Through this discussion it was understood that the SSC performance was evaluated for all LBEs credited with performing prevention and mitigation safety functions, and that evaluation feeds back into the design through SSC-specific design requirements, reliability and capability targets, and special treatments. Revisions to PSAR sections 6.3 and 7.2 summarized this process.

  Additionally, audit discussions resulted in revisions to PSAR chapters 6 and 7 to support NRC staff conclusions that the preliminary design of SSCs is consistent with the relevant PDCs.

- **Research and Development (R&D)**

  The NRC staff discussed R&D program scope with LME. Through this discussion it was understood that aspects of the materials qualification program, discussed in PSAR chapter 3.8, that are associated with metallic safety related SSCs are in scope of the R&D program. In addition, items associated with the graphite topical report, discussed in PSAR table 1.4-14, and fuel qualification, discussed in PSAR table 6.4.2-1, are in scope. Results of this discussion are captured in PSAR chapter 13.

- **Defuel Chute**

  The NRC staff discussed the defuel chute with LME. The defuel chute performs an important function in providing structural support to the pebbles within the core as the fuel pebbles transition from the high temperature core environment to the lower temperature fuel handling system. The discussion included the pressure vessel that surrounds and supports the defuel chute, the vessel that receives the fuel as it exits the defuel chute, and the equipment that controls the rate of fuel movement. The NRC staff sought an understanding of how the environmental conditions would be evaluated and how potential accident conditions had been considered.

  Through this discussion and review of supporting preliminary thermal analyses, the NRC staff gained an understanding of the current development of the defuel chute design and its importance to safety. The applicant included applicable safety-related defuel chute metallic materials in the R&D program and further explained plans for additional analysis related to evaluation of the following: accident conditions identified through probabilistic approaches; potential consequences of failure; and thermal conditions, including changes in the decay of fuel entering the defuel chute. This engagement resulted in revisions to PSAR sections 6.4.5, 6.4.8, and 7.3.6.

- **Hydrology**

  The NRC staff conducted a series of audit discussions to develop an understanding of the process, data, and methodologies used to evaluate plausible flood causing

mechanisms at the LMGS site, groundwater flow characteristics and levels, and the postulated accidental radioactive liquid effluents transport analysis. The discussions also included considerations of flood mitigation mechanisms to provide reasonable assurance about the protection of SSCs important to safety. These engagements resulted in revisions to PSAR section 2.4.

- **Dispersion Factors**

  The NRC staff conducted a series of audit discussions to develop an understanding of the inputs, assumptions, and methodologies used to evaluate the atmospheric dispersion for the LMGS site. The discussions included the reasons for any departures from the analysis outlined in the atmospheric dispersion and dose consequences methodology topical report. The discussions also included details of the site-specific analysis that will be included in a future operating license application to verify that conservative dispersion values are used in analyses for the LMGS site. These engagements resulted in revisions to PSAR sections 2.3.4, 2.3.5, and 11.4.

- **Structural Engineering**

  The NRC staff discussed with LME differences between the safety classification for safety significant SSCs and the safety classification of structures in their load path that provide essential support. LME revised the safety classification of certain structures and updated its seismic categorization approach, including enhanced seismic treatment for NSRST structures supporting SR SSCs, to ensure that structures providing load path support achieve performance levels consistent with the SSCs they are supporting.

  Additionally, the NRC staff reviewed and discussed supporting structural/seismic design and analysis information including demand and capacity determinations, analysis, design, and construction techniques for precast concrete systems. The NRC staff also reviewed analysis techniques for developing seismic design inputs, including verification of earthquake time histories against design response spectra enveloping criteria and target power spectral density function, and the development of the design response spectra and associated site class for non-safety-related SSCs. The NRC staff gained an understanding of the structural/seismic analysis and design information described in the PSAR. These discussions resulted in updates to PSAR sections and tables including, section 3.7.6.1, table 3.7-3, section 6.4.1.2.1, and table 6.4.1-2.

- **Structural Integrity of Metallic Materials**

  The NRC staff discussed the structural integrity evaluation method for metallic components with LME and requested supporting information on the codes and standards selection and supplementation, as well as environmental compatibility assessment. These engagements resulted in revisions to PSAR section 3.8.

- **Structural Materials**

  The NRC staff discussed the SR and NSRST structural materials with LME and requested supporting information on the material, environment, selected codes and standards, code supplementation, and special treatments. These engagements resulted in revisions to PSAR Chapters 6 and 7.

- **Emergency Planning Zone (EPZ)**

  The NRC staff discussed LME's implementation of the plume exposure pathway (PEP) emergency planning zone sizing (EPZ) methodology. The audit focused on LME's implementation of the methodology used to establish the site-specific PEP EPZ size for the LMGS site. These engagements resulted in revisions to Part VI-A of LME's CP application (X-energy, LLC, "Xe-100 Technical Report, Preliminary Plume Exposure Pathway Emergency Planning Zone Analysis," Revision 4).

- **Mechanistic Source Term (MST)**

  The NRC staff discussed multiple aspects of the MST, including pebble inventory, steady-state inventories, accident source terms, atmospheric dispersion, and temperature and thermal hydraulics. The outcome of the audit discussions allowed the NRC staff to understand the use of the XSTERM computer code to develop MSTs for use in consequence analysis.

