WCS Consolidated Interim Spent Fuel Storage Facility Environmental Report

(Public Version)

Docket Number 72-1050

Revision 3

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LIST OF ABBREVIATIONS:

Acronym	Long Form
ACEC	Area of Critical Environmental Concern
AFCI	AFCI Texas, LLC
ALARA	As Low as Reasonably Achievable
AMP	Aging Management Program
APE	Area of Potential Effects
AVLIS	Atomic Vapor Laser Isotope Separation
BLM	Bureau of Land Management
BMP	Best Management Practices
BTU	British Thermal Unit
CAS	Central Alarm Station
CDE	Committed Dose Equivalent
CEDE	Committed Effective Dose Equivalent
CESQG	Conditionally Exempt Small Quantity Generator
CFR	Code of Federal Regulations
CGP	Construction General Permit
CISF	Consolidated Interim Storage Facility
CMC	Carlsbad Medical Center
CMEC	Cox McLain Environmental Consulting, Inc.
CoC	Certificate of Compliance
CT	Census Tract
CTA	Council of Texas Archaeologists
CWF	Compact Waste Disposal Facility
D	Absorbed Dose
DART	Days Away from Work Rate
dB	Decibel
DE	Dose Equivalent
DHHS	Department of Health and Human Services
DOE	Department of Energy
DOI	Department of the Interior
DOT	Department of Transportation

ED	Effective Dose
EDE	Effective Dose Equivalent
EIS	Environmental Impact Statement
ELEA	Eddy-Lea Energy Alliance
EMR	Experience Modifier Rate
EPA	Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	Environmental Report
ESA	Environmental Site Assessment
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FWF	Federal Waste Disposal Facility
GAO	Government Accountability Office
GEIS	Generic Environmental Impact Statement
GISF	Generic Interim Storage Facility
H	Equivalent Dose
HSM	Horizontal Storage Module
HSR9	Health Service Region 9
HUD	U.S. Department of Housing and Urban Development
IC NCDU	In-Cell Non-Containerized Disposal Unit
ICRP	International Commission on Radiation Protection
ISFSI	Independent Spent Fuel Storage Installation
ISP	Interim Storage Partners
ka	thousand years ago
LLRW	Low-Level Radioactive Waste
LRMC	Lea Regional Medical Center
Ma	million years ago
MDC	Minimum Detectable Concentration
MTU	metric tons of uranium
NAAQS	National Ambient Air Quality Standards
NBS	National Bureau of Standards
NEF	National Enrichment Facility

NEI	Nuclear Energy Institute
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NMCRIS	New Mexico Cultural Resources Information System
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NPP	Nuclear Power Plant
NRC	Nuclear Regulatory Commission
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWPA	Nuclear Waste Policy Act
NWS	National Weather Service
OCA	Owner Controlled Area
OCAW	Oil, Chemical and Atomic Workers International Union
OSE	Office of the State Engineer
OSHM	Official State Historical Markers
OSL	Optically Stimulated Luminescent dosimeters
PFS	Private Fuel Storage
POTW	Publically Owned Treatment Works
QA	Quality Assurance
QC	Quality Control
QRA	Quivira Research Associates
RBE	Relative Biological Effect
RCRA	Resource Conservation and Recovery Act
REC	Recognized Environmental Conditions
REMP	Radiological Environmental Monitoring Program
RML	Radioactive Material Licenses
ROI	Region of Interest
RTHL	Recorded Texas Historic Landmarks
SAL	State Antiquities Landmarks
SAR	Safety Analysis Report
SDWA	Safe Drinking Water Act

SHPO	State Historic Preservation Officer
SIA	Socioeconomic Impact Assessment
SNF	Spent Nuclear Fuel
SONGS	San Onofre Nuclear Generating Station
SPCC	Spill Prevention, Control, and Countermeasures Plan
STEERS	State of Texas Environmental Electronic Reporting System
SVBG	Skull Valley Band of Goshute Indians
SWPPP	Stormwater Pollution Prevention Plan
TARL	Texas Archeological Research Laboratory
TCEQ	Texas Commission on Environmental Quality
TCR	Texas Cancer Registry
TEDE	Total Effective Dose Equivalent
THC	Texas Historical Commission
TLD	Thermoluminescent Dosimeters
TNMR	Texas and New Mexico Railway
TPDES	Texas Pollution Discharge Elimination System
TRC	Total Recordable Case
TSAR	Technical Safety Analysis Report
TSCA	Toxic Substance Control Act
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Service
UST	Underground Storage Tanks
USW	United Steelworkers Union
VCC	Vertical Concrete Casks
WCS CISF	WCS Consolidated Interim Storage Facility
WIPP	Waste Isolation Pilot Plant
WQCC	Water Quality Control Commission
WRCC	Western Regional Climate Center

WCS CONSOLIDATED INTERIM SPENT FUEL STORAGE FACILITY
DOCKET NO. 72-1050

ENVIRONMENTAL REPORT

CHAPTER 1

INTRODUCTION OF THE ENVIRONMENTAL REPORT

1.0 INTRODUCTION OF THE ENVIRONMENTAL REPORT

Interim Storage Partners LLC (ISP), a joint venture between Waste Control Specialists LLC and Orano CIS LLC, has prepared a license application for a Consolidated Interim Storage Facility (CISF) for approval by the U.S. Nuclear Regulatory Commission (NRC) pursuant to the requirements specified in Title 10 of the Code of Federal Regulations (CFR), Part 72, *Licensing Requirements for the Independent Storage of Spent Nuclear Fuel, High-Level Radioactive Waste, and Reactor-Related Greater Than Class C Waste*. On the currently controlled Waste Control Specialists property of 5,666 ha (14,000 acres) in Andrews County, Texas the CISF would be constructed and operated on an approximately 41 ha (100 acre) initial footprint within an approximately 130 ha (320 acre) parcel where security would be maintained. This land would be controlled by ISP through a long term lease from ISP joint venture member Waste Control Specialists. Waste Control Specialists also will support the project through activities performed by its existing facilities adjacent to the WCS CISF site.

The ISP Environmental Report (ER) evaluates the radiological and non-radiological impacts associated with the construction and operation of the CISF for Spent Nuclear Fuel (SNF) and Reactor-Related Greater than Class C Low-Level Radioactive Waste (LLRW) (henceforth referred to collectively as SNF unless otherwise specified) in Andrews County, Texas. ISP is currently requesting authorization to possess and store 5,000 Metric Tons of Uranium (MTUs), which includes a small quantity of mixed oxide fuel, and related GTCC waste. If the requested license is issued by the NRC, ISP anticipates subsequently requesting amendments to the license to request authorization to possess and store an additional 5,000 MTUs of SNF for each of seven subsequent expansion phases to be completed over the course of 20 years. Ultimately, ISP anticipates that 40,000 MTUs of SNF and related GTCC waste would be stored at the CISF upon completion of all eight phases. Therefore, this report analyzes the environmental impacts of possession and storage of 40,000 MTUs of SNF and related GTCC waste.

This ER was prepared to support a License Application for review and approval by the NRC pursuant to the requirements specified in 10 CFR Part 72.34 and in 10 CFR 51.61, *Environmental Report—Independent Spent Fuel Storage Installation (ISFSI) or Monitored*

Retrievable Storage Installation (MRS) license. This is ER consistent with the guidance provided in two regulatory documents:

- Regulatory Guide 3.50, *Standard Format and Content for A Specific License Application for an Independent Spent Fuel Storage Installation or Monitored Retrievable Storage Facility*
- NUREG-1748, *Environmental Review Guidance for Licensing Actions Associated with NMSS Programs*

ISP anticipates that the NRC would issue the Final Environmental Impact Statement (FEIS) and License by September 2020. Phase 1 construction would begin after issuance of the license and after ISP successfully enters into a contract for storage with the U.S. Department of Energy (DOE) or holders of the title to SNF at commercial nuclear power facilities (SNF Title Holder(s)). Construction is estimated to take approximately one year to complete. Both construction and preoperational testing are expected to be complete by April 2022. ISP anticipates continued storage for approximately 60 years or until a final geologic repository is licensed and operating in accordance with the Nuclear Waste Policy Act (NWPA) of 1982, as amended.

History and Background

Since 1997, ISP joint venture member Waste Control Specialists has been licensed and authorized to treat, store, and dispose of certain types of radioactive materials at its facilities located in Andrews County, Texas. Waste Control Specialists is authorized to dispose of Class A, B, and C LLRW at the Texas Compact Waste Disposal Facility and the Federal Waste Disposal Facility . Waste Control Specialists is also authorized to dispose of 11e.(2) byproduct materials at its Byproduct Material Disposal Facility . These activities are regulated by the Texas Commission on Environmental Quality (TCEQ) under regulations determined to be compatible with NRC requirements, pursuant to Section 274 of the Atomic Energy Act of 1954, as amended.

ISP joint venture member Orano CIS, through its parent company, Orano USA, and affiliate company TN Americas LLC has been in the dry fuel storage and transportation business for over 50 years, supporting several site specific licenses to store SNF and GTCC waste, currently stores SNF under several general licenses and holds several transportation licenses, including casks licensed to ship SNF and GTCC waste.

The U.S. Congress enacted the NWPA of 1982 charging the DOE with developing a geologic repository for the disposal of SNF generated by commercial nuclear power plants located throughout the U.S. In 1987, Congress amended the NWPA to streamline and focus waste management on developing the geologic repository at Yucca Mountain, located in Nye County, Nevada. Pursuant to the NWPA, the DOE was responsible for licensing Yucca Mountain with operations beginning on January 31, 1998.

On July 23, 2002, President George W. Bush approved Congressional legislation designating Yucca Mountain as the final geologic repository intended for the disposal of commercial SNF and high level waste generated by the federal government. The DOE submitted a license application to the NRC for authorization to construct and operate Yucca Mountain. The NRC reviewed the license application and issued a series of Safety Evaluation Reports addressing the long-term environmental performance of Yucca Mountain. However, much uncertainty remains as to whether or not the facility will open and begin accepting commercial SNF or high level waste for disposal.

In January 2010, President Barack Obama established the Blue Ribbon Commission on America's Nuclear Future. The Commission was directed by the Secretary of Energy to conduct a comprehensive review of policies for managing the back end of the nuclear fuel cycle and to recommend a new strategy. On January 26, 2012, the Blue Ribbon Commission issued a final report consisting of eight key recommendations. Of paramount importance to this licensing action was the Blue Ribbon Commission's recommendation to adopt a new consent-based approach to siting future nuclear waste management facilities in order to initiate prompt efforts to develop one or more consolidated storage facilities .

Development of the CISF has strong support from the state, regional, and local communities located in west Texas. In March 2014, Texas Governor Rick Perry called for a Texas solution for SNF generated at 6 reactor sites located in the state . On September 19, 2014, the Texas Radiation Advisory Board also issued a position stating it is in the state's best interest to request that the federal government consider Texas as a CISF site . On January 20, 2015, the Andrews County Commissioners unanimously approved a resolution in support of establishing an Independent Spent Fuel Storage Installation (ISFSI) in Andrews County, Texas, for the consolidated interim storage of SNF and high level radioactive waste (Attachment 1-1).

Governor Perry asked state leadership to consider the interim storage of SNF in Texas based on a study conducted by the TCEQ. The report, *Assessment of Texas' High Level Radioactive Waste Storage Options*, published in March 2014 states that interim storage of SNF would "Reduce the cost verses storage at 77 sites, increase safety and security, allow the DOE to take title to the SNF sooner and help the DOE to optimize the thermal loading of the HLW into the repository" (Attachment 1-2).

The report prepared by TCEQ (2014) addressed the previous efforts by Private Fuel Storage to construct and operate an ISFSI licensed under 10 CFR 72 that was to be located on the Skull Valley Indian Reservation in Tooele County, Utah. While the NRC issued a license authorizing construction and operation of the ISFSI in February 2006, actions by the Department of the Interior (regarding right-of-way for rail access to the site) and the Bureau of Indian Affairs (regarding uncertainties over land trust issues) precluded the facility from becoming operational .

The Private Fuel Storage facility was designed and licensed to store up to 40,000 MTUs of spent fuel in sealed metal casks (approximately 4,000 storage casks) for a term of 20 years. The environmental impacts for these major licensing actions were thoroughly evaluated and discussed in *Final Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation of the Skull Valley Band of the Goshute Indians and Related Transportation Facility in Tooele County, Utah*, NUREG-1714, published in December 2001 .

The NRC directed staff to develop a waste confidence decision and promulgated the Continued Storage Rule supported by an environmental impact statement (SRM-COMSECY-12-0016) . As such, the NRC completed a *Generic Environmental Impact Statement (GEIS) for Continued Storage of Spent Nuclear Fuel* (NUREG-2157) that addressed the impacts attributable to continued storage of SNF. The report was needed by the NRC to fulfill its responsibilities under the National Environmental Policy Act (NEPA) . The environmental impacts evaluated in NUREG-2157 include those related to short-term (60 years), long-term (an additional 100 years), and indefinite storage of SNF at existing commercial nuclear power plants, as well as at an "away-from-reactor" storage facility.

In developing NUREG-2157, NRC referred to the previous environmental analyses that supported issuance of the FEIS for the Private Fuel Storage facility in Tooele, Utah. The NRC

concluded that implementation of the Preferred Alternative to issue a license to PFS authorizing construction and operation of an ISFSI in Tooele County, Utah would not result in significant adverse impacts to the environment.

1.1 PURPOSE AND NEED FOR THE PROPOSED ACTION

The DOE has not yet developed a permanent geologic repository that would allow for the disposal of commercial SNF at Yucca Mountain in Nye County, Nevada, as required under the NWPA. The DOE was required to open the repository and begin accepting SNF for disposal at Yucca Mountain on January 31, 1998. However, the earliest estimated time by which a permanent geologic repository could be licensed and operational is 2048. The only alternative currently available to the commercial nuclear power utilities is to continue to store SNF at an ISFSI located at an existing operating commercial nuclear reactor or at an "away-from-reactor" storage facility.

At present, 3 power plants have been shutdown and 9 nuclear power plants across the U.S. have been decommissioned (referred to hence forth as 12 decommissioned shutdown sites) to levels that would allow for unrestricted release of the site in accordance with the NRC's License Termination Rule (10 CFR 20, Subpart E). Even though the nuclear power plants, including the spent fuel pools have been dismantled and decommissioned, the SNF remains and continues to be stored in onsite ISFSIs. Many policymakers and stakeholders in the communities that host shutdown reactors want to have the SNF removed to complete decommissioning of the site and to allow for more beneficial uses of the land.

While decommissioning activities have been completed at 9 locations across the U.S. (except for removing the SNF from dry cask storage), other financial pressures are expected to cause utilities to begin decommissioning at other commercial nuclear reactors. A CISF is needed to ensure that the SNF at these commercial reactor sites can be safely removed so that the remaining lands can be returned to greenfield status. This point is further underscored with the announcement by other electric utilities of their plans to decommission additional commercial reactors located throughout the U.S.

The nuclear power utilities continue to remain responsible for the surveillance, maintenance, emergency preparedness, and physical security of the SNF stored at their ISFSI (unless otherwise exempted by the NRC). These activities are estimated to cost each of the utilities an estimated $6 million per year .

Developing a CISF in Andrews County, Texas, would serve a national strategic need by providing for an orderly transfer of SNF from the twelve shut down reactors to a safer and more secure centralized storage location . Not only would the CISF serve the needs of the 12 shutdown reactors, it would also be available to serve the needs of the existing 99 operating commercial nuclear reactors in the U.S., including those located in Texas, until a permanent repository becomes available.

1.2 THE PROPOSED ACTION

ISP is requesting a license that would allow it to construct and operate a CISF in Andrews County, Texas (Figure 1.2-1). The CISF would be located on approximately 130 ha (320 acres) of land just north of and adjacent to the Waste Control Specialists LLRW Disposal Facilities licensed by the TCEQ in accordance with Texas Radioactive Material License No. R04100 (TCEQ 2015a) (Figure 1.2-2).

ISP is requesting authorization to store up to 5,000 MTU in Phase 1, but this ER analyzes the environmental impacts of storing up to 40,000 MTU and related GTCC waste at the CISF. The major benefit of the proposed actions of the Proposed Action is authorizing the receipt of the SNF currently in storage at the shutdown decommissioned reactor facilities, thus returning the land at the reactor sites to greenfield status. After the land has been returned to greenfield status the communities that hosted the commercial reactor plants would gain additional benefits as the land could be redeveloped for other purposes. Additional benefits of the Proposed Action should the NRC authorize future construction of Phases 2 through 8 and to store additional SNF is that it would provide a regulatory path forward to receive SNF from other commercial reactors that may be decommissioned in the future, as well from operating commercial reactors prior to decommissioning. Providing a regulatory path forward as described in the Proposed Action would serve as an interim storage facility until a geologic repository can be opened.

ISP would use existing dry cask storage systems currently used at several operating commercial nuclear power plants in the U.S. and abroad. These dry cask storage systems store SNF inside of sealed canisters instead of in a spent fuel pool. These dry cask storage systems are safe and confine radioactive materials, thereby minimizing the potential release of radioactive contamination into the environment.

The dry cask storage systems that would be employed at the CISF are currently licensed by the NRC in accordance with 10 CFR Part 72 and therefore comply with the NRC requirements for

the independent storage of SNF. ISP anticipates the SNF would be stored at the CISF for 60-100 years before a permanent geologic repository is opened consistent with the NRC's Continued Storage Rule.

The CISF will be decommissioned at the end of facility life in accordance with 10 CFR 20, Subpart E.
Below is the anticipated schedule for the construction and operation of the proposed CISF:

- Request restart of review of License Application in May 2018
- Receive license by September 2020
- Construction of Phase 1 of the CISF begins in September 2021
- WCS CISF commences operations in July 2023

1.3 APPLICABLE REGULATORY REQUIREMENTS, PERMITS, AND REQUIRED CONSULTATIONS

Construction and operation of the CISF in Andrews County, Texas, would require several environmental permits and related plans by various federal and state regulatory agencies. Pursuant to the National Environmental Policy Act (NEPA) and the Council on Environmental Quality (40 CFR 1500-1508) enabling regulations, consultations with other federal agencies may be required, e.g. U.S. Fish and Wildlife Service (USFWS). Comments and recommendations by any affected or responsible agencies are part of the review process by the NRC. ISP has letters prepared for participating agencies and does not anticipate any administrative delays. *Table 1.3-1 provides a list of Federal, State, Tribal, and local approvals, authorizations, certifications, consultations, and permits required to construct and operate the facility.*

Table 1.3-1, Federal, State, Tribal, and Local Authorizations Required for the CISF

ORGANIZATION	*REQUIRED ACTION*	*CURRENT STATUS*
U.S. Nuclear Regulatory Commission	*Materials License SNM-1050 (10 CFR Part 72)*	*Under NRC review*
U.S. Nuclear Regulatory Commission	*Transportation Package Approval and Certification (10 CFR Part 71). Certificate of Compliance*	*71-9255: Issued* *71-9255: Issued* *71-9302: Issued* *71-9235: Issued* *71-9270: Issued* *71-9356: Issued*
U.S. Fish and Wildlife Service	*Consultation Required*	*Complete (ER Attach. 3-5)*
Texas Parks and Wild	*Consultation Required*	*Complete (ER Attach. 3-5)*

ORGANIZATION	REQUIRED ACTION	CURRENT STATUS
Texas Commission on Environmental Quality (TCEQ)	Texas Pollutant Discharge Elimination System (TPDES) Permit	Application will be submitted one year prior to start of construction
TCEQ	Construction General Permit (CGP TXR150000)	Will be submitted 90 days prior to start of construction (Pre-Construction)
TCEQ	Stormwater Pollution Prevention Plan (SWPPP)	Will be submitted 90 days prior to start of construction (Pre-Construction)
TCEQ	Notice of Intent (NOI)	Will be submitted 90 days prior to start of construction (Pre-Construction)
TCEQ	Spill Prevention, Control, and Countermeasures Plan (SPCC)	Will be submitted 90 days prior to start of construction (Pre-Construction)
Texas Historical Commission (THC)	Notification Required	Notification has been made and ISP has received a “No Effects” Confirmation Letter from THC (Dated 6/15/2005).
New Mexico Department of Cultural Affairs (NMDCA)	Notification Required for 1 mile buffer area around CISF disturbance.	Notification has been made and ISP has received a letter of concurrence from NMDCA
U.S. Army Corp of Engineering (USACE)	Notification Required under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act of 1899.	ISP has received a Determination of Non-Jurisdiction from USACE (Dated 6/24/2019)
Tribal Organizations	None	NA
Local Law Enforcement Agency: Andrews Texas Police Department	Memorandums of Understanding	Draft Updates of Existing MOU will be executed 90 days prior to start of operations
Local Law Enforcement Agency: Andrews County Sheriff’s Office	Memorandums of Understanding	Draft Updates of Existing MOU will be executed 90 days prior to start of operations
Local Law Enforcement Agency: Eunice Fire And Rescue	Memorandums of Understanding	Draft Updates of Existing MOU will be executed 90 days prior to start of operations
Local Law Enforcement Agency: Eunice NM Police Department	Memorandums of Understanding	Draft Updates of Existing MOU will be executed 90 days prior to start of operations
City Of Andrews	Memorandums of Understanding	Draft Updates of Existing MOU will be executed 90 days prior to start of operations

1.3.1 United States Government

The following is a summary of federal agencies that would be involved in the environmental approvals and consultation process for resources in their jurisdiction for the CISF project construction and operations activities proposed by ISP.

1.3.1.1 U.S. Nuclear Regulatory Commission

The NRC is responsible for the review and licensing of SNF storage facilities in accordance with 10 CFR Part 72. Submittal of a comprehensive license application, including, among other things, a Safety Analysis Report (SAR) and ER that address safety and environmental issues, is required pursuant to 10 CFR Part 72. This ER and other required plans/documents are being submitted concurrently to the NRC for its review and approval.

The transportation of spent fuel from a commercial nuclear power plant to the CISF requires a transportation package that is approved and certified by the NRC in accordance with 10 CFR Part 71. The Certificate of Compliance (CoC) ensures the transport packages are designed to maintain confinement of the SNF during shipping and ensure there will not be any radiological release caused by a severe hypothetical accident scenarios.

The storage/transportation system vendors providing the storage and transportation packages (e.g., TN Americas and NAC) must submit applications to the NRC for review and approval of a storage system and transportation package in accordance with 10 CFR Parts 72 and 71, respectively. Upon approval of such applications, the NRC would issue a CoC for the specific designs.

1.3.1.2 U.S. Fish and Wildlife Service

The CISF site would be located within the known range of two species of concern: the Texas horned lizard and the dunes sagebrush lizard.

The Texas horned lizard (*Phrynosoma cornutum*) has been reported as present on, or near, the land proposed for the CISF by previous surveys. Suitable habitat is present throughout much of the study area, and it is likely that the species is widespread in the region, as reported by previous investigators.

The dunes sagebrush lizard (*Sceloporus arenicolus*) has been reported in the area northwest of the proposed CISF. Habitat characteristics favorable for the species include open sandy blowouts near shinnery oak . Since such habitat was found in much of the study area, the species might occur in the area. However, within the study area, such areas of habitat are small and isolated from each other, so no estimate of actual distribution or abundance could be made on the basis of present surveys. Areas farther to the west, north, northeast, south, and southeast of the proposed CISF have the potential to be suitable habitat. A juvenile lizard, presumably of this species, was captured, photographed, and released from a sandy blowout location approximately 4 km (2.5 mi) southeast of the proposed CISF. The habitat in which the specimen was collected is a small blowout with shinnery oak, sand sage, and soapweed with sparse grasses present at the periphery.

A nomination has been submitted to the Bureau of Land Management (BLM) to designate two public land parcels within Lea County, New Mexico as an Area of Critical Environmental Concern (ACEC) for the lesser prairie chicken (*Tympanuchus pallidicinctur*). The nearest nominated ACEC straddles Lea and Eddy Counties and is about 48 km (30 mi) northwest of the proposed CISF site. The other nominated ACEC, which is further north, borders the northwest corner of Lea County. Currently, the BLM is evaluating this nomination and expects to make a decision within the next several years .

