

TerraPower, LLC 15800 Northup Way Bellevue, WA 98008



Natrium™ - A TerraPower & GE-Hitachi Technology

Draft Construction Permit and Preliminary Safety Analysis Report Table of Contents

TP-LIC-LET-0037

August 29, 2022

CPA Submittal Letter Enclosures:

- 1. General and Financial Information
- 2. Preliminary Safety Analysis Report
- 3. Environmental Report
- 4. Quality Assurance Program Description
- 5. Regulatory Exemptions
- 6. Fuel Qualification Prop
- 7. Fuel Qualification Non-Prop (Public)
- 8. Affidavit for withholding

Separate Submittal CPA submittal with SGI/SRI

- 1. Plan for security plan
- 2. Plan for cyber security plan
- 3. Plan for safeguards contingency plan

Table of Contents for the PSAR

- 1. General Plant and Site Description and Overview of the Safety Case
 - 1.1. Plant Description
 - 1.1.1. Reactor Supplier and Model
 - 1.1.2. Intended Use of the Reactor
 - 1.1.3. Overall Configuration
 - 1.1.4. Description of Plant Structures, Systems, and Components
 - 1.1.4.1. Reactor Systems and Components
 - 1.1.4.2. Secondary Systems and Components
 - 1.1.4.3. Significant Support Systems and Components
 - 1.1.4.4. Major Structures
 - 1.2. Site Description
 - 1.2.1. Site Characteristics and Site Parameters
 - 1.2.2. Geography and Demography
 - 1.2.2.1. Site Location and Description
 - 1.2.2.2. Exclusion Area Authority and Control
 - 1.2.2.3. Population Distribution
 - 1.2.3. Nearby Industrial, Transportation, and Military Facilities
 - 1.2.4. Regional Climatology, Local Meteorology, and Atmospheric Dispersion
 - 1.2.5. Hydrological Description

- 1.2.5.1. Floods
- 1.2.5.2. Flooding Protection
- 1.2.5.3. Groundwater
- 1.2.6. Geology, Seismology, and Geotechnical Engineering
 - 1.2.6.1. Geologic Hazards
 - 1.2.6.2. Vibratory Ground Motion
 - 1.2.6.3. Surface Deformation
 - 1.2.6.4. Stability of Subsurface Materials & Foundations
 - 1.2.6.5. Stability of Slopes
- 1.2.7. Volcanic Hazards
- 1.2.8. Summary of Design Basis External Hazards
- 1.3. Safety Case
 - 1.3.1. Safety Case Methodology
 - 1.3.2. Fundamental Safety Functions
 - 1.3.2.1. Retaining Radionuclides
 - 1.3.2.2. Controlling Heat Generation
 - 1.3.2.3. Controlling Heat Removal
 - 1.3.3. Defense-in-Depth
- 1.4. Conformance with Regulatory Criteria and Referenced Material
 - 1.4.1. Regulatory Guidance
 - 1.4.2. Generic Safety Issues, Unresolved Safety Issues, and Three Mile Island Action Items
 - 1.4.3. Referenced Topical and Technical Reports
- 2. Methodologies and Analyses
 - 2.1. Probabilistic Risk Assessment
 - 2.1.1. Overview of PRA
 - 2.1.2. Summary of PRA Results Essential to the LMP-Based Affirmative Safety Case
 - 2.2. Mechanistic Source Term
 - 2.3. DBA Analytical Methods
 - 2.4. Other Methodologies and Analyses
- 3. Licensing Basis Events
 - 3.1. Licensing Basis Event Selection Methodology
 - 3.2. LBE Summary

- 3.2.1. Summary Evaluation of AOOs, DBEs, and BDBEs
- 3.2.2. Summary Evaluation of DBAs
- 3.3. Anticipated Operational Occurrences
- 3.4. Design Basis Events
- 3.5. Beyond Design Basis Events
- 3.6. Design Basis Accidents
- 4. Integrated Evaluations
 - 4.1. Overall Plant Risk Performance Summary
 - 4.1.1. Exclusion Area Boundary Dose
 - 4.1.2. Exclusion Area Boundary Early Fatality Risk
 - 4.1.3. Latent Cancer Risk
 - 4.2. Defense-in-Depth
 - 4.2.1. Plant Capability Summary
 - 4.2.1.1. LBE Margin
 - 4.2.1.2. Layers of Defense Evaluation
 - 4.2.1.3. Single Feature Reliance
 - 4.2.1.4. Prevention-Mitigation Balance
 - 4.2.2. Programmatic DID Summary
 - 4.2.2.1. Evaluation of Significant Uncertainties
 - 4.2.2.2. Programs Required for SR SSC Performance Monitoring
 - 4.2.2.3. Programs Required for NSRST SSC Performance Monitoring
 - 4.2.3. Integrated DID Evaluation
- 5. Safety Functions, Design Criteria, and SSC Safety Classification
 - 5.1. Safety Classification of SSCs
 - 5.2. Required Safety Functions
 - 5.3. Required Functional Design Criteria and Principal Design Criteria
 - 5.4. Safety-Related SSCs
 - 5.5. Non-Safety-Related with Special Treatments SSCs
 - 5.5.1. NSRST SSCs Performing Risk-Significant Functions
 - 5.5.2. NSRST SSCs Performing Functions Necessary for Adequate DID
 - 5.6. Principal Design Criteria Complementary Design Criteria
- 6. Safety-Significant SSC Criteria and Capabilities

