



LONG MOTT GENERATING STATION (LMGS) PRELIMINARY SAFETY ANALYSIS REPORT CHAPTER 2 – SITE CHARACTERISTICS

FEBRUARY 12, 2025

Department of Energy Acknowledgement and Disclaimer

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Agenda:

- Opening Remarks/Key Messages
- Summary of Scope
- Site Introduction
- PSAR Chapter 2 “Site Characteristics”
 - Meteorology (Section 2.3)
 - Hydrology (Section 2.4)
 - Geology (Section 2.5)
- Closing Remarks

Objectives:

- Communicate the site-specific data, information, and analyses that will be provided in PSAR Chapter 2.3, 2.4, and 2.5
- Demonstrate that the content provided in PSAR Chapter 2.3, 2.4, and 2.5 supports an acceptable Construction Permit Application (CPA)

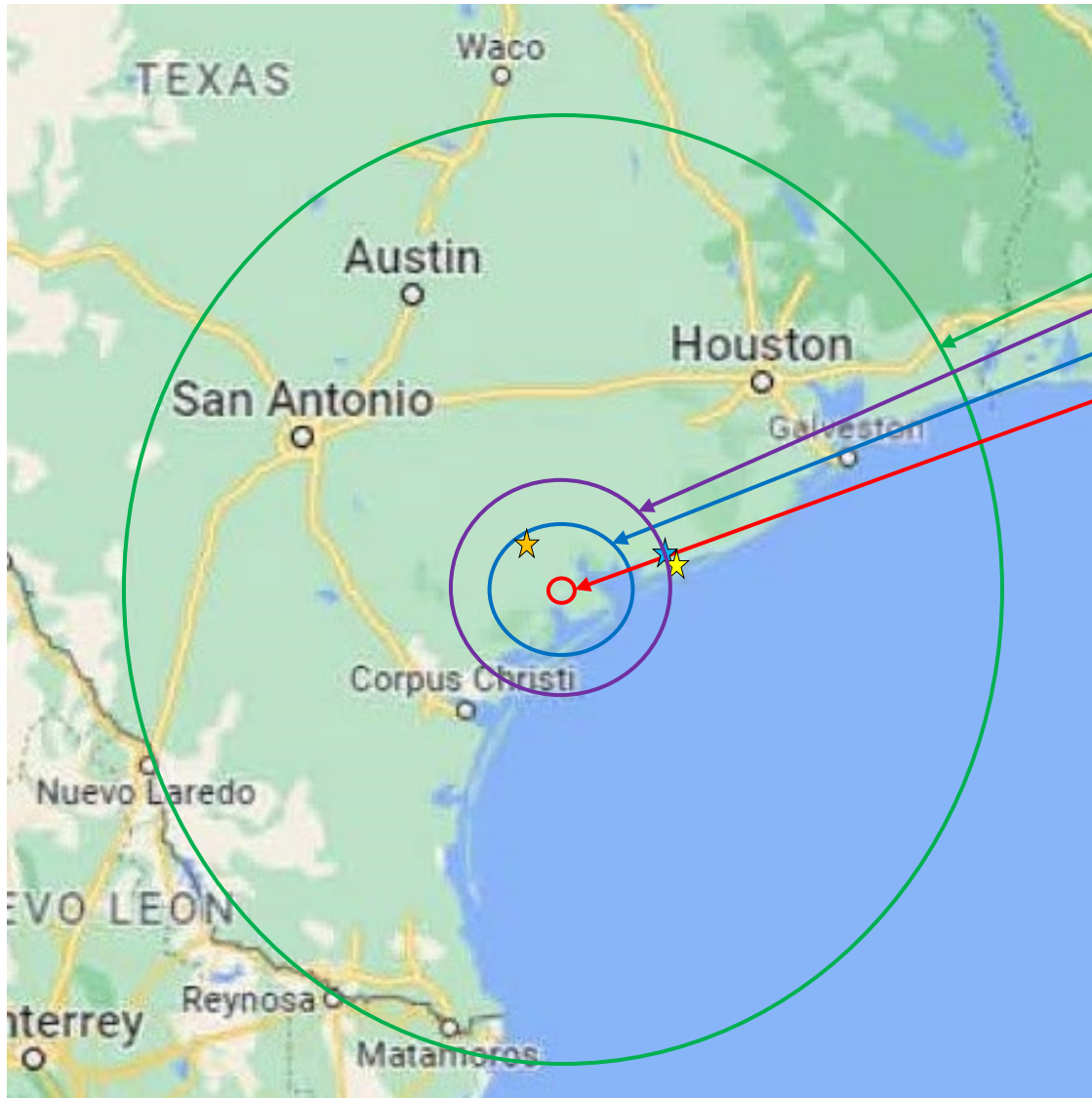
PSAR Ch. 2 Site Characteristics Summary and Key Takeaways