- **Inherent Reactivity Feedback**

  The NRC staff discussed inherent reactivity feedback with LME. Inherent reactivity is one of the two independent means of controlling reactivity for Xe-100 design. As described in the PSAR, the second means to meet diversity and independence from inherent reactivity feedback, is provided by the control rods and the design is covered under PDC-RFDC 26 and PDC-CDC 26. The scope and intent of MHTGR-DC 26 of RG 1.232 is collectively addressed by PDC 11 and PDC 26 for the Xe-100 design.

  During audit, the NRC staff discussed with LME that the language of PDC-CDC 26 in the CP application was not clear and that the words independent and diverse from the required functional design criteria seemed to be pointing to PDC-RFDC 26. Based on the audit discussions, LME updated PDC-CDC 26 to clarify its applicability as one of the two independent and diverse means to control reactivity, i.e., moveable poisons, and clarified that independence and diversity discussed in PDC-CDC 26 is from inherent reactivity discussed in PDC-RFDC 11. With the change, the scope and intent of MHTGR-DC 26, as applicable to Xe-100, is collectively addressed by PDC 11 and PDC 26.

  In addition to the PDC aspects of inherent reactivity feedback, the NRC staff discussed with LME the challenges of using inherent reactivity feedback as a shutdown mechanism, which requires higher temperatures to be effective and could be seen as conflicting with the fundamental safety function of controlling heat removal. Discussions centered around the transient analysis demonstrating that fuel temperature limits are not exceeded, with consideration for the full range of initial conditions. LME added commitments related to the transient analysis in PSAR section 3.1.7 based on these audit discussions.

- **Spent Fuel Storage**

  The NRC staff discussed spent fuel storage with respect to cooling and reactivity control functions with LME. The NRC staff found that these functions relied heavily on the

control of fuel storage geometry provided by the pebble storage canisters and the storage racks supporting the canisters within the storage building. This discussion resulted in identification of applicable PDCs and the application of additional special treatments to the canisters and storage racks to ensure geometry is maintained and to ensure excessive challenges to the contained fuel pebbles are prevented, which are described in PSAR sections 3.7 and 7.3.1.3.

- **Reactor Cavity Cooling System (RCCS)**

  The NRC staff discussed LME's plans to address design aspects for the RCCS and to complete the development of the RCCS evaluation model. The audit discussion focused on the planned integral effects testing program, scaling methodology, and evaluation of the applicability of the RCCS model. These engagements resulted in revisions to PSAR section 6.4.11.

- **Reliability and Integrity Management (RIM)**

  The NRC staff discussed LME's reliability and integrity (RIM) program, focusing on the areas of program scope and degradation mechanism assessments. These engagements resulted in revisions to PSAR section 8.2.

- **Probabilistic Risk Assessment (PRA)**

  The NRC staff discussed LME's development and use of PRA to develop the preliminary LMGS licensing basis following the licensing modernization project (LMP) approach and application of specific risk insights to the LMGS design. The NRC staff also discussed LME's application of the technical elements in the American Society of Mechanical Engineers (ASME) and American Nuclear Society (ANS) RA-S-1.4-2021 non-light water reactor PRA standard, the application of appendix A of RG 1.253, and the results of the LME self-assessment to assess whether the PRA in use at the CP stage was developed using generally accepted methods and reflects an appropriate level of technical rigor to support the LMP-related activities.

- **Licensing Modernization Project (LMP) Implementation**

  The NRC staff discussed LME's implementation of the LMP methodology. The audit focused on LME's implementation of licensing basis event (LBE) categorization and safety classification of structures, systems, and components (SSCs) and confirming consistency with NEI 18-04 and the clarifications in RG 1.233 in these areas. Some inconsistencies between LMP and LME's implementation of LMP were identified through the audit discussions. LME made updates to their LMP implementing processes and PSAR sections 3.2 and 5.1 based on these audit discussions. The NRC staff also issued RCI-1, which LME responded to with confirmation of process changes and preliminary results.

- **Fuel and Transition from Non-Fueled to Steady-State Core**

  The NRC staff discussed with LME the various pebble types used in the Xe-100 reactor design, including startup fuel-free pebbles, low-enriched uranium pebbles, and high-assay low-enriched uranium pebbles and the process LME plans to use to transition

from SFFPs to the steady-state core which contains HUPs at various stages of burnup. The discussion included aspects such as methods for loading pebbles and transitioning between pebble types, the potential placement of the startup source or sources relative to the neutron flux detectors, and the points at which LME plans to perform measurements of the inherent reactivity feedback, shutdown margin, and other key core physics parameters to ensure they are within the scope of their safety analysis. LME updated sections 1.1.4.1, 3.1.6, and 6.4.2 of the PSAR based on these audit discussions.

As a result of the audit discussions, LME docketed the following information to support NRC staff's review of the LMGS CP application:

Type	**Topic or Subject**	**Accession Number**
Revision 1 to the Long Mott Energy, LLC, Construction Permit Application for Long Mott Generating Station	Revised Construction Permit Application	ML26261A419
Confirmatory of Information Regarding Risk Significance for the Long Mott Generating Station Construction Permit Application		ML26239A157
Confirmatory of Information Regarding 95th Percentile Consequences for the Long Mott Generating Station Construction Permit Application		ML26260C204
Submittal of Letter from the Department of Energy to Long Mott Energy, LLC "Confirmation of Active and Good Faith Negotiations for Disposal Contract with Long Mott Energy, LLC for Project Long Mott, X-energy Xe-100 Reactors, to be located at Dow Chemical Company's Seadrift, Texas facility"		ML26275A165

6.0 DEVIATIONS FROM THE AUDIT PLAN

None.