



NATrIUM

Infrastructure Reuse: Meteorological Tower & Water Supply

a TerraPower & GE-Hitachi technology

NATD-LIC-PRSNT-0016

SUBJECT TO DOE COOPERATIVE AGREEMENT NO. DE-NE0009054
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Objectives

- SodiumTM Reactor Overview
- Purpose & Need
- Site Selected: Naughton Parcel 19/20
- Potential Coal Plant Infrastructure Reuse
 - Meteorological Tower
 - Water Supply

Natrium Reactor Licensing Overview

- Regulatory Engagement Plan submitted 6/8/2021
- 10 CFR 50 licensing process will be followed
 - Construction Permit Application 8/2023
 - Operating License Application 3/2026
- Numerous pre-application interactions are planned to reduce regulatory uncertainty and facilitate the NRC's understanding of Natrium technology and its safety case
- The LMP (NEI 18-04), as endorsed by RG 1.233, will support this application

Natrium Reactor Licensing Overview

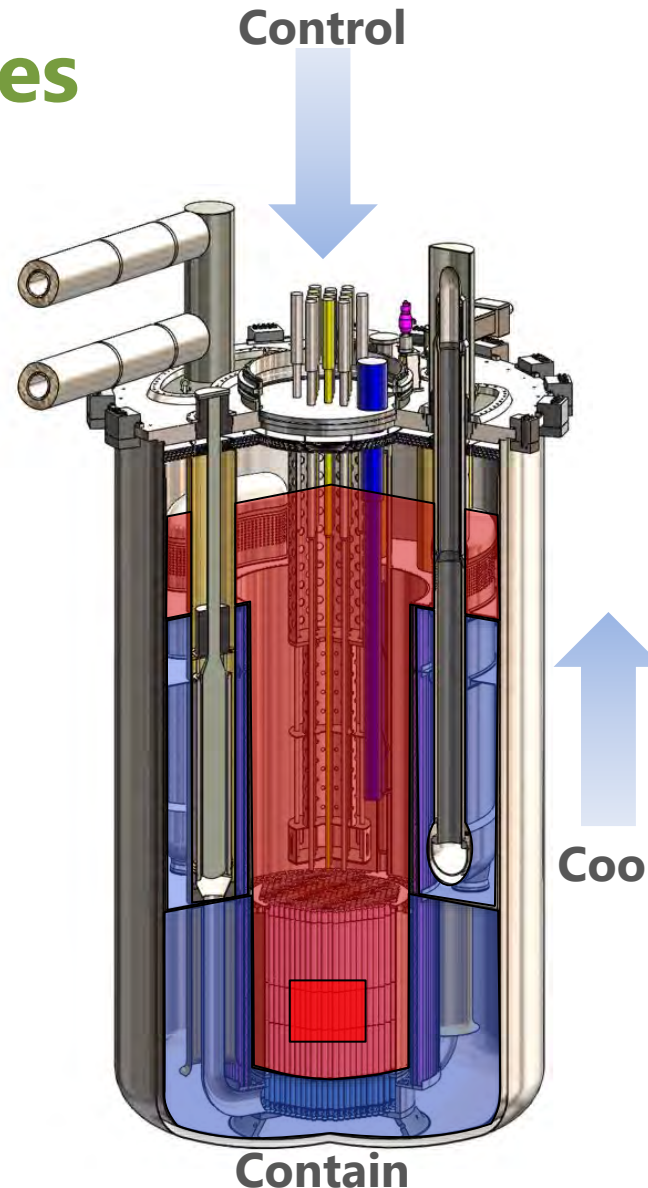
- Each pre-application interaction will build upon risk insights from prior interactions to demonstrate the Natrium reactor's safety case.
- Future Meetings and Presentations include:
 - Testing Plan and Methodology
 - Environmental Coordination with Cooperating Agencies
 - Applicability of Codes & Standards

Advanced Reactor Demonstration Program

- Demonstrate the ability to design, license, construct, startup and operate the Sodium reactor within the Congressionally mandated seven-year timeframe.
- Include improvements in safety, security, economics, and environmental impacts.
- Utilize a simple, robust, reliable, and proven safety profile.
- Lower emissions by initiating the deployment of a fleet of Sodium reactors – Demonstrate that the plants can be built economically and that they will be attractive for future owner/operators.