- LME has completed a representative assessment of site characteristics for the proposed LMGS site, including detailed siting field activities related to meteorology, hydrology, and geosciences needed to prepare PSAR Chapter 2
- Site-specific characteristics and hazard levels were incorporated into the siting assessment to provide confidence that the facility will be both protected against external hazards and ensure any radiological consequences are below NRC regulatory limits. The hazard levels provided in the upcoming CPA submittal are used to inform design decisions
- While significant site-specific and regional data have been collected and incorporated, additional data collection, sample analyses, and confirmatory modeling will be provided to confirm or augment information presented in the PSAR Chapter 2 CPA submittal
- Overall, when considering the overall safety profile of the facility, external hazards and site characteristics do not pose any unique safety concerns
- Although not expected, if findings provided in the supplement conflict with conclusions provided in the CPA, then appropriate revisions will be made to all associated PSAR sections to include any necessary design changes

- ❑ Section 2.3 Meteorology
- ❑ Section 2.4 Hydrology
- ❑ Section 2.5 Geology

- Content is driven by:
 - ✓ 10 CFR 20, 10 CFR 100, and 10 CFR 50
 - ✓ NUREG-0800, Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants
 - ✓ DANU-ISG-2022-02, ARCAP, Advanced Reactor Content of Application Project, Chapter 2, “Site Information”

Site Location and Nearby Sites of Interest



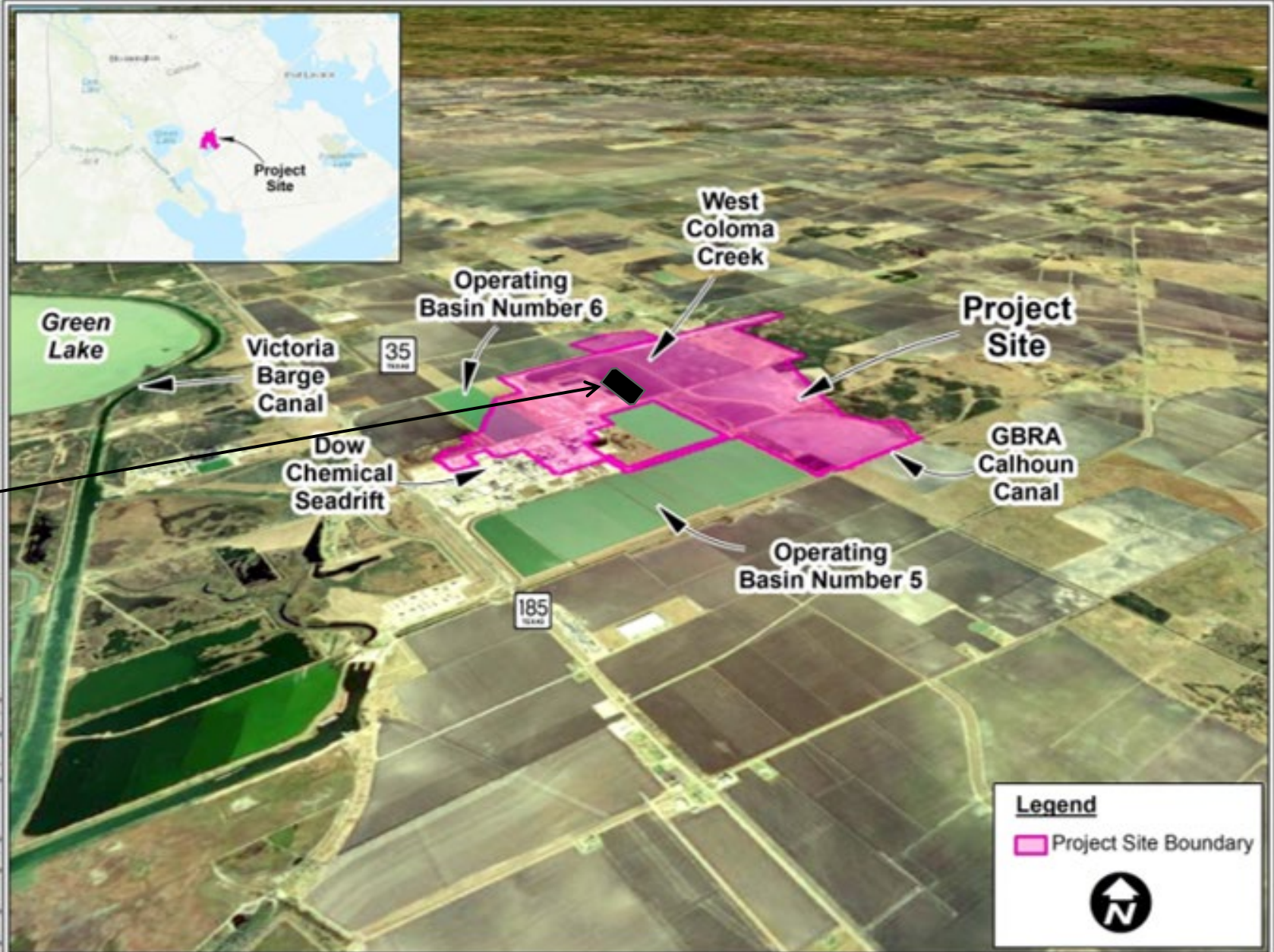
- **Region** (radius of 200 miles)
 - **45 Mile Radius**
 - **Vicinity** (radius of 25 miles)
 - **Area** (radius of 5 miles)
- Victoria County Station (VCS)**
 - South Texas Project (STP)**
 - Matagorda (MAT)**
 - Long Mott Generating Station (LMGS)**