- 6.1. Design Requirements of Safety-Related SSCs
 - 6.1.1. Design Basis Hazard Levels
 - 6.1.2. Summary of SRDC
 - 6.1.3. Summary of DBHL-Related Requirements for Non-Safety-Related SSCs
- 6.2. Reliability and Capability Targets for SR SSCs
- 6.3. Special Treatment Requirements for SR SSCs
- 6.4. Reliability and Capability Targets for NSRST SSCs
- 6.5. Special Treatment Requirements for NSRST SSCs
- 7. Descriptions for Safety-Significant SSCs
 - 7.1. Nuclear Heat Supply Systems
 - 7.1.1. Reactor Core and Core Components Systems
 - 7.1.2. Reactor Enclosure System
 - 7.1.3. Primary Heat Transport System
 - 7.1.4. Intermediate Heat Transport System
 - 7.1.5. Nuclear Island Salt System
 - 7.2. Reactor Auxiliary Systems
 - 7.2.1. Reactor Air Cooling
 - 7.2.2. Intermediate Air Cooling
 - 7.2.3. Sodium Cover Gas System
 - 7.2.3.1. Primary Cover Gas
 - 7.2.3.2. Sampling and Monitoring
 - 7.2.3.3. Intermediate Cover Gas
 - 7.2.4. Sodium Processing System
 - 7.2.5. Control Rod Drive System
 - 7.3. Fuel Handling Systems
 - 7.3.1. Water Pool Fuel Handling System
 - 7.3.2. Ex-Vessel Fuel Handling System
 - 7.3.3. In-Vessel Fuel Handling System
 - 7.4. Radwaste Systems
 - 7.4.1. Solid Radwaste Processing
 - 7.4.2. Liquid Radwaste Processing
 - 7.4.3. Gaseous Radwaste Processing

- 7.5. Ancillary Systems
 - 7.5.1. NI Cranes and Hoists
 - 7.5.2. NI HVAC Systems
 - 7.5.3. Air and Inert Gas Distribution System
 - 7.5.4. NI Fire Protection System
 - 7.5.5. NI Major Maintenance Equipment
- 7.6. Integrated Controls Systems
 - 7.6.1. Integrated Controls Systems Introduction
 - 7.6.2. NI Control System
 - 7.6.3. Reactor Protection System
 - 7.6.4. Nuclear Instrumentation System
 - 7.6.5. Reactor Instrumentation System
 - 7.6.6. Radiation Monitoring System
 - 7.6.7. Seismic Monitoring System
 - 7.6.8. NI Communication System
 - 7.6.9. NI Control Room
- 7.7. Electrical Systems
 - 7.7.1. NI Control Room Panels
 - 7.7.2. NI Auxiliary Electrical System
- 7.8. Buildings and Structures
 - 7.8.1. Reactor Building
 - 7.8.1.1. RES Supporting Subgrade Portion
 - 7.8.1.2. RAC Supporting Portion
 - 7.8.1.3. Above Grade Portion of Reactor Building
 - 7.8.2. Fuel Handling Building
 - 7.8.3. Reactor Auxiliary Building
 - 7.8.4. Nuclear Island Control Building
 - 7.8.5. Fuel Auxiliary Building
- 8. Plant Programs
 - 8.1. Maintenance Program
 - 8.2. Other Programs

- 8.3. Quality Assurance
- 9. Control of Routine Plant Radioactive Effluents, Plant Contamination, and Solid Waste
 - 9.1. Liquid and Gaseous Effluents
 - 9.2. Contamination Control
 - 9.3. Solid Waste
- 10. Control of Occupational Dose
 - 10.1. Assuring that Occupational Radiation Exposures Are ALARA
 - 10.2. Radiation Sources
 - 10.3. Radiation Protection Design Features
 - 10.4. Operational Radiation Protection Program
- 11. Organization and Human-System Considerations
 - 11.1. Organization
 - 11.2. Human Factors Engineering
- 12. Post-construction Inspection, Testing, and Analysis Program
- 13. Emergency Planning
- 14. Aircraft Impact Analysis
- 15. Research and Development
- 16. Technical Specifications