Sodium Safety Features

- Pool-type Metal Fuel SFR with Molten Salt Energy Island
 - Metallic fuel and sodium have high compatibility
 - No sodium-water reaction in steam generator
 - Large thermal inertia enables simplified response to abnormal events
- Simplified Response to Abnormal Events
 - Reliable reactor shutdown
 - Transition to coolant natural circulation
 - Indefinite passive emergency decay heat removal
 - Low pressure functional containment
 - No reliance on Energy Island for safety functions
- No Safety-Related Operator Actions or AC power
- Technology Based on U.S. SFR Experience
 - EBR-I, EBR-II, FFTF, and TREAT.
 - SFR inherent safety characteristics demonstrated through testing in EBR-II and FFTF



Control

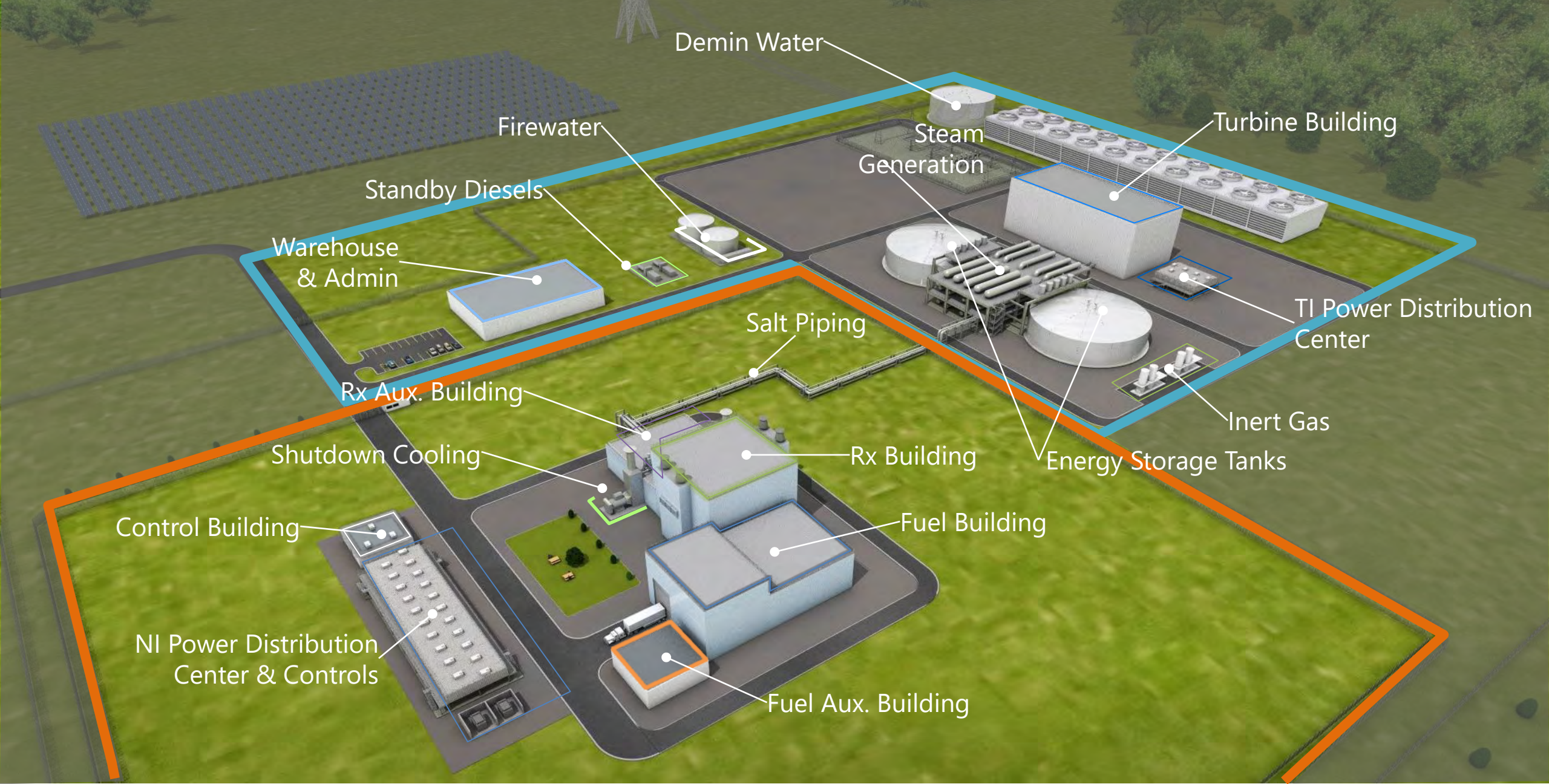
- Motor-driven control rod runback
- Gravity-driven control rod scram
- Inherently stable with increased power or temperature

Cool

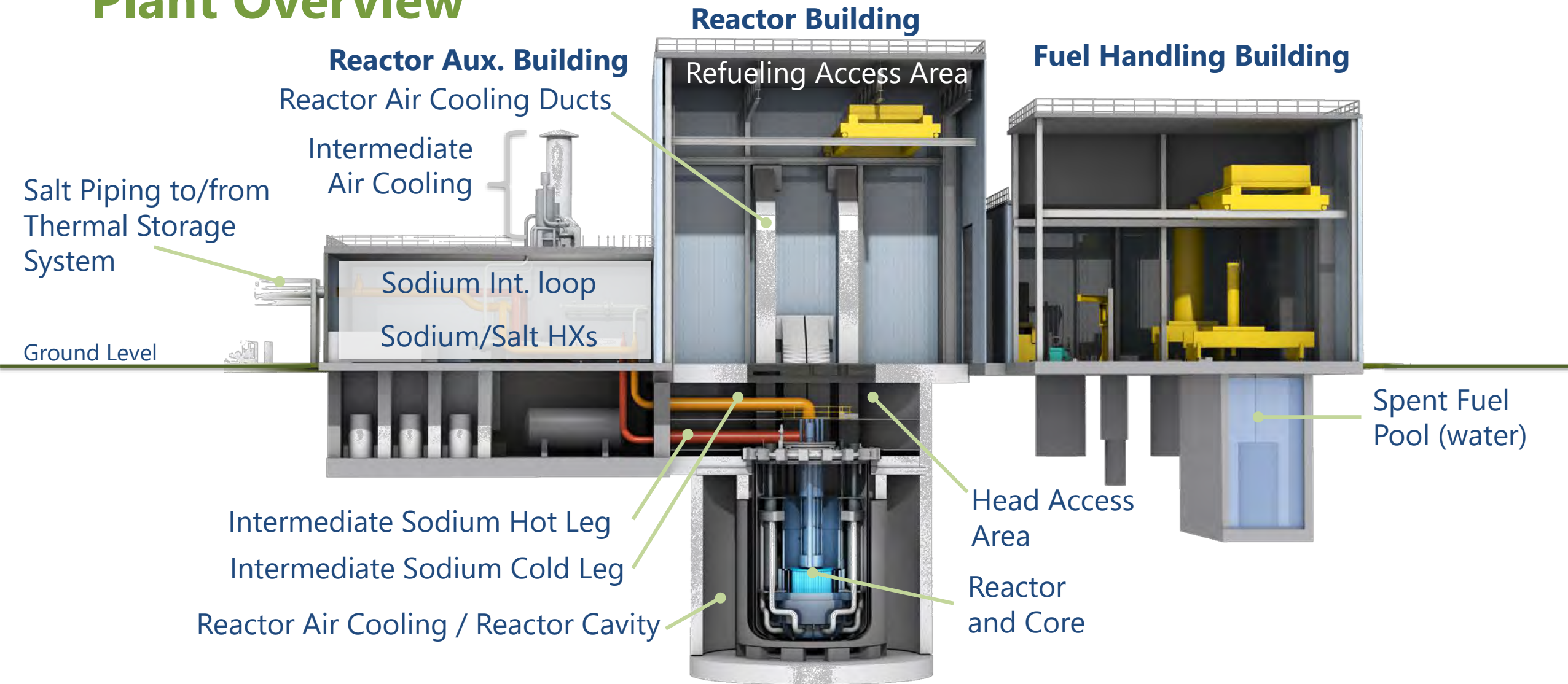
- In-vessel primary sodium heat transport (limited penetrations)
- Intermediate air cooling natural draft flow
- Reactor air cooling natural draft flow – always on

Contain

- Low primary and secondary pressure
- Sodium affinity for radionuclides
- Multiple radionuclides retention boundaries