Facility	Approximate Distance from LMGS – Miles (kilometers)
MAT	49 (78)
STP	48 (77)
VCS	17 (27)

Project Area: 1,537 acres
(in pink)

Includes:

- Potential laydown and construction areas
- LMGs location
- Electrical and pipe corridors, which are within the project area



Prior Regulatory Engagements: Use of Meteorological Data for Project Long Mott [ML24017A254, ML24017A255]

Meteorology Approach:

- Meteorological data was obtained from the following sources for the CPA:
 - Cooperative (COOP) weather monitoring stations
 - Automated Surface Observing Stations (ASOS)
 - Local Climatological data (LCD) summaries from the National Centers for Environmental Information (NCEI)
 - American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc. (ASHRAE)
 - American Society of Civil Engineers/Structural Engineering Institute (ASCE/SEI)
 - U.S. Department of Commerce (DOC) 100-year return-interval two-day liquid equivalent precipitation for Texas
 - NCEI online storm events database
 - U.S. EPA air quality summaries and monitor data for Calhoun County, TX
 - Data from South Texas Project (STP) Nuclear Generating Station (NGS), Victoria National Weather Service (NWS) Station (KVCT), Calhoun County-Port Lavaca Airport (KPKV), and Palacios-R.B. Trull Municipal Airport (KPSX)

Meteorology Approach (cont.):

- South Texas Project (STP):
 - Raw hourly meteorological data are not publicly available
 - Seasonal joint wind direction/speed/Pasquill stability joint frequency distributions (JFDs) are publicly available in effluent release reports provided to the NRC
 - Seasonal JFDs are compiled into annual JFDs for input into dose calculations requiring JFDs
- Victoria Regional Airport (KVCT):
 - Raw meteorological data are publicly available
 - Pasquill stability classes are estimated from hourly wind speed, cloud height, cloud cover, and time of day using the Turner method
 - The Turner method was developed in the mid-1960s. Analyses using the Turner method have been previously submitted to and accepted by the NRC
 - Resulting hourly data with Pasquill stability classifications can be used in short-term dose calculations requiring hourly input data

Meteorology Approach (cont.):