1.3.1.3 U.S. Department of Transportation

Transportation of SNF is regulated under 49 CFR Part 173, Shippers – *General Requirements for Shipments and Packagings*. Other requirements pertaining to the transportation of material to the CISF are:

- 49 CFR Part 171, General Information, Regulations, and Definitions
- 49 CFR Part 172, *Hazardous Materials Tables, Special Provisions, Hazardous Material Communication, Emergency Response Information, and Training Requirements*
- 49 CFR Part 177, *Carriage by Public Highway*
- 49 CFR Part 107 Subpart G (registration/fee to DOT as a person who offers or transports hazardous materials)

1.3.2 State of Texas

At the state level, the environmental permitting of the CISF, which is located on ISP joint venture member Waste Control Specialists property, which will be subject to a long term lease to ISP, is primarily governed by the TCEQ. The following is a summary of environmental permitting activities to be undertaken with TCEQ.

1.3.2.1 Surface Water Protection

In order to protect jurisdictional waters from pollutants that could be conveyed in construction-related storm water runoff, TCEQ enabling regulations require construction projects disturbing five or more acres of soil to secure coverage under a Texas Pollutant Discharge Elimination System (TPDES) permit authorizing construction-related storm water discharges.

The Owner Controlled Area (OCA) at the CISF is approximately 130 ha (320 acres). The CISF would require removal of vegetation in areas both within and outside of the OCA. The majority of construction-related operations at the CISF would be performed inside of the OCA. In order to protect surface water from construction-related storm water runoff for large construction activities which disturb five or more acres, or are part of a larger common plan of development that would disturb five or more acres, the TCEQ regulates the proper disposition of storm water with the Construction General Permit (CGP TXR150000). The construction operator would file and implement a Stormwater Pollution Prevention Plan (SWPPP) and a Notice of Intent (NOI) in accordance with CGP TXR150000.

Soil disturbing activities associated with construction of the CISF inside and outside the OCA include:

- 130 ha (320 acres) for the OCA, including all facility building and storage pads
- *0.6* ha (*1.5* acres) for the rail side track

- 1.2 ha (3 acres) for construction of the 1.6 km (1 mi) long site access road
- 1.6 ha (4 acres) for a construction lay down area south of the CISF

Thus, approximately *133.4* ha (*330* acres) of soil would be disturbed during construction of the CISF and ancillary facilities on the site.

The NOI would provide general information about the site such as name, location, dates, and other general information relevant to the nature of the construction activities. Provisional coverage under CGP TXR150000 begins seven days after the completed storm water permit application NOI is postmarked for delivery to the TCEQ or immediately if the completed NOI is submitted electronically using the State of Texas Environmental Electronic Reporting System (STEERS). However, prior to filing an NOI, the construction operator must complete development and preparation of the SWPPP for the permitted construction site according to the provisions of this general permit. The SWPPP must include appropriate controls and measures to reduce erosion and discharge of pollutants in stormwater runoff from the construction support activities. The construction operator must also ensure the proper posting at the construction site of the CGP TXR150000 General Permit required "Large Construction Site Notice".

Implementation of the SWPPP requirements would occur prior to any discharge and continue until permit termination. Within the SWPPP, there would be provisions outlining erosion and sediment controls, soil stabilization practices, structural controls, and other best management practices (BMPs) that would be employed during construction to protect offsite waters from adverse impacts from construction-related activities and mitigate any storm water runoff. The SWPPP would also outline maintenance and inspection requirements and identify BMPs for the effective management of storm water runoff.

The SWPPP would be maintained onsite throughout the construction process and would be updated as appropriate. This document would also be made available for review, upon request, to the TCEQ, NRC, and other authorized individuals.

Once construction has been completed, a separate TPDES permit is not required for the operation of the CISF since facility operations would not result in the discharge of process wastewater. In addition, facility operations are not subject to stormwater permit regulations.

A Spill Prevention, Control, and Countermeasures Plan (SPCC) may need to be developed since all diesel fuel storage tanks at the CISF would be placed above the ground. This fuel tank

orientation may lead to the exceedance of the 40 CFR Part 112 SPCC permitting threshold, which would require the preparation of a SPCC plan prepared by a Professional Engineer. If an SPCC plan is required, it will be maintained onsite.

1.3.2.2 Drinking Water and Groundwater Protection

Drinking water needs for CISF construction activities are expected to be met by the purchase of offsite drinking water supplies. During operation activities drinking water needs are expected to be met by using the drinking water from the adjacent existing disposal facility's potable water system, with a secondary option to install a new potable water system dedicated to the CISF.

In the unlikely event that new well drilling is selected, all applicable Safe Drinking Water Act (SDWA) enabling regulations associated with treatment to ensure meeting National Primary Drinking Water Standards for non-transient, non-community drinking water systems would be met.

Sanitary wastewater generation during CISF construction is not expected as the use of portable toilets is likely, although use of sewage collection tanks, as planned for the operations phase is another option. During CISF operation it is expected that sanitary wastewater would be disposed of using two sewage collection tanks and underground digestion tanks similar to septic tanks but with no leach field. After testing the waste in the collection tanks to ensure release criteria in 30 TAC 336.359 and 30 TAC 336.215 are met, the sewage would be disposed of at a Texas Publicly Owned Treatment Works (POTW).

1.3.2.3 Preservation of Air Quality

Construction of the proposed CISF will take place completely within the state of Texas. Permitting requirements taking place in the state of Texas are under the jurisdiction of the Texas Commission on Environmental Quality (TCEQ). Construction and operations activities at the CISF are not expected to have any measurable impact on the local air quality since no significant criteria or hazardous air pollution emissions would occur. Gaseous criteria pollutant emissions at the CISF are limited to small propane space heating furnaces, a standby emergency diesel generator, a fire pump diesel engine, heavy haul trucks, cask transporters and workers' private vehicles.

Small space heating sources of air pollutants less than one million British Thermal Unit (BTU) per hour heat input are exempt from applicable air quality regulations. The emergency and fire pump diesel engines, which are non-construction stationary sources of air pollutants smaller than 150 kW and not operating more than 250 hours per year, would not trigger any new source review requirements. Moreover, the heavy haul trucks, transporters, and private vehicles are considered mobile sources, which are not regulated by the TCEQ.

Since the proposed CISF will not directly affect operations or emissions from the areas of the existing Waste Control Specialists facility that are covered under the New Source Rule (NSR) permit or other Permits By Rule (PBR), potential stationary sources at the CISF are likely eligible for a new authorization under PBR per 30 TAC 106.4 without amending the site's existing NSR permit.

Permitting requirements typically apply to stationary sources of emissions at a site. Emissions anticipated during construction and operation of the CISF would be from mobile on-road and non-road sources that are not subjected to permitting requirements. Additionally, the buildings and other structures at the site that require electricity will be connected to existing infrastructure and will not rely on electric generating units for standard operating electrical power. It is not anticipated that the emissions from the construction and operation of the CISF will require permitting from the state of Texas.

Any potential air quality-related impacts associated with construction of the CISF would result from gaseous pollutant emissions from diesel-powered construction equipment and from fugitive dust emissions from excavation activities and construction equipment. However, for a project of this size, steps need to be taken to minimize fugitive dust emissions. Accordingly, a BMP

Emissions Control Plan would be developed to provide assurance that fugitive dust emissions would be effectively managed and minimized throughout all of the construction phases of the project. This BMP Emission Control Plan would include dust control techniques, such as watering and/or chemical stabilization of potential dust sources. *Dust control will be maintained under the requirements of the Construction General Permit (Table 1.3-1).*

There are no expected airborne effluents of radionuclides from normal operations at the CISF. Accordingly, airborne effluent monitoring should not be required.

Refrigerants used for air conditioning at the CISF would consist of Class II refrigerants (i.e., non-ozone depleting substances). Therefore, permits for Clean Air Act Title VI, Stratospheric Ozone Protection, relative to the usage and storage of refrigerants would not be required.

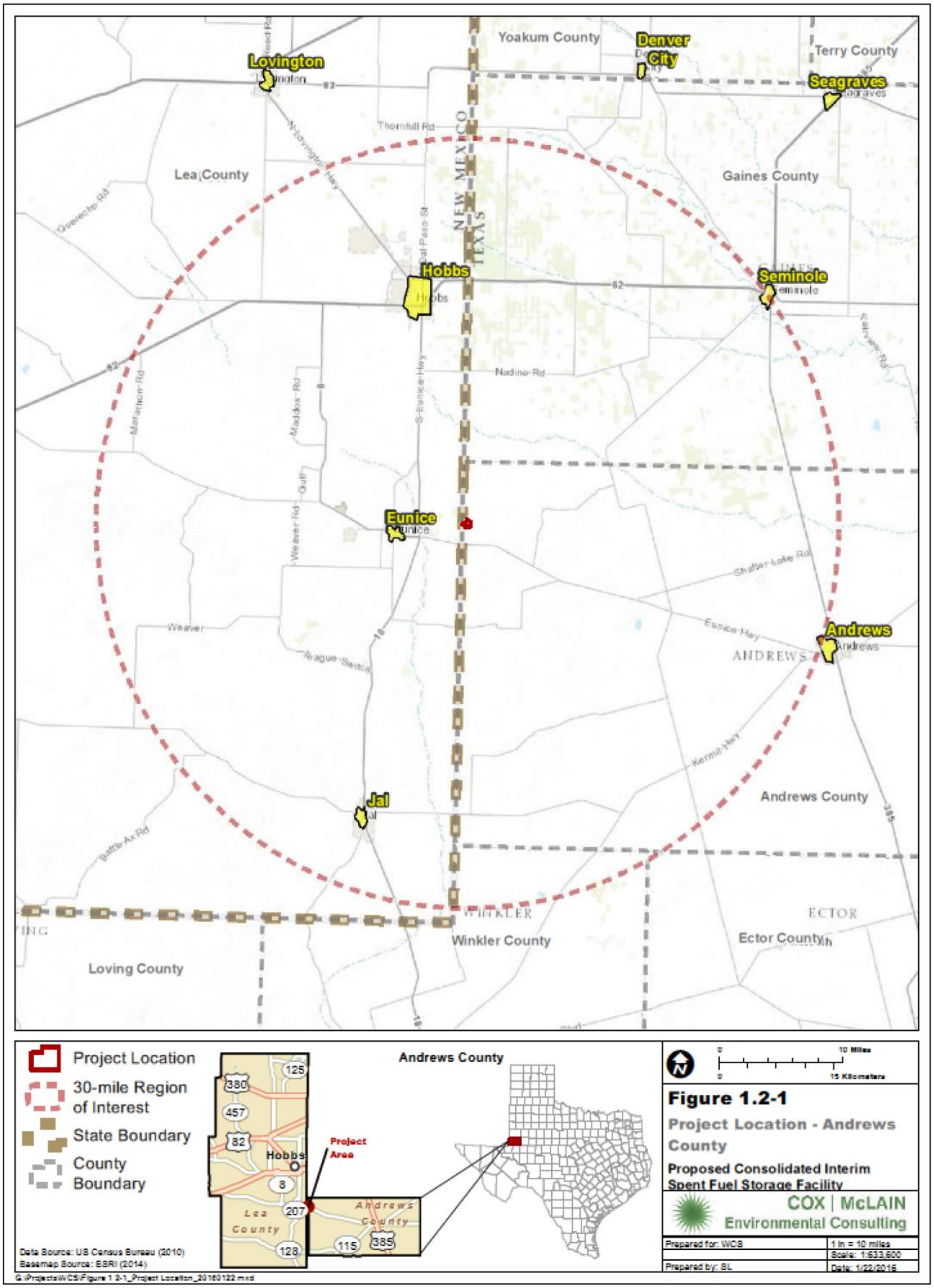
1.3.2.4 Pollution Prevention and Waste Management

The CISF project is committed to pollution prevention practices and would incorporate all TCEQ pollution prevention goals, as identified in 30 TAC 335. Non-hazardous wastes from construction activities would be disposed of appropriately. During operations, the small quantities of waste generated in the health physics lab and the potentially hazardous materials, such as lead, dye-penetrant materials (i.e., phosphorescent materials), hydraulic fluids, and miscellaneous lubricants used at the CISF, would be appropriately handled and disposed of. The small quantities of hazardous wastes that would be generated are expected to be much less than 100 kg/month. Thus, the CISF would qualify as a Conditionally Exempt Small Quantity Generator (CESQG). All hazardous wastes that are generated would be identified, stored, and disposed of in accordance with state and federal requirements applicable to CESQGs. Since the CISF design does not include Underground Storage Tanks (USTs), no UST registration with TCEQ would be required.

1.3.2.5 Historic and Archeological Resources

Because licensing of the CISF would be a federal action by NRC, Section 106 of the National Historic Preservation Act (NHPA) applies to the project. Coordination with the Texas Historical Commission (THC) and New Mexico State Historic Preservation Office (SHPO) has been completed for the CISF and a buffer area around the anticipated construction area. An archeological survey of the proposed facility was completed and no significant sites were identified within the area surveyed. Should the impacted area change, additional archeological

investigations could be warranted. See the Socioeconomic Impact Assessment (SIA) and attachments, 2015 (Appendix A).


Lovington
Denver City
Seagraves
Yoakum County
Terry County
Lea County
Gaines County
NEW MEXICO
TEXAS
Hobbs
Seminole
Eunice
Andrews
ANDREWS
Jal
Andrews County
WINKLER
Winkler County
ECTOR
Ector County
Loving County
Thornhill Rd
Nadine Rd
Shafter Lake Rd
Eunice Hwy
Kermit Hwy
Project Location
30-mile Region of Interest
State Boundary
County Boundary
Andrews County
Project Area
Hobbs
Lea County
Andrews County
Data Source: US Census Bureau (2010)
Basemap Source: ESRI (2014)
Figure 1.2-1
Project Location - Andrews County
Proposed Consolidated Interim Spent Fuel Storage Facility
COX | McLAIN Environmental Consulting
Prepared for: WCS
Prepared by: SL
1 in = 10 miles
Scale: 1:633,600
Date: 1/22/2016

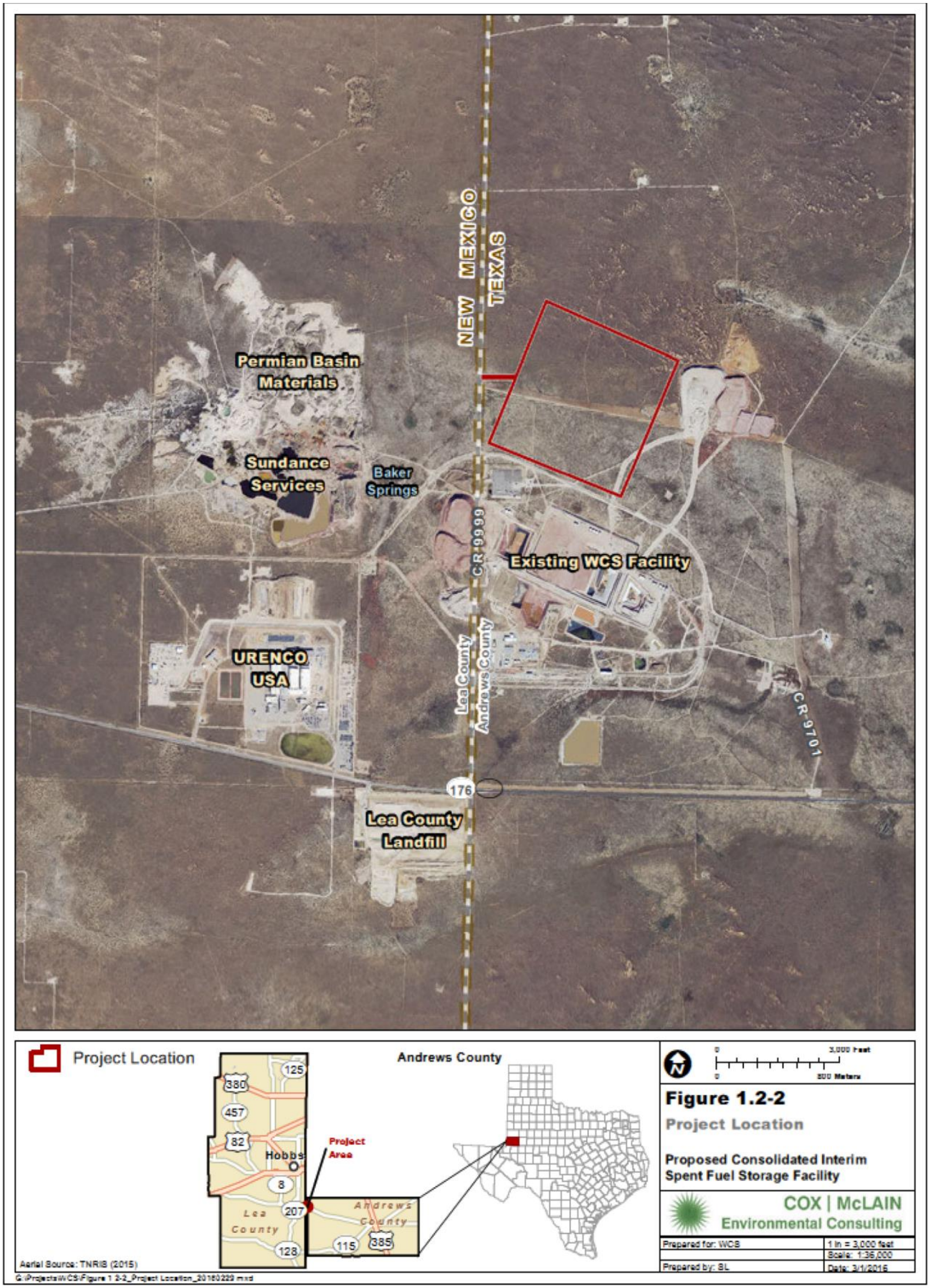


Figure 1.2-2
Project Location
Proposed Consolidated Interim Spent Fuel Storage Facility

CHAPTER 2

ALTERNATIVES

2.0 ALTERNATIVES

This chapter describes the proposed action discussed in Section 1.2 of this ER and the alternatives to the proposed action. Reasonable alternatives to the Proposed Action were evaluated to ensure consideration of alternate options in accordance with NEPA requirements.

Two alternatives, the No Action Alternative and the Proposed Action are analyzed in detail in this ER. Other alternatives that alter the design or location of the project were identified, but were ultimately not carried forward for detailed analysis. Those alternatives, and the reasons for eliminating them from detailed consideration, are presented in Section 2.4. The range of alternatives considered was based on the constraints of technical design requirements, the presence/absence of public and governmental support for a CISF, and on meeting the need to provide a safe option for storing SNF for 60-100 years or until a permanent geologic repository is licensed, constructed, and operating pursuant to the requirements of the NWPA.

This chapter also presents the potential cumulative impacts of past, present, and reasonably foreseeable future actions in the environs of the proposed action.

2.1 NO ACTION ALTERNATIVE

The no action alternative for ISP would be to not construct and operate the CISF. Under the no action alternative, the NRC would not approve the license application that would allow ISP to construct and operate the proposed facility. Accordingly, ISP would be allowed to pursue other alternative uses for the land just north of its LLRW Disposal Facilities. Additionally, commercial reactor sites that have already undergone site-wide decommissioning would be required to continue storing SNF onsite until another away-from-reactor ISFSI is available or a permanent geologic repository is ultimately licensed, constructed, and operating. It is estimated that the earliest time by which a geological repository could become available for permanent disposal of SNF would be 2048.

Under the no action alternative, commercial reactors that have already undergone decommissioning would be required to operate their ISFSIs in accordance with regulatory and license requirements and maintain a physical security program to ensure that the SNF remains adequately protected against potential malevolent acts.

Additionally, the shutdown decommissioned reactor sites would not be returned to a greenfield condition and the land could not be further developed in a manner that is most beneficial to the local communities. These local communities would be required to continue to host an ISFSI even if such action was not the preference of community members.

Existing commercial nuclear reactors that are currently operating would be required to construct new or expand existing ISFSIs to accommodate the need to store used fuel that is currently stored in spent fuel pools. As such, safety controls would be required by the NRC to protect against leaks and potential spent fuel fires. Additionally, the operational commercial reactors would similarly be required to expend resources to maintain their existing physical security programs to protect the used fuel from potential malevolent acts.

Under the No Action alternative, a decision by the NRC not to approve the WCS CISF license would constitute inaction in response to the Commission's rulemaking on the Continued Storage of SNF and the recommendations from the President's Blue Ribbon Commission on America's Nuclear Future to promote efforts to develop one or more consolidated storage facilities in the U.S. The No Action alternative would not meet the purpose of and need for the proposed action
.

2.2 PROPOSED ACTION

The proposed action, as described in Section 1.2 of the ER, is the issuance of an NRC license under 10 CFR 72 authorizing receipt, possession and transfer of SNF and reactor-related GTCC at a CISF located on approximately 130 ha (320 acres) of land that would be leased by ISP from ISP joint venture member Waste Control Specialists in Andrews County, Texas. The proposed action continues the receipt, possession and storage of up to 40,000 MTU of SNF and related GTCC waste at the CISF.

2.2.1 Description of the Proposed Site

The proposed site is located north of the LLRW Disposal Facility controlled by Waste Control Specialists, approximately 52 km (32 mi) west of Andrews, Texas. The protected area of the CISF comprises approximately 41 ha (100 acres) that will be encompassed by approximately

5,666 ha (14,000 acres) of land controlled by Waste Control Specialists. The center of the CISF is at latitude 32°27′09″ north and longitude 103°03′23″ west. The facility and regional area of interest (the area within a 48 km [30 mi] radius around the proposed CISF site) are presented in Figure 2.2-1.

The CISF is located approximately 2 km (1.25 mi) north of Texas State Highway 176 and just east of the Texas/New Mexico state line and State Line Road, also designated Andrews County Road 9998. The topography is relatively flat and slopes gently upwards from Texas State Highway 176 towards the north. The elevations range from approximately 1,041 m (3,416 feet) to 1,065 m (3,496 feet) above msl.

A railroad loop encompasses the Waste Control Specialists site and is currently used to transport radioactive waste to the site. Shipments of used fuel will be routed eastward from Eunice, New Mexico to the CISF on the railroad loop which is controlled and maintained by ISP joint venture member Waste Control Specialists. Aerial views of the site depicting the CISF location are provided in Figure 2.2-2. As shown in Figure 2.2-3, no highways or railroad lines cross the CISF site. There are also no pipelines crossing the CISF site. Maps showing rail access to the CISF are provided in Figures 2.2-4 and 2.2-5, and a proposed rail sidetrack into the CISF is shown in Figure 2.2-6. Additional information on the connected environmental impacts associated with SNF transport from shutdown decommissioned reactors, the transportation corridors, and the CISF rail spur can be found in Sections 3.2.1, 3.2.2 and 3.2.3 respectively.

Outside of the CISF and Waste Control Specialists footprint, industries include gravel and caliche mining, oil and gas production, landfill operations, cattle and ranching. Louisiana Energy Services operates the National Enrichment Facility (NEF) as URENCO, USA, about 1.6 km (1 mi) southwest of the site, under license by the NRC. Other businesses in proximity to the Waste Control Specialists property include Permian Basin Materials; Sundance, Inc.; and DD Landfarm located about 1.6 km (1 mi) northwest and west of the proposed CISF. The majority of the remaining land in the vicinity of the proposed CISF is used for ranching activities (livestock grazing), oil and gas production, or is unused land. The Lea County, New Mexico Landfill occupies approximately 16 ha (40 acres) and is located about 2 km (1.25 mi) south-southwest of the proposed CISF.

Waste Control Specialists currently operates a facility to store and treat hazardous waste, including mixed Class A, B, C, and Greater than Class C LLRW, regulated under the Resource Conservation and Recovery Act (RCRA). This facility also disposes of hazardous waste along with low activity radioactive waste that has been exempted by the TCEQ. Waste Control Specialists also operates a facility authorized to dispose of 11e.(2) byproduct materials. Additionally, Waste Control Specialists operates two facilities authorized to dispose of Class A, B, and C LLRW. The two facilities are referred to as the Compact Waste Disposal Facility (CWF) and Federal Waste Disposal Facility (FWF). The CWF serves the Texas Compact (Texas and Vermont) and the FWF serves the DOE. Each of these facilities is located south of the CISF. A storage pad is located just to the northwest of FWF and is used to support waste storage and offloading operations.

The location where the CISF would be constructed is currently vacant, undeveloped land. It is located just east of the Texas State Line Road that separates Texas and New Mexico, on property controlled by Waste Control Specialists.

Just to the southwest of the proposed CISF are large spoil piles consisting of soils that were excavated by Waste Control Specialists to support construction of the 11e.(2) byproduct materials and hazardous waste landfill. These soils are currently used to support maintenance of the private roads controlled and used by Waste Control Specialists. In the future, Waste Control Specialists plans to use the soils to close the existing landfills. Electrical power lines currently traverse the area to the west of the proposed CISF in a north-south direction.

Baker Spring is located about 1.6 km (1 mi) to the southwest of the proposed CISF and is typically dry, except during periods of rain (Figure 2.2-7). It is currently sampled when water is present as part of Waste Control Specialists' Environmental Monitoring Program as required pursuant to Radioactive Material License No. R04100 issued by the TCEQ.

The nearest resident is located approximately 6 km (3.8 mi) to the west of the CISF, just east of Eunice, New Mexico. The center of Eunice is about 10 km (6 mi) west of the CISF site. The city of Hobbs, New Mexico had a population of approximately 34,122 persons in 2010 according to the U.S. Census Bureau and is located northwest of the CISF. Eunice, New Mexico had 2,922 persons in 2010. The city of Andrews, Texas, with a population of approximately 11,088 in 2010, is located approximately 52 km (32 mi) to the east/southeast of the CISF. The nearest,

largest population center; Midland-Odessa, Texas is located to the southeast, about 103 km (64 mi) from the CISF with a population over 278,000 (Appendix A).

2.2.2 Description of the Facility

The CISF would be constructed in eight phases over 20 years on approximately 130 ha (320 acres) of land just north of the CWF and FWF.

The CISF will include SNF storage systems licensed under 10 CFR 72, SNF storage pads, a Cask Handling Building used to offload spent nuclear fuel canisters licensed under 10 CFR 71, a Security And Administration Building, and a railroad side track. More detailed descriptions of the facility components, as well as additional design features, can be found in Section 4.1, *Summary Description, Section 4.2, Storage Structures, Section 4.3, Auxiliary Systems,* Section 1.2, *General Description of Installation,* and Section 1.3, *General Description of Systems and Operations* in the SAR.

2.2.2.1 SNF Storage Systems

Currently, the NRC has licensed and approved SNF storage systems owned by TN Americas, NAC International, HOLTEC International, and Energy*Solutions*. Each of these systems is engineered to safely store spent fuel for 50 years or longer and this time can be extended almost indefinitely through rigorous inspections, aging management programs, maintenance, and re-licensing. SNF is stored horizontally in the TN Americas systems, vertically in both the NAC International or Holtec International systems, and either horizontally or vertically in the Energy*Solutions* system.

Approximately 80% of the SNF (approximately 4,000 MTU) currently stored at 12 decommissioned shutdown sites is in either TN Americas NUHOMS® or NAC International systems. ISP has teamed with TN Americas and NAC International to provide a safe alternative to store up to 40,000 MTUs of SNF at the CISF. Both NUHOMS® and MAGNASTOR® systems owned by TN Americas and NAC International, respectively, would be used for storing SNF at the CISF. The NRC has approved both of these SNF storage systems for use at existing commercial nuclear power plants located across the U.S. Additionally, both the NUHOMS® and MAGNASTOR® systems are licensed by the NRC for storage of SNF transported in canisters pursuant to the requirements in 10 CFR 71.

The NUHOMS® and MAGNASTOR® systems were selected for two primary reasons. First, TN Americas and NAC International provided ISP with proprietary information about the storage systems, including the requirements and technical specifications. This level of detail is essential to preparing a detailed SAR and ER. Second, since these two systems account for 80% of the stored SNF, utilizing these systems is the best way for ISP to support DOE's mission to remove the SNF from 12 decommissioned shutdown sites located across the DOE's goal is presented in a report entitled, *Strategy for the Management and Disposal of Used Nuclear Fuel and High Level Radioactive Waste* . Removal of SNF at these commercial nuclear reactor sites is needed to complete the decommissioning and allow the former reactor facilities to be returned to a greenfield status.

A listing of the 12 decommissioned shutdown sites is provided in Table 2.2-1 (also see Figure 2.2-8).

Table 2.2-1 Listing and Location of Shutdown Decommissioned Reactor sites

Site	County	State
Big Rock Point	Charlevoix County	MI
Connecticut Yankee	Middlesex County	CT
Crystal River	Citrus County	FL
Humboldt Bay	Humboldt County	CA
Kewaunee	Kewaunee County	WI
LaCrosse	Vernon County	WI
Maine Yankee	Lincoln County	ME
Rancho Seco	Sacramento County	CA
San Onofre	San Diego County	CA
Trojan	Columbia County	OR
Yankee Rowe	Franklin County	MA
Zion	Lake County	IL

2.2.2.2 SNF Storage Pads

The SNF storage systems will be placed on a concrete storage pad. The CISF will have a total of eight phases. Each phase will encompass an area 107 m (350 feet) wide and 244 m (800 feet) long. Each phase is sized to hold approximately 5,000 MTU for a total facility capacity of 40,000 MTU when all eight phases are complete. Within each phase there will be a series of concrete storage pads and vehicle approach aprons. The concrete pads will be 46 to 91 cm (18 to 36 in) thick, depending on specific load conditions and design requirements.

Casks received from the different facilities will be stored separately, to accommodate the different types of storage systems, the characteristics of different fuel types received from the facilities, and different storage and inspection requirements.

2.2.2.3 Cask Handling Building

The Cask Handling Building is where the SNF canisters will be transferred from rail cars onto transporters at the CISF. The building will be approximately *60* m (*197* feet) wide by *55* m (*179* feet) long and will have a height of approximately *22* m (*72* feet). Rail cars will enter on the *east* side of the building to be unloaded by an overhead 100-metric-ton crane. Once a rail car is unloaded, it will proceed forward and exit out the east side of the building. Adjacent to the rail track inside the building is space for cask staging and transporter loading. Once the transporter is loaded, it can exit the building and proceed to the appropriate storage module. The building will be tall enough to transfer casks for either horizontal or vertical storage modules. Areas are included in the building for radiological surveys of casks and transport vehicles and their cleaning and decontamination (in case contamination is discovered). Also placed in the Cask Handling Building are waste management areas and chemical storage areas for cleaning supplies needed to support these activities. There will be two 100-metric-ton overhead cranes inside the building to provide a redundant crane system for unloading casks. Preventative maintenance is performed on a regular basis on the overhead transfer cranes, transfer equipment, shipping casks, and other equipment in this building. Additional storage is provided for temporary staging of impact limiters and casks, as well as storage for maintenance tools and supplies.

2.2.2.4 Security and Administration Building

The Security and Administration building is located along the west edge of the Protected Area. The western exterior wall of the building will be integral with the Protected Area fence. The single story building is divided into two major functions: security and administration. Included inside the security portion will be the surveillance and monitoring stations for the Central Alarm Station (CAS), access control, and the armory. Security personnel will monitor sensors and intrusion alarms, control employee access, process visitors into the CISF, and control rail and vehicle access to the CISF. The Administration portion of the building will contain offices for operations, maintenance, and material control personnel; administrative functions related to processing shipments; emergency equipment and operations; communication and tracking center/facility; training and visitor center; health physics area; records storage; conference room; break room; and restroom facilities. Health physics will have areas in this building for operation and storage equipment and accumulation of small quantities of LLRW in a waste management area. Building dimensions are approximately 10 m (32 feet) wide by *48* m (*156* feet) long of enclosed space. Specific areas of the building which house the CAS and other essential functions will be constructed with ballistic materials. Adjacent to the building will be two outdoor covered areas. The first outdoor area is outside of the Protected Area and provides a covered entrance to the Access Control portion of the building for workers and visitors. The second outdoor covered area is inside the Protected Area and provides shelter for the emergency backup generators for the facility.

2.2.2.5 Railroad Side Track

The CISF would be built adjacent to the existing Waste Control Specialists railroad access loop. The new side track will consist of approximately *6,600* feet of track for SNF deliveries to the CISF. *The railroad side track connects to the existing WCS rail line in Texas. Figure 2.2-6 provides an overall layout and limit of the new side track. The new rail side track will be constructed using conventional methods to meet the standards of 49 CFR Part 213, “Track Safety Standards” and will be maintained and inspected in accordance with Federal Railroad Administration (FRA) Class 1 Standards. Standard maintenance of the rail track over the life of the facility consists of monthly inspections and upkeep. The rail side track will stay in place after decommissioning activities occur.*

2.2.2.6 *Not Used*

2.2.2.7 Monitoring Wells

Located within the CISF OCA are eight monitoring wells associated with the adjacent Waste Control Specialists disposal facilities that are gauged periodically to check for the presence of water. Five of these wells are between the CISF OCA boundary and the CISF Protected Area Boundary and three are within the CISF Protected Area Boundary. Two of the five wells that are within the CISF Protected Area Boundary are within the footprint of a late-phase CISF storage cask array and will be removed or relocated as needed as the phased CISF project construction schedule progresses. There are no pipelines crossing the CISF. At the Security and Administration Building and at the Cask Handling Building, ISP will have underground sewage tank systems that discharge into above ground, grey water holding tanks with no onsite discharge. After testing to ensure compliance with applicable limits, the wastewater from these holding tanks will be drained or pumped for removal to an offsite POTW. There are no plans for underground tanks at the CISF other than the underground sewage tanks.

2.2.2.8 Waste Management

Waste management impacts associated with the construction of and operations at the CISF are expected to be very low. The CISF will be designed to minimize the volumes of radiological waste generated during operations and at the time of license termination. The volumes of non-radiological solid waste will also be minimized to the extent practical. Descriptions of the sources and effluent systems for each of these waste streams are discussed in Section 3.12 of this report. Disposal plans, waste minimization practices, and related environmental impacts are discussed in Section 4.13 of this report and in Chapter 6 of the CISF SAR. Environmental impacts and mitigation measures for CISF facilities and associated operations are discussed in detail in Chapters 4 and 5 of this ER, respectively, whereas radiological monitoring is described in Chapter 6 of this ER. Sections 1.2, *General Description of Installation* and Section 1.3, *General Description of Systems and Operations* of the SAR provide additional details.

2.3 PROCESS FOR IDENTIFYING POTENTIAL CISF SITE LOCATIONS

In order to identify potential locations for a CISF site, a rigorous search and screening process was conducted. ISP began by identifying a Region-of-Interest (ROI) consisting of a set of states that have the basic characteristics appropriate for a CISF site. This set of states was then narrowed down to states and counties that had explicitly expressed support for siting a CISF in

their area. This resulted in the identification of four counties in two states that were subjected to a rigorous two-tier screening process evaluating 15 criteria ranging from local political support and land availability to operational considerations and environmental impacts. Ultimately, this process resulted in the identification of Andrews County, Texas as the site for the Proposed Action. The other Location Alternatives were eliminated from detailed analysis. Details are provided in this section.

2.3.1 Site Selection Process: Region of Interest

The site selection process was initiated pursuant to NEPA by identifying seven states located in the more arid western regions of the U.S. The states considered included Arizona, California, Colorado, Nevada, New Mexico, Texas, and Utah. ISP believes that selecting states with sparsely populated areas and relatively arid climates was an important step in the site selection process due to many of the concerns about storage of SNF previously raised by people in more densely populated areas. ISP also believes that a CISF should only be located in a state that has voiced its support for hosting such a facility. Of these seven states, only stakeholders in New Mexico and Texas have expressed an interest in hosting a CISF within their borders.

In March 2014, Texas Governor Rick Perry stated his support for siting a CISF in Texas. He directed the TCEQ to prepare a report addressing the challenges posed by the presence of SNF and other High Level Waste currently stored at the four commercial nuclear power reactors in Texas. On March 28, 2014, Governor Perry, in a letter to Lieutenant Governor David Dewhurst, voiced his support for storing SNF in Texas . He also forwarded the report prepared by the TCEQ entitled, *Assessment of Texas' High Level Radioactive Waste Storage Options* . The TCEQ recognized that—while SNF currently stored in Texas is safe—it is not an adequate long-term solution and that a program needed to be established in a community that was willing to host such a facility . The TCEQ suggested that "in looking at how to successfully site a facility, one should take into account current successfully sited and built radioactive waste disposal facilities such as the Waste Isolation Pilot Plant in New Mexico for transuranic waste and the Low Level Radioactive Waste Facility in Texas."

On April 10, 2015, New Mexico Governor Susana Martinez voiced her support for a consent-based approach to locate a CISF in southeastern New Mexico, Attachment 2-1 . She stated that such a facility was necessary given that millions of dollars of taxpayer funds were currently being spent on monitoring and oversight of SNF each year, and millions more were expended in

settlement payments related to waste disposition. Governor Martinez stated that such actions are carried out in communities that were not supportive of SNF storage. Governor Martinez referenced the work that had been conducted by the Eddy-Lea Energy Alliance (ELEA) in the southeastern portion of New Mexico. She noted that residents in that area of the state had a high level of understanding of the nuclear industry and its importance to our national security. Furthermore, Governor Martinez stated that a pre-existing strong scientific and nuclear operations workforce was present in the area, and that the dry, remote region was well-suited for an interim storage site.

2.3.2 Site Selection Process: Counties

Fifty-four counties were identified in west Texas and 2 counties in southeastern New Mexico that merited further consideration as potential locations for the CISF. When deciding where to locate a disposal facility for LLRW in 2003, the Texas legislature had limited its search to 53 counties in west Texas . Among other attributes, these counties had an average rainfall of less than 51 cm (20 in) annually, were located at least 100 km (62 mi) from Mexico, and were located away from certain river segments in the state,. The Texas legislature took this approach with the intent to open a disposal facility for Class A, B, and C LLRW, having previously failed to open the Sierra Blanca facility that would have been located near El Paso, Texas. The Sierra Blanca facility failed to be licensed due, in part, to opposition from the local community, as well as by the government of Mexico. ISP believed that finding a location with a willing host community was a critical early step to identifying a location that would be suitable for a CISF in Texas and that a supportive host community would be needed to support the successful licensing of its facility for disposal of Class A, B, and C LLRW.

ISP believes that selecting a county that had voiced its support was paramount to the successful licensing of a CISF. Of the 53 counties initially listed by the Texas legislature for siting a disposal facility for Class A, B, and C LLRW, only Andrews County has voiced its support for siting a CISF. The Texas legislature did not select Loving County as a potential candidate for hosting a disposal facility for Class A, B, and C LLRW because of its proximity to certain river segments of the Devils River and the Upper and Lower Pecos Rivers. However, Loving County has since expressed its willingness to host such a facility. For this reason, Loving County was included for further consideration as a potential location for the CISF.

In New Mexico, both Eddy and Lea Counties were selected for further consideration as a candidate site for the CISF. The local communities in both of these counties have expressed their strong support for hosting a CISF.

Thus, the analysis of a potential CISF site is narrowed to four counties (Figure 2.-1). Each of the four counties in Texas and New Mexico selected for further consideration are perceived to have the required general support at the state and community level consistent with the consent-based siting philosophy as recommended by the Blue Ribbon Commission on America's Nuclear Future. Residents in these communities strongly support the nuclear industry and are willing to host facilities that process, store, or dispose of radioactive waste. Nuclear facilities already present in these communities include the DOE's Waste Isolation Pilot Plant (WIPP) (located in Eddy County, New Mexico), the NEF operated by URENCO USA (located in Lea County west of Waste Control Specialists' existing operations), and Waste Control Specialists' processing and disposal facilities in Andrews, Texas. This region of the U.S. is often referred to as "America's Nuclear Corridor".

2.3.3 Site Selection Process: Factors in the Two-Tiered Screening Process

A two-tiered screening process was developed for evaluating each of the four counties for the purpose of identifying the preferred site location and suitable location alternatives. Under the first screening tier, five “Go: No Go” criteria were evaluated to determine whether any county should be excluded from further consideration. Criteria 1-5 comprised the first tier of the screening process: political support for the project, favorable seismological and geological characteristics, availability of rail access, land parcel size, and land availability. Any county that scored a “No Go” for any of these five criteria would be excluded from further consideration.

After completing the first tier of evaluations, a second tier screening process was used to evaluate each of the four counties in more detail. *Criteria 1-5 as previously discussed were quantitatively scored for each of the four counties.* Criteria 6 through 10 assessed Operational Needs and Criteria 11 through 15 assessed Environmental Considerations. For the second tier screening process, a score of 0 to 100 was assigned to multiple scoring factors for each criterion.

Descriptions of all criteria are provided below.

Criterion 1 assessed whether a county has adequate political support for a CISF, specifically whether the state and county governments had expressed an interest in siting a CISF.

Criterion 2 assessed the seismology and geology of the area to ensure that potential sites within each of the four counties were located in areas that were tectonically stable with favorable geologic characteristics.

Criterion 3 assessed the availability of rail access, which was determined to be important given the desire to transport SNF exclusively by rail. A county that could not support receipt of SNF exclusively by rail would require double handling of the SNF and additional adverse environmental impacts due to construction of the rail spur. The need to construct a spur less than 8 km (5 mi) long to connect to the rail line was considered a “Go”. Requiring transport by road or constructing a spur more than 8 km (5 mi) to a rail line was considered “acceptable”, but was not considered a substantial enough constraint to exclude the county from further consideration.

Criterion 4 assessed whether land parcels of adequate size were available in the area. Approximately 202 ha (500 acres) were expected to be required in order to provide a buffer zone around an area adequate for interim storage could store up to 40,000 MTUs of SNF.

Criterion 5 assessed whether or not the land was owned or required purchase from the current land owners.

Criterion 6 assessed the following variables on the availability of utilities:

- Electric Power Availability–This rating is based on the apparent relative availability and level of effort needed to construct electric power infrastructure needed by the CISF at the proposed site.
- Cellular and Data Towers (cell phone, internet)—It is desirable that existing service is available for dependable cell phone and internet services.
- Water Supply—It is desirable that groundwater or water from another source is readily available to provide ample water supply to the facility for both potable and processing uses.

Criterion 7 assessed the following variables, on construction labor force:

- Sufficient Labor Force—The local area has a sufficient pool of skilled construction labor to construct the facility on the desired schedule. Craft requirements include all major construction crafts (e.g., steelworkers, electricians, pipe fitters, operators, finishers, etc.).
- Competing Projects—No major construction projects of similar scope in the area will be competing for the same labor pool resources and thus substantially limit resource availability.
- Large Project Experience—To support project cost, schedule, and conformance to design basis, the CISF site applicant should possess the experience and technical qualifications needed to provide oversight of the planning and execution of a large nuclear facility construction project in accordance with ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications.* A scoring of large nuclear facility construction project management experience for each site license applicant, owner, or operator is therefore provided.

Criterion 8 assessed the following variables, on operational labor force:

- Sufficient Labor Force—Sufficient supply of qualified labor that can readily be trained for operations, maintenance, technical support, and waste management.
- Multi-task Employees—Local labor rules do not prohibit or discourage multi-tasking of employees.
- Technical School/Training—Community has technical school, technical/community college, or local nuclear facility that is willing to provide candidates and training classes for the operations.
- Mature Nuclear Safety Culture—It is advantageous to safety if CISF operations, maintenance, technical support, and waste management personnel available in the area will be members of a pre-existing mature nuclear safety culture before, during, and at the start of CISF operations.
- Radiation Worker Staff—CISF site applicant pre-staffed with highly trained and experienced radiation workers (e.g., operations, maintenance, technical support, and waste management) who are permanent local residents.
- Health Physicist and Radiation Protection Organizations—It is highly desirable and significantly beneficial to as-low-as-is-reasonably-achievable (ALARA) planning and execution if the site chosen has a CISF applicant that has assembled and employed a functioning and proven team of experienced health physicists and radiation protection technicians that are established in the area as permanent local residents at CISF start-up. This need is profound due to both the importance of immediately achieving and maintaining dose ALARA and the difficulties of hiring and retaining high demand, talented employees in remote locations such as those under consideration for any CISF site.

Criterion 9 assessed the following variables on transportation routes:

- Site Railhead—It is desirable to have a railhead located at the site.
- Highway Access—Close proximity to controlled-access highways and/or interstate highways is desirable.
- Traffic Capacity—There should be traffic infrastructure for construction and operation activities, with minimal improvements required.
- Efficient Access—There should be optimal and efficient highway and rail access to support safe and reliable storage cask material, component, and other deliveries.

Criterion 10 assessed the following variables on amenities for the workforce:

- Housing—It is desirable that housing, hotels, and lodging be available for the work force, as well as recreational facilities.
- Schools—It is desirable for recruitment and retention of high quality scientific and technical CISF employees that the site selected allow for these workers to commute to residential areas in public school districts meeting state and federal accountability standards.
- Health Services—an assessment of whether emergency room and routine medical care is reasonably available to CISF personnel, contractors, and visitors is provided.
- Parks/Recreation/Culture—It is desirable that parks and recreational facilities be available in the CISF area for use by the workforce. It is also desirable that there be cultural activities at or near the area.

Criterion 11 assessed the following variables on environmental protection:

- Existing Site Characterization Data—It is highly preferable that site characterization surveys are available for hydrology, meteorology (rain, wind, tornadoes, temperatures, etc.), topography, archeology and protected species.
- Documentation of Presence/Absence of Contamination—It is highly preferable that the site have existing, well-documented site surveys and monitoring studies for radiological, chemical, and hazardous material contamination, and that the site not be contaminated.
- Neighboring Plume—Within the area that includes the site, it is highly preferable that no facility has existing release plumes (air or water) of hazardous material or radiation.
- Future Migration—The potential for future migration of contamination from adjoining or nearby sites should be negligible.
- No Rad Contamination—Site is not contaminated with radiological material in soil or groundwater to a level that would inhibit *licensing* or transfer of *property* with clear identification of liabilities.
- Not CERCLA or RCRA—Site is not identified as a CERCLA or RCRA site contaminated with hazardous wastes or materials.
- No Remediation Needed—Site does not have contamination that would require remediation prior to construction.
- Flood Plain—The site is not within the 500-year Flood Plain.

- Ponding—It is desirable that the natural site contours minimize the potential for localized flooding or ponding. Factors to consider include stream beds, natural and potential runoffs, runoff from adjacent areas, storm drainage systems in place, and requirements for retention ponds.
- Protected species—The site should not be habitat for protected species (USFWS federally listed threatened or endangered species). Also, adjacent properties should have no areas designated as wildlife refuges, critical habitat, or vegetation such as rare plant species that would be adversely affected by the facility.
- Archeological and Cultural Resources—The site should have a low probability of containing archeological/cultural resources.
- Environmental Permits—Any new facility construction or operations should not be hindered by any existing environmental or other permit requirements in the area. Any required new CISF environmental permits, such as for wastewater management, should be obtainable.
- Environmental Justice—The site should have a low probability of disproportionate, adverse impacts to low-income or minority communities.

Criterion 12 assessed the following variables on discharge routes:

- Facility Discharges—Facility discharge and runoff controls can be economically implemented for minimal effect to the existing environment.
- Differentiation—For sites with extant nuclear facilities, facility discharges are readily identifiable from extant facility discharges.

Criterion 13 assessed the following variables on the proximity of hazardous operations:

- Hazardous Chemical Sites— the distance of the site from any facility storing, handling, or processing large quantities of hazardous chemicals is considered.
- Gas Pipelines— the distance of the site from one or more large propane or natural gas pipelines is considered.
- Airports—The site should not be located within 16 km (10 mi) of a commercial airport.
- Emergency Area—The site should be outside the general emergency area for any nearby hazardous operations facility (other than an extant nuclear-related facility).
- Air Quality—The site should not be located within 8 km (5 mi) of an operating/manufacturing facility that inhibits site air quality. In addition, the site should

have high air quality. The site terrain should not limit air dispersal. Finally, the surrounding community's air quality should be within regulatory requirements ("in attainment" of National Ambient Air Quality Standards [NAAQS]).

Criterion 14 assessed the following variables on ease of decommissioning:

- Ease of Decommissioning—Site characteristics (e.g., hydrology) do not negatively affect decommissioning activities.
- Adjacent Site's Medium/Long-Term Plans—It is desirable that planned major construction and heavy industrial activities in adjacent sites within 1.6 km (1 mi) of the site boundary are minimal over the reasonably anticipated period of CISF decommissioning.

Criterion 15 assessed the following variables on disposal of low-level waste:

- Availability to Disposal Options—Site-specific issues (e.g., availability/access to nearby facilities for disposal of low-level waste, transportation modes, etc.) do not impede disposal of low-level waste.
- Licenses and Permits—Prospective facility operator possesses the necessary Licenses and Permits for generation and storage of LLRW, RCRA, and low-level mixed waste or has the technical qualifications and means to obtain them.

2.3.4 Site Selection Process: Results for Andrews County, Texas

This section presents the results of the analysis of the Andrews County, Texas location for each of the scoring criteria. Based on the results of the first tier screening process, Andrews County was carried forward for detailed evaluation of Operational Needs and Environmental Considerations (Criteria 6-15). Ultimately, based on evaluation of all criteria, Andrews County was identified as the preferred location for the Proposed Action.

<u>CRITERION 1—POLITICAL SUPPORT</u>

Andrews County in Texas has expressed support for a CISF facility. On January 20, 2015, the Andrews County Commissioners unanimously approved a resolution supporting siting a CISF in the county. Andrews County is considered a "Go" for political support.

CRITERION 2—SEISMOLOGICAL AND GEOLOGICAL CHARACTERISTICS

Several regional surveys have been conducted to support the siting of the WIPP, NEF, and Waste Control Specialists operations. These surveys demonstrated that Andrews County, Texas is tectonically stable and has suitable geological characteristics to site a CISF. Andrews County is considered a "Go" for seismological and geological characteristics.

CRITERION 3—AVAILABILITY OF RAIL ACCESS

Access via rail in Andrews County, Texas is excellent; an existing spur extends to the Waste Control Specialists property where the CISF would be located. Andrews County is considered a "Go" for availability of rail access.

CRITERION 4—LAND PARCEL SIZE

Over 5,666 ha (14,000 acres) are available for consideration at the Waste Control Specialists site in Andrews County. Andrews County is considered a "Go" for land parcel size.

CRITERION 5—LAND AVAILABILITY

The entire Waste Control Specialists property was evaluated to determine the best parcel of land to build the CISF in Andrews County, Texas. It was determined that sections 16 and 25 (Figure 2.3-2), consisting of approximately 486 ha (1,200 acres), represent the best parcels of land within the approximately 5,666 ha (14,000) acres of the Waste Control Specialists property. These sections of land are located close to the State Line Road between Texas and New Mexico and near the intersection of an existing private road running through the property, which would allow easy access for construction and operations. This parcel of land is also close to the rail line that already runs through the Waste Control Specialists property, which affords an opportunity to install a rail spur with minimal environmental impacts. Another characteristic these sections of land offer is that they are located just north of the LLRW FWF. Due to the low potential environmental impacts and low cost given the existing rail, these parcels of land with existing rail and road infrastructure represent the most feasible site location for the CISF in Andrews County, Texas. Finally, ISP joint venture member Waste Control Specialists is willing to sign a long term lease with ISP for the CISF. Therefore, sections 16 and 25 were evaluated in the screening process. Andrews County is considered a "Go" for land availability.

CRITERION 6—UTILITIES

Electric power is readily available at the Andrews County site. The electric transmission and distribution service provider, Oncor Electric Delivery Company LLC, upgraded the distribution lines into Waste Control Specialists during construction of the adjacent LLRW Disposal Facilities in 2011. Additionally, Oncor is further upgrading service as they have recently purchased the 138 KV power lines running through Waste Control Specialists property parallel to (and adjacent to) the Texas-New Mexico state line and are installing a new substation about 2 km (1.25 mi) south of the Andrews County site. The Waste Control Specialists Communications tower allows sitewide cellphone service and high speed internet and landline communications. A 15 cm (6 in) water line currently providing the Waste Control Specialists facilities with water from the City of Eunice will provide sufficient water for construction and operations, although water from Waste Control Specialists wells or other sources may be used for construction water as needed.

CRITERION 7—CONSTRUCTION LABOR FORCE

Labor support for construction of the CISF in Andrews County should be fully available within the ROI unless a large concurrent construction project becomes competitive for the same resources. The contracting of construction companies from outside of the region, such as from Albuquerque, New Mexico; Lubbock, Texas; and El Paso, Texas, is common practice in west Texas and southeastern New Mexico, so the prospective CISF licensee should be able to find and contract an adequately skilled labor pool to construct the facility on the desired schedule even if another construction project were to interfere with local contracting. The Andrews county site operator, and ISP joint venture member Waste Control Specialists, having licensed and constructed the CWF and the FWF, has essential experience planning, contracting, and executing a project such as CISF site construction from beginning to end. In order to support project cost and schedule, as well as conformance to design basis, regulatory requirements, and license conditions, the CISF site licensee/applicant should possess an appropriate degree of experience and technical qualifications needed to provide rigorous oversight of the planning and execution of a large nuclear facility construction project (e.g., in accordance with ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications*). ISP joint venture member Waste Control Specialists has been operating under applicable NQA-1 requirements since 1997 and successfully completed construction of the Low Level Disposal Facilities (CWF and FWF) in accordance with all regulatory requirements and license conditions under intense regulatory review.

CRITERION 8—OPERATIONAL LABOR FORCE

Operations labor force considerations for the Andrews County CISF operator would be virtually identical to those at a southeastern New Mexico CISF. Most CISF operations workers for the site in Andrews County will need to be degreed, technical, and highly trained workers hired from outside of the ROI or hired away from one of the nuclear–related facilities in the region for initial CISF operations. For long term hiring, major universities and other post-secondary schools are located in Midland-Odessa and Lubbock, while a local junior college in Hobbs is available to assist with training and qualification of workers. Given that the Andrews County site is in west Texas, where workers have not joined unions, the labor environment is favorable to multi-tasking of employees.

The Andrews County CISF operator has a staff of experienced radiation workers, radiation protection technicians, and health physicists it has established to create a stable organization of permanent resident employees. Additionally, ISP joint venture member Waste Control Specialists has worked many years to inculcate and mature a nuclear safety culture in operations, maintenance, technical support, and waste management personnel that will be highly advantageous during and at the start of CISF operations at the Andrews County CISF.

CRITERION 9—TRANSPORT ROUTES

A dedicated Waste Control Specialists–controlled rail loop encircles the Waste Control Specialists waste management facilities. The proposed CISF is to be built north of and adjacent to the existing Waste Control Specialists railroad access loop. ISP will have access to this rail loop for CISF purposes. A new side track will extend *northeast* to run east and west on the CISF Pad through the Cask Handling Building to provide for optimal and safe rail delivery of spent fuel and associated materials.

Texas State Highway 176, approximately 2 km (1.25 mi) south of the Andrews County site, provides for efficient movement of operations and construction traffic. Approximately 6 km (4 mi) to the west on Texas State Highway 176 is divided New Mexico Highway 18 in New Mexico; Interstate 20 is another 105 km (65 mi) south from there. Approximately 55 km (32 mi) to the east on Texas State Highway 176 is divided U.S. Highway 385; Interstate 20 at Odessa, Texas is another 68 km (42 mi) south from there.

CRITERION 10—AMENITIES FOR WORKFORCE

Workforce amenities for an Andrews County CISF site would share many characteristics with the proposed Lea County CISF because the proposed Andrews County CISF is on the Texas-New Mexico border 10 km (6 mi) east of central Eunice, New Mexico. A number of hotels/motels and restaurants are located in Hobbs, New Mexico about 37 km (23 mi) from the site by road and in Andrews, Texas, approximately 55 km (32 mi) east of the site by road.

ISP joint venture member Waste Control Specialists experience has shown that about half of the workforce will choose to live in New Mexico and half in Texas. Housing for the operations workforce would also mostly be in Andrews, Eunice, and Hobbs, with a few in Midland and Odessa. Although the housing market is generally tight in these cities, CISF personnel at this site should be able to locate suitable housing in a timely manner in Andrews or Hobbs due to the relatively small size of the operational workforce and current downturn in oil and gas exploration.

Public schools in Andrews and Hobbs are rated as average with Andrews having the better ratings of the two. Medical facilities include the Permian Regional Medical Facility which is a general medical and surgical hospital in Andrews, Texas, with 44 beds. Larger advanced full service hospitals are in Midland and Odessa Texas. Midland Memorial Hospital (MMH) is a general medical and surgical hospital in Midland, Texas, with 229 beds. Survey data for the latest year available shows that 61,164 patients visited MMH's emergency room. The hospital had a total of 10,542 admissions. Its physicians performed 3,707 inpatient and 5,883 outpatient surgeries. In Odessa, Texas, Medical Center Hospital is a general medical and surgical hospital with 326 beds. It is also a teaching hospital. Survey data for the latest year available shows that 51,487 patients visited the hospital's emergency room. The hospital had a total of 13,658 admissions. Its physicians performed 3,570 inpatient and 4,888 outpatient surgeries. Lea Regional Medical Center (LRMC) in Hobbs, New Mexico is a 201-bed, acute care facility providing complete care - from cardiac care and pediatrics to mental health and outpatient surgery.

There are multiple well-maintained parks in the city and county of Andrews. Lakeside Park in northwest Andrews provides opportunities for fishing, jogging, and barbequing with grills and picnic tables. The new City of Andrews Water Park attracts visitors from neighboring counties in west Texas and New Mexico. The Andrews golf course is also a local attraction. Lubbock, Midland, and Odessa each boast symphony orchestras, museums and multiple movie theaters.

Three national parks are available to CISF employees: two to the west of the Andrews County site and one to the south. Carlsbad Caverns National Park in New Mexico and Guadalupe Mountains National Park in Texas are both southwest of Carlsbad. These facilities offer recreational activities including rafting, spelunking, hiking, and backpacking. Big Bend National Park is about three and one-half hours south of Andrews on U.S. Highway 385. Limited local recreational and cultural activities are also available in Hobbs (e.g., Harry McAdams State Park).

CRITERION 11—ENVIRONMENTAL PROTECTION

The proposed Andrews County CISF site is adjacent and contiguous to Waste Control Specialists' LLRW Disposal Facilities, which is among the most thoroughly characterized sites in the world. The Waste Control Specialists site has been under a monitoring plan to detect the release of trace amounts of radiological and hazardous chemical constituents since it was permitted and licensed in 1997. No contamination of any kind has been detected near the proposed CISF site.

The site is not in a flood zone. There is no potential for flooding or ponding because, although the site is basically flat, within the proposed CISF footprint is a topographic high promoting very good drainage in every direction away from the facility. There are no natural perennial water features near the site. However, there is an ephemeral playa to the east of the site and Baker Spring southwest of the site. Historically, Baker Spring was known as a spring as well as the site of historical excavation of gravel and caprock materials that are present above the red bed clay. In recent years Baker Spring has been mostly ephemeral and dry, with water ponding during rain events in an excavation into the red beds at the base of the spring. Baker Spring has not supported an aquatic ecosystem for monitoring purposes for many years. A "fish pond" at the Permian Basin Materials Gravel Pit to the west of the site is an artificial surface water feature because it is manmade and because it is artificially recharged by transfer of water captured in excavated areas of the quarry and by pumping of groundwater, if encountered, from quarry excavations.

The climate at the site supports efficient construction and operations with delays due to inclement weather being very unlikely or short and very infrequent. Precipitation data from the Waste Control Specialists application for a license to authorize near-surface land disposal of LLRW, Appendix 2.3.1: Meteorological and Climatology Data, was used to describe site climate.

The climate data presented is for January 2000 through December 2005. Onsite measured air temperatures during this period were consistent with an annual pattern of high summer temperatures and low fall (and winter) temperatures. The highest and lowest temperatures recorded onsite were 107.9 °F and 3.7 °F, respectively. The mean monthly average temperatures onsite ranged from 82.0 °F in July to 42.2 °F in December. The lowest and highest relative humidity values recorded are from 30% in April to 84% in October . The average monthly relative humidity ranged from 50% in April to 70% in October. The average annual rainfall at the proposed site was 40.1 cm (15.8 in) and the maximum site rainfall amount recorded for a 24-hour period was 11.3 cm (4.45 in). Minimum and maximum monthly rainfall totals recorded for this period were 0.25 and 22.4 cm (0.1 and 8.8 in), respectively. Average annual totals for the January 2000 through December 2005 were 38.9 cm (15.3 in) for Andrews, 40.6 cm (16.0 in) for Hobbs, and 35.6 cm (14.0 in) for Midland. The data clearly demonstrate an annual rainfall in the region of less than 51 cm (20 in). The maximum 24-hour maximum rainfall amounts recorded at the three stations were 19.3, 19.1, and 12.2 cm (7.6, 7.5, and 4.8 in) for Andrews, Hobbs, and Midland, respectively. By comparison, the 24-hour, 100-year storm event for the region, as calculated by The National Oceanic and Atmospheric Administration (NOAA), is 15.5 cm (6.1 in) . Annual snowfall averages were recorded at 8.6, 13.0, and 10.4 cm (3.4, 5.1, and 4.1 in) for Andrews, Hobbs, and Midland, respectively.

Wind direction measured onsite is primarily from the south, south-southeast, and south-southwest, with the greatest percentage from the south. These sectors together account for 28.5% of hourly average wind data for the period. The next most frequent wind directions are east-northeast, northeast, and east, accounting for 17.2%. Average wind speeds varied very little from month to month. The strongest average winds during the monitoring period were from the southerly directions with average wind speeds of 8 to 11.5 mph. The highest one-hour wind speeds occurred during September, blowing from the south-southeast direction. The highest recorded one-hour wind speeds were 32.8 and 43.6 mph at the 2 m (6.5 ft) and 10 m (33 ft) height, respectively. Sand or dust storms typically occur in the winter or early spring when rotors (horizontal vortices) generated by strong westerly winds blowing across the region touch the ground. Most episodes of dust prevail for only six hours or less, when visibility is restricted to less than 0.8 km (0.5 mi). Statistical information is lacking on seasonal distribution intensity and duration of dust storms for the region. Recent data recorded in Lubbock, Texas (177 km [110 mi] northeast of the site) indicates blowing dust occurred an average of 12 times in the spring and 9 times during the remainder of the year . Two F2 Class (wind speed from 113 to 157 mph)

tornadoes have been recorded in Andrews County, Texas from 1880 through 1989 . According to data reported by NOAA, two F2 Class and eight F1 Class (wind speed from 73 to 112 mph) tornadoes have been recorded in Andrews County since 1950.

As part of the Waste Control Specialists application for a license to authorize near-surface land disposal of LLRW, Appendix 11.9.2: Ecological Baseline Assessment was used to describe site potential to adversely affect rare, threatened or endangered species and habitats. The assessment was performed during 2006. The dominant plant species on the site are native. However, several native species are considered invasive; their presence onsite is the result of previous range/livestock grazing. These invasive species include honey mesquite and prickly pear. There are also several exotic forb species on the site, such as Russian thistle, but they were absent where the soil surface has not been disturbed and would likely not invade ungrazed grassland locations. Invertebrates were sampled using sweep nets and pit traps. Most were identified to family. One amphibian, the Texas toad (*Bufo speciosis*), was observed during the assessment in surface water areas created by runoff water released onto the surface. No permanent surface waters were on or within 5 km (3.1 mi) of the site. Eight reptile species were recorded during the assessment. Texas horned lizards (*Phrynosoma cornutm*) were observed at several locations on and near the site. This species is listed as threatened in Texas and is the Texas State Reptile. It is protected by the State of Texas because of shrinking populations due to fire and loss of habitat and was observed at several locations on and around the then–proposed LLRW facility. Fifty-three species of birds were observed during the assessment in the course of baseline ecological surveys. All of these are known to occur in similar habitats throughout the region. Analysis of seasonal data indicated that most were migrants. Small mammal trapping was conducted. Mammal species observed during the assessment included a kangaroo rat, wood rat, desert cottontail, black-tailed jackrabbit, mule deer, and coyote. No federally threatened or endangered species were observed during surveys .

The Socioeconomic information below is from Sections 1.1.3 and 1.1.6 of the *Socioeconomic Impacts of the Proposed Spent Nuclear Fuel Consolidated Interim Storage Facility Andrews County, Texas* report (Appendix A). Based on U.S. Census Bureau data in 2010, the minority populations of counties within the project area ROI were as follows: Andrews County was 52.1% minority; Gaines County was 39.4% minority; Winkler County was 57.5% minority; Ector County was 58.9% minority; and Lea County, New Mexico was 57.0% minority. By comparison, the percentages at the state level were 59.5% (New Mexico) and 44.3% (Texas). The city closest to the WCS CISF is Eunice, New Mexico, which had a minority population of 49.9% in 2010.

Hispanic or Latino populations are the largest percentages of minorities within the ROI, ranging from 36.6% of the population in Gaines County to 53.8% in Winkler County. Black or African American populations had the next-largest share, with percentages ranging from 0.9 to 5.6%, depending on the location.

According to 2009–2013 county-level American Community Survey data, the highest median household income for the ROI was in Andrews County ($57,825); at the city level, Jal, New Mexico in Lea County had the lowest median household income of $48,790. Within the three census tracts (CT) in Andrews, Texas, the median household incomes ranged from $61,719 (CT 9504) to $88,250 (CT 9501). Ector County has one census tract and the median household income is $36,927. Seminole, Texas, has two census tracts and median household incomes were $46,512 (CT 9503) and $64,024 (CT 9502), respectively. Winkler County, Texas, has one census tract and the median household income is $49,583. Jal, Lea County, New Mexico, has 15 census tracts within the ROI. Median household incomes ranged $29,882 in CT 3 to $108,922 in CT 7.03.

The U.S. Census Bureau uses an income threshold that varies by family size and composition to determine who is in poverty. If the family's total income is less than the family's threshold, then the family and every individual is considered in poverty. The preliminary estimate of the poverty threshold for 2014 for a family of four is $24,221. The final 2014 thresholds were released in September 2015 and that threshold was $24,036 (Appendix A). U.S. Department of Health and Human Services (DHHS) also publishes a poverty guideline. For comparison purposes, the 2015 DHHS poverty guideline is $24,250 for a family of four. The median household incomes for all the counties and cities within the ROI are above the poverty thresholds established by the U.S. Census Bureau and the DHHS.

The Socioeconomic information below is from Sections 1.1.10.1 and 1.1.10.2 of the *Socioeconomic Impacts of the Proposed Spent Nuclear Fuel Consolidated Interim Storage Facility Andrews County, Texas* report (Appendix A). Based on U.S. Census Bureau data, the percentages of the population considered to be minority for the two block groups within the 6.4 km (4-mi) radius are 37.3% and 31.9%. The NRC guidance states that if the minority percentage in the relevant block groups exceeds 50%, or if the minority percentage in the relevant block groups is more than 20 percentage points greater than the state or county percentages, environmental justice should be considered in greater detail. The minority

percentages for the relevant block groups are below 50% and are also each lower than the respective county and state in which the block group is located.

The 2014 Poverty Thresholds (the most recent data available) were obtained from the U.S. Census Bureau and compared to the median household income for the block groups within the 6.4 km (4 mi) radius, based on data from the 2009–2013 ACS. The median household income levels were conservatively compared to the highest Census poverty threshold ($52,685), as the Census presents several thresholds for varying family sizes and characteristics. The median household incomes for the relevant block groups are above the *highest* 2014 Census poverty threshold. In 2014 dollars, these numbers would be even higher.

Data from the 2009–2013 ACS was collected regarding the percentage of households living below the poverty level in the relevant block groups and for the reference geographies. Neither of the block groups have greater than 50% of the households with incomes below the poverty level. Furthermore, the percentages of households with incomes below the poverty level are lower in the block groups than in the reference geographies, and therefore do not exceed the 20% criterion. Furthermore, no minority or low-income populations were identified within the 6.4 km (4 mi) study area. Based on the foregoing, further environmental justice analysis is not necessary.

An intensive pedestrian archeological field survey carried out in 2015 concluded that no archeological materials were observed within the 87.7 ha (216.6 acre) area of potential effects.

Range and brush fires that may occur should not pose a substantial danger to a CISF at the Andrews County site due to the relative sparseness of vegetation and facility design. The area is predominately desert scrub and trees are absent. Desert range land will burn but does not support a sufficient fuel load to sustain a major fire.

CRITERION 12—DISCHARGE ROUTES

There is minimal chance of future contamination from adjacent facilities due to inherent facility design, safe conduct of operations, and early detection from environmental monitoring programs. The NEF to the southwest of the site is strictly regulated by the NRC and is operated under detailed procedures with multiple barriers to any radiological release. Waste Control Specialists LLRW Disposal Facilities and Storage and Processing Facility (TSDF) are regulated

by TCEQ and the U.S. Environmental Protection Agency (EPA) but are designed and operated the same way as the NEF.

CRITERION 13—PROXIMITY OF HAZARDOUS OPERATIONS/HIGH-RISK FACILITIES

There are no facilities handling large quantities of hazardous materials, chemicals, or other material in proximity to the site. NEF handles Uranium Hexafluoride but manages it in a manner that minimizes risk to a CISF at the site.

There are no major propane pipelines that pose a danger to the proposed CISF.

Air quality at the site is very good; it is not in a non-attainment zone. The distance to the nearest commercial airport, Lea County Regional Airport, is approximately 40 km (25 mi).

CRITERION 14—EASE OF DECOMMISSIONING

Construction, operations and decommissioning at the proposed CISF will be easily coordinated with the same ongoing activities at the adjacent Waste Control Specialists facilities by proper scheduling of shipments and phased activities. The large area of Waste Control Specialists property surrounding the CISF site provides for multiple supporting laydown areas and construction access roads that may be needed to support these efforts.

CRITERION 15—DISPOSAL OF LOW-LEVEL WASTE

The adjacent LLRW Disposal Facility virtually eliminates high transportation costs for CISF–generated LLRW and the CISF operator already possesses the necessary permits and license to dispose of CISF LLRW, mixed waste, and hazardous waste. This advantage, along with the elimination of waste transportation costs, should prove to be highly cost-effective at the time of decommissioning if the FWF remains open at CISF decommissioning time.

2.3.5 Site Selection Process: Results for Loving County, Texas

A potential site to construct and operate a CISF in Loving County, Texas was evaluated because of the community's willingness to support hosting such a facility and due to the many positive siting and environmental characteristics present in Loving County, Texas. The evaluation is based on readily available information and interviews with local county officials. One potential tract of land has been identified as a potential candidate site for constructing and operating a CISF in the northwestern portion of Loving County on the border with Lea County, New Mexico.

CRITERION 1—POLITICAL SUPPORT

In Texas, Loving County has expressed support for a CISF facility. On February 11, 2013, the Commissioner's Court of Loving County approved a resolution that called for, among other things, identifying a potential site for constructing and maintaining a storage facility for SNF on an interim basis. The Loving County Commissioner's Court resolution noted that the State of Texas, operating through the General Land Office/School Land Board on behalf of the Texas Permanent School Fund had executed a "Letter of Intent" to negotiate a lease of state-owned land with AFCI for the purpose of identifying a potential site for the CISF. A similar agreement for constructing a CISF could also be reached with Loving County. Loving County is considered a "Go" for political support.

CRITERION 2—SEISMOLOGICAL AND GEOLOGICAL CHARACTERISTICS

Several regional surveys have been conducted to support the siting of the WIPP, NEF, and Waste Control Specialists operations. These surveys demonstrated that Loving County, Texas is tectonically stable and has suitable geological characteristics to site a CISF. Loving County is considered a "Go" for seismological and geological characteristics.

CRITERION 3—AVAILABILITY OF RAIL ACCESS

A facility supporting interim storage in Loving County would require a rail spur more than 8 km (5 mi) long or transport by road from the nearest rail lines in either Monahans, Texas or from Carlsbad, New Mexico. Loving County, Texas was considered “Acceptable” for availability of rail access.

CRITERION 4—LAND PARCEL SIZE

In Loving County, Texas, approximately 405 ha (1,000 acres) of land intended for interim storage of SNF was considered by AFCI Texas, LLC (AFCI). Loving County is considered a “Go” for land parcel size.

CRITERION 5—LAND AVAILABILITY

Loving County, Texas, is a sparsely populated area in the western portion of the state. The land is used primarily for oil and gas development and ranching. AFCI had identified a parcel of land, approximately 405 ha (1,000 acres) in size, for constructing and operating a CISF in the northwest portion of Loving County, Texas. However, the land owners were opposed to selling the land for the purpose of constructing and operating a CISF because the natural resources (oil and gas) underlying the proposed site were considered more valuable than the benefits of a facility that would store SNF (Kirk, 2015). As such, Loving County was only ranked as “acceptable” because adequate land is available and the current land owners could change their positions if the CISF became a more realistic and lucrative prospect at a later date. Loving County is considered “Acceptable” for land availability.

CRITERION 6—UTILITIES

Utilities at the proposed site in Loving County would be available, but would require considerable development. Oncor Electric Delivery Company LLC, provides power lines within the region, but new lines and a substation would be needed to serve the CISF. Both cellular and land-based telephone services in the region were also available in the county but would require further development. Water from the Pecos aquifer, which underlies the proposed site, would be available to support the project.

CRITERION 7—CONSTRUCTION LABOR FORCE

The availability of construction labor for the potential Loving County CISF would be comparable to Andrews County, Texas or Lea or Eddy counties, New Mexico. The population in Loving County was listed as 82 in the 2010 Census, making it the least populated county in the U.S. However, contracting with construction companies from outside the region in Albuquerque, New Mexico; Lubbock, Texas; and El Paso, Texas, is common practice in southeastern New Mexico and west Texas, so the prospective licensee should be able to contract an adequate skilled labor pool to construct the facility on the desired schedule even if another construction project were to interfere with local contracting.

The importance of controlling the planning, contracting, and execution of a project such as CISF site construction from the beginning cannot be overstated. In order to support project cost and schedule, as well as conformance to design basis, regulatory requirements, and license conditions, the CISF site licensee/applicant should possess an appropriate degree of experience and technical qualifications needed to provide rigorous oversight of the planning and execution of a large nuclear facility construction project (e.g., in accordance with ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications*). A scoring of large facility construction project management experience for each site license applicant/owner/operator is therefore provided, see Table 2.3-2.

CRITERION 8—OPERATIONAL LABOR FORCE

Operations labor force considerations for a potential Loving County CISF would be virtually identical to those at an Andrews County or Lea or Eddy counties, New Mexico CISF. Most CISF operations workers for the site in Loving County will need to be degreed, technical, and highly trained workers hired from outside of the ROI or hired away from one of the nuclear–related facilities in the region for initial CISF operations. For long-term hiring, major universities and other post-secondary schools are located in Midland-Odessa and Lubbock, while a local junior college in Hobbs, New Mexico is available to assist with training and qualification of workers. Given the proximity of the Loving County site to the WIPP, where many workers have joined the United Steelworkers Union (USW) and the Oil, Chemical and Atomic Workers International Union (OCAW), labor rules may be established at this site that prohibit or discourage multi-tasking of these employees.

Experienced radiation protection technicians can be hired from outside of the region but there is a high turn-over rate in remote locations for these employees who are in high demand across the country. Finding and retaining the required qualified and experienced health physicists needed to establish a fully functioning and reliable Health Physics Organization at the Lea County site is likely to be challenging and would take some time to establish a stable organization of permanent resident health physicist employees. It is highly advantageous to safety if CISF operations, maintenance, technical support, and waste management personnel available in the area will already be members of a pre-existing mature nuclear safety culture before, during and at the start of CISF operations.

Criterion 9—TRANSPORT ROUTES

There is currently no rail access to the proposed Loving County CISF. The nearest rail line is located in Monahans, Texas. This criterion is one of the least favorable for locating a CISF in Loving County, Texas. Construction of a rail line over 64 km (40 mi) in length would be required to support the transport of SNF to the proposed Loving County CISF. Otherwise, construction of a transfer station and significant upgrades would be required to transport SNF by heavy haul truck from Monahans, Texas to the Loving County CISF. Providing for the transportation infrastructure at a CISF in Loving County is most challenging when compared to those that already exist in Andrews County, Texas or Eddy and Lea counties, New Mexico.

CRITERION 10—AMENITIES FOR WORKFORCE

The county seat and only community in Loving County is Mentone, Texas. As previously discussed, the 2010 Consensus reported the population in Loving County at 82 residents, making it the least populated county in the U.S. Providing housing, temporary or otherwise, needed to accommodate a labor force needed during construction would be challenging. Housing for the operations workforce could be acquired in Carlsbad, New Mexico located approximately 113 km (70 mi) north of Mentone, or Monahans, Texas approximately 81 km (50 mi) to the southeast. The 2010 Census listed the populations of Carlsbad, New Mexico and Monahans, Texas at 26,138 and 6,953 residents, respectively. CISF personnel could find suitable housing, given the small size of the operational workforce.

Public schools were consolidated with those in nearby Winkler County, Texas. The Loving-Wink Independent School District provides education to students from pre-kindergarten through grade 12.

The Winkler County Memorial Hospital is the nearest hospital; it is located approximately 42 km (26 mi) to the east in Wink, Texas. Larger medical facilities are also provided in Odessa, Texas and Carlsbad, New Mexico. Medical facilities at both locations are approximately 113 km (70 mi) to the east and north, respectively.

There are three state parks and three national facilities that would be available to CISF employees in the vicinity of the Loving County site. Living Desert State Park is in Carlsbad; Brantley Lake State Park is northwest of Carlsbad on the Pecos River; and Bottomless Lakes State Park, also on the Pecos River, is east of Roswell. Bitter Lake National Wildlife Refuge is also east of Roswell and Carlsbad Caverns and Guadalupe Mountains National Parks are southwest of Carlsbad. These facilities offer some recreational and cultural activities, including boating and water activities on Lake Carlsbad and the Pecos River, hiking and backpacking in the nearby Guadalupe Mountains, and Carlsbad Caverns National Park. Other local amenities include a local museum, community theater, and community concert and art associations. Limited local recreational and cultural activities are also available in Hobbs (e.g., Harry McAdams State Park) and in Odessa-Midland, (e.g., golf, professional minor league baseball, rodeos, museums, art galleries, symphony, and theatres). Since the site is not located near a large population base, amenities are limited.

CRITERION 11—ENVIRONMENTAL PROTECTION

There are no existing surveys for the proposed site in Loving County. Additional characterization would be required to support a CISF license application for the proposed site. The proposed site is not believed to be contaminated by previous use. However, since the land is used for oil and gas exploration and development, additional surveys would be needed. No known RCRA or CERCLA sites have been identified and no known groundwater plumes have been identified at the proposed site.

Based on FEMA flood insurance maps, no 100-year floodplains are anticipated to cross the site boundary.

CRITERION 12—DISCHARGE ROUTES

Stormwater is the only anticipated discharge at the facility and stormwater runoff could be directed to a natural drainage network. All septic waste could be collected in above ground

tanks and periodically pumped and discharged at a POTW facility. No radiological effluents are anticipated.

Wastewater from a CISF should be chemically and radiologically distinguishable from pre-existing oilfield waste contamination at the site. Monitoring for approximately 1 year would be required in order to establish a baseline prior to site development in order to differentiate an accidental release from the CISF.

CRITERION 13—PROXIMITY OF HAZARDOUS OPERATIONS/HIGH RISK FACILITIES

Loving County is sparsely populated and has very little industry other than the oil and gas field industry. There are several compressor stations, oil and gas pipelines, and pump jacks in Loving County. There are no hazardous chemical sites within a 16 km (10 mi) radius of the site. There are no airports within a 16 km (10 mi) radius of the site. The nearest international airport is Midland Odessa Air and Space Port which is over 161 km (100 mi) from the site. There are no (air pollutant) non-attainment areas in the vicinity.

CRITERION 14—EASE OF DECOMMISSIONING

The natural site characteristics (climate, hydrology, etc.) at the Loving County site can be expected to support efficient decommissioning activities during decommissioning. There are no known future projects for the site vicinity that could add additional impacts to decommissioning the proposed facilities.

CRITERION 15—DISPOSAL OF LOW-LEVEL WASTE

There is ready access to the Waste Control Specialists LLRW disposal facilities located approximately 106 km (65 mi) from where the Loving County CISF would be located. Waste Control Specialists provides a location for LLRW disposal at both its LLRW Disposal Facility and its RCRA Landfill. To store and ship these wastes, the Loving County site licensee would have to hire and build a waste management staff capable of demonstrating the technical qualifications required to obtain the appropriate LLRW licenses and authorizations for generating, storing, and transporting CISF-generated wastes.

2.3.6 Site Selection Process: Results for Lea County, New Mexico

A potential site to construct and operate a CISF in Lea County, New Mexico was evaluated due to the many positive siting and environmental characteristics present in the area. The evaluation is based on readily available information.

CRITERION 1—POLITICAL SUPPORT

Lea County is considered a "Go" for political support.

CRITERION 2—SEISMOLOGICAL AND GEOLOGICAL CHARACTERISTICS

Several regional surveys have been conducted to support the siting of the WIPP, NEF, and Waste Control Specialists operations. These surveys demonstrated that Lea County is tectonically stable and has suitable geological characteristics to site a CISF. Lea County is considered a "Go" for seismological and geological characteristics.

CRITERION 3—AVAILABILITY OF RAIL ACCESS

Access via rail to Lea County is suitable for constructing and operating a CISF. Lea County is considered a "Go" for availability of rail access.

CRITERION 4—LAND PARCEL SIZE

Approximately 405 ha (1,000 acres) of land was purchased by the ELEA Project Area in Lea County, New Mexico and would be available for the CISF. Lea County is considered a "Go" for land parcel size.

CRITERION 5—LAND AVAILABILITY

Lea County is considered a "Go" for land availability.

CRITERION 6—UTILITIES

Utilities at the site in Lea County are in need of some development. Numerous power transmission lines exist within the region but new lines and a substation would be needed to serve the CISF at the site.

No potable groundwater is known to exist in the immediate vicinity of the site. However, the City of Carlsbad owns and operates Double Eagle Water System, located near Maljamar, New Mexico in northwestern Lea County. The Double Eagle Water System is supplied by groundwater pumped from 11 wells completed in the Ogallala Formation. The first 18 km (16 mi) segment of the pipeline carrying water from these wells to the WIPP facility has a 61 cm (24 in) diameter and runs to Highway 62/180. Previous research indicates a facility at the site will be able to tap into the Double Eagle Water System which is 4.8 km (3 mi) west of the site. This source of water is adequate for construction and operation of the CISF. However, the approximately 4.8 km (3 mi) long pipeline extension, requiring a federal right-of-way, would be needed to convey the water from the 61 cm (24 in) WIPP line to the site.

A communications tower that could possibly be used to provide cell phone and data service is located in the southwest corner of the site.

CRITERION 7—CONSTRUCTION LABOR FORCE

Construction labor force considerations for a potential Lea County CISF would be virtually identical to those at an Eddy County CISF. Labor support for construction of the CISF in Lea County should be fully available within the ROI unless a large concurrent construction project becomes competitive for the same resources. The contracting of construction companies from outside of the region, such as from Albuquerque, New Mexico; Lubbock, Texas; and El Paso, Texas, is common practice in southeastern New Mexico and west Texas, so the prospective CISF licensee should be able to find and contract with an adequately skilled construction labor pool to construct the facility on the desired schedule even if another construction project were to interfere with local contracting.

The importance of controlling the planning, contracting, and execution of a project such as CISF site construction from the beginning cannot be overstated. In order to support project cost and schedule, as well as conformance to design basis, regulatory requirements, and license conditions, the CISF site licensee/applicant should possess an appropriate degree of experience and technical qualifications needed to provide rigorous oversight of the planning and execution of a large nuclear facility construction project (e.g., in accordance with ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications*). A scoring of large facility construction project management experience for each license applicant/owner/operator is therefore provided, see Table 2.3-2.

CRITERION 8—OPERATIONAL LABOR FORCE

Operations labor force considerations for a potential Lea County CISF would be virtually identical to those at an Andrews County and Eddy County CISF. Most CISF operations workers for the site in Lea County will need to be degreed, technical, and highly trained workers hired from outside the ROI or hired away from one of the nuclear–related facilities in the region for initial CISF operations. For long term hiring, major universities and other post-secondary schools are located in Midland-Odessa and Lubbock, and a local junior college in Hobbs is available to assist with training and qualification of workers. Given the proximity of the Lea County site to the WIPP, where many workers have joined the USW and the OCAW, labor rules may be established at this site that prohibit or discourage multi-tasking of these employees.

Experienced radiation protection technicians can be hired from outside of the region but there is a high turn-over rate in remote locations for these employees who are in high demand across the country. Finding and retaining the required qualified and experienced heath physicists needed to establish a fully functioning and reliable Health Physics Organization at the Lea County site is likely to be challenging and would take some time to establish a stable organization of permanent resident health physicist employees. It is highly advantageous to safety if CISF operations, maintenance, technical support, and waste management personnel available in the area will be members of a pre-existing mature nuclear safety culture before, during, and at the start of CISF operations.

CRITERION 9—TRANSPORT ROUTES

There is currently no rail access to the Lea county site but an industrial railroad lies 4.8 km (3 mi) to the west. The railroad is currently serving local potash mines by transporting ore to refineries and finished product to markets, refineries, and the agricultural sector. A new rail spur would have to be built to connect the railroad to a new railhead at the site, which would also have to be constructed. Construction of the new rail spur would be across public lands and would be along right-of-way to be obtained from state and federal agencies; the route would also likely require additional NEPA analysis for right-of-way on federal lands.

Highway 62/180 serving the site is a well-established, well-maintained radioactive waste transportation corridor established by the DOE for shipping transuranic mixed waste to the WIPP. It is a major 4-lane, divided, federal highway that runs within 0.8 km (0.5 mi) of the site, from both of the nearby major population centers (Carlsbad and Hobbs). Improvements from the

highway into the site would need to be made but with the improvements efficient access for construction and operations traffic could be readily achieved.

CRITERION 10—AMENITIES FOR WORKFORCE:

Workforce amenities for a potential Lea County CISF would be very much like those at an Eddy County CISF. A number of hotels/motels and restaurants are located in Hobbs, New Mexico, 52 km (32 mi) to the east of the site and 55 km (34 mi) west of the site in Carlsbad, New Mexico. Housing for the operations workforce would also mostly be in Hobbs and Carlsbad. Larger population centers are Roswell, New Mexico, 119 km (74 mi) to the northwest; Odessa, Texas, 148 km (92 mi) to the southeast; and Midland, Texas, also to the southeast at a distance of 166 km (103 mi). The nearest large population center is El Paso, Texas (population 563,662), approximately 306 km (190 mi) southwest of the site. Although the housing market is generally tight in these locations, CISF personnel at this site should be able to locate suitable housing in a timely manner due to the relatively small size of the operational workforce.

Public schools in Carlsbad and Hobbs are rated as average. Carlsbad has the better ratings of the two.

Medical facilities include Carlsbad Medical Center (CMC) which is a full-service, 127-bed community-oriented hospital providing medical, surgical, and restorative patient care at the main center and two medical office buildings, the Pecos Valley Medical Complex and the Southwest Medical Complex. Carlsbad Medical Center’s larger sister facility is LRMC in Hobbs, New Mexico, a 201-bed, acute care facility providing complete care from cardiac care and pediatrics to mental health and outpatient surgery.

There are three state parks and three national facilities that would be available to CISF employees in the vicinity of the Lea County site. Living Desert State Park is in Carlsbad; Brantley Lake State Park is northwest of Carlsbad on the Pecos River; and Bottomless Lakes State Park, also on the Pecos River, is east of Roswell. Bitter Lake National Wildlife Refuge is east of Roswell and Carlsbad Caverns and Guadalupe Mountains National Parks are southwest of Carlsbad. These facilities offer some recreational and cultural activities, including boating and water activities on Lake Carlsbad and the Pecos River, hiking and backpacking in the nearby Guadalupe Mountains, and Carlsbad Caverns National Park. Other amenities include a local museum, community theater, and community concert and art associations. Limited local recreational and cultural activities are also available in Hobbs (e.g., Harry McAdams State Park)

and in Odessa-Midland (e.g., golf, professional minor league baseball, rodeos, museums, art galleries, symphony, and theatres). Since the site is not located near a large population base, amenities are limited.

CRITERION 11—ENVIRONMENTAL PROTECTION

A Phase I Environmental Site Assessment (ESA) of the site was performed by the ELEA (Attachment 2-2). In Appendix 2G, Attachment 2-2, a full report is provided. The purpose of the ESA was to identify Recognized Environmental Conditions (RECs) in connection with the Subject Property, to the extent feasible, pursuant to the processes prescribed in the ASTM Practice E 1527-05 entitled *Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process* (ASTM Standard), the EPA Rule entitled, *Standards and Practices for All Appropriate Inquiries: Final Rule* (AAI Rule, 40 CFR Part 312) and professional judgment. The ASTM Standard defines RECs as “the presence or likely presence of any hazardous substances or petroleum products on a property under conditions that indicate an existing release, a past release, or a material threat of a release of any hazardous substances or petroleum products into structures on the property or into the ground, groundwater, or surface water of the property. The term includes hazardous substances or petroleum products even under conditions in compliance with laws.” A limited Phase II sampling regime investigated contamination from the two known oil-field related waste disposal areas within and immediately adjacent to the prospective Lea County CISF with only one water sample and one soil sample taken elsewhere within the boundary of the prospective CISF.

Results of lab analyses indicate soil, surface water, and groundwater have been impacted by oilfield waste disposal in the area. In general, the data indicate that organic, metal, and radiological impacts to soil appear to be localized to the immediate vicinity of the two primary (oilfield-related) disposal sites. Although total petroleum hydrocarbons in three soil samples from the Pollution Control Inc. disposal facility averaged over five hundred times the standard of 100 mg/kg, no volatile or semi-volatile organic compounds, pesticides, or PCBs were detected in any soil or water samples taken. There is potential that hazardous or NORM waste was disposed of in the area where oil field solids have been landfilled.

Radium 226 and radium 228 were detected in all water samples. New Mexico Water Quality Control Commission (WQCC) standards for radium 226 were exceeded in three samples; radium 228 standards were exceeded in two samples. The site is situated in an area where the

potential for impacts to groundwater from surface contamination appears to be low due to hydrogeological properties. The limited drilling and testing performed at the site indicates that the base of the alluvium at the top of the Triassic shale bedrock, or the shallowest and most susceptible potential water-bearing zone, is dry. Further, groundwater in the shallow alluvium elsewhere in the vicinity of the site is too mineralized to qualify for protection under the WQCC regulatory framework. Other potential water-bearing zones beneath the site are approximately 122 m (400 feet) beneath the top of the relatively impermeable shale bedrock; these zones have very low susceptibility to any impacts from surface sources at the site. The highest areas of soil contamination are localized to the oilfield disposal sites and impacted areas identified as RECs in the Phase I ESA. Soil sampling results confirmed that areas of high contamination from oilfield waste disposal sites appear to be localized at these facilitates. These areas within the proposed property boundary are excluded from the site construction zone.

Therefore, results of those Phase I and limited Phase II investigations suggest that the Lea County site, minus the areas excluded from the site construction zone due to contamination from oil-field waste, may be suitable for the proposed facilities. However, other potential environmental concerns at the site were identified in Attachment 2-2 as follows: “The property has been associated with oil and gas exploration and development with numerous plugged oil or gas wells located on the property. Based on the age of the wells (1940s through the 1980s) the pits associated with these wells were likely not lined or closed properly and are potential sources of contamination; commercial brine disposal operations as well as past oil production operations have resulted in discharges of large quantities of brine into Laguna Gatuna. This may have caused an increase of salinity of any fresh water present in the subsurface or created brine groundwater saturation beneath the site.”

Further characterization appears to be appropriate considering that it is desirable to ensure that: (a) the CISF site does not have contamination that would require remediation prior to construction, (b) no facility is in the area of the CISF site with an existing release plume (air or water) of hazardous material or radiation release that includes the site, (c) any future migration of contamination from adjoining or nearby sites into the area of the CISF site is negligible, and (d) the CISF site is not contaminated with radiological material in soil or groundwater to a level that would inhibit licensing or transfer of property with clear identification of liabilities. There are no listings of the site on the National Priorities List or on the Federal Comprehensive Environmental Response, Compensation and Liability Information System. There are no known concerns that would prevent the federal, state, and local regulatory and permitting requirements

from being fulfilled for the construction of a CISF at the site. Other facilities and uses can be accommodated while using the site for construction of a CISF. An abandoned waterline that crosses the site is constructed of concrete pipe and poses no environmental risk for relocation.

The Lea County site topography indicates the terrain in the survey area is nearly level and topographic relief is low, with a total of only about 20 m (66 feet). The highest area (about 1,081 m [3,546 feet]) is along the south edge of the two sections and the low point is in the northwest corner of section 13 (approximately 1,061 m [3,480 feet]). Hydrology is such that the site is naturally drained, does not lie in a 100- or 500-year flood plain and does not have the potential for ponding except where Laguna Gatuna occupies the southeastern portion of the site. The area contains no perennial streams, and the only bodies of water in or around the site are ephemeral playas. No important surface water or groundwater features or aquatic or riparian habitats or wetlands are located at the site.

The site climate is well-suited to support CISF construction and operations, being typical of a semi-arid region, with generally mild temperatures, low precipitation and humidity, and a high evaporation rate.

Range and brush fires that may occur should not pose a significant danger to a CISF at this site due to the relative sparseness of vegetation and facility design. The area is predominately desert scrub and trees are absent. Desert range land will burn but does not support a sufficient fuel load to sustain a major fire.

Climate and meteorological characterization data relating to the site is available in Section 2.2 of Attachment 2-2. Climate information from Hobbs, New Mexico obtained from the Western Regional Climate Center was used for this characterization. In addition, NOAA Local Climatological Data recorded at Midland-Odessa Regional Airport, Texas and at Roswell, New Mexico, were used. Use of the Hobbs, Midland-Odessa, and Roswell observations for a general description of the meteorological conditions at the site was deemed appropriate as they are all located within the same region and have similar climates. Midland-Odessa is the closest first-order National Weather Service (NWS) station to the site. These same sources could be used to update the site's meteorological characterization data.

An archeological and cultural resources field survey has not been performed at the Lea County site. A literature and archival search to establish baseline data for cultural resources that were already identified for the 421 ha (1,040 acre) site and within a 9.7 km (6 mi) zone around the site

was performed by Quivira Research Associates (QRA). QRA's complete report, *Cultural Resources in the Eddy-Lea Energy Alliance Project Area, Lea County, New Mexico, March 31, 2007*, is Appendix 2D of Reference 4-28-07 ELEA Letter to DOE . QRA's report predicts:

- "Site densities of 23 or slightly more sites per square mi (640 ac) are indicated by the single large (717 ac) block survey in the 6-mi radius around the project area.
- Most sites will probably be small (8000 sq m/1.7 ac), but larger sites are a definite possibility.
- Approximately two-thirds of newly discovered sites will be determined eligible for listing on the National Register (NR), which will require avoidance or data recovery.
- The NR-eligibility of approximately one-fourth will be undetermined and will require testing or, if historic, appropriate historical research such as literature and archival reviews, interviewing, etc. A few sites will be determined ineligible for listing on the NR at the time of survey."

Attachment 2-2 Section 2.6 and Appendix 2.B provide descriptions of the ecological resources, including protected species information collected about the Lea County site based on a review of the available literature, consultation with wildlife biologists with expertise in regional habitat, and data identified in the ecological field surveys of the site that were conducted in March 2007. Two conclusions of this research were that: no important or unique terrestrial habitats are situated within the site, and no threatened or endangered species or their critical habitats were identified within the site. However, since the 2007 ecological field surveys of the site were conducted, the USFWS has listed two of the bird species observed at the site, the Least Tern, *Sterna antillarum* and the Western Snowy Plover, *Charadrius alexandrinus nivosus* as an endangered species and threatened species, respectively. This includes their range in New Mexico. Concerning the plover, in ELEA Appendix 2.B, *Ecologic Component,* the author opines "the observation of two western snowy plovers along the western edge of Laguna Gatuna was of particular interest. This species is a highly imperiled shorebird that in New Mexico nests in playa lakes and salt flats in the southeastern part of the state (Page et al. 1995). This area appears to not be a significant wintering area for the species (Page et al. 1995), so the plovers observed were probably migrating through or staying to breed in the area. Without making additional visits to the site during the breeding season, it is impossible to say if these birds were migrating or already on their breeding territories. Additional visits should be made during the breeding season (peak incubation period is April or May) to determine how the species is using the site" . An updated study of the site for continued presence of these species would be appropriate.

Demographic information for the Lea County site area indicates that there is little likelihood of disparate (environmental justice) impacts due to the CISF facilities. This conclusion is based on the fact that, although there are census tracts within the 81 km (50 mi) radius that have minority percentages exceeding 64%, they are confined to urban areas that are at least 48 km (30 mi) from the site. Consequently, minority inhabitants share the same hypothetical risks as their non-minority neighbors, irrespective of concentric geographic distance from the site.

CRITERION 12—DISCHARGE ROUTES

The letter in Attachment 2-2 states that “A permit is required for facilities that discharge an aggregate waste water of more than 2,000 gallons per day to septic systems. A permit may also be required for discharges to surface impoundments such as evaporative basins. It is likely the facility will require a ground water discharge permit. The nearby NEF recently received a ground water discharge permit for discharges to evaporative basins and domestic treatment facilities. The nearby WIPP project is permitted for a facultative sewage treatment facility and the treatment of industrial waste water in lined evaporation ponds. It is anticipated that this facility will be able to obtain this permit” . Wastewater from a CISF should be chemically and radiologically distinguishable from pre-existing oilfield waste contamination at the site.

CRITERION 13—PROXIMITY OF HAZARDOUS OPERATIONS/HIGH-RISK FACILITIES

Concerning the proximity of facilities with hazardous operations that could impact the site, there are no major airports within 15 km (10 mi) of the site. However, an abandoned landing strip (305 m [1,000 feet] long) is located 8 km (5 mi) west of the site. There are 12 industrial facilities (“potentially hazardous facilities”) located within 8 km (5 mi) of the site boundary. The industrial facilities consist of four compressor stations, one booster station, two gas plants, two potash mines, one major natural gas transmission pipeline, one hydrocarbon remediation landfarm, and one industrial solid waste landfill. There are no (air pollutant) non-attainment areas in the vicinity.

CRITERION 14—EASE OF DECOMMISSIONING

The natural site characteristics (climate, hydrology, etc.) at the Lea County site can be expected to support efficient decommissioning activities during decommissioning. There are no known future projects for the site vicinity that could add additional impacts to decommissioning the proposed facilities.

CRITERION 15—DISPOSAL OF LOW-LEVEL WASTE

There is ready access to the Waste Control Specialists LLRW disposal facilities 10 km (6 mi) east of Eunice, New Mexico. To store and ship these wastes, the Lea County site licensee would have to hire and build a waste management staff capable of demonstrating the technical qualifications required to obtain the appropriate LLRW licenses and authorizations for generating, storing, and transporting CISF-generated wastes.

2.3.7 Site Selection Process: Results for Eddy County, New Mexico

The Eddy County, New Mexico site was evaluated using the NEF ER and the Technical Memorandum prepared for ISP joint venture member Waste Control Specialists by Cox|McLain Environmental Consulting, Inc. (CMEC) and by collecting remotely available data from a variety of sources . The proposed site in Eddy County is bordered on the south by the DOE's WIPP. The main access road to the facility is on the southeastern edge of the proposed site. The site is buffered from residential areas. The closest town is Loving, New Mexico, which is approximately 29 km (18 mi) from the site. Two ranches are within 16 km (10 mi) of the site. The property readily supports a rectangular 600 x 800 m (1,969 x 2,625 ft) plant footprint and also supports the rectangular footprint for the expanded plant. It is assumed that the site is owned by the DOE and surrounded by BLM lands.

The approximately 405 ha (1,000 acre) site study area is located in a sparsely populated region of southeastern New Mexico. As of 2013, there are 11 permanent residents living within 16 km (10 mi) of the site, mostly associated with ranching. The majority of the population living within 81 km (50 mi) of the site is concentrated in and around Carlsbad, Hobbs, Eunice, Loving, Jal, Lovington, and Artesia, New Mexico. The nearest community is the village of Loving, approximately 29 km (18 mi) west-southwest of the site. The site is bordered on the west by a string of oil wells and their associated pads and access roads. The southern half of the site is bisected by an access road and the entire site is located within the DOE's WIPP off-limits area. WIPP is the nation's first underground repository permitted to safely and permanently dispose of transuranic radioactive waste, radioactive waste, and mixed waste generated from defense activities and programs (DOE, 2014).

CRITERION 1—POLITICAL SUPPORT

In New Mexico, an Eddy County resolution supporting interim storage of SNF was passed on September 3, 2013 . Eddy County is considered a “Go” for political support.

CRITERION 2—SEISMOLOGICAL AND GEOLOGICAL CHARACTERISTICS

Several regional surveys have been conducted to support the siting of the WIPP, NEF, and Waste Control Specialists operations. These surveys demonstrated that Eddy County is tectonically stable and has suitable geological characteristics to site an interim storage facility. Eddy County is considered a “Go” for seismological and geological characteristics.

CRITERION 3—AVAILABILITY OF RAIL ACCESS

Eddy County is considered a “Go” for rail access.

CRITERION 4—LAND PARCEL SIZE

A site comprising over 202 ha (500 acres) in Eddy County, New Mexico, in close proximity to DOE’s WIPP, is considered suitable for siting a CISF. Eddy County is considered a “Go” for land parcel size.

CRITERION 5—LAND AVAILABILITY

The entire site is located within the DOE’s WIPP off-limits area. Eddy County is considered a “Go” for land availability.

CRITERION 6—UTILITIES

The electric energy provider near the Eddy County site is Xcel Energy and their service area includes the proposed project site. Xcel currently has a 115 KV power line located near the project area. Though Xcel provides electric utility services to the nearby WIPP site, installation of new supporting infrastructure, including a substation, would be required to make use of the 115 KV power line to serve a CISF at the site .

Since the Eddy County site is adjacent to the WIPP, it should be able to make use of the Carlsbad City Water System providing water to the WIPP site through a water main. The water utility provider in the area is Double Eagle Water Systems, operated by the city of Carlsbad. Groundwater is the only source for the utility, and every water well has a unique storage and

pipeline system. This utility has a total storage capacity of 16 million gallons in four reservoirs. The city water line follows the WIPP North Access Road that crosses the southeast corner of the proposed Eddy County site. A line from this water main could be extended to provide an adequate water supply for the proposed CISF. A communications tower exists a few hundred yards to the northeast of the WIPP. This tower could potentially be used for cellular and data transmission to support construction and operations at the proposed CISF site.

CRITERION 7—CONSTRUCTION LABOR FORCE

Construction labor force considerations for a potential Eddy County CISF would be virtually identical to those at a LEA County CISF. Labor support for construction of the CISF in Lea County should be fully available within the ROI unless a large concurrent construction project becomes competitive for the same resources. The contracting of construction companies from outside of the region, such as from Albuquerque, New Mexico; Lubbock, Texas; and El Paso, Texas, is common practice in southeastern New Mexico and west Texas, so the prospective CISF licensee should be able to find and contract an adequately skilled construction labor pool to construct the facility on the desired schedule even if another construction project were to interfere. However, the importance of controlling the planning, contracting, and execution of a project such as CISF site construction from the beginning cannot be overstated. In order to support project cost and schedule, as well as conformance to design basis, regulatory requirements, and license conditions, the CISF site licensee/applicant should possess an appropriate degree of experience and technical qualifications needed to provide rigorous oversight of the planning and execution of a large nuclear facility construction project (e.g., in accordance with ASME NQA-1, *Quality Assurance Requirements for Nuclear Facility Applications*). A scoring of large nuclear facility construction project management experience for each site license applicant/owner/operator is therefore provided.

CRITERION 8—OPERATIONAL LABOR FORCE

Operations labor force considerations for a potential Eddy County CISF would be virtually identical to those at a LEA County CISF. Most CISF operations workers for the site in Eddy County will need to be degreed or highly trained technical workers hired from outside of the ROI or hired away from one of the nuclear–related facilities in the region for initial CISF operations. In Carlsbad there is a university, other post-secondary schools, and a technology training center that could provide specialized technical resources. For four year and post-graduate degrees not available locally, major universities and other post-secondary schools are located in Midland-Odessa and Lubbock. There is an additional local junior college in Hobbs available to assist with training and qualification of workers.

Given the proximity of the Eddy County site to the WIPP, where many workers have joined the USW and the OCAW, labor rules may be established at this site that prohibit or discourage multi-tasking of these employees. Experienced radiation protection technicians can be hired

from outside of the region but there is a high turn-over rate in remote locations for these employees who are in high demand across the country. Finding and retaining the required qualified and experienced health physicists needed to establish a fully functioning and reliable Health Physics Organization at the Eddy County site is likely to prove even more difficult and could it take many years to establish a stable organization of permanent resident health physicist employees. It is highly advantageous to safety if CISF operations, maintenance, technical support, and waste management personnel available in the area will already be members of a pre-existing mature nuclear safety culture before, during, and at the start of CISF operations.

CRITERION 9—TRANSPORT ROUTES

The potential Eddy County site is approximately 0.8 km (0.5 mi) from a spur that services the WIPP and leads into Loving, New Mexico. The rail line in the area dates to the 1930s, and was constructed to service potash mines, later coming under control of the Atchison Topeka and Santa Fe Railroad and then the Burlington Northern & Santa Fe Railroad. The 13.4 km (8.3 mi) spur was constructed in 1983-1984 for the WIPP site and used for transport of materials for construction of the facility. The WIPP intended to use the rail line for transport of nuclear waste, but later decided to truck the materials instead because of the higher cost for dedicated rail service and the need for carrier assurance of transit times. The WIPP rail spur was placed in reserved status in 1997, meaning that regular maintenance was discontinued. .

The WIPP North Access Road (Louis Whitlock Road) is a paved, two-lane, undivided facility that borders the site on the east and connects to a 4-lane, controlled-access highway (US 62/180) approximately 21 km (13 mi) north of the site. The US 285/Pecos Highway can be accessed by traveling approximately 43 km (26.7 mi) southeast along New Mexico Highway 128/31. These existing routes and roads to the site should provide adequate traffic capacity for additional CISF construction and operations traffic/load, with minimal improvements required.

CRITERION 10—AMENITIES FOR WORKFORCE

Workforce amenities for a potential Eddy County CISF would be very much like those at a Lea County CISF. A number of hotels/motels and restaurants are located in Carlsbad, New Mexico, 60 km (37 mi) west of the site by road, and Hobbs, New Mexico, approximately 84 km (52 mi) northeast of the site by road. Housing for the operations workforce would also mostly be in Carlsbad, Hobbs, or one of the several smaller towns in the area. Larger population centers in

the area are Odessa, Texas, approximately 216 km (134 mi) to the southeast of the site by road and Midland, Texas, located approximately 241 km (150 mi) to the southeast. The nearest large population center is El Paso, Texas (population 563,662), approximately 435 km (270 mi) southwest of the site by road. Although the housing market is generally tight in all these locations, CISF personnel at this site should be able to locate suitable housing in a timely manner due to the relatively small size of the operational workforce. Public schools in Carlsbad and Hobbs are rated as average with Carlsbad having the better ratings of the two.

Medical facilities include CMC which is a full-service, 127-bed community-oriented hospital providing medical, surgical, and restorative patient care at the main facility and two medical office buildings, the Pecos Valley Medical Complex and the Southwest Medical Complex. CMC's larger sister facility is LRMC in Hobbs, New Mexico. LRMC is a 201-bed, acute care facility providing complete care from cardiac care and pediatrics to mental health and outpatient surgery.

There are three state parks and three national facilities that would be available to CISF employees in the vicinity of the Lea County site. Living Desert State Park is in Carlsbad; Brantley Lake State Park is northwest of Carlsbad on the Pecos River; and Bottomless Lakes State Park, also on the Pecos River, is east of Roswell. Bitter Lake National Wildlife Refuge is also east of Roswell and Carlsbad Caverns and Guadalupe Mountains National Parks are southwest of Carlsbad. These facilities offer some recreational and cultural activities including boating and water activities on Lake Carlsbad and the Pecos River, hiking and backpacking in the nearby Guadalupe Mountains, and Carlsbad Caverns National Park. Other amenities include a local museum, community theater, and community concert and art associations. Limited local recreational and cultural activities are also available in Hobbs (e.g., Harry McAdams State Park) and in Odessa-Midland (e.g., golf, professional minor league baseball, rodeos, museums, art galleries, symphony, and theatres). Since the site is not located near a large population base, amenities are limited.

CRITERION 11—ENVIRONMENTAL PROTECTION

According to the NEF ER , there are no existing surveys for the Eddy County site. However, the extensive amount of data collected from the WIPP facility (adjacent to the site) should be applicable to the site because of the homogeneity of the landscape and environmental conditions in the area. Additional characterization would be required to support a CISF license

application for the Eddy County site. Environmental data consolidated from a variety of sources and incorporated into the CMEC Technical Memorandum were used for evaluation of environmental considerations for the Eddy County site.

The proposed project area is located between approximately 1,024 and 1,049 m (3,360 and 3,440 feet) above the median sea level between the site's lowest and highest points, respectively. The slope runs downward towards the northwest corner of the project area. The Livingston Ridge is located just east of the site within 3.2 km (2 mi) .

No water features appear to be present on the property. There are no perennial streams on the site. At its nearest point, the Pecos River is about 21 km (13 mi) southwest of the site boundary. The drainage area of the Pecos River at this location is approximately 49,210 square km (19,000 square mi). A few small creeks and draws are the only westward flowing tributaries of the Pecos River within 32 km (20 mi) north or south of the site. The Hill Tank Draw drainage area is the most prominent drainage feature near the site. The drainage area is about 10.4 square km (4 square mi) with an average channel slope of 1 to 100, and drainage westward into the Nash Draw. Two years of U.S. Geological Service (USGS) observations showed only four flow events. The USGS estimates that the flow rate for these events was under 0.06 cubic m (2 cubic feet) per second . According to topographic maps, the site would drain northwest towards the Livingston Ridge, which is approximately 2.4 km (1.5 mi) from the site. From there, surface water discharge would join the many draws and channels that transverse the ridge and subsequently pool and evaporate under normal conditions once reaching the flat expanse west of the ridgeline.

The climate is semiarid, with a mean annual precipitation of about 31 cm (12 in), a mean annual runoff of from 0.25 to 0.5 cm (0.1 to 0.2 in), and a mean annual pan evaporation of more than 254 cm (100 in). More than 90% of the mean annual precipitation at the site is lost by evapotranspiration. On a mean monthly basis, evapotranspiration at the site greatly exceeds the available rainfall; however, intense local thunderstorms may produce runoff and percolation. The maximum recorded 24-hour precipitation at Carlsbad was 13 cm (5.12 in) in August 1916. The predicted maximum 6-hour, 100-year precipitation event for the site is 9.1 cm (3.6 in) and is most likely to occur during summer. Most of the annual precipitation in the area comes as a result of very violent spring and early summer thunderstorms. These are usually accompanied by excessive rainfall over limited areas, and sometimes hail. Due to the flat nature of the terrain, local flooding occurs, but is of short duration. Tornadoes are occasionally sighted. During late

winter and early spring, blowing dust occurs frequently. The flat plains of the area with only grass as vegetation offer little resistance to the strong winds. The sky is occasionally obscured by dust but during most storms, visibility ranges from 1.6 to 4.8 km (1 to 3 mi). Daytime temperatures are hot in summer, but there is a large diurnal range of temperature and most nights are comfortable. The temperature drops below 32 °F in the fall about mid-November and the last temperature below 32 °F in spring is in early April, on average. Winters are characterized by frequent cold periods followed by rapid warming. Cold frontal passages are often followed by chilly weather for two or three days. Cloudiness is at a minimum. Summers are hot and dry with numerous small convective showers .

The prevailing wind direction in this area is from the southeast. This, together with the upslope flow of the terrain from the same direction, causes occasional low cloudiness and drizzle during winter and spring months. Snow is infrequent. Maximum temperatures during summer months frequently are from 2 to 6 °F cooler than those at places 160 km (100 mi) southeast, due to the cooling effect of the upslope winds .

The project area is located in an arid climate within the Chihuahuan Desert Grassland region. Due to low precipitation, there is little ground cover, and dominant species include black, blue, and sideoats grama; dropseeds; bush muhly; and tobosa (EPA, 2006). Scattered creosotebush, as well as prickly pear and cholla cacti are also present (EPA, 2006). Soils information for the project area was obtained from the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) Web Soil Survey (USDA, 2015). Four soil series underlie the project:

- BA, Berino loamy fine sand, 0 to 3% slopes
- BB, Berino complex, 0 to 3% slopes, eroded
- KM, Kermit-Berino fine sands, 0 to 3% slopes
- Protected Area, Pajarito loamy fine sand, 0 to 3% slopes, eroded

Each soil series profile consists of loamy fine sand and/or fine sandy loam with a parent material of mixed alluvium and/or eolian sands. There are no hydric soils located on the site.

Several Groundwater-bearing zones have been identified and studied at and near the site. Limited amounts of potable water are found in the middle Dewey Lake Redbeds Formation and the overlying Triassic Dockum group in the southern part of the site. Two water-bearing units, the Culebra Dolomite and the Magenta Dolomite, occur in the Rustler Formation and produce

brackish to saline water at and in the vicinity of the site. Another very low-transmissivity, saline water-bearing zone occurs at the Rustler–Salado Formation contact. There are three recorded Office of the State Engineer (OSE) wells located in the project area.

The Eddy County site adjoins the DOE WIPP site. No protected properties other than the WIPP site are near the Eddy County site. Although the WIPP facility is not licensed by the NRC, the facility went through stringent NEPA and regulatory permitting processes prior to initiating underground disposal of transuranic wastes. Environmental sampling was conducted as part of the WIPP monitoring and permitting process, and there is no indication of hazardous or radioactive contamination. Environmental monitoring, including soil sampling, is performed annually along the southern edge of the proposed site, adjoining the WIPP, and north, northeast, and northwest of the site. There are no known air or groundwater plumes within 3.2 km (2 mi) of the site, and no future migration is anticipated from the nearby WIPP site.

The current and historical use of the Eddy County site was/is as range land for grazing. No hazardous or radioactive contamination was found during environmental sampling conducted as part of the WIPP permitting process. Additionally, none has been found during the ongoing WIPP environmental monitoring, including soil sampling, performed annually along the southern edge of the proposed site (adjoining the WIPP), as well as to the north, northeast, and northwest of the site. There are no known air or groundwater plumes within 3.2 km (2 mi) of the site, and no future migration is anticipated from the nearby WIPP site.

There are no FEMA flood insurance maps for the project area; the nearest map is approximately 7.2 km (4.5 mi) west-southwest of the project location. Based on the nearest available FEMA flood insurance maps, no 100-year floodplains are anticipated to cross the site boundary. The maximum recorded flood on the Pecos River occurred near the town of Malaga, New Mexico, on August 23, 1966, with a discharge of 3,390 cubic m (120,000 cubic feet) per second and a stage elevation of about 896 m (2,938 feet) above msl . The general ground elevation in the vicinity of the surface facilities (approximately 1,036 m [3,400 feet] above msl) is about 152 m (500 feet) above the river bed and over 122 m (400 feet) above the maximum recorded historical flood elevation. The project would not be anticipated to increase the base flood elevation to a level that would violate applicable floodplain regulations.

There are no existing protected species surveys for the Eddy County site. Existing information from the WIPP indicate that no protected species occur on the WIPP site. Given the

homogeneity of the landscape between the proposed site and the WIPP site and the narrow habitat requirements for the protected species known to occur in Eddy County, it is unlikely that protected species occur on The Eddy County site. Existing surveys for the WIPP (adjacent to the site) indicate that there is a high likelihood for archeological isolated occurrences in the general area. Studies at the WIPP site and other studies in the area have found an average of one isolated occurrence every 18 ha (45 acres); no significant or potentially significant sites were found. There are no existing archeological or cultural resource surveys for the Eddy County site. Existing information from the adjacent WIPP facility should be applicable to the site, given the extensive amount of data collected and homogeneity of the landscape in the area. Characterization of the site archeological and cultural resources would be required to support a CISF license application.

According to lists of threatened, endangered, and candidate species maintained by the USFWS and the New Mexico Department of Game and Fish, 16 federally listed species and 30 state-listed species have the potential to occur in Eddy County, New Mexico. Federally listed species of potential occurrence include 8 birds, 2 fish, 1 mollusk, and 5 plants. State-listed species of potential occurrence include 1 mammal, 15 birds, 6 reptiles, 6 fish, and 2 mollusks. According to the New Mexico Rare Plant List, 27 rare plants have the potential to occur in Eddy County, 3 of which are federally listed endangered. Lists of rare, threatened, and endangered species of potential occurrence in Eddy County are included in the Environmental Technical Memorandum prepared for ISP joint venture member Waste Control Specialists by Cox McLain Environmental Consulting .

Critical habitat for two species, gypsum wild-buckwheat (*Eriogonum gypsophilum*) and Pecos bluntnose shiner (*Notropis simus pecosensis*), is designated in Eddy County ; however, the project is not located within the critical habitat areas. According to aerial photography, the site consists mainly of undeveloped desert brushland with a few well pads and an access road crossing through it. No water features appear to be present on the property. Based on this, no fish or mollusk species would be anticipated to occur on the site. A field habitat assessment would be necessary for the site in order to determine potential impacts to listed species.

NPDES permits for construction-related stormwater discharge, industrial stormwater discharge, and possibly for facility discharge will be required. There are no identified impediments, and obtaining an NPDES permit for this site should be readily achievable through the EPA; the State of New Mexico does not administer the NPDES program. There are no wetlands or other waters

of the U.S. on the site. Neither a Clean Water Act Section 404 permit nor a State Section 401 Water Quality Certification will be required to construct on the site.

Within the boundaries of the proposed project area, there are three water wells administered by the New Mexico OSE. Two of those wells are owned by the DOE and the third well is owned by Sandia National Laboratories. The project area also has an old petroleum well administered by the Oil Conservation Division of the New Mexico Department of Energy, Minerals, and Natural Resources. That particular well has long been out of operation. No air permits, hazardous waste permits, nor wastewater discharge permits could be located within the proposed project area. There are also no discharge routes located within the project area.

The site is adjacent to an existing radiological hazard but that facility (the WIPP) does not handle uranium hexafluoride (UF6). The proposed project will provide a new radiological hazard to the area through the handling of a different source of radiation. The proposed site is in an area designated for buildings designed for 112 km/hr (70 mi/hr) winds. Data collected for the WIPP indicate the area has potential for violent convectional storms. The WIPP SAR indicates a recurrence interval for 132 km/hr (82 mi/hr) winds of every 100 years in southeastern New Mexico, although no winds of this speed or greater velocity have been recorded. Tornado frequency has been estimated as 1 in every 1,235 years (WIPP, 2003). There is no significant fire hazard. The area is predominately desert scrub, and trees are absent. Desert range land will burn but does not support a sufficient fuel load to sustain a major fire. The site topography and soil characteristics do not promote ponding. The topography is level, and there is no potential for rock/mud slides.

Data collected for the WIPP site included an 80 km (50 mi) ROI, which encompassed the adjacent Eddy County site. Within the designated ROI, the percentage of Hispanics and the percentage of persons living below poverty level were above the national average and the state averages for New Mexico and Texas. The relative isolation of the proposed facility should reduce the potential for impacts to these population groups.

CRITERION 12—DISCHARGE ROUTES

There are no existing NPDES-permitted discharges at the proposed site. Control and discharge of stormwater runoff from the site or into a lined, evaporative retention pond should be manageable. There are no existing radiological waste streams that may need to be

differentiated from the site waste stream. The only discharge from the adjacent WIPP site is to lined, evaporative sewage lagoons.

CRITERION 13—PROXIMITY OF HAZARDOUS OPERATIONS/HIGH-RISK FACILITIES

The site is adjacent to an existing radiological hazard but that facility (the WIPP) does not handle spent nuclear fuel. The proposed project would provide a new radiological hazard to the area through the handling of a different source of radiation. There are no facilities storing or handling large quantities of hazardous chemicals within 8 km (5 mi). However, the adjacent WIPP site handles large quantities of transuranic wastes. There are no major propane pipelines within 3.2 km (2 mi) of the site, although a high-pressure gas line runs through the WIPP site, approximately 0.8 km (0.5 mi) south of the site. There are no commercial airports within 16 km (10 mi), and the site is not located in a general emergency area. The proposed site is in an attainment zone. The only facility nearby is the WIPP, and it is not expected to affect the permitting effort for the site. Other than the WIPP facility, there are no facilities within 8 km (5 mi) that would provide a nearby air emissions source that could potentially affect air quality.

CRITERION 14—EASE OF DECOMMISSIONING

The natural site characteristics (climate, hydrology, etc.) at the Lea County site can be expected to support efficient decontamination and decommissioning activities. There are no known future projects for the site vicinity that could add additional impacts to decommissioning the proposed facilities.

CRITERION 15—DISPOSAL OF LOW-LEVEL WASTE

There is ready access to the Waste Control Specialists LLRW disposal facilities 10 km (6 mi) east of Eunice, New Mexico. To store and ship these wastes the Eddy County site licensee will have to hire and build a waste management staff capable of demonstrating the technical qualifications required to obtain the appropriate LLRW licenses and authorizations for generating, storing, and transporting CISF-generated wastes.

2.3.8 Site Selection Process: Summary of Scores

Four possible locations to construct and operate a CISF were explored. One of these locations, the Waste Control Specialists property in Andrews County, Texas, ultimately became the Proposed Action, as described in Section 2.2 of this ER. The remaining three locations were not carried forward for detailed analysis based on their scores for the screening criteria.

The four locations were first evaluated using the first tier of five “Go: No Go” screening criteria. All four counties received “Go” or “Acceptable” ratings for all five criteria (Table 2.3-1). Therefore, all four locations were advanced to the second tier of screening.

Table 2.3-1 First Tier Go: No Go Screening Criteria

	FIRST PHASE SCREENING MATRIX				
Location	Criterion 1 Political Support	Criterion 2 Seismology/ Geology	Criterion 3 Rail Access	Criterion 4 Land Parcel Size	Criterion 5 Land Availability
Andrews County, TX	Go	Go	Go	Go	Go
Loving County, TX	Go	Go	Acceptable	Go	Acceptable
Lea County, NM	Go	Go	Go	Go	Go
Eddy County, NM	Go	Go	Go	Go	Go

Results of the second tier of screening, which evaluated *quantitatively the site selection criteria, which are the same as the Go: No Go criteria, as well as* the operational considerations and environmental impacts at each location, are shown in Tables *2.3-1a, 2.3-2, and 2.3-4.*

Table 2.3-1a Second Phase Screening Matrix: Site Selection Scoring Summary

Site Selection Criteria*	Weight %	Sub-Criteria	Andrews County	Loving County	Lea County	Eddy County
Criterion 1 - Political Support	100	Advocates	10	5	7	7
	100	Incentives	10	10	10	10
	80	Cooperation in Permitting	10	10	10	10
Criterion 2 - Favorable Seismological and Geological Characteristics	100	Peak Ground	10	10	10	10
	80	Liquefaction Potential	8	8	8	8
	100	Acceptable Weight Bearing	8	8	8	8
	50	Differential Settling	8	8	8	8
	30	Surveys Available	10	1	7	7
	80	Away from Population Centers Exceeding 50,000	10	10	10	10
	100	Away from Flood Plains	10	10	10	10
	100	Away from Aquifers	10	10	10	10
	80	Away from Rivers	10	10	10	10
	80	Away from Lakes	10	10	10	10
Criterion 3 - Rail Access	100	Proximity to Existing Rail Lines	10	1	8	7
	100	Existing Rail Spur	10	1	6	6
Criterion 4 - Land Parcel Size	100	Future Expansion	10	10	10	10
	100	Buffer Zone	10	10	10	10
	80	Plant Layout	10	10	10	10
Criterion 5 - Land Availability	80	Available and No Purchase Required	10	1	10	5
		Score	**157.4**	**124.5**	**147.5**	**142.5**
*Total weight for site selection criteria is 100						

Table 2.3-2 Second Phase Screening Matrix: Operational Criteria Scoring Summary

Operational Criteria	Weight %	Sub-Criteria	Andrews County	Loving County	Lea County	Eddy County
Criterion 6 - Utilities	100	Electric Power Availability	10	3	7	7
	80	Cellular and Data Towers	10	3	8	8
	100	Water Supply	10	5	8	10
Criterion 7 - Construction Labor Force	100	Sufficient Labor Force	10	10	10	10
	50	Competing Projects/Sites	10	10	10	10
	90	Large Project Experience	10	10	10	10
Criterion 8 - Operational Labor Force	100	Sufficient Labor Force	8	5	7	7
	80	Multi-Task Employees	8	5	7	7
	80	Technical School/training	9	3	9	9
	100	Mature Nuclear Safety Culture	10	1	8	8
	100	Radiation Worker Staff	10	1	8	8
	100	Health Physicist and Radiation Protection Organization	10	1	8	8
Criterion 9 - Transport Routes	100	Site Railhead	9	0	6	8
	90	Access to Highways	10	3	10	10
	90	Traffic Capacity	10	3	10	10
	90	Efficient Access	8	3	8	8
Criterion 10 - Amenities for Workforce	100	Housing	9	3	10	9
	100	Schools	10	10	10	10
	100	Health Services	10	5	10	10
	80	Parks/Recreation	9	5	9	10
		Score	**174.0**	**78.9**	**157.6**	**161.4**
*Total weight for operational criteria is 80						

Table 2.3-3 Second Phase Screening Matrix: Environmental Selection Scoring Summary

Criterion*	Weight %	Sub-Criteria	Andrews County	Loving County	Lea County	Eddy County
Criterion 11 - Environmental Protection	100	Existing Site Characterization Data	10	1	6	6
	100	Documentation	10	3	9	5
	100	Neighboring Plume	10	10	8	10
	100	Future Migration	10	10	8	10
	100	No RAD Contamination	10	10	10	10
	100	Not CERCLA or RCRA	10	10	10	10
	100	No Remediation needed	10	10	10	10
	100	Flood Plain	10	10	10	10
	50	Ponding	10	10	10	10
	100	Protected Species	10	10	8	10
	100	Archeological and Cultural Resources	10	5	5	5
	80	Environmental Permits	10	10	10	10
	100	Environmental Justice	10	7	7	7
Criterion 12 - Discharge Routes	50	Facility Discharge	10	10	10	10
	50	Differentiation	9	10	10	10
Criterion 13 - Proximity of Hazardous Operations/High-Risk Facilities	90	Hazardous Chemical Sites	8	10	10	10
	80	Gas Pipelines	10	10	8	8
	70	Airports	10	10	10	10
	70	Emergency Area	8	10	10	10
	80	Air Quality	10	10	10	10
Criterion 14 - Ease of Decommissioning	50	Ease of Decommissioning	10	10	10	10
	25	Adjacent Site's Medium/Long-Term Plans	8	10	10	10
Criterion 15 - Disposal of LLRW	100	Proximity to and Availability of Disposal Options	10	8	8	8
		Score	**185.3**	**163.5**	**166.9**	**168.9**

*Total weight for environmental criteria is 100

Table 2.3-4 Second Phase Screening Matrix: Overall Scoring

Criteria	Weight %	Andrews County, TX	Loving County, TX	Lea County, NM	Eddy County, NM
Siting	100	157.4	124.5	147.5	142.5
Environmental Considerations	100	185.3	163.5	166.9	168.9
Operational Considerations	80	174	78.9	157.6	161.4
Score		**481.9**	**351.1**	**440.5**	**440.5**

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED

Alternatives to the proposed design that alter the design or the location of the project were identified. Ultimately, none were carried forward for detailed analysis. The range of reasonable design and location alternatives considered and the reasons for eliminating them from detailed analysis are presented here.

2.4.1 Design Alternative

Currently, the NRC has licensed and approved SNF storage systems owned by TN Americas, NAC International, HOLTEC International, and Energy*Solutions*. ISP has teamed with TN Americas and NAC International to use their systems to store SNF at the CISF and use of these systems is analyzed as part of the Proposed Action. A potential design alternative would be to use the Holtec International and Energy*Solutions* systems. This alternative was considered.

In order for the Holtec International and Energy*Solutions* systems to be considered as a viable alternative to the Proposed Action, ISP would need access to information about the characteristics of the SNF within the casks, the technical specifications of the casks, and the inspection requirements for those systems. Currently, Holtec International and Energy*Solutions* have declined to partner with ISP and have not provided that proprietary information to ISP. Without that information, ISP cannot prepare a detailed site plan, SAR, or impacts analysis. The requirements of the different storage systems could necessitate a different site layout, handling procedures for transport, or different inspection schedules, to name just a few potential variables.

Without access to detailed technical information for the Holtec International and Energy*Solutions* systems, ISP is unable to prepare a sufficiently detailed plan incorporating these systems; therefore, ISP cannot evaluate the potential impacts from such an alternative. Because of these constraints, the Design Alternative was not carried forward for detailed analysis.

2.4.2 Location Alternatives

The Proposed Action in Andrews County, Texas, was identified through the process conducted to evaluate a range of possible locations for a CISF site.

ISP supports the Blue Ribbon Commission's recommendation to only site a CISF in a state and community willing to host such a facility. ISP joint venture member Waste Control Specialists' success in licensing the nation's first LLRW disposal facility since Congress enacted the Low-Level Radioactive Waste Policy Act of 1980, as amended in 1985, was predicated on the tremendous support provided by Texas, the regional and local communities in west Texas, Andrews County, and southeastern New Mexico. ISP agrees with the findings of the Blue Ribbon Commission that many of the failures to site nuclear and radioactive waste disposal facilities, including the proposed repository at Yucca Mountain, Nevada, are directly attributable to the failure to garner the support of the host state and local communities. The site selection process is geared to identify a ROI focused upon states and communities that have expressed their willingness to host an interim storage facility. A summary of this process is provided immediately below; details of the process are provided in the following sections.

The evaluations of alternate site locations started with seven states in the southwestern U.S. These seven were chosen based on their low population and arid or semi-arid climates. The states considered included Arizona, California, Colorado, Nevada, New Mexico, Texas, and Utah.

Five of the seven states were screened out for further consideration due to the lack of political or community support for hosting an SNF storage facility—consistent with the recommendations from the BRC. This included elimination of a potential site on the Skull Valley Band of Goshute Indians (SVBG) reservation. Since their license is effective until February 21, 2026, SVBG contacted ISP joint venture member Waste Control Specialists on April 28, 2015 about acquisition and transfer of the licenses to Waste Control Specialists (Attachment 2-1). Waste Control Specialists met with the executive committee of the SVBG on September 29, 2015 to

discuss acquiring the license that was approved by the NRC authorizing Private Fuel Storage (PFS) to store SNF on its reservation in Utah. Despite the availability of the existing license, this potential location was not carried forward for detailed analysis due to the lack of state and community support needed to transfer important lands required for successful operations of an away-from-reactor SNF CISF. The states eliminated from further analysis included Arizona, California, Colorado, Nevada, and Utah.

Texas and New Mexico voiced their strong support for hosting a CISF and therefore were selected for further screening.

In west Texas, 54 counties were initially considered based on criteria established by the State of Texas for siting a disposal facility for Class A, B, and C LLRW. ISP then selected for further review the specific counties in Texas that had expressed a willingness to host a CISF. As such, Andrews and Loving counties, Texas, were selected for further consideration in site-selection screening. In New Mexico, strong community and political support for a CISF were present in two counties: Lea and Eddy counties. Therefore, these two counties were considered as possible alternate locations for the CISF site. All other states and counties were eliminated from further consideration.

Subsequently, an environmental screening analysis and an operational screening analysis were performed on the four counties (Andrews and Loving counties in Texas and Lea and Eddy counties in New Mexico) to determine the one that would best support the CISF with the least amount of impacts. Through these two screening phases, these four locations were scored to show a quantitative outcome to compare each location.

Ultimately, the alternative site locations that were considered but eliminated from detailed analysis were Loving County, Texas; Lea County, New Mexico; and Eddy County, New Mexico. These sites were eliminated because the final scores for Andrews County, Texas were the highest—the Andrews County site had the fewest environmental and operational impacts. The most important operational impacts that contributed to the low score of the eliminated site locations were the availability of utilities, the established local labor culture, and the absence of a site railhead. Andrews County scored the highest in these areas with respect to the operational impacts. Moreover, Andrews County did not score below a 10 in any of the environmental protection categories. Through this screening processes, it was determined that Andrews County was the superior site location and no other location could reasonably serve as

the location for the CISF site. Thus, the other three alternative site locations were eliminated from detailed analysis.

2.5 SUMMARY OF THE NO ACTION ALTERNATIVE, PROPOSED ACTION ALTERNATIVE, AND ELIMINATED ALTERNATIVES

Under the No Action Alternative, the license would not be approved and the CISF would not be built. The shutdown, decommissioned and operating commercial reactor sites would be required to operate an ISFSI on their current property. In this alternative the shutdown, decommissioned commercial reactors would not be able to return to a greenfield condition, causing a disadvantage for the local communities because this land will not be available for further economic development. This alternative does not support the communities' needs or the recommendations from the President's Blue Ribbon Commission on America's Nuclear Future.

Under the Proposed Action, ISP will construct and operate a CISF on 130 ha (320 acres) of ISP joint venture member Waste Control Specialists' existing property of approximately 5,666 ha (14,000 acres) in Andrews County, Texas. The SNF that is now being stored at the reactor sites will be shipped by rail to the CISF for storage for 60–100 years, until a permanent repository is opened.

The potential Design Alternative would use different SNF storage systems. As discussed in Section 2.4.1, without access to detailed technical information for the Holtec International and Energy*Solutions* systems, ISP is unable to prepare a sufficiently detailed plan incorporating these systems. Therefore, ISP cannot evaluate the potential impacts from such an alternative. Because of these constraints, the Design Alternative was not carried forward for detailed analysis.

As discussed in Section 2.3, four counties located in west Texas and southwest New Mexico were reviewed that have strong state and community support for the construction and operation of a CISF: Andrews and Loving counties in Texas and Eddy and Lea counties in New Mexico. ISP analyzed and scored each county for operational considerations and environmental considerations (see Tables 2.3-1 through 2.3-4). Each county was carefully analyzed based on the 15 different criteria and scored based on the information available (Attachment 2-3). These analyses led to the overall scores shown in Table 2.3-4. Based on this analysis, the Andrew County, Texas location was identified as the preferred location and the other three locations were eliminated from detailed analysis.

Thus, based on a consideration of the available design and location alternatives, only the No Action and Proposed Action alternatives were carried forward for detailed analysis; all other alternatives were eliminated from detailed analysis. Table 2.5-1 provides a summary of the operational, environmental, and state and community support factors for the No Action, Proposed Action, and alternatives eliminated from detailed analysis.

Table 2.5-1 Comparison of the No Action Alternative, Proposed Action Alternative, and Alternatives Eliminated from Detailed Analysis

	Alternative	Operational Impacts Considerations	Environmental Impacts Considerations	State and Community Support
Alternatives to be Analyzed	**No Action**	Would need to license each site to store spent fuel onsite until a permanent repository is opened	Would need to analyze environmental aspects at each site	Each site would need community support; goes against recommendations of the President's Blue Ribbon Commission
	Proposed Action: Andrews County, TX	Scored highest with 174.0	Scored highest with 185.3	Has state and community support to construct and operate the CISF
Alternatives Eliminated from Detailed Analysis	**Design Alternative**	Information unavailable, could not be assessed	Information unavailable, could not be assessed	Lacks state and community support; has support of SVBG
	Location Alternative: PFS, Utah	License was authorized by the NRC	License was authorized by the NRC	BLM does not support; State of Utah government and senators do not support
	Location Alternative: Loving, TX	Lowest score with 78.9	Lowest score with 163.5	Has state and local support
	Location Alternative: Lea, NM	Scored third highest with 157.6	Scored third highest with 166.9	Has state and local support
	Location Alternative: Eddy, NM	Scored second highest with 161.4	Scored second highest with 168.9	Has state and local support

2.6 CUMULATIVE EFFECTS

The cumulative effects that would occur when the proposed action to license, construct, and operate a CISF is added to the past, present, and reasonably foreseeable developments that may occur at other nearby facilities within a 48 km (30 mi) radius were evaluated. The purpose of this analysis is to assess the cumulative or incremental environmental impacts from past, current, and potential facilities and activities that could present the potential for cumulative environmental impacts. The cumulative impacts for storing 40,000 MTUs of SNF for the next 60 years were evaluated.

The types of cumulative environmental impacts attributable to storing 40,000 MTUs of SNF were addressed by the NRC in the NUREG-1714 report titled, *Final Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation of the Skull Valley Band of the Goshute Indians and Related Transportation Facility in Toole County, Utah* . The types of cumulative environmental effects analyzed by the NRC for the project in Tooele County, Utah, are comparable to those anticipated at the CISF.

The proposed CISF would be constructed adjacent to the NEF uranium facility that supports the commercial nuclear industry and is licensed by the NRC pursuant to the requirements in 10 CFR 70. The cumulative impacts from the NEF to other nearby facilities were previously evaluated by the NRC. The results from this analysis included the impacts from Waste Control Specialists located approximately 1.6 km (1 mi) to the east; Permian Basin Materials, a quarry located just north of NEF; the Lea County landfill which is across New Mexico Highway 234, approximately 1.6 km (1 mi) to the south; and Sundance Industries "produced water" treatment facility that is adjacent to Permian Basin Materials. The NEF reported that the cumulative effects with the greatest likelihood of occurring were to air quality and noise during construction of this facility that has since been completed.

The impacts to air quality and increased noise attributable to the NEF have been considerably reduced since major construction at the NEF has been completed. The results from this analysis were reported in the NUREG 1790 report titled, *Environmental Impact Statement for the Proposed National Enrichment Facility in Lea County, New Mexico* .

The most substantial cumulative impacts are expected to occur during construction and operation of the proposed CISF in Andrews County. These impacts may combine with other proposed construction projects in the area, such as expansion of the ISP joint venture member

Waste Control Specialists–controlled CWF and FWF, to create local cumulative impacts. These cumulative impacts may affect air quality during construction of the CISF and may combine with impacts from operations at Permian Basin Materials and from the manufacture of concrete at Waste Control Specialists' existing batch plant, which supports operations at Waste Control Specialists' LLRW disposal operations. The combined cumulative impacts from these operations are expected to be small.

Other non-radiological cumulative impacts attributable to construction of the CISF involve the competition for and use of aggregate, crushed rock, and other mineral resources. The expansion of the Waste Control Specialists–controlled FWF and CWF will have a minimal cumulative impact on the demand for these resources and it should be noted that the cumulative impacts for the complete buildout of the CWF and FWF have been reviewed and approved by the TCEQ. However, currently there are no other known projects planned for this area of Andrews County for the period during which ISP plans to start construction. Further, due to the abundance of these materials in the area, the potential for adverse cumulative impacts to geological resources is anticipated to be small.

The environmental impacts from Waste Control Specialists' LLRW Disposal Facilities were also evaluated by the TCEQ. The results of the analysis were reported by TCEQ in a report titled, *Draft Environmental and Safety Analysis of a Proposed Low-Level Radioactive Waste Disposal Facility in Andrews County, Texas* .

The radiological environmental impacts attributable to operations at the Waste Control Specialists LLRW Disposal Facility have been well below the radiation protection standards established by the TCEQ. Since operations at this facility began in 2012, the highest effective radiation dose to a member of the public was conservatively estimated at 0.057 mSv/yr (5.7 mrem/yr).

A review of the Radiological Environmental Monitoring Program (REMP) Reports was conducted to assess the cumulative impacts to the ROI attributable to operations at the NEF from September 2006 through December 2011. Information contained in the REMP prepared by NEF provided a summary of potential radiological effluent releases to the environment, ambient levels of gamma and neutron radiation measurement, and other environmental media from 2006 through 2011. Results reported by NEF concluded that no releases of radioactive material occurred and that the radiological impacts to the environment from uranium enrichment

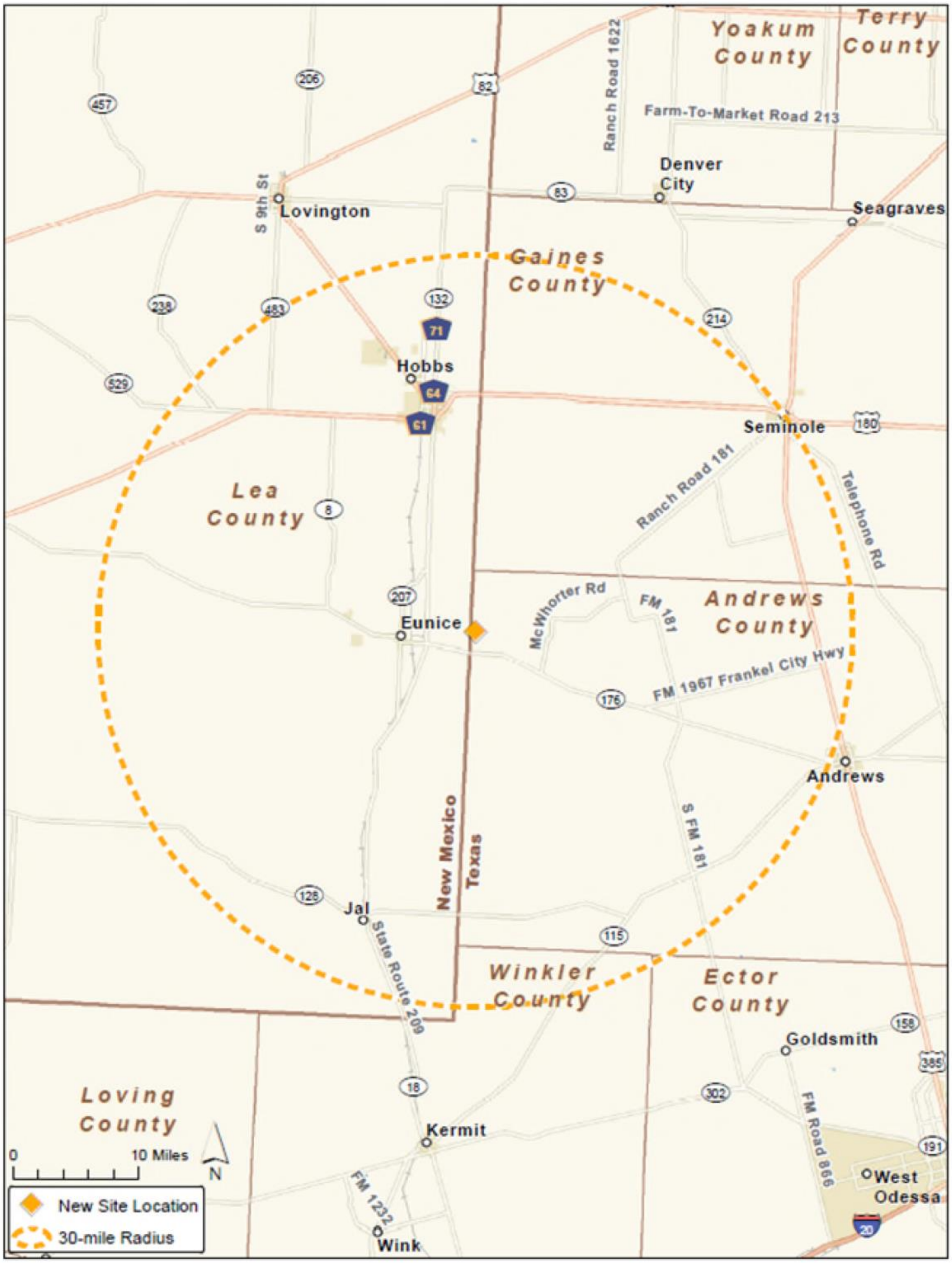
operations were consistent with those of the natural environment, and well below those permissible pursuant to 10 CFR 20.1301. .

The radiological impacts associated with storing up to 40,000 MTUs of SNF and related GTCC waste at the CISF were estimated at 0.011 mSv/yr (11 mrem/yr). The cumulative radiological impacts from all regional sources of radiation are well below the 1 mSv/yr (100 mrem/yr) radiation protection standard for individual members of the public established in 10 CFR 20.1301.

A non-local cumulative impact is the cumulative dose to the public associated with transporting radioactive materials in commerce. Both the NRC and the TCEQ evaluated the environmental impacts attributable to transportation at the NEF and Waste Control Specialists LLRW Disposal Facility, respectively . The number of annual shipments transported by highway in the analysis by NEF was estimated at 1,500. Approximately 1,026 shipments by highway and 96 shipments by rail were received in 2015 to support operations at Waste Control Specialists. In comparison, ISP anticipates that no more than 200 shipments of SNF would be received annually at the CISF.

The maximum individual dose of radiation that any individual member of the public would receive from a single shipment of SNF along any of the three transportation routes, Figure 2.6-1, was estimated at 0.0179 μSv (1.79E-3 mRem). The maximum collective dose for transporting 200 shipments of SNF per year along any of the three transportation routes was estimated at 0.4 person-Sv (40 person-Rem).

The cumulative environmental effects are not expected to be significant and represent a small fraction of the limits established by federal and state regulatory agencies. The cumulative effects will be offset by the positive cumulative effects provided by increased employment opportunities and increases in the local tax base and revenues.

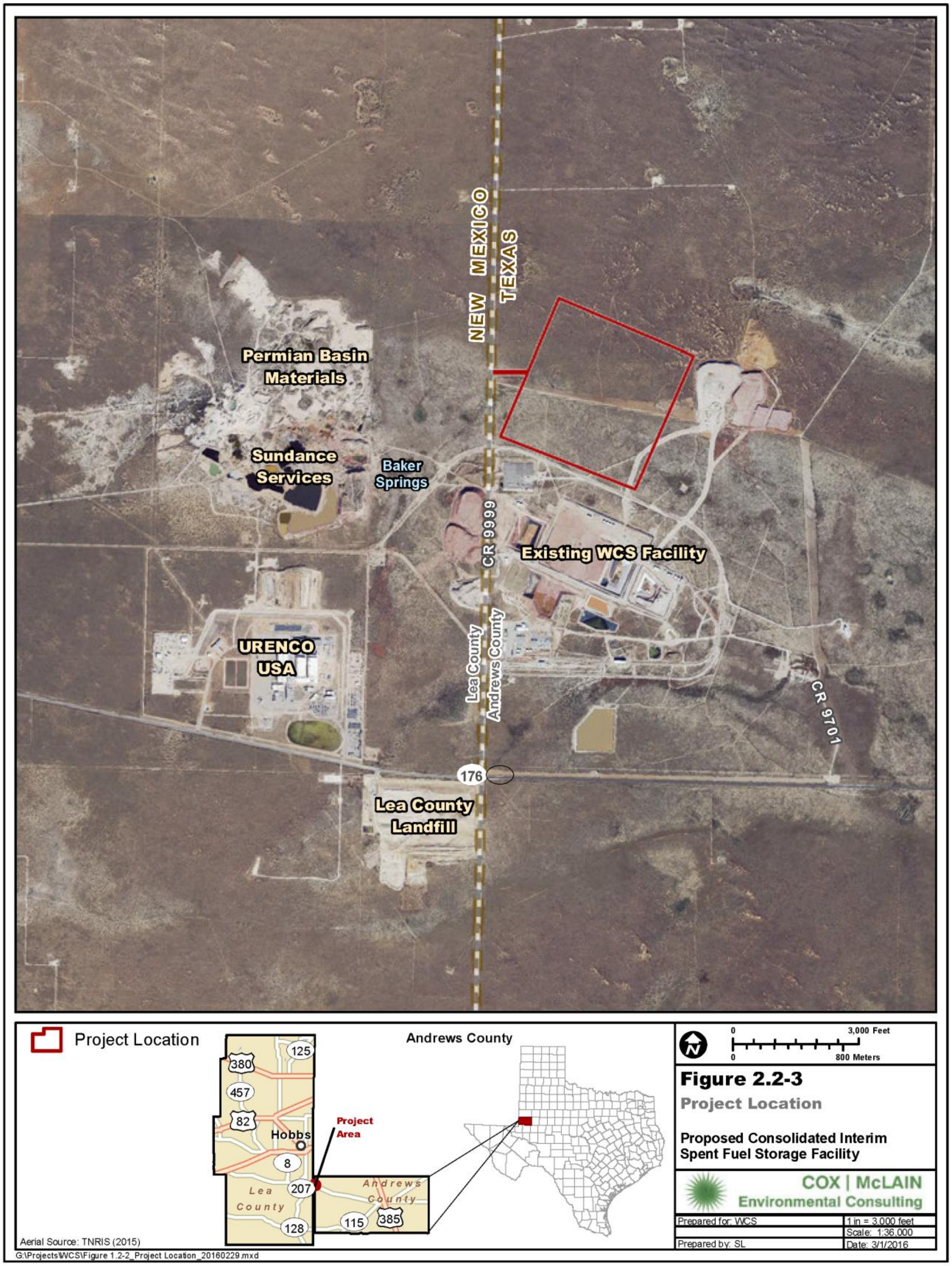


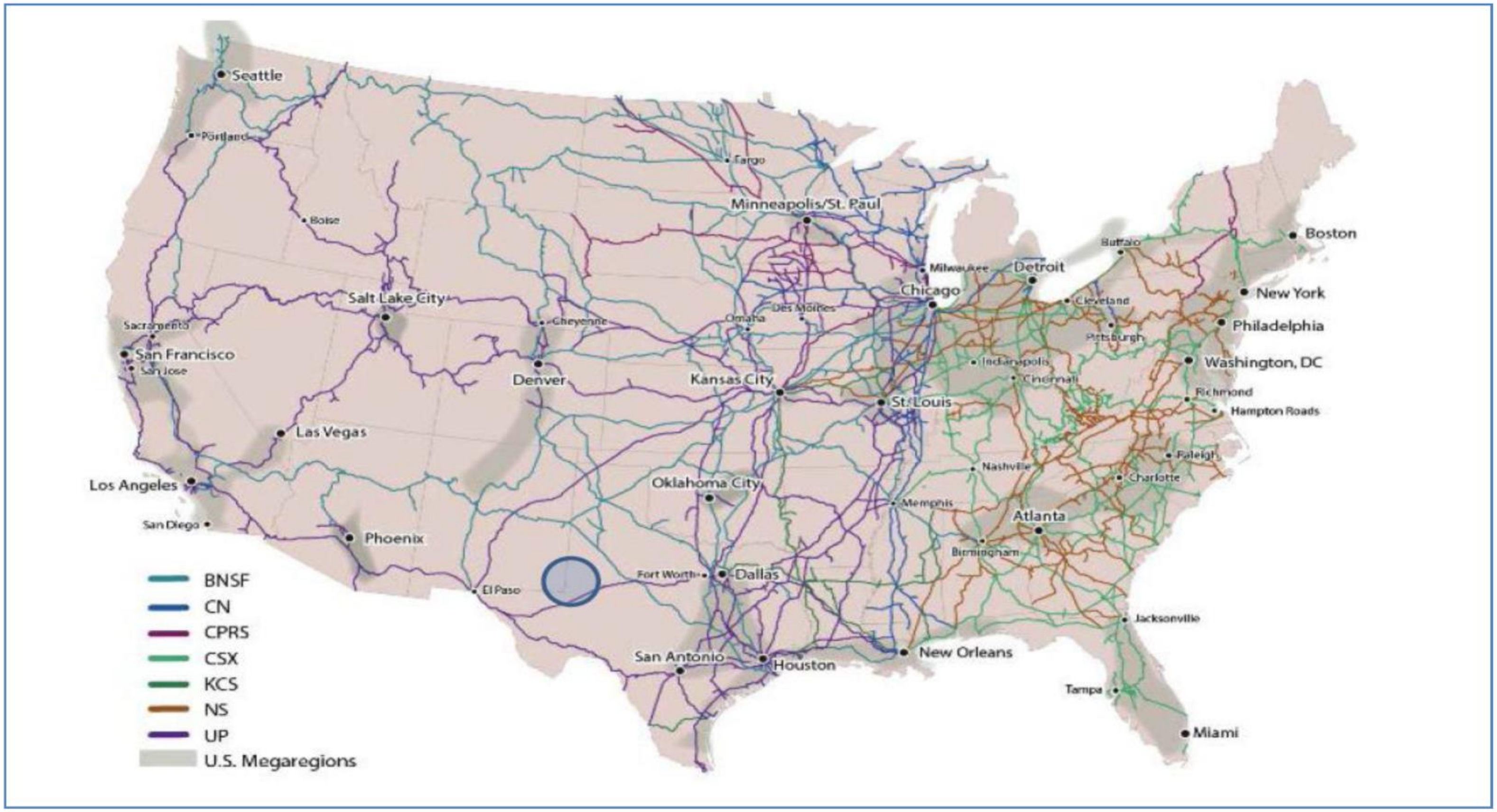
AMERICA'S NUCLEAR SOLUTION

Figure 2.2-1
Region of Interest Within 30 Mile Radius of the CISF

AMERICA'S NUCLEAR SOLUTION

Figure 2.2-2
Aerial Photograph of the Waste Control Specialists Site, including the collocated CISF


NEW MEXICO
TEXAS
Permian Basin Materials
Sundance Services
Baker Springs
CR 9999
Existing WCS Facility
URENCO USA
Lea County
Andrews County
CR 9701
176
Lea County Landfill
Project Location
Andrews County
125
380
457
82
Hobbs
8
Project Area
Lea County
207
128
Andrews County
115
385
0
3,000 Feet
0
800 Meters
Figure 2.2-3
Project Location
Proposed Consolidated Interim Spent Fuel Storage Facility
COX | McLAIN Environmental Consulting
Prepared for: WCS
1 in = 3,000 feet
Scale: 1:36,000
Prepared by: SL
Date: 3/1/2016
Aerial Source: TNRIS (2015)
G:\Projects\WCS\Figure 1.2-2_Project Location_20160229.mxd



Title:	Figure:	Date:	
RAIL LINES MAP	2.2-4	11/16/2015	WCS ANDREWS, TEXAS
		Scale: NONE	

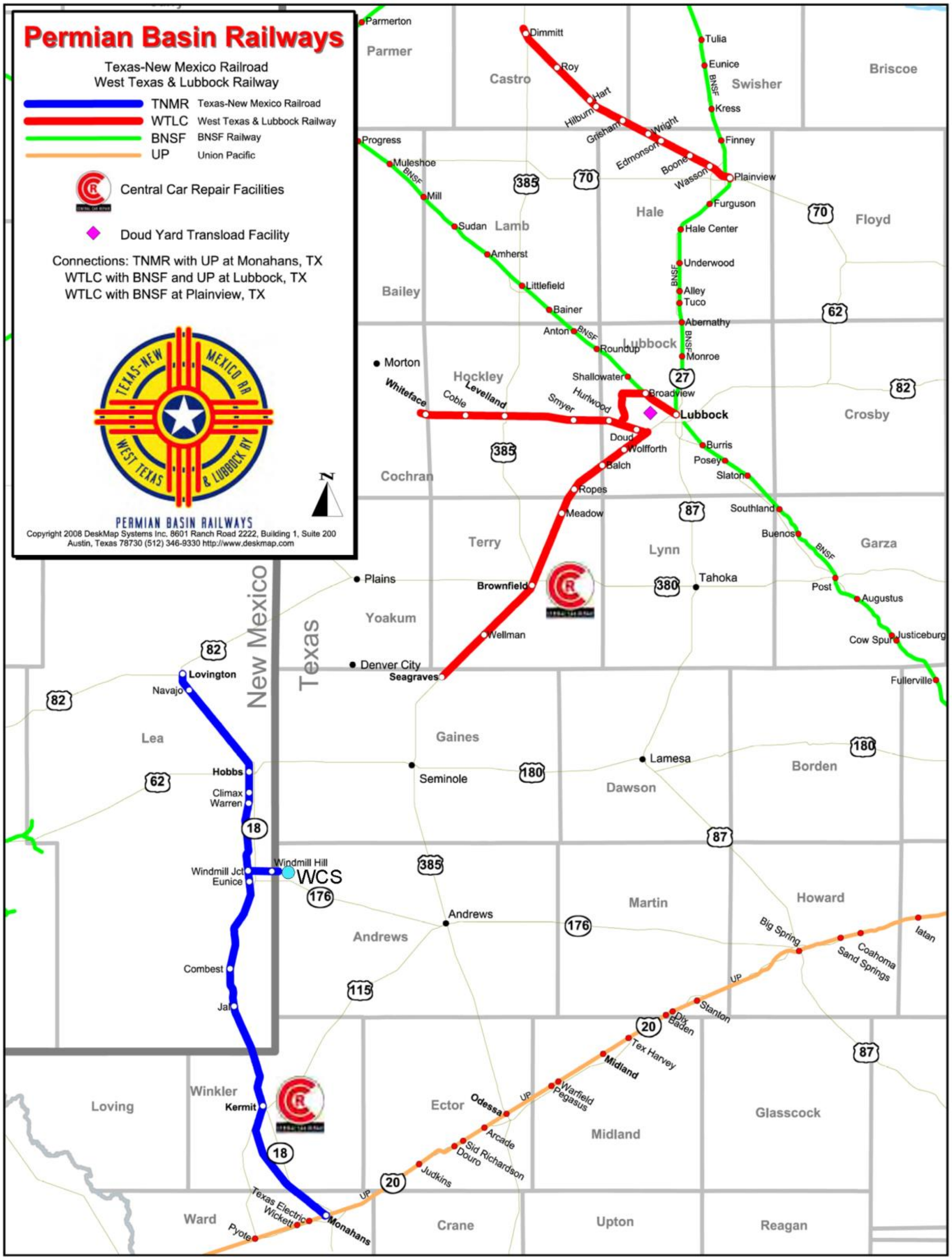
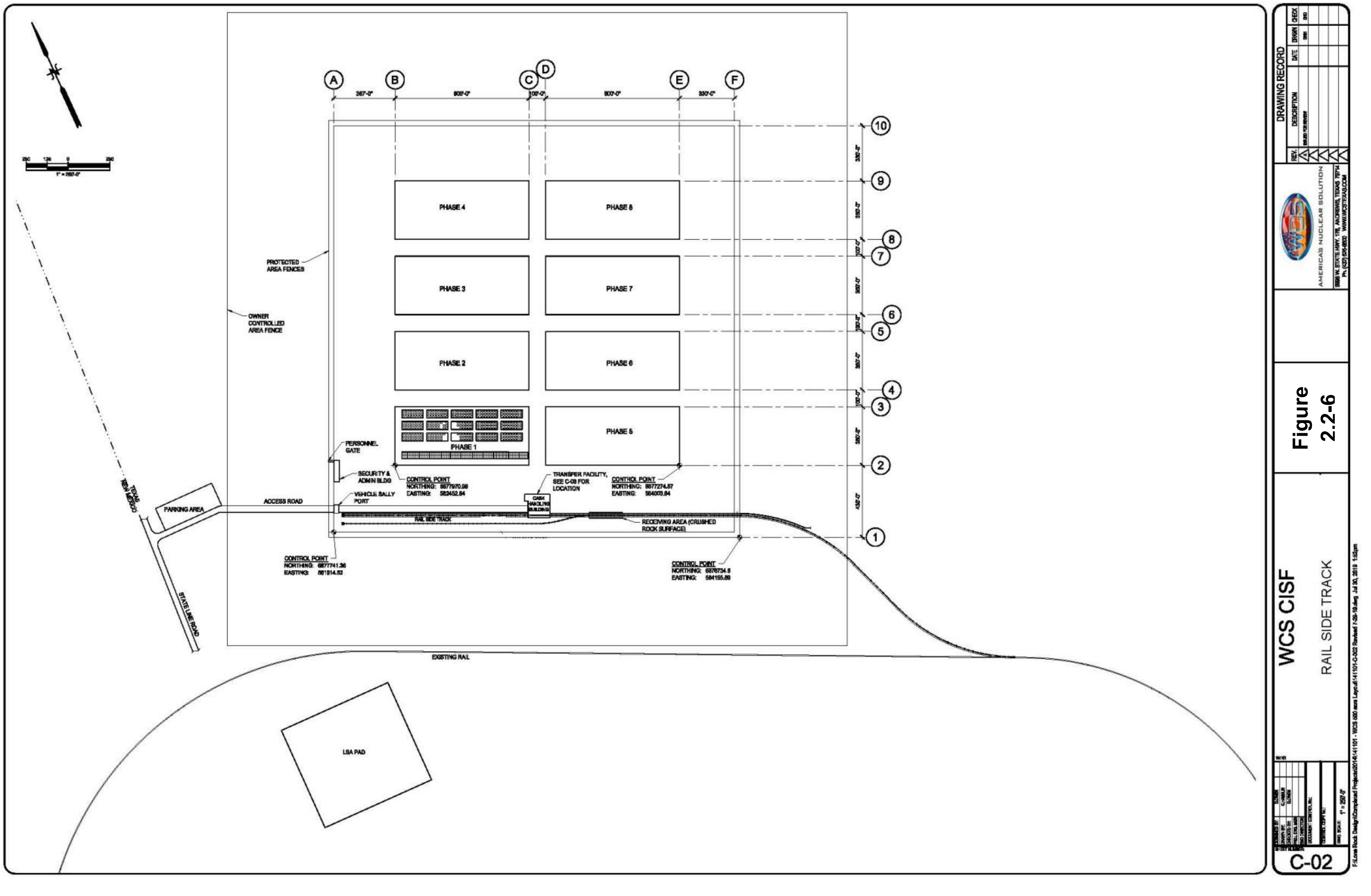


Figure 2.2-5
Rail Corridor


PHASE 4
PHASE 8
PHASE 3
PHASE 7
PHASE 2
PHASE 6
PHASE 1
PHASE 5
PROTECTED AREA FENCES
OWNER CONTROLLED AREA FENCE
PERSONNEL GATE
SECURITY & ADMIN BLDG
VEHICLE SALLY PORT
ACCESS ROAD
PARKING AREA
CONTROL POINT
NORTHING: 6877970.98
EASTING: 582452.84
TRANSFER FACILITY, SEE C-08 FOR LOCATION
CASK HANDLING BUILDING
CONTROL POINT
NORTHING: 6877274.57
EASTING: 584003.84
RAIL SIDE TRACK
RECEIVING AREA (CRUSHED ROCK SURFACE)
CONTROL POINT
NORTHING: 6877741.36
EASTING: 581914.52
CONTROL POINT
NORTHING: 6876734.8
EASTING: 584155.89
STATE LINE ROAD
EXISTING RAIL
LSA PAD
A
B
C
D
E
F
1
2
3
4
5
6
7
8
9
10
DRAWING RECORD
REV.
DESCRIPTION
DATE
DRAWN
CHECK
AMERICA'S NUCLEAR SOLUTION
Figure
2.2-6
WCS CISF
RAIL SIDE TRACK
1" = 250'-0"
C-02

AMERICA'S NUCLEAR SOLUTION

Figure 2.2-7
Baker Springs Photograph

AMERICA'S NUCLEAR SOLUTION

Figure 2.2-8
Location of Decommissioned Reactor Sites and WCS

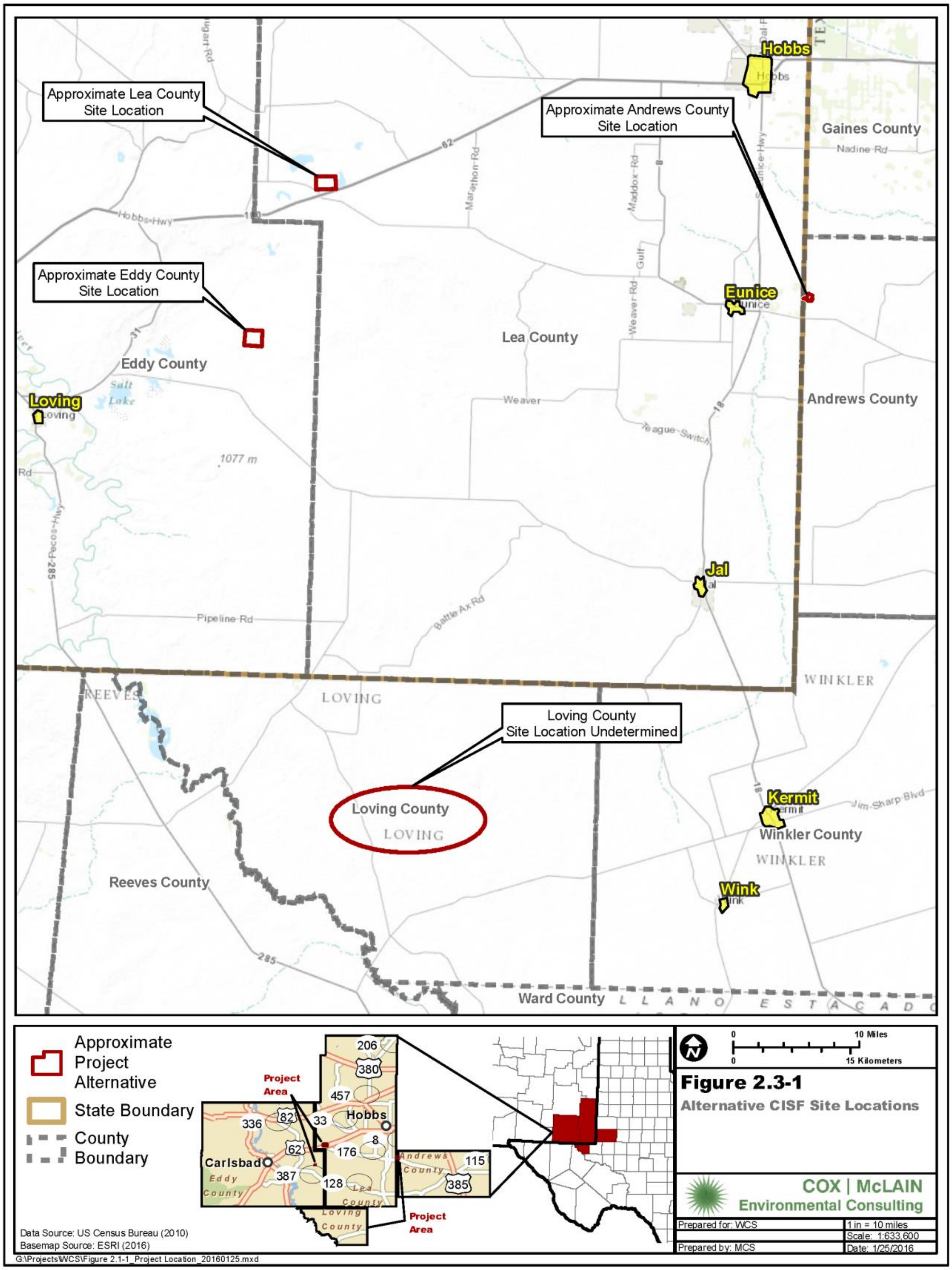
