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NATRIUM

# Environmental Report: Socioeconomic Characteristics

a TerraPower & GE-Hitachi technology

TP-LIC-PRSNT-0018

*SUBJECT TO DOE COOPERATIVE AGREEMENT NO. DE-NE0009054*

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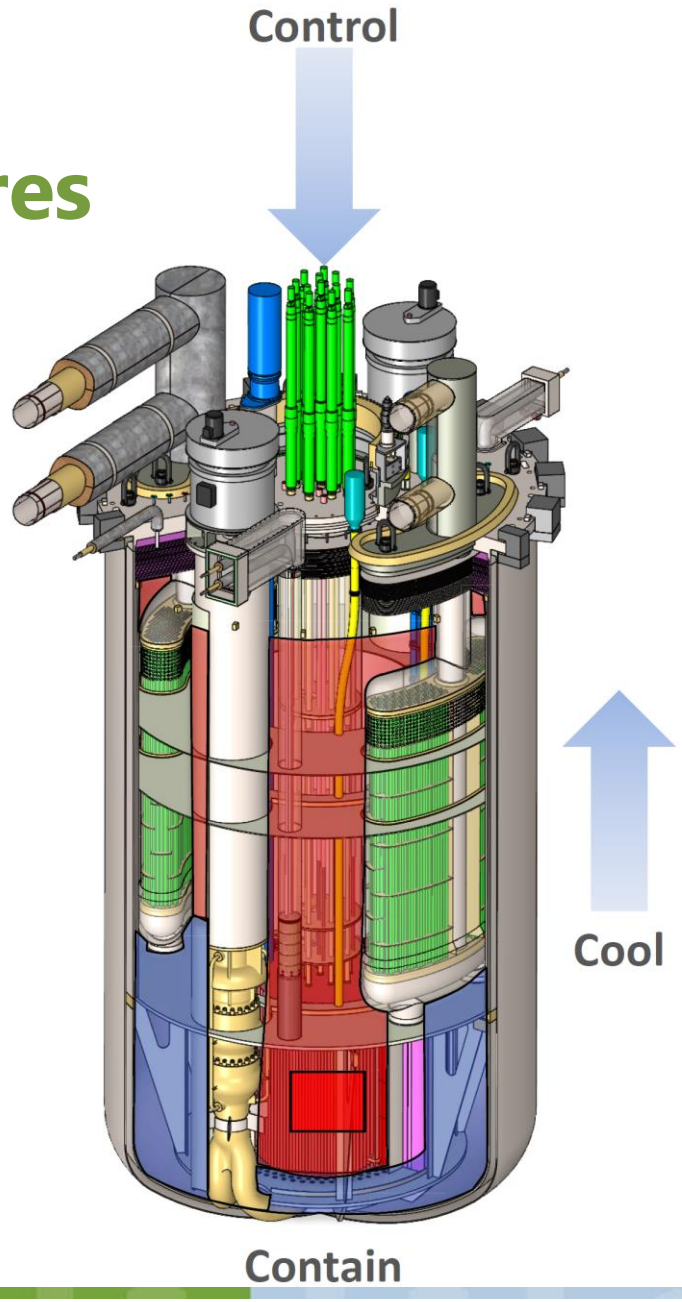
# Natrium Reactor Overview

- The Natrium project is demonstrating the ability to design, license, construct, startup and operate a Natrium reactor.

- Pre-application interactions are intended to reduce regulatory uncertainty and facilitate the NRC's understanding of the Natrium design and its safety case.

# Natrium 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, TREAT
  - SFR inherent safety characteristics demonstrated through testing in EBR-II and FFTF




## Control

- Motor-driven control rod runback and scram follow
- 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





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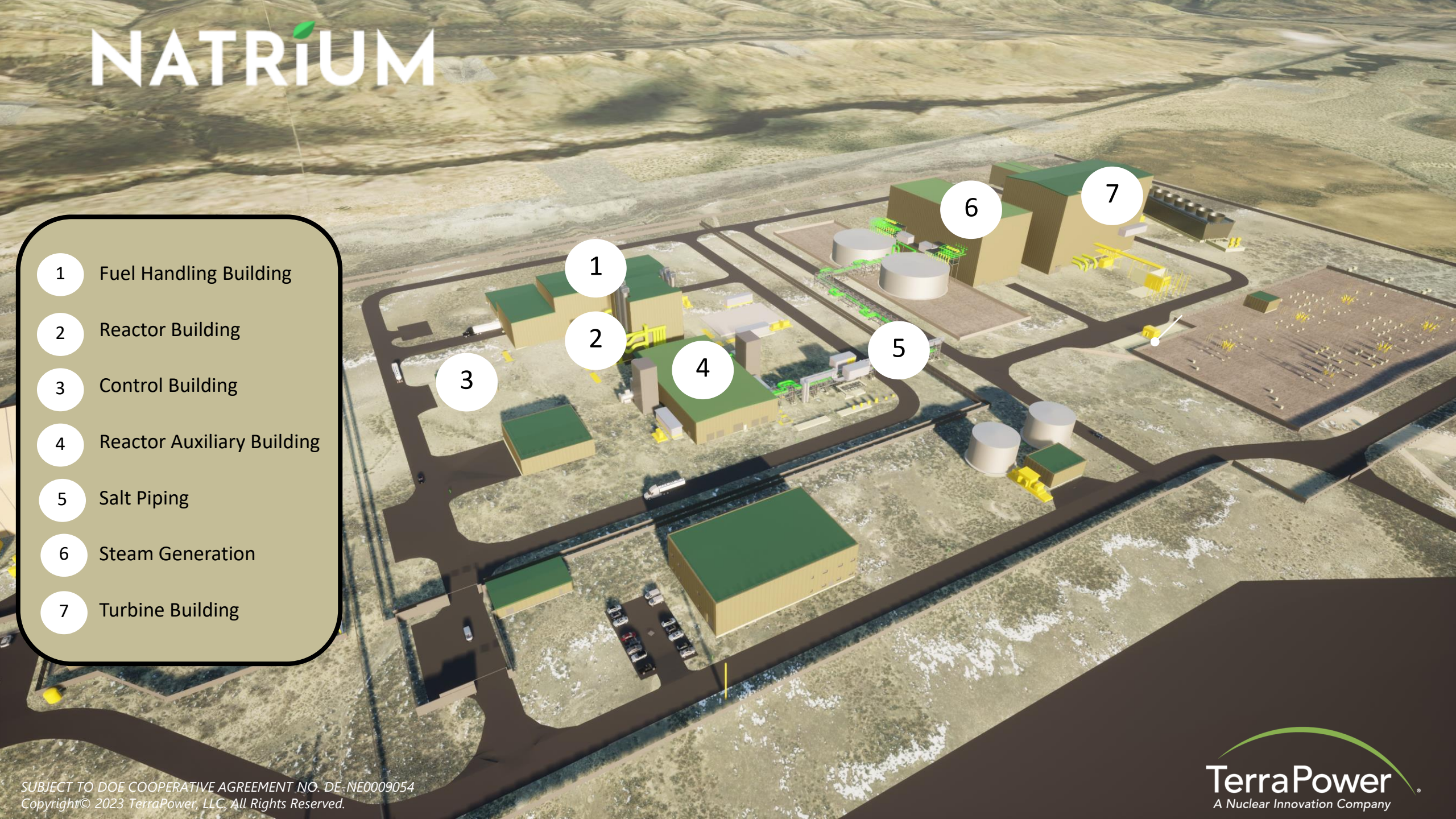


1. Fuel Handling Building
2. Reactor Building
3. Control Building
4. Reactor Auxiliary Building
5. Salt Piping
6. Steam Generation
7. Turbine Building