- The analysis included Calhoun County (location of LMGS site) and surrounding counties (Victoria, Refugio, Aransas, and Jackson)
- Meteorological data from the STP NGS Tower includes:
 - Measurements taken at 10 meters (m) (32.8 feet [ft.]) and 60 m (196.9 ft.) above ground level (AGL)
 - Measurements of wind speed, wind direction, temperature, relative humidity, air pressure, and precipitation
- Short and long term atmospheric and meteorological sections of the PSAR will use STP NGS Tower and Victoria NWS Station (KVCT) data
- Stability factors used in PSAR Chapter 3 for atmospheric dispersion are conservative. Site-specific meteorological data will be used to support FSAR Chapter 3 to quantify dispersion factors. Initial calculations suggest improvement by up to 10x.

Meteorology Approach (cont.):

- On-site meteorological tower data will not be available for CPA submittal
- LME plans to install a meteorological instrumentation on an existing tower in 2025 that meets the requirements of Regulatory Guide 1.23, Revision 1, March 2007 to be the primary source of meteorological data
- Two years of on-site data will be provided once collected and will be used to support site-specific analyses and to confirm that the publicly available meteorological data from STP, Victoria (KVCT), and Palacios (KPSX) adequately bound the on-site data
- The two years of on-site meteorological data will be the basis for the Operating License Application (OLA)

General Approach:

- CPA relies on regional data and set of groundwater data from the LMGS site and the Dow Seadrift plant that are available at the time of preparation
- CPA includes a full spectrum flooding analysis
- Over 60 monitoring wells installed at the site to support groundwater model development

Relevant Prior NRC Engagements:

- Xe-100 Preliminary Safety Analysis Report (PSAR) Chapter 2 “Site Characteristics” and Environmental Report [ML23325A240, ML23325A241, ML23325A242]
- X-energy, LLC – Project Long Mott Geotechnical and Groundwater Modeling Approach [ML24177A295, ML24177A296, ML24177A297, ML24177A298, ML24199A225, ML24199A226]

- Section 2.4.2 “Floods”
- Provided in the CPA:
 - This section identifies historical flooding and potential flooding mechanisms (both individual and combined flood-producing phenomena) for consideration in plant flood design bases. Discussion of local intense precipitation (LIP) is also included in this section
 - A conservative and bounding quantitative assessment is provided for LIP
 - LIP in the area surrounding the site is expected to have low impact on the site flooding hazard level due to proposed site grading
 - United States Geological Survey (USGS) and United States Army Corps of Engineers (USACE) historical flooding info is summarized
 - Drainage design for the site is currently under development. As such, site grading is not considered in the flooding analyses, but site grading activities will ultimately limit the impact of LIP at the site. Therefore, what is being submitted with the CPA is bounding. Conservatively, the site is considered flat in the CPA analysis
- Provided with the supplement:
 - The two-dimensional (2D) analysis will be refined to incorporate site grading in the CPA LIP model

- Section 2.4.3 “Probable Maximum Flood (PMF) on Streams and Rivers”
- Provided in the CPA:
 - Probable maximum precipitation (PMP) is developed from data available from the National Weather Services and other sources. PMP is used to develop probable flood flow at the site and assess overall watershed response to maximum flooding events.
 - Probable maximum flood (PMF) on Guadalupe River due to probable maximum precipitation (PMP) is performed as part of Victoria County Station (VCS) site analysis, which is publicly available and will be used as part of this section. Proper justification is provided on how the San Antonio River is an input to the combined PMF
- Provided with the supplement:
 - A stand-alone PMF analysis for Guadalupe River combined with coincident 500-year event from San Antonio will be provided to further confirm CPA submittal information
 - Results of preliminary stand-alone analyses show that the site is not flooded