Plant Overview



Purpose & Need Review

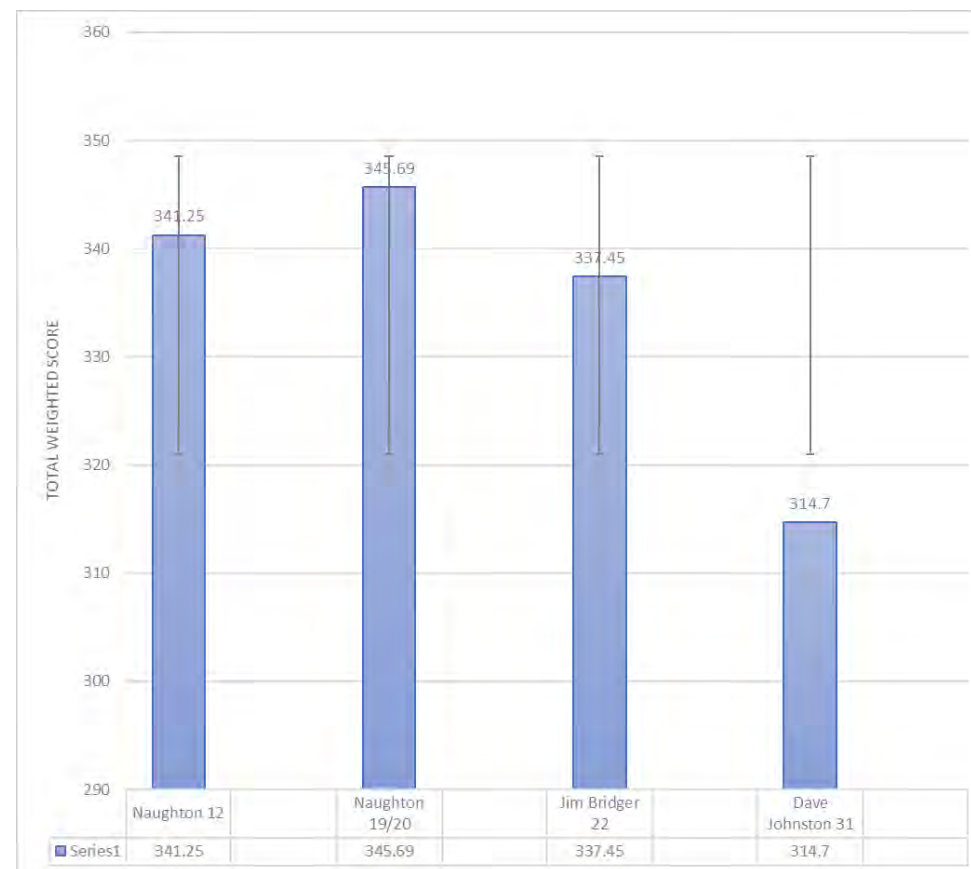
DRAFT Statement:

"The Purpose and Need of the proposed action is to demonstrate the Natrium advanced reactor while replacing electricity generation capacity in the PacifiCorp service area following planned retirement of existing coal-fired facilities, furthering the environmental goals of the United States Government for achieving a carbon net-zero or net-negative carbon emission goal by 2050, and providing operational flexibility through energy storage to complement regions with high penetration of renewables."

Site Selected: Naughton Parcel 19/20

TerraPower used a Four-Step Process presented September 2021

- The top three ranked sites, selected at the end of Step 3, as candidate sites moved forward included:
 1. Naughton Parcel 19/20
 2. Naughton Parcel 12
 3. Jim Bridger Parcel 22
- At completion of Step 4, the Naughton 19/20 site was identified as the Proposed Site, with the Naughton 12 and Jim Bridger 22 sites selected as the Alternative Sites.



Potential Coal Plant Infrastructure Reuse

The potential to reuse infrastructure, where feasible, was included as part of the site selection and reconnaissance site visits. Infrastructure considered for reuse during the reconnaissance visits, and as part of the site selection criteria, included:

- Meteorological Data/Tower
- Water Supply
- Transmission substations and corridors
- Building Structures
- Roads and Rail

Meteorological Data Collection & Tower

A few Regulatory Considerations [emphasis added]:

- 10 CFR 100.20(c)(2) **requires consideration of the meteorological characteristics** of the site that are necessary for safety analysis or that may have an impact upon plant design in determining the acceptability of a site for a nuclear power plant.
- In order for the Commission to fulfill its responsibilities under the National Environmental Policy Act of 1969, and in accordance with the requirements of Subpart A, "National Environmental Policy Act — Regulations Implementing Section 102(2)," of 10 CFR Part 51, "Environmental Protection Regulations for Domestic Licensing and Related Regulatory Functions," **basic meteorological information must be available for use in assessing (1) the environmental effects of radiological and non-radiological emissions and effluents resulting from the construction or operation of a nuclear power plant and (2) the benefits of design alternatives.**
- Per RG 1.23, "Meteorological Monitoring Programs for Nuclear Power Plants," the minimum amount of onsite meteorological data to be provided at the time of application (1) for a construction permit is a representative consecutive 12-month period; (2) for an operating license is a representative consecutive 24-month period, including the most recent 1-year period; and (3) for an early site permit or a combined license that does not reference an early site permit is a consecutive 24-month period of data that is defensible, representative and complete, but not older than 10 years from the date of the application. However, **3 or more years of data are preferable and, if available, should be submitted with the application.**

Meteorological Data Collection & Tower

TerraPower Meteorological Data/Tower Strategy for CPA Submittal:

- Provide 3 years of historical data from the Naughton Power Plant Meteorological Tower.
- Construct Data Validation Meteorological Tower at Naughton Parcel 19/20.
- Perform “PSAR Comparative Study”: Consists of collecting and comparing data sets for one year, from both meteorological towers to confirm representativeness.
- Post PSAR: Continue to collect data at both the Naughton Power Plant Meteorological Tower and the Data Validation Meteorological Tower at Naughton Parcel 19/20 to complete a full 3-year comparative study.

Existing Meteorological Tower

Location – East of Naughton Power Plant and approximately 3.5 mi northeast of proposed Natrium plant.

Instrumentation 10M Level and 50M Level

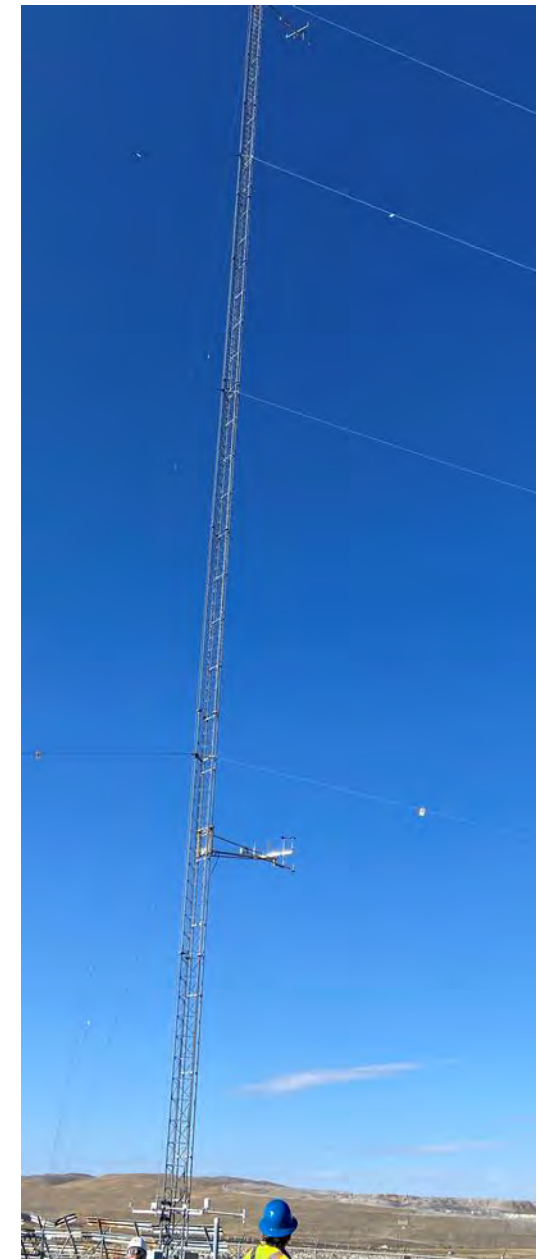
- Wind Speed and Direction and Vertical Wind Speed
- Temperature (also 2M Level)
- Relative Humidity (only 2M Level)
- Solar and Net Radiation (only 2M Level)

Instrumentation Ground Level

- Data Logger – CR3000
- Rain Gauge w/ wind shield
- Barometric Pressure
- All instrumentation meets or exceeds NRC requirements.

Data Review

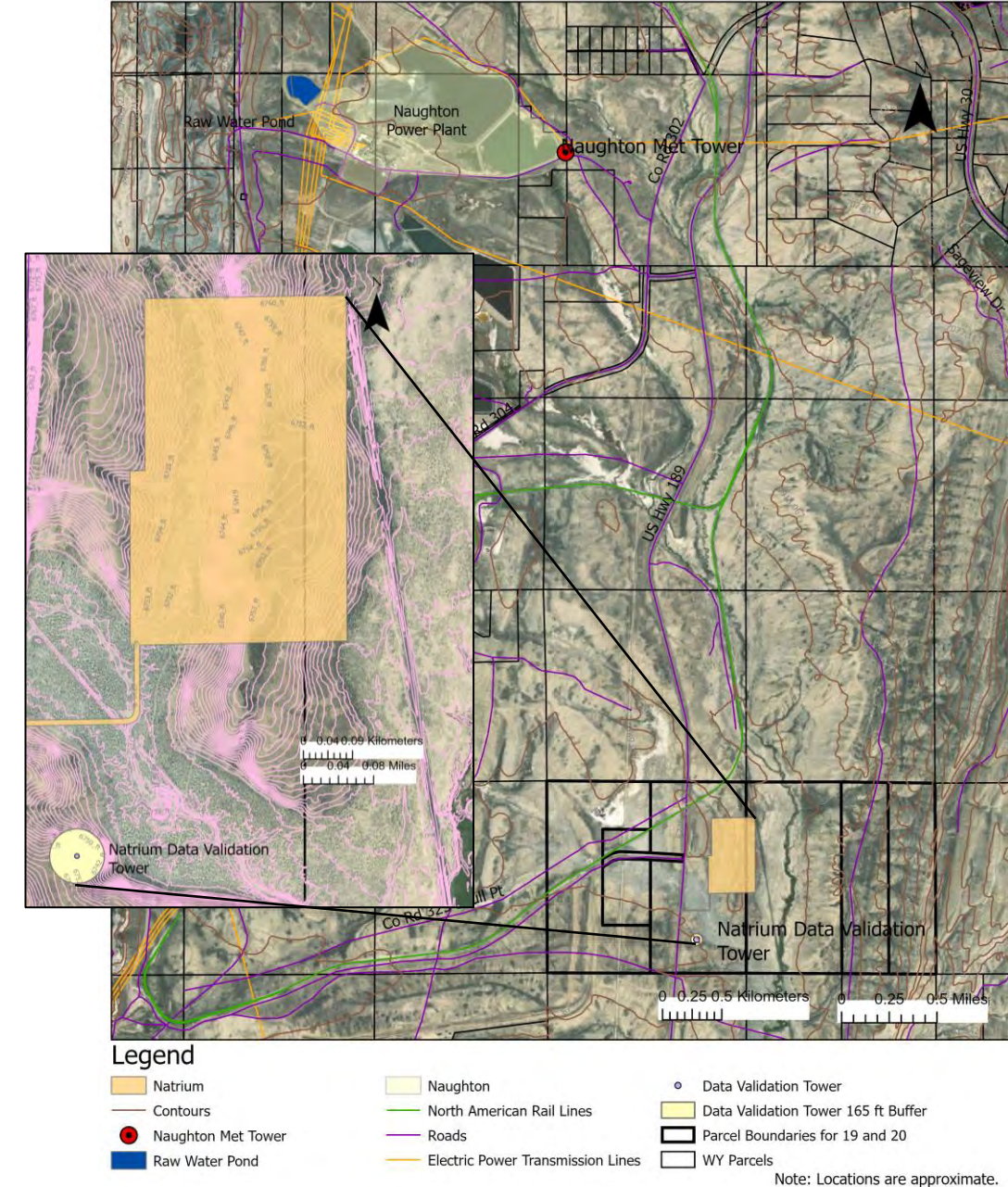
- NRC Program, NUREG-0917 used to identify issues with wind direction, speed, and other outliers.
- Comparison of data with surrounding weather service data.



Data Validation Meteorological Tower – Naughton Parcel 19/20

Tower Location:

- South of Natrium Plant site (Naughton Parcel 19/20), approximately 4 mi from Existing Naughton Power Plant Meteorological Tower.
- Flat terrain at same elevation as the plant (approximately 6750 feet).
- No buildings, hills, or trees that will impact flow near the Data Validation Meteorological Tower.
- Same flow region as the Naughton Power Plant Meteorological Tower.



Data Validation Meteorological Tower – Naughton Parcel 19/20

Data Collection:

- Remote Data Collection via Cellular Communications
- Daily Inspection of the Data for Problems – Tracked with a Log
- Monthly and Annual Data Summaries – Wind Rose Plots, Joint Frequencies Distributions
- Calibration of Met Instruments on Tower to NRC Standards – 6 Month Interval
- Assurance of >90% Data Recovery – RG 1.23

Instrumentation:

10m Level and 60m Level

- Wind Speed and Direction
- Temperature (Primary and Backup)
- Relative Humidity (only 10m Level)
- Delta Temperature at 60m-10m (Primary+Backup at 60m level only)

Ground Level

- Data Logger – CR1000
- Rain Gauge w/ wind shield



Water Supply and Usage

Current Water Requirements

- Naughton Power Plant is located in the Green River Basin planning area.
- PacifiCorp owns and operates Viva Naughton Reservoir, located approximately 10 mi northwest of Kemmerer, which serves as the primary supply for the Naughton Power Plant.
- Principal Water Rights for PacifiCorp (Naughton Power Plant) is approx. 14,500 acre-ft/year.
- The Naughton Power Plant raw water storage pond is designed to hold 88.6 acre-ft of water or about 3-4 days of water storage for the Naughton Units.
- The water usage for the 3 units currently at the Naughton Power Plant, at full plant capacity, is approximately 11,000 acre-ft per year.
- The Natrium plant's water usage is anticipated to be equal to or less than the two retiring coal units that the Natrium plant is replacing.

Raw Water Pond – Naughton Power Plant



Water Supply and Usage

Resource Area Delineation:

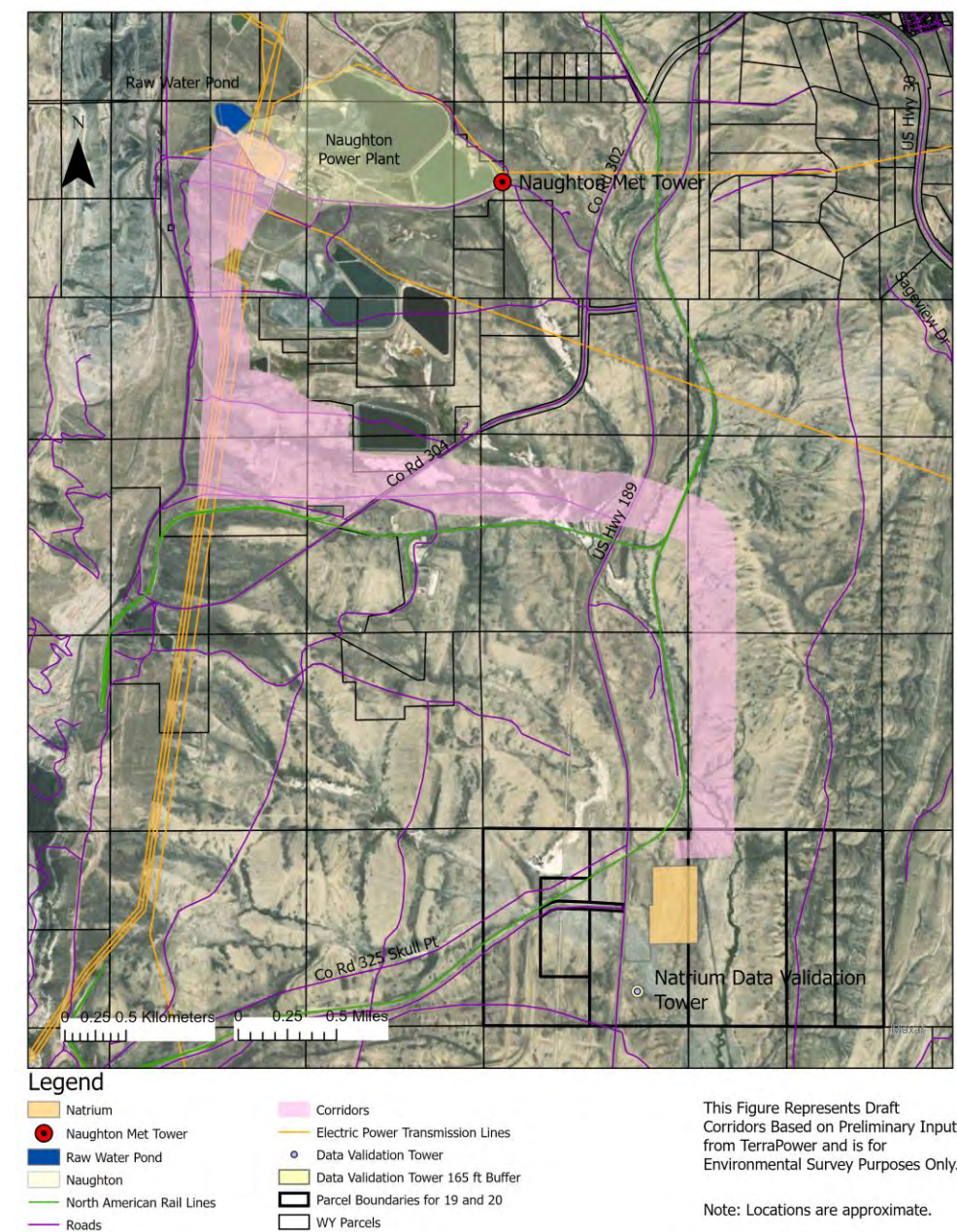
- RG 4.2: *"...the resource impact area may be defined as the station and the surrounding area out to a distance sufficient to encompass those water resources that may affect or be reasonably assumed to be affected by the building or operation of the station."*

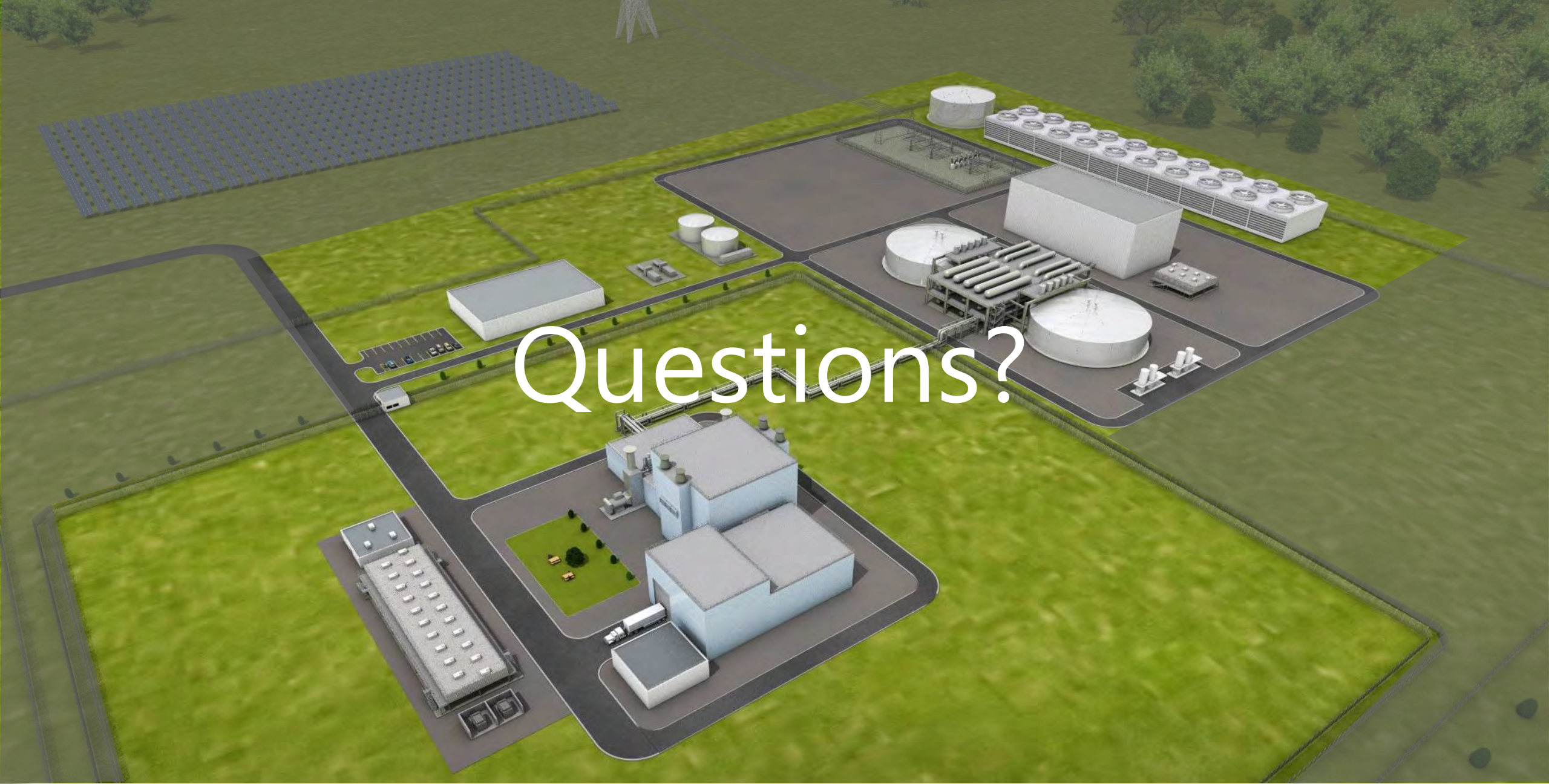
TerraPower Strategy for CPA submittal:

- Water withdrawn from current raw water pond at an amount equal to or less than two retiring coal units.
- No improvements are planned upstream of the Raw Water Pond.
- Resource area assumed to emanate from the Raw Water Pond and encompasses the water pipeline corridor to the Natrium site, Naughton Parcel 19/20.
- Resource area has been designated to capture any potential impacts from the construction or operation of the Natrium advanced reactor.

Environmental Survey Corridor to Naughton Parcel 19/20

- Corridor planned to co-locate the following:
 - Transmission
 - Water Supply
 - Potable water/sewer potential
- Planned Environmental Surveys
 - Cultural
 - Biological





Questions?

Acronym List

CFR – Code of Federal Regulations
CPA – Construction Permit Application
EBR – Experimental Breeder Reactor
FFTF – Fast Flux Test Facility
LMP – Licensing Modernization Project
NEI – Nuclear Energy Institute
NRC – U.S. Nuclear Regulatory Commission
NUREG – U.S. NRC technical report
PDC – Principal Design Criteria
PSAR – Preliminary Safety Analysis Report
RG – Regulatory Guide
RIPB – Risk-Informed, Performance-Based
SFR – Sodium Fast Reactor
TREAT – Transient Reactor Test