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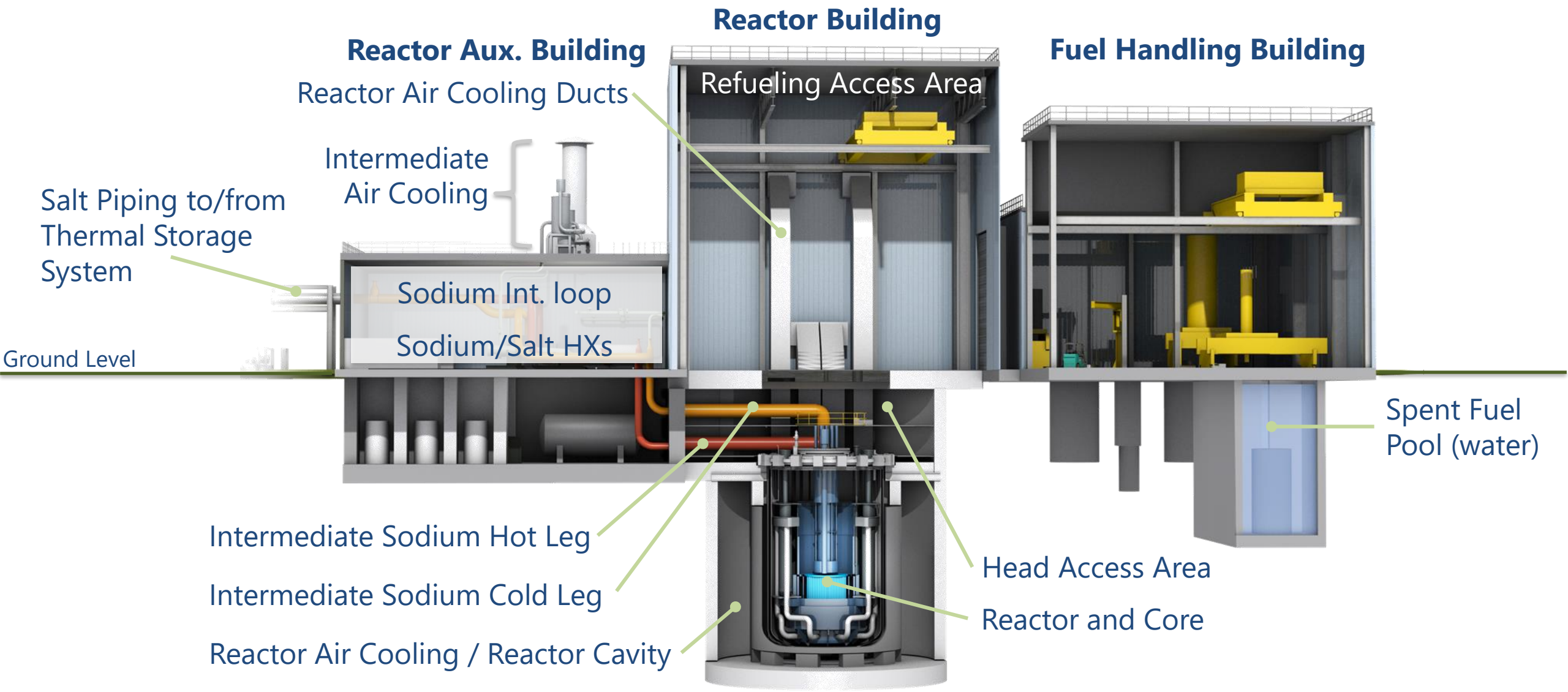






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# Project Vicinity and Region

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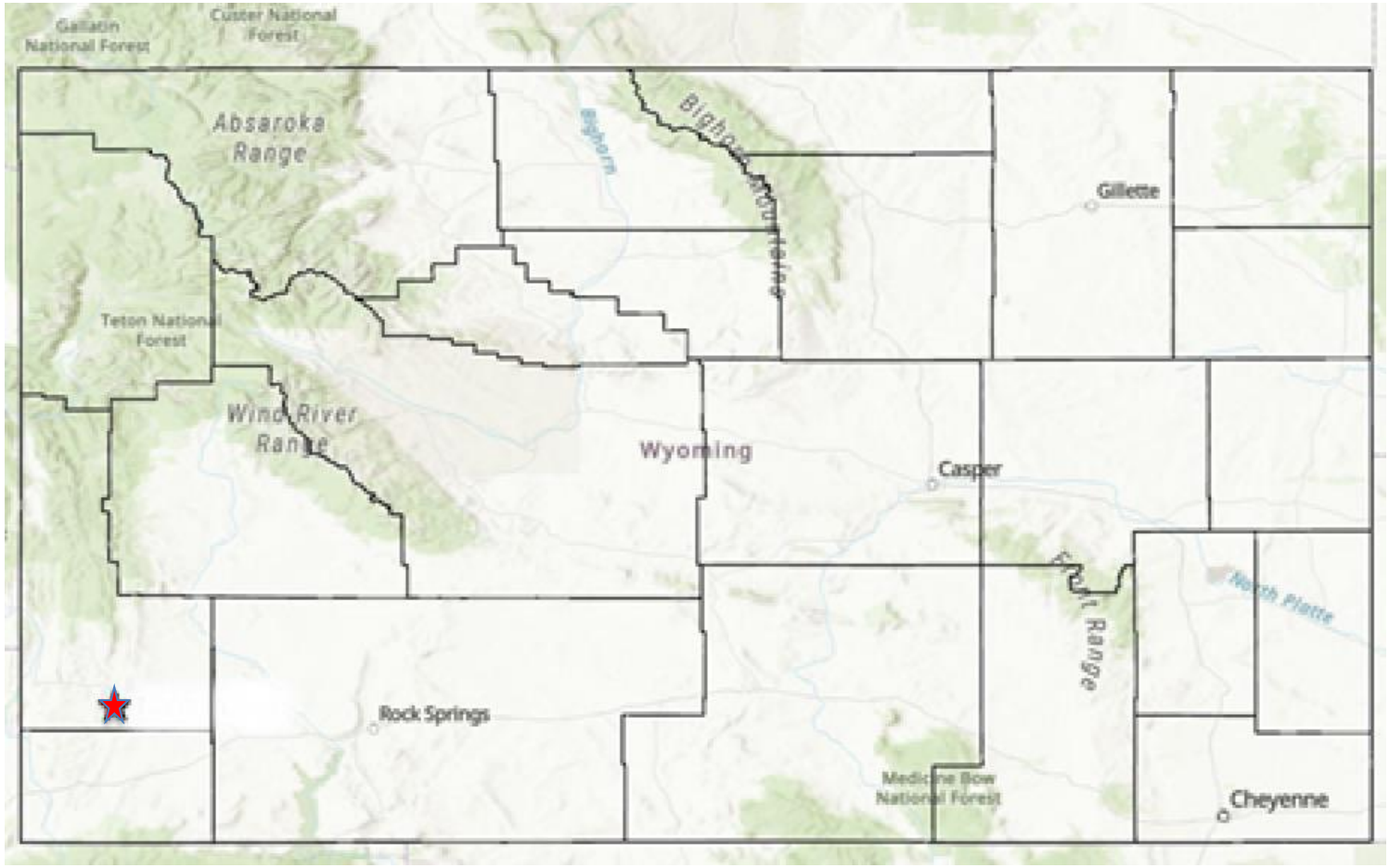
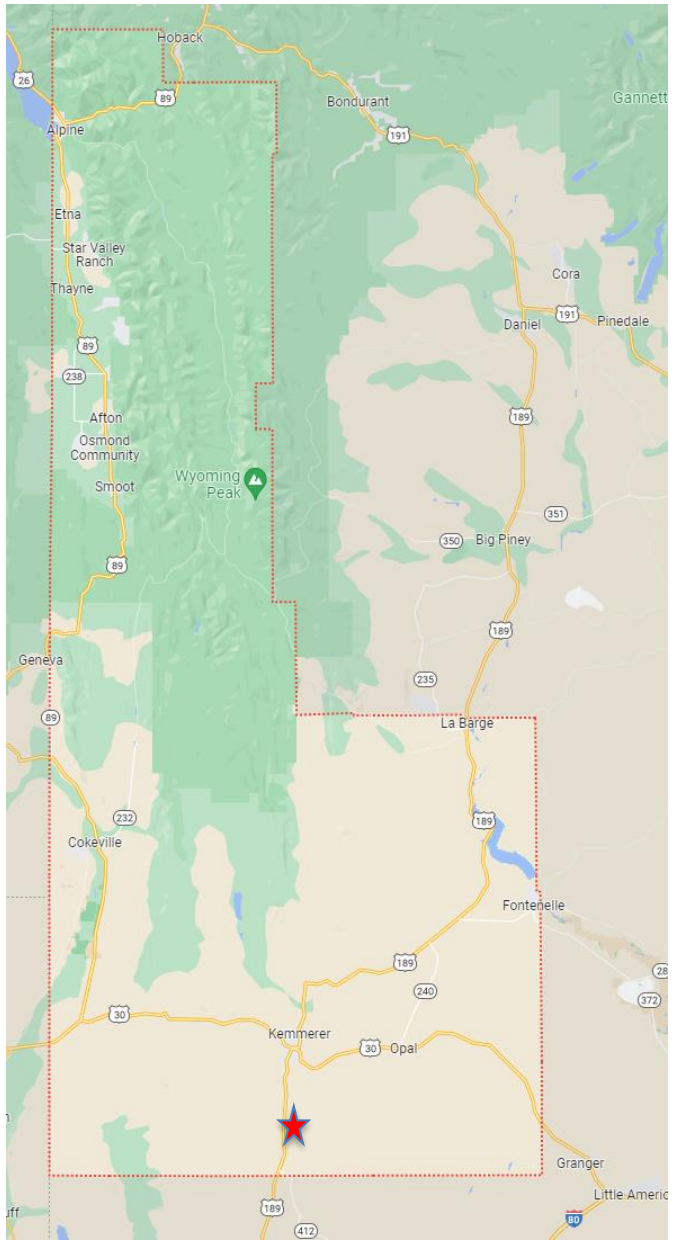



Source: Google Maps, modified

# Project Vicinity and Region

- Kemmerer Power Station Unit 1 (Kemmerer Unit 1) is located ~5 miles southwest of Kemmerer, in Lincoln County, WY

- PacifiCorp owns Naughton Power Plant, a three-unit electricity generating site totaling 700 MW nearby to the northwest
  - Naughton Units 1 and 2 coal to natural gas in 2026; retirement in 2036
  - Naughton Unit 3 natural gas; retirement in 2036

- Kemmerer Unit 1 will use existing water and electrical transmission infrastructure of Naughton Power Plant

# Regulations and Guidance

# Regulations and Guidance

- 10 CFR 51.45
- RG 4.2, Revision 3
- SRP NUREG-1555 (1999)
- NUREG-1437, Revision 2 (2023) – Draft GEIS for License Renewal of Nuclear Plants
- WYDEQ'S ISD permit regulations (WY statutes in Title 35, Chapter 12)
- ANSI/ANS-2.6-2018 (Reaffirmed 2023) –"Guidelines for Estimating Present & Projecting Future Population Distributions Surrounding Nuclear Facility Sites"
- NUREG-0800 – "Standard Review Plan for the Review of Safety Analysis Reports…"
- NRR Office Instruction No. LIC-203, Revision 4 – "Procedural Guidance for Preparing Categorical Exclusions, Environmental Assessments, and Considering Environmental Issues"
- COL/ESP-ISG-026, Attachment 2 - ISG for Socioeconomics and EJ Analysis

# Economic Region Determination

# Economic Region Determination: Considerations

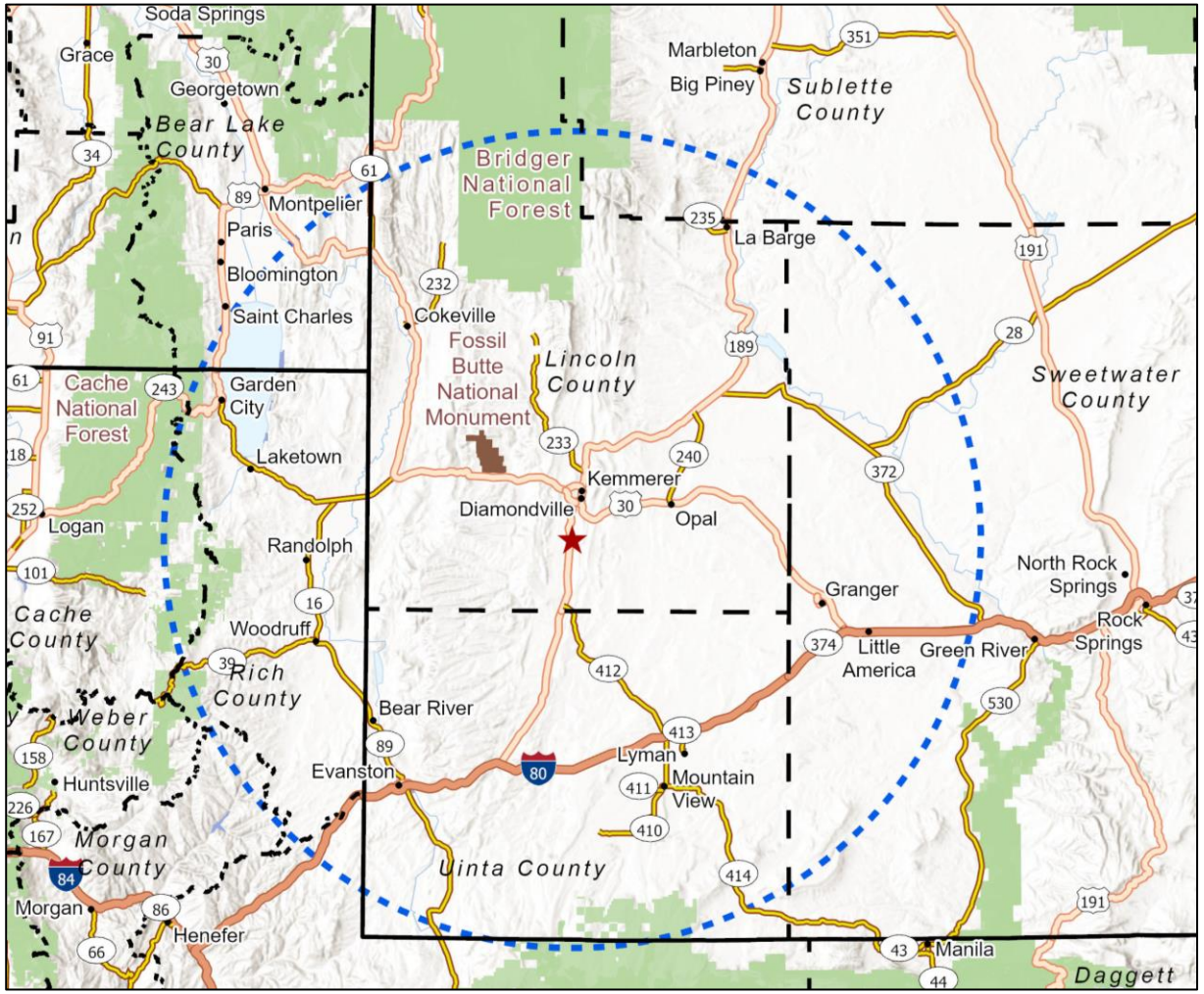
- Naughton Power Plant operations employee distribution:
  - 67% Lincoln County
  - 21% Uinta County
  - 4% Sweetwater County
- Kemmerer Unit 1 operations workforce distribution will follow distribution of Naughton Power Plant
- Kemmerer Unit 1 construction workforce distribution guided by housing availability in Lincoln, Uinta, and Sweetwater Counties
- WY has geographically large counties with small populations and low densities
- Three county economic region for construction includes Lincoln (partial), Uinta, and Sweetwater (partial) Counties. Operations economic region includes two counties, Lincoln and Uinta

# Economic Region Determination: 50-Mile Radius

**Largest Municipalities in Region**

| Municipality | USCB 2020 Population | Driving Distance |
|---|---|---|
| *Lincoln County* | | |
| Kemmerer/ Diamondville | 2,935 | 7 miles N |
| *Uinta County* | | |
| Evanston | 11,747 | 45 miles SSW |
| *Sweetwater County* | | |
| Green River* | 11,825 | 75 miles ESE |
| Rock Springs* | 23,526 | 92 miles ESE |

*Located outside of 50-mile region





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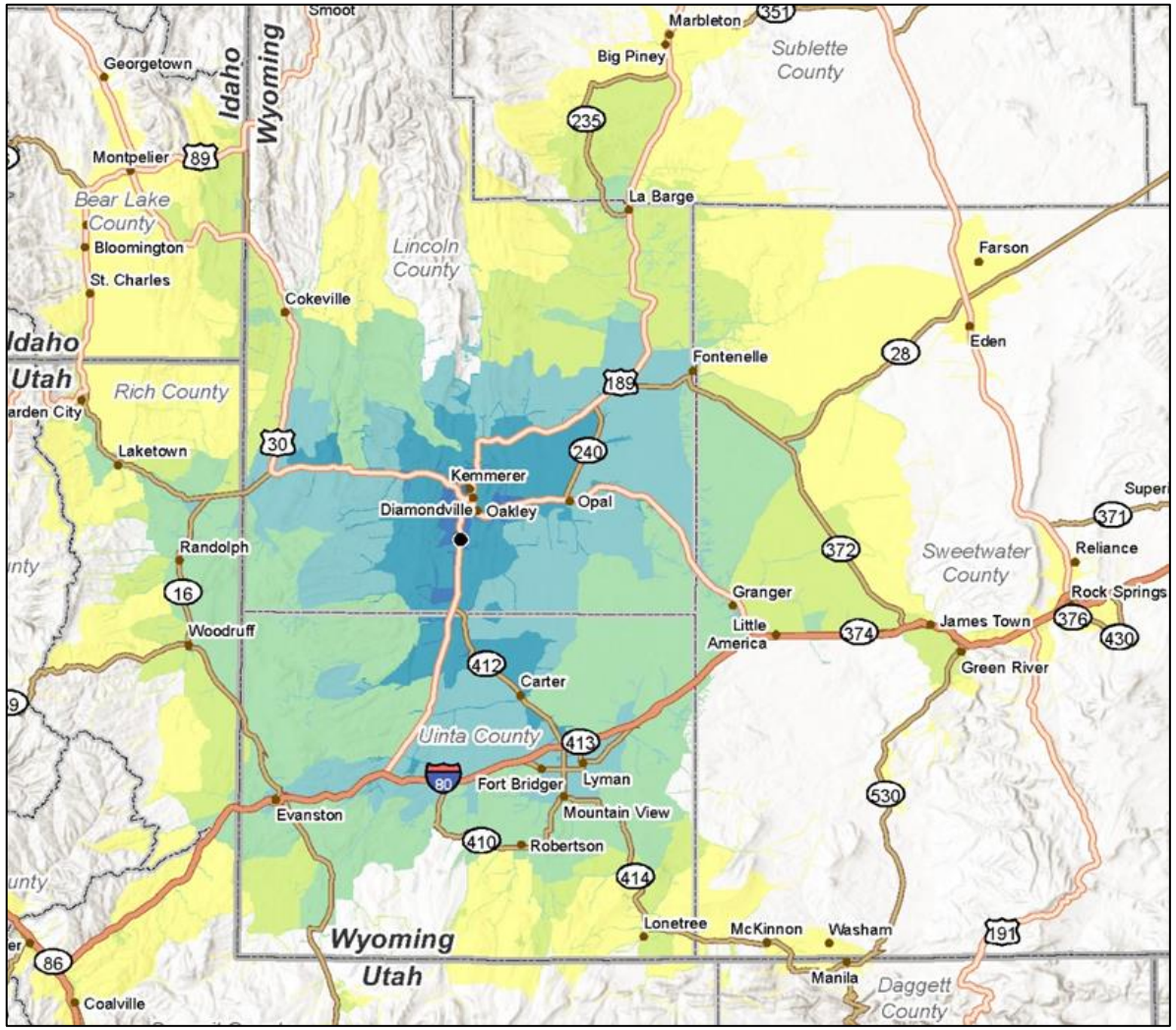
# Economic Region Determination: Drive Time Map

Drive Time (minutes)

- < 15
- 15 - 30
- 30 - 45
- 45 - 60
- 60 - 75
- 75 - 90





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# Affected Environment

# Affected Environment: Process

- Data Collection:
  - Meetings with city leaders and attendance at community meetings
  - Desktop searches for data from websites of:
    - Local, state, and federal government
    - Commercial
    - Non-profit
  - Phone interviews and email exchanges (personal communications) with:
    - Federal, state, and local government agency representatives and frontline workers
    - Business owners and workers (e.g., real estate developers, tourism operators, data vendors, etc.)
    - Non-profit agency representatives and frontline workers

# Affected Environment: Data Sources

- Primary Sources:
  - USCB 2020 Decennial Census data for total population
  - USCB 5-year data from ACS (2016-2020) for EJ and housing (2020 Decennial Census housing data not yet available)
  - Wyoming Department of Information and Administration, Economic Analysis Division (WEAD), Idaho Department of Labor, and University of Utah for population projections
  - Numerous other governmental (federal, state, and local), commercial, non-profit source documents, phone interviews, and emails
- COVID-19
  - Some source data may reflect economic disruptions and data collection complications
  - Where possible, pre-2020 data presented for comparison

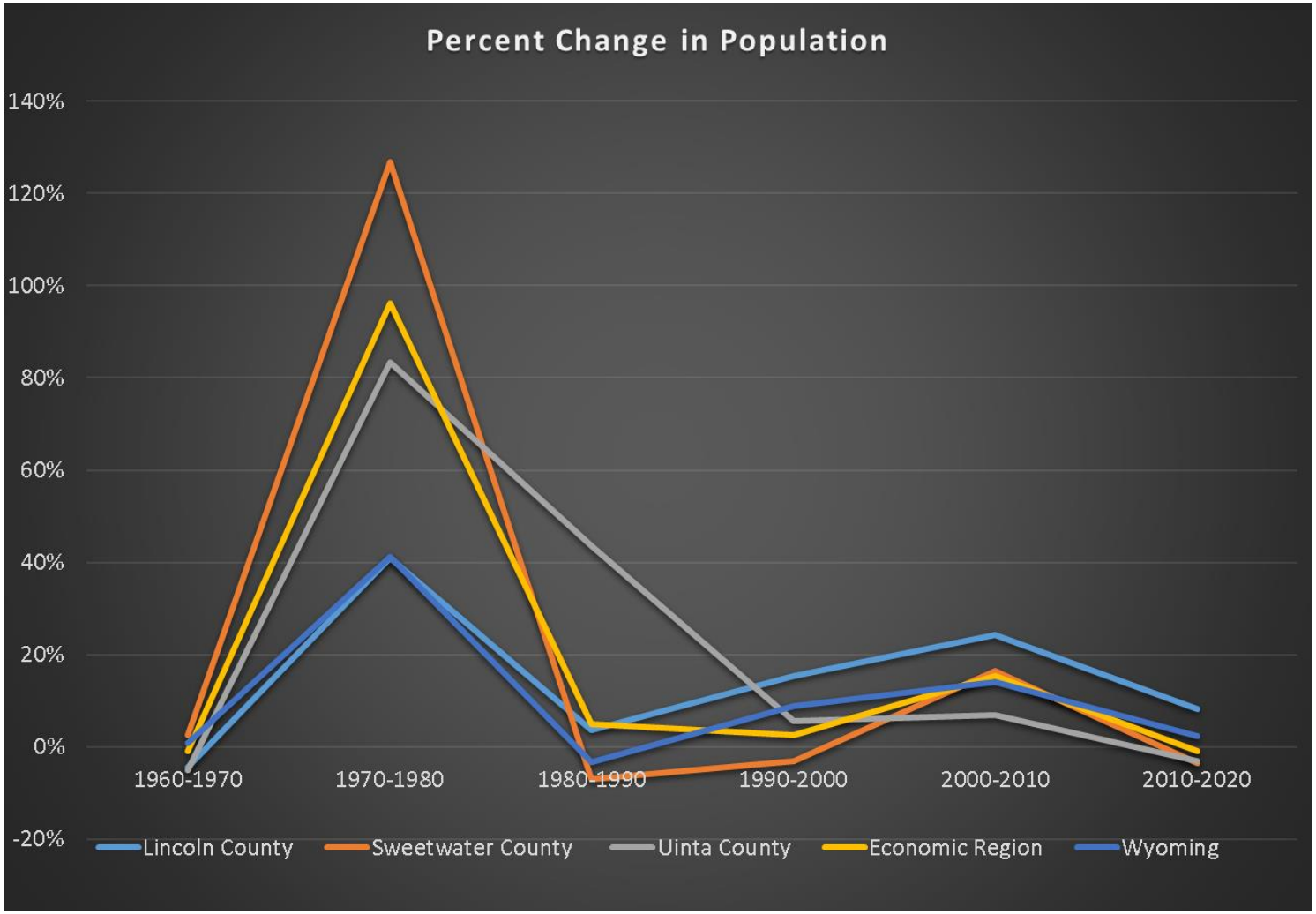
# Affected Environment: Unique Considerations

- Economic Region Configuration:
  - Geographically large counties, small populations, and low densities
  - Where possible, municipal data provided for Lincoln and Sweetwater Counties because counties are partially inside 50-mile radius
  - 84% of Sweetwater County population in Green River and Rock Springs, so county-level data still useful
- EJ expands beyond the 50-mile radius into parts of Sweetwater County

# Affected Environment: Demographics

- Population:
  - Portions of WY, UT, and ID included in demographic region
    - 50-mile population: 30,950
    - 50-mile density: 3.9 persons per square mile
    - 20-mile population: 5,907
    - 20-mile density: 4.7 persons per square mile
- "Low Population Area" (1.1 on NRC sparseness/proximity matrix [NUREG-1437, R2, 2023])
- Three-county economic region 2020 population was 82,303
- Population growth of economic region has been slow
  - Average annual growth rate (1960-2020) of 1.45%
  - Decade-to-decade population has been variable
    - Oil and gas mining boom-bust 1970-1980
    - Natural gas and fracking boom 2000-2010

# Affected Environment: Demographics





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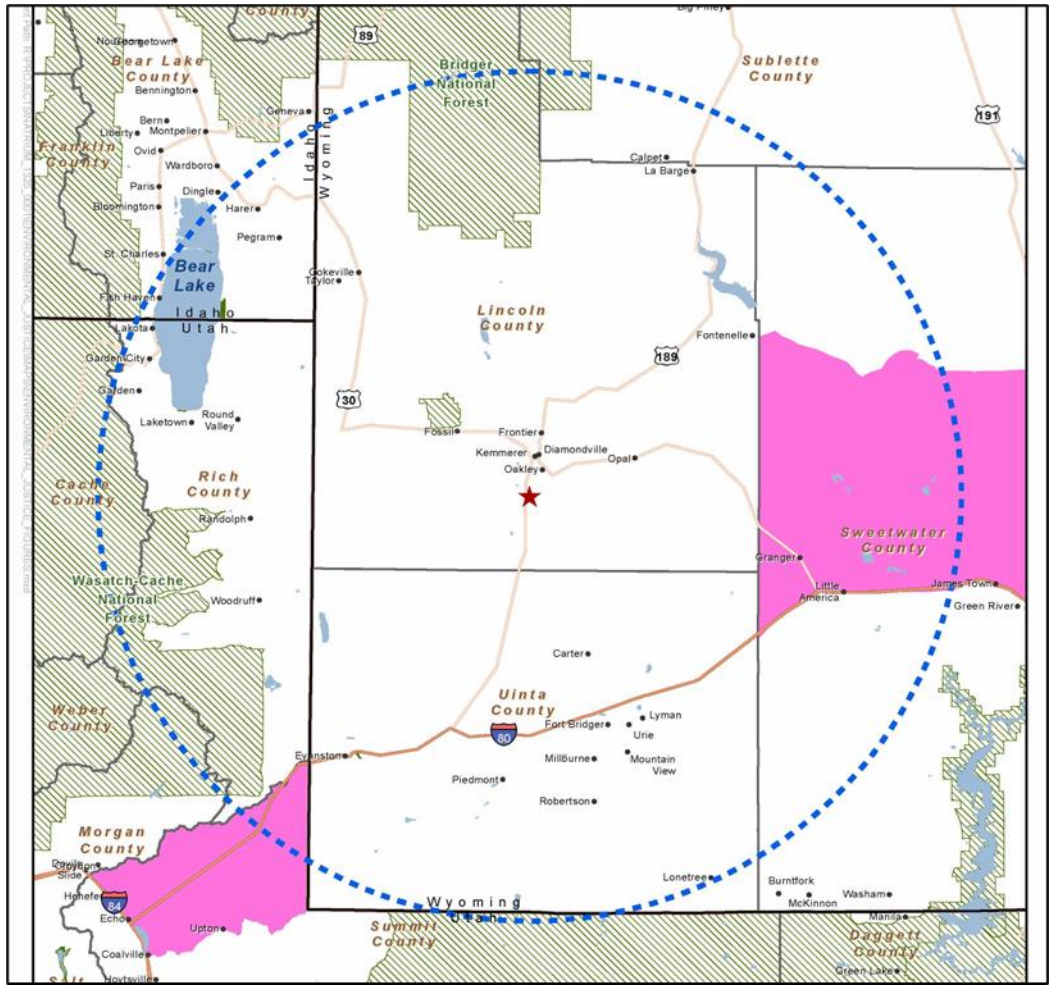
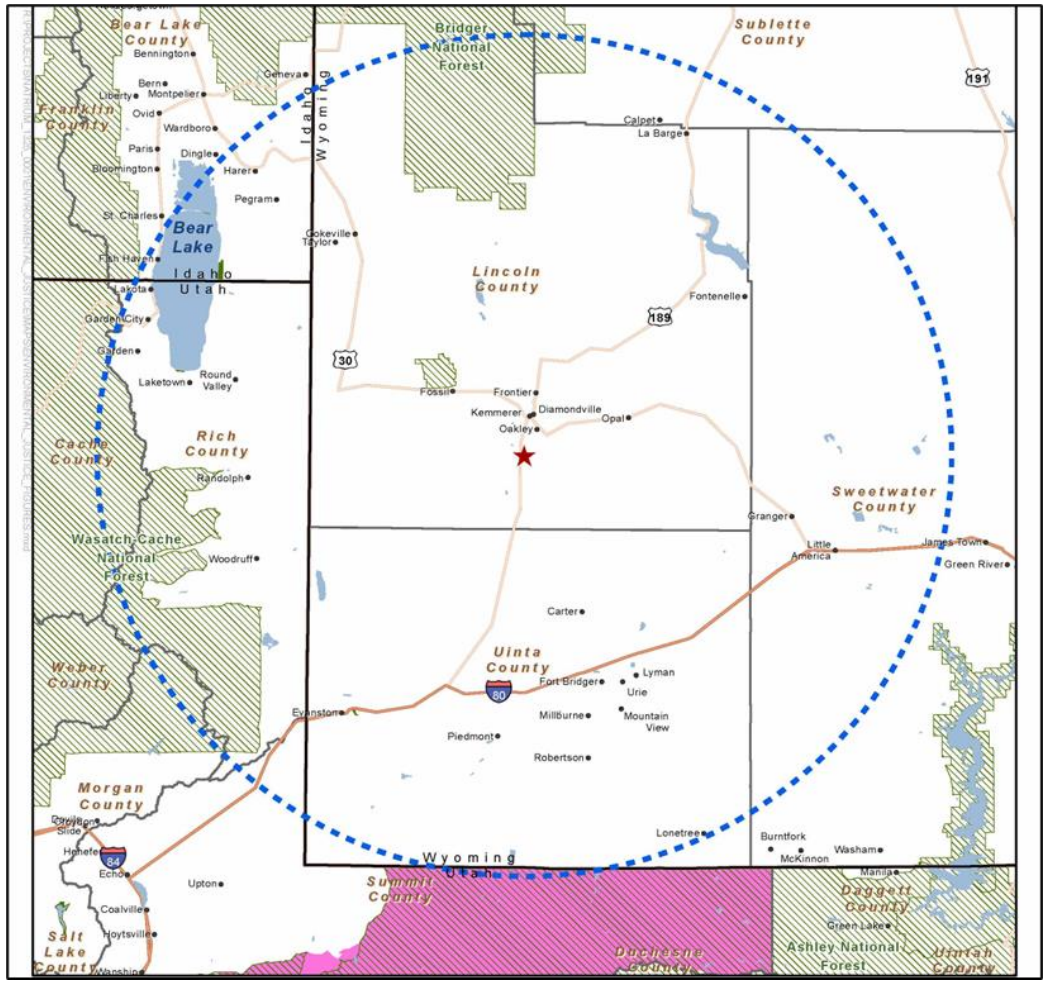
# Affected Environment: Demographics, EJ

- Two block groups with significant Hispanic, Latin, or Spanish Origin ethnicity populations
- No significant low-income or other racial minority populations within 50-mile radius (caveat, see next slide)
- Few migrant workers (~15 sheepherders, seasonally)



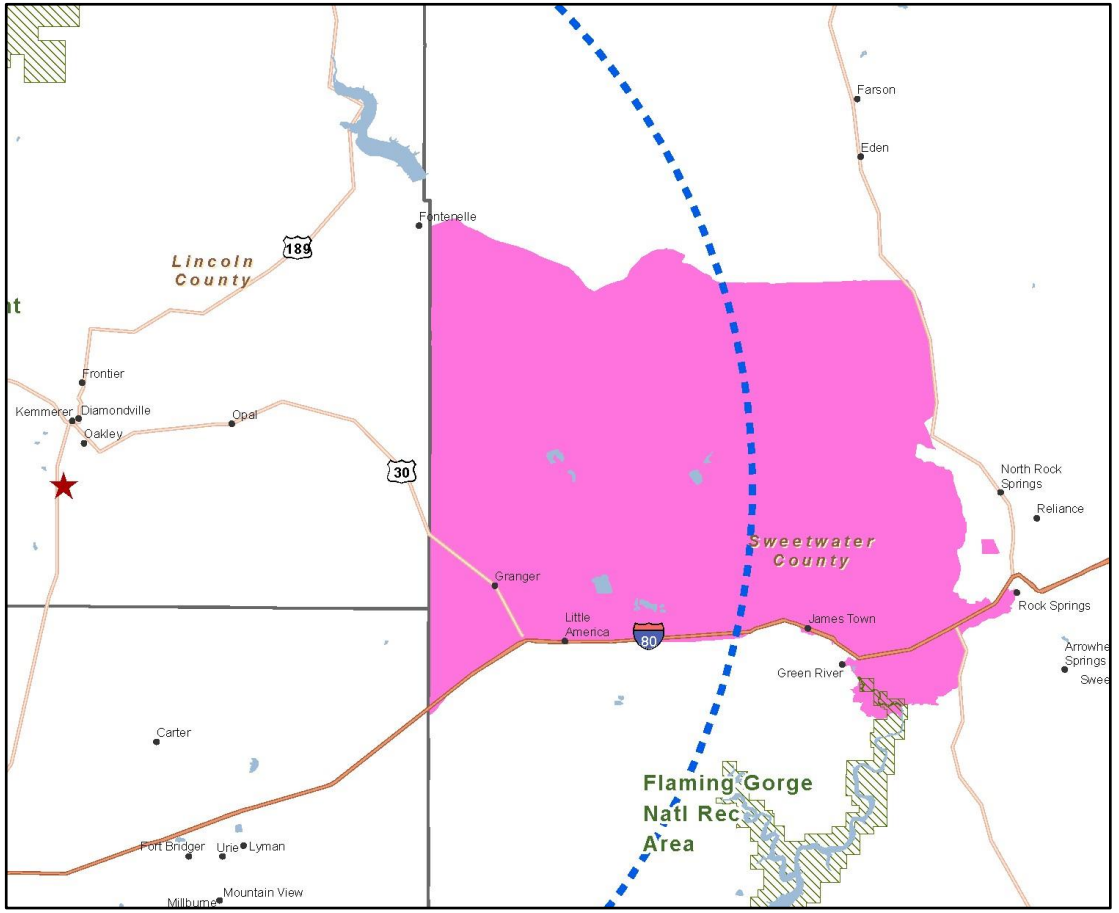
# Affected Environment: Demographics, EJ: Data Fidelity

- One block group with significant black population was found, using ACS 2016-2020 data; may be erroneous



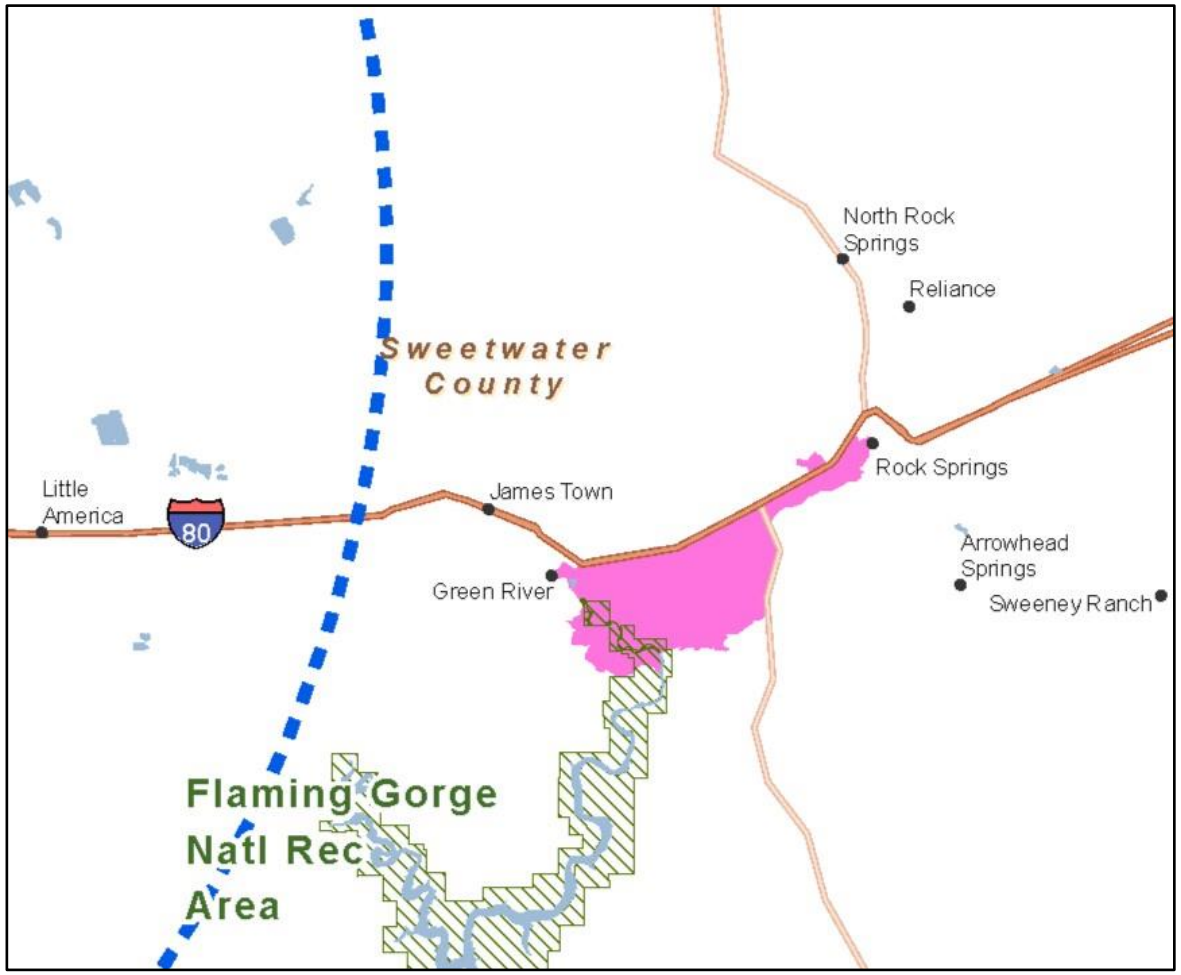
# Affected Environment: Demographics, EJ: GR and RS

- 31 additional block groups analyzed
- Four additional block groups with significant Hispanic, Latin, or Spanish Origin ethnicity populations
- Block group traversing radius line is same as that found on 50-mile radius Hispanic, Latin, or Spanish Origin ethnicity population slide (above)



# Affected Environment: Demographics, EJ: GR and RS

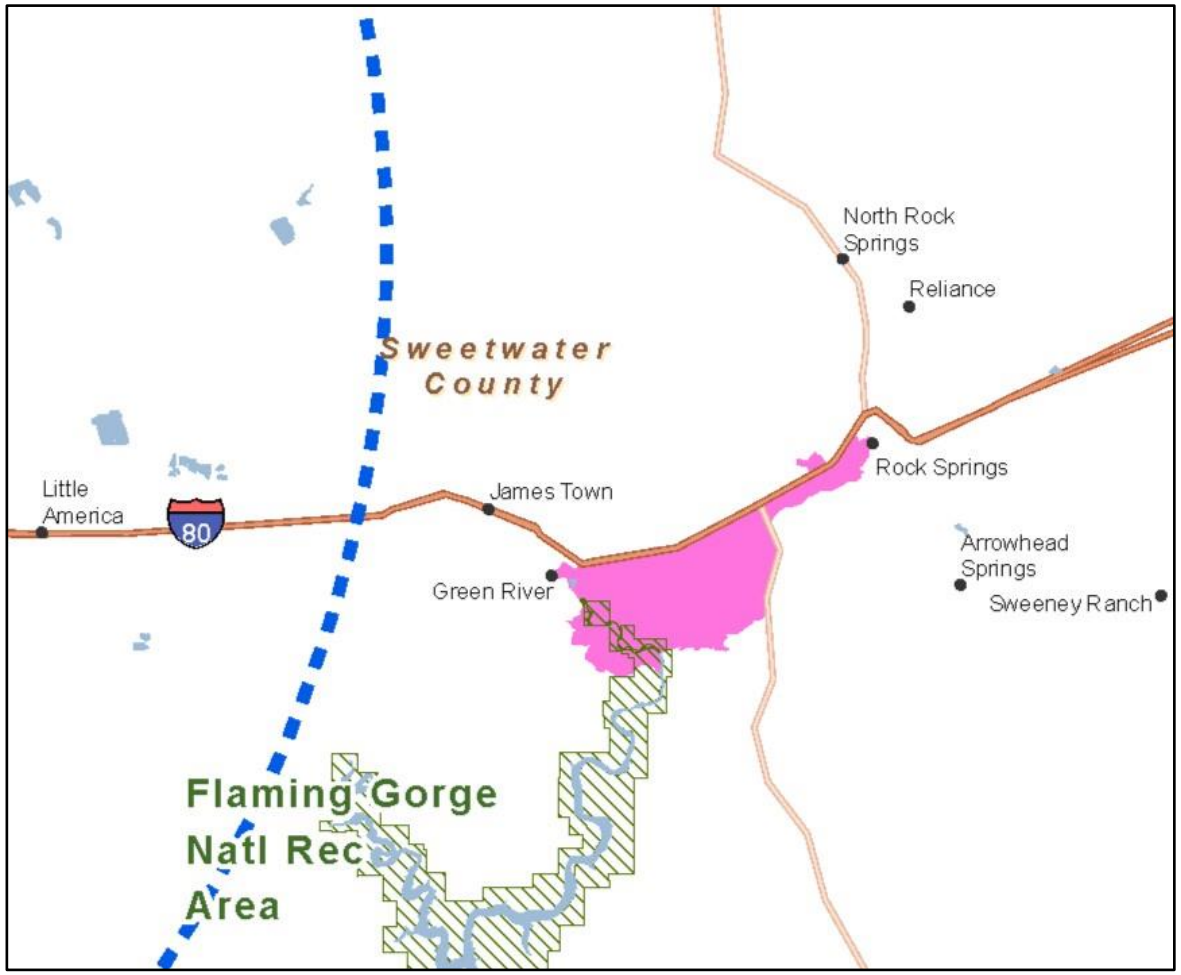
- Three block groups with significant Aggregate Minority populations



# Affected Environment: Demographics, EJ: GR and RS

- Two block groups with significant Low-Income Household populations

- Note:  9 additional block groups are listed on these Green River and Rock Springs slides, but the actual number of additional block groups is 5, as 2 block groups contain 2 types of significant populations, and one block group contains 3



# Affected Environment: Potential Constraints

- Housing
- Wastewater treatment
- School facility
- Medical facility and provider shortages
- Public safety and fire fighting personnel shortages

# Affected Environment: Housing

- 4,300 units across three-county economic region available during summer months, more in winter:
  - Existing: 3,600 units
  - New: 700-800 units (assuming 50% of planned are constructed)
    - Most are permanent units (single family homes, condos, apartments, townhouses)
- Housing available to Kemmerer Unit 1 assumed to be 75% of total available:
  - Lincoln County: 600-700 units
  - Uinta County: 500-600 units
  - Sweetwater County: 2,000 units
- Housing types evaluated: single family houses, condos, apartments, townhomes, RV parks, and hotels/motels
- Will not rely on seasonal, recreational, or occasional use units (vacation housing)

# Affected Environment: Wastewater Treatment (KDJPB)

- Kemmerer/Diamondville Joint Powers Board WYPDES Permit:
  - Design Flow of 1.43 MGD
    - limited to 0.8-1.0 MGD by plant processes
  - Average Daily Flow of 0.25-0.5 MGD
- I&I issues limiting excess capacity
- Kemmerer/Diamondville Joint Powers Board (KDJPB):
  - State and county grants procured to correct most I&I issues
  - Anticipates freeing up ~375,000 gpd
  - Project water use represents 67% of available capacity before, and 30% after I&I improvements

# Impacts of Construction and Operation

# Impacts of Construction and Operation: Data Sources

- Notable sources, in addition to those for Affected Environment:
  - Bureau of Economic Analysis (BEA) for RIMS II multipliers
  - USCB 2020 for family size and number of children under 18 per family (Wyoming statistics versus U.S. statistics, most conservative)

# Impacts of Construction and Operation: Process

- Project impacts, created by fluctuations in employment and spending in the region, are quantified
- Quantified employment and spending activities are measured against quantified baseline data reported in the Affected Environment section of the ER
- Impact significance is assigned to each resource area based on NRC, and other agency, criteria
- Mitigations addressing moderate and large impacts are identified

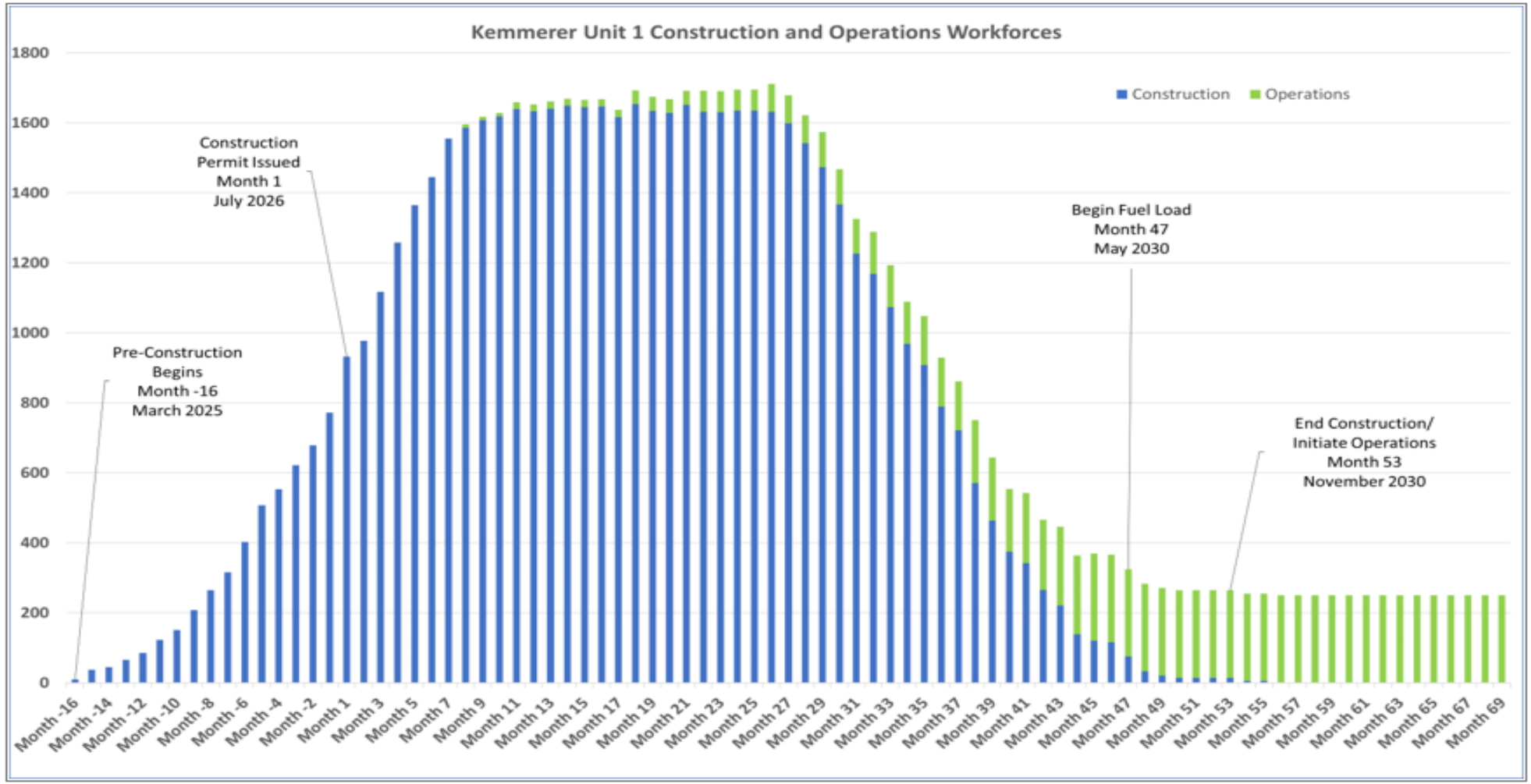
# Impacts of Construction and Operation: Project Details

- 62-month construction period
- 60-year operation period, assumed 40-year operating license plus 20-year license extension
- Peak construction workforce occurs in month 26 and is composed of:
  - 1,632 construction workers
  - 80 operations workers
- Operations workforce is 250
- Outage duration and frequency:
  - Type 1 fuel: ~3 weeks, annually
  - Type 1B fuel: ~2 weeks, biennially
  - Number of outage workers: ~500

# Impacts of Construction and Operation: Project Details continued

- 95% in-migration for construction workforce
- 37% construction workers bring families
- 100% in-migration for operations and indirect workforces
- 80% operations workers bring families
- Approximately 2,000 direct and indirect workers migrating into economic region during construction; approximately 467 direct and indirect, during operations
- Estimate 50% of single construction workers will share housing units
- Estimated residential distribution of direct and indirect workforces during construction:
  - Lincoln County: 41%
  - Uinta County: 32%
  - Sweetwater County: 27%
- Estimated residential distribution of direct and indirect workforces during operations is same as Naughton Power Plant distribution

# Impacts of Construction and Operation: Project Details continued





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# Impacts of Construction and Operation: Project Details continued

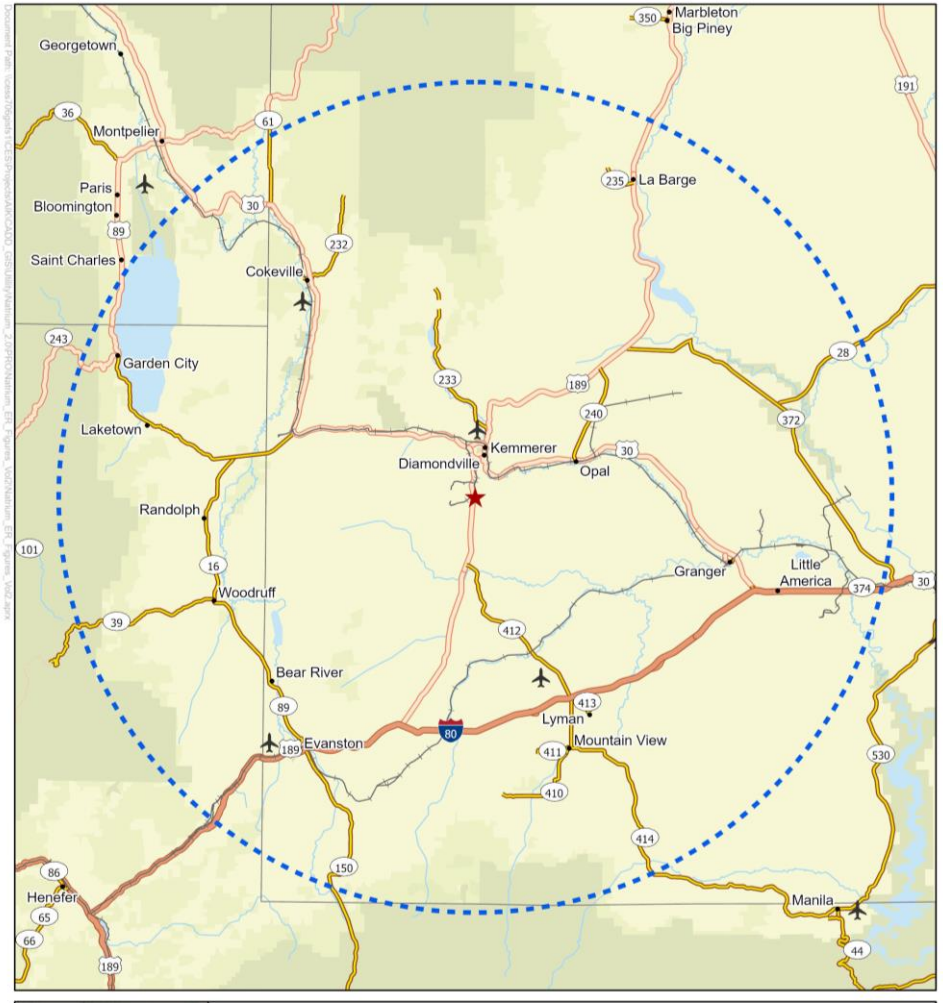
- Taxes:
  - Impact from maximum annual property tax payments to local taxing bodies appears to be large, and beneficial (using NRC criteria):
    - Construction = ~$12 million, final year
    - Operations = ~$7.5 million, initially (straight-line depreciation over life of plant); possibility of payments in lieu of taxes
  - Impacts from all other tax types likely small (using NRC criteria)
  - No corporate or individual income taxes in WY

# Impacts of Construction and Operation: Preliminary Results

- Potential beneficial impacts:
  - Property taxes to most local taxing bodies would be large
- Potential adverse impacts:
  - Housing of Lincoln and Uinta Counties during construction
  - Wastewater treatment capacity of Kemmerer/Diamondville during construction
  - School facility capacity of some schools in economic region
  - Medical facility capacity and provider shortages in select areas
  - Public safety and fire fighting provider shortages in select areas during construction

# Impacts of Construction and Operation: Transportation

- Access to site is via US 189, a 2-lane highway connecting Kemmerer with I-80 in Uinta County
- New intersection proposed at US 189
- No rail use is planned
- No plan to construct any offsite routes



# Impacts of Construction and Operation: Transportation

- Inputs into the ER:
  - Workforce curves
  - Truck shipment projections
  - WYDOT traffic counts for area roadways
  - Existing roadway features and conditions and proposed roadway improvements
  - Project-specific traffic study and traffic management mitigation measures
  - Consideration of traffic commuting patterns based on housing analysis
  - Wyoming vehicle accident data
- Impact assessments in the ER
  - Physical impacts of increased traffic on roadways
  - Impacts to traffic congestion and traffic flow (change in Level of Service rating)
  - Accident-related consequence of additional traffic

# Potential Mitigating Activities

# Potential Mitigating Activities

- Housing monitoring and adaptive management being considered
- Wyoming education equalization programs: School Foundation Program and School Capitalization Construction program
- Wyoming Impact Assistance Payment Program (WYDEQ's ISD): state-funded impact assistance for communities
  - Payments used to enhance infrastructure and mitigate personnel shortages
- Kemmerer/Diamondville efforts to address I&I wastewater issues with state and local grants

# Questions?





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# Acronym List

BEA - U.S. Bureau  of Economic Analysis
EBR - Experimental Breeder Reactor
EJ - environmental justice
FFTF - Fast Flux Test Facility
GR - Green River
HX - heat exchanger
I&I - inflow and infiltration
ISD – Industrial Siting Division
ISG – Interim Staff Guidance
KDJPB – Kemmerer/Diamondville Joint Powers Water Board
KU1 - Kemmerer Unit 1
MGD - million  gallons per day
NI - Nuclear Island
RG – Regulatory Guide
RIMS II - Regional Input-Output Modeling System II (BEA)
RS - Rock Springs
SFR - Sodium Fast Reactor
SPT – Standard Review Plan
TI - Turbine Island
TREAT - Transient Reactor Test
USCB - US Census Bureau
WEAD - Wyoming Department of  Administration and Information , Economic Analysis Division
WYDEQ - Wyoming Department of Environmental Quality
WYDOT - Wyoming Department of Transportation
WYPDES - Wyoming Pollutant Discharge Elimination System