- Section 2.4.4 “Potential Dam Failures”
- Provided in the CPA :
 - Dams located upstream of the site will be identified and the potential dynamic impact of dam breaks on the project site will be assessed
 - Dam failure of sites on Guadalupe River watershed are performed as part of Victoria County Station (VCS) site analysis and will be used here. There are 29 dams within Guadalupe watershed. VCS dam failure is presented in CPA, which considers failure of Canyon Dam and Coletto Creek Dam. These two dams combined are 85% of the entire reservoir volume of all 22 dams. VCS analysis is not based on JLD-ISG-2013-01.
 - There are 35 dams in San Antonio watershed, but they are not considered in the CPA submittal as the largest dam is only 8.5% of the volume of the largest dam in Guadalupe watershed
 - Dam failures affecting the Guadalupe River watershed are expected to have more of a flooding impact compared to the San Antonio River watershed
 - This subsection is expected to be bounding for CPA
- Provided with the supplement:
 - Supplemental analysis will be based on JLD-ISG-2013-01 (Guidance For Assessment of Flooding Hazards Due to Dam Failure) and both Guadalupe and San Antonio dams

- Section 2.4.5 “Probable Maximum Surge and Seiche Flooding”
- Provided in the CPA:
 - National Weather Service (NWS) 23 will be used to establish probable maximum hurricane (PMH) parameters, including track angles, landfall, forward speed, radius of maximum wind, etc., per NUREG/CR-7046, and RG 1.59, Revision 2
 - Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model from National Oceanic and Atmospheric Administration (NOAA) will be used to estimate storm surge at the site
 - CPA is based on SLOSH model results
- Provided with the supplement:
 - The ADvanced CIRCulation (ADCIRC) storm surge model will be used to further analyze PMH tracks that are screened out from SLOSH as highest. Simulating WAVes Nearshore (SWAN) model will then be combined with ADCIRC to establish waves for track that resulted in highest surge
 - Preliminary analysis showed that ADCIRC will result in lower storm surge. However, as it gets combined with waves and runup from the waves, ADCIRC+SWAN results might reach SLOSH levels. It is expected that the SLOSH results in the CPA are bounding values
 - Wave runup on the Shield Structure is not expected to have adverse impact on safety-significant SSCs

- Section 2.4.12 “Groundwater”
 - Provided in the CPA:
 - A bounding qualitative assessment will be performed and is expected to demonstrate that groundwater effects will have a negligible impact on Reactor Building (RB) structural integrity and a negligible impact on systems contained inside the RB required to maintain core geometry
 - A regional groundwater study identifying sources of groundwater and estimate potential availability and capacity to be used at the site. Data used to assist with the characterization of the site groundwater and evaluate the potential impact from the site to off-site groundwater use
 - A qualitative assessment based on existing groundwater data and supplemented with on-site aquifer data collected from strategically-placed monitoring and pumping test wells. Assessment components include: a literature review and field investigation, evaluation of hydraulic conductivity for select site aquifers using slug test methodology, and evaluation of aquifer transmissivity, storage coefficient and hydraulic conductivity characteristics, collected from aquifer pumping tests
 - A site-specific groundwater model developed to simulate site groundwater flow based on current subsurface hydrogeologic conditions which are not expected to be affected by surface construction. The model will include model geometry, layering, boundary conditions, and spatial distribution of hydraulic/hydrogeologic parameters, designed as a steady-state flow model representing long term average flow at the site. The model detail will be limited to the data available at the time of CPA submittal
 - Provided with the supplement:
 - The calculations and fate and transport model will be updated/revised to incorporate the final hydrogeologic investigation data and groundwater model
 - Information provided in the supplement will be used to validate the calculation results and modeling information presented in the CPA

- Section 2.4.13 “Accidental Releases of Radioactive Liquid Effluents in Ground and Surface Waters”
 - Provided in the CPA:
 - An accidental release study identifying: the nature of release and in-situ conditions (constituents, hydrogeologic data, groundwater model from 2.4.12), appropriate literature range of soils absorption coefficients for site soil types, and bounding conditions (constituent attenuation, velocities, transport parameters)
 - Accidental release calculations for vadose zone soil and groundwater fate and transport impacts, and a predictive model for transport and disposition of released radionuclides
 - Provided with the supplement:
 - The calculations and fate and transport model will be updated/revised to incorporate the final hydrogeologic investigation data and groundwater model
 - Information provided in the supplement will be used to validate the calculation results and modeling information presented in the CPA



2.4 Hydrology

PSAR Section	Section Title	CPA	Supplement Info
2.4.2	Floods	Effects of local intense precipitation or local probable maximum precipitation (FLO-2D model)	Local Intense Precipitation update and refined 2D quantitative analysis to consider site grading (Q3 2025 submittal)
2.4.3	Probable Maximum Flood on Streams and Rivers	PMF for Guadalupe River and Coloma Creek using regional studies, including available Victoria County Station (VCS) data	Additional scenarios to include detailed PMF analysis with postulated coincidental wind set up and wave runup (Q3 2025 submittal)
2.4.4	Potential Dam Failures	One scenario of cascading dam failure of major upstream dams on the Guadalupe River, based on early site permit application analysis for VCS, and site-specific breach of embankments of on-site operating basins are analyzed	Two to three additional dam failure scenarios with detailed dam failure analysis including wind setup and wave runup, and will incorporate guidelines in JLD-ISG-2013-01, Guidance for Assessment of Flooding Hazards Due to Dam Failure (Q3 2025 submittal)
2.4.5	Probable Maximum Surge and Seiche Flooding	Slosh model based on probable maximum hurricane in Gulf of Mexico	Refinement-level assessment of storm surge with additional modeling (ADCIRC and SWAN), to include wave setup and runup (Q3 2025 submittal)
2.4.12	Groundwater	A groundwater model based on site-specific data available at time of preparation	Additional site data and analysis to include 12 months of groundwater data to evaluate seasonal effects (additional CPT and slug test data) (Q3 2026 submittal)
2.4.13	Accidental Releases of Liquid Effluents to Ground and Surface Waters	A groundwater model based on site-specific data available at time of preparation	Additional site data and analysis to include 12 months of groundwater data to evaluate seasonal effects (additional CPT and slug test data) (Q3 2026 submittal)

General Approach:

- CPA relies on regional data and site-specific data from the LMGS site and the Dow Seadrift plant that are available at the time of preparation. CPA uses appropriate regional information, and site-specific information available at the time of CPA preparation.

Relevant Prior NRC Engagements:

- Xe-100 Preliminary Safety Analysis Report (PSAR) Chapter 2 “Site Characteristics” and Environmental Report [ML23325A240, ML23325A241, ML23325A242]
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2.5 Geology

- Section 2.5.1 “Basic Geologic and Seismic Information”
- Provided in the CPA:
 - Review of geologic history of the site region and site area based on regional data and publicly available site-specific data
- Provided with the supplement:
 - A review and interpretation of site-specific boring and geophysical data added to subsection 2.5.1.2

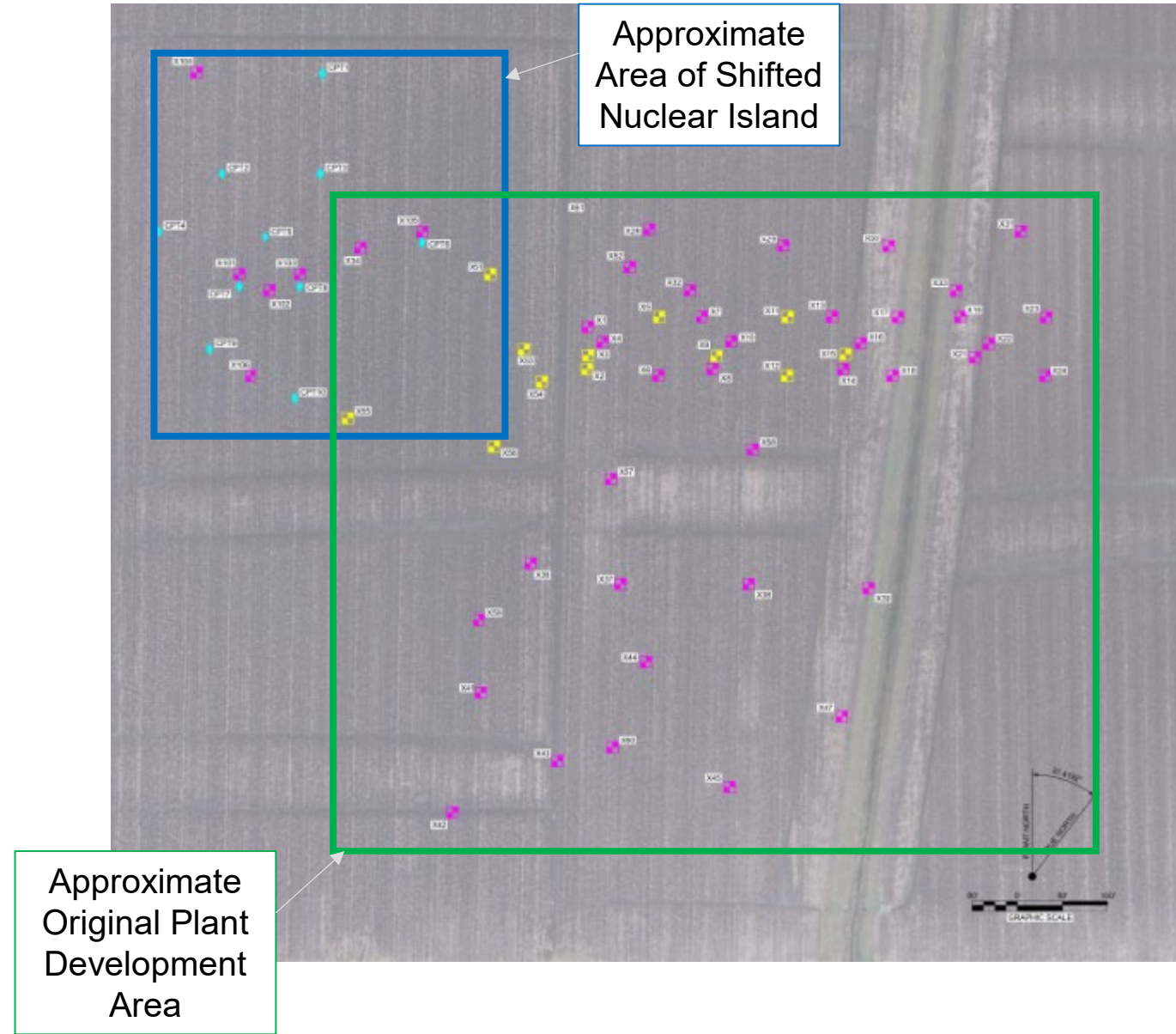
- Section 2.5.2 “Vibratory Ground Motion”
- Provided in the CPA:
 - Updated earthquake catalog (Subsection 2.5.2.1)
 - Updated seismic source characterization model (Subsection 2.5.2.2)
 - Evaluation of correlation between earthquake activity and seismic sources (Subsection 2.5.2.3)
 - Characterization of mean and uncertainty in site amplification based on results obtained for VCS and STP and adjustments from recent literature. (Subsection 2.5.2.5)
 - Probabilistic Seismic Hazard Analysis, controlling earthquake, and ground motion response spectra obtained using the updated seismic hazard model and approximate site amplification. (Subsections 2.5.2.4 and 2.5.2.6)
- Provided with the supplement:
 - Vibratory Ground Motion analysis (PSHA, controlling earthquakes, and GMRS) to use a site-specific characterization of site amplification and its uncertainties obtained using geotechnical and geophysical data collected at the LMGS site.
 - Supplement will replace Subsection 2.5.2 information provided with CPA submittal



- Section 2.5.3 “Surface Deformation”
- Provided in the CPA:
 - Analysis of publicly available regional data, site-specific data for evidence of surface deformation at the site and site conditions which could lead to surface deformation
- Provided with the supplement:
 - Information related to site-specific geology (review of boring data for tectonic/non-tectonic faulting) will be added to this subsection

Sections 2.5.4, Stability of Subsurface Materials and Foundations, and 2.5.5, Stability of Slopes Analysis:

- Completed over 15,000 linear ft of geotechnical borings, and over 2000 linear ft of CPT/SCPT soundings to determine site conditions
- Rely on data collected and available at the time of report preparation, as well as detailed geologic literature review, to develop PSAR Chapter 2.5.4 and 2.5.5 for the CPA
- Borings indicated by yellow icons were evaluated in CPA
- Soil borings, geophysical testing and laboratory testing were performed on soils within the footprint of safety-related structures, in accordance with RG 1.132, Appendix D, and meet spacing and depth requirements



- Section 2.5.4 “Stability of Subsurface Materials and Foundations”
- Provided in the CPA:
 - Analysis based on available on-site data obtained from borings located east of the Nuclear Island (NI)
 - Literature review
- Provided with the supplement:
 - Additional field and laboratory data collected from the site in the NI area and will include dynamic properties of the soil strata, foundation interface review, and evaluation of liquefaction potential
 - Geophysical survey data collected includes suspension P-S velocity logging, natural gamma logging, three-arm caliper, deviation survey, acoustical televiewer, seismic cone (CPT) down hole shear wave profiling, and Spectral Analysis of Surface Waves (SASW)
 - Supplement will revise/replace subsection 2.5.4 info provided with CPA submittal



- Section 2.5.5 “Stability of Slopes Analysis”
- Provided in the CPA:
 - Analysis based on available on-site data obtained from borings located east of the NI
 - Literature review
- Provided with the supplement:
 - Additional field and laboratory data collected from the site in the NI area
 - Supplement will revise/replace subsection 2.5.5 info provided with CPA submittal



2.5 Geology

PSAR Section	Section Title	CPA	Supplement Info
2.5.1	Basic Geologic and Seismic Information	Discussion on geologic and seismologic information based on review of published scientific literature and other peer-reviewed publications	Review of site-specific boring and geophysical data (Q3 2025 submittal)
2.5.2	Vibratory Ground Motion	Discussion of seismicity, geologic and tectonic characteristics of site region, correlation of earthquake activity with seismic sources, Probabilistic Seismic Hazard Analysis (PSHA), controlling earthquakes and ground motion response spectra (GMRS) obtained with a characterization of site amplification based on data collected at VCS and STP and on published models.	Vibratory Ground Motion analysis (PSHA, controlling earthquakes, and GMRS) to use a site-specific characterization of site amplification and its uncertainties obtained using geotechnical and geophysical data collected at the LMGS site. (Q3 2025 submittal)
2.5.3	Surface Deformation	Evaluation of potential for surface faulting and deformation at the site	Review of site-specific boring and geophysical data (Q3 2025 submittal)
2.5.4	Stability of Subsurface Materials and Foundations	Analysis based on available on-site data obtained from borings located east of the of the Nuclear Island	Additional field and laboratory data collected from the NI area and will include dynamic properties of the soil strata and foundation interface review (Q3 2025 submittal)
2.5.5	Stability of Slopes Analysis	Analysis based on available on-site data obtained from borings located east of the of the Nuclear Island	Additional field and laboratory data collected from the NI area (Q3 2025 submittal)

LME is confident that the approach described provides a **strong basis for the applicability of regional data as defined and supported by:**

- The quantity of completed borings and wells under Appendix B
- The proximity of the borings to the NI
- The general uniformity of the of the geologic setting and site soil profile at depth
- The known regional geological and seismological conditions



PSAR Ch. 2 Site Characteristics Summary and Key Takeaways

- LME has completed a representative assessment of site characteristics for the proposed LMGs site
- Site-specific characteristics and hazard levels were incorporated into the siting assessment to provide confidence that the facility will be both protected against external hazards and ensure any radiological consequences are below NRC regulatory limits.
- While significant site-specific and regional data have been collected and incorporated, additional data collection, sample analyses, and confirmatory modeling will be provided to confirm or augment information presented in the PSAR Chapter 2 CPA submittal
- Overall, when considering the overall safety profile of the facility, external hazards and site characteristics do not pose any unique safety concerns
 - Section 2.3, Meteorology: Stability factors used for atmospheric dispersion are conservative. Site-specific meteorological data will be used to support FSAR Chapter 3 to quantify dispersion factors. Initial calculations suggest improvement by up to 10x
 - Section 2.4, Hydrology: For storm surge, preliminary analysis using ADCIRC indicates that the SLOSH model results in the CPA are likely bounding values. Wave runup on the Shield Structure is not expected to have an adverse impact on safety-significant SSCs
 - Section 2.5, Geology: Discussion of seismicity and probabilistic seismic hazard for reference rock condition are well developed in CPA. GMRS and Peak Ground Acceleration (PGA) were obtained with a characterization of site amplification based on data collected at VCS, STP, and published models
- Although not expected, if findings provided in the supplement conflict with conclusions provided in the CPA, then appropriate revisions will be made to all associated PSAR sections to include any necessary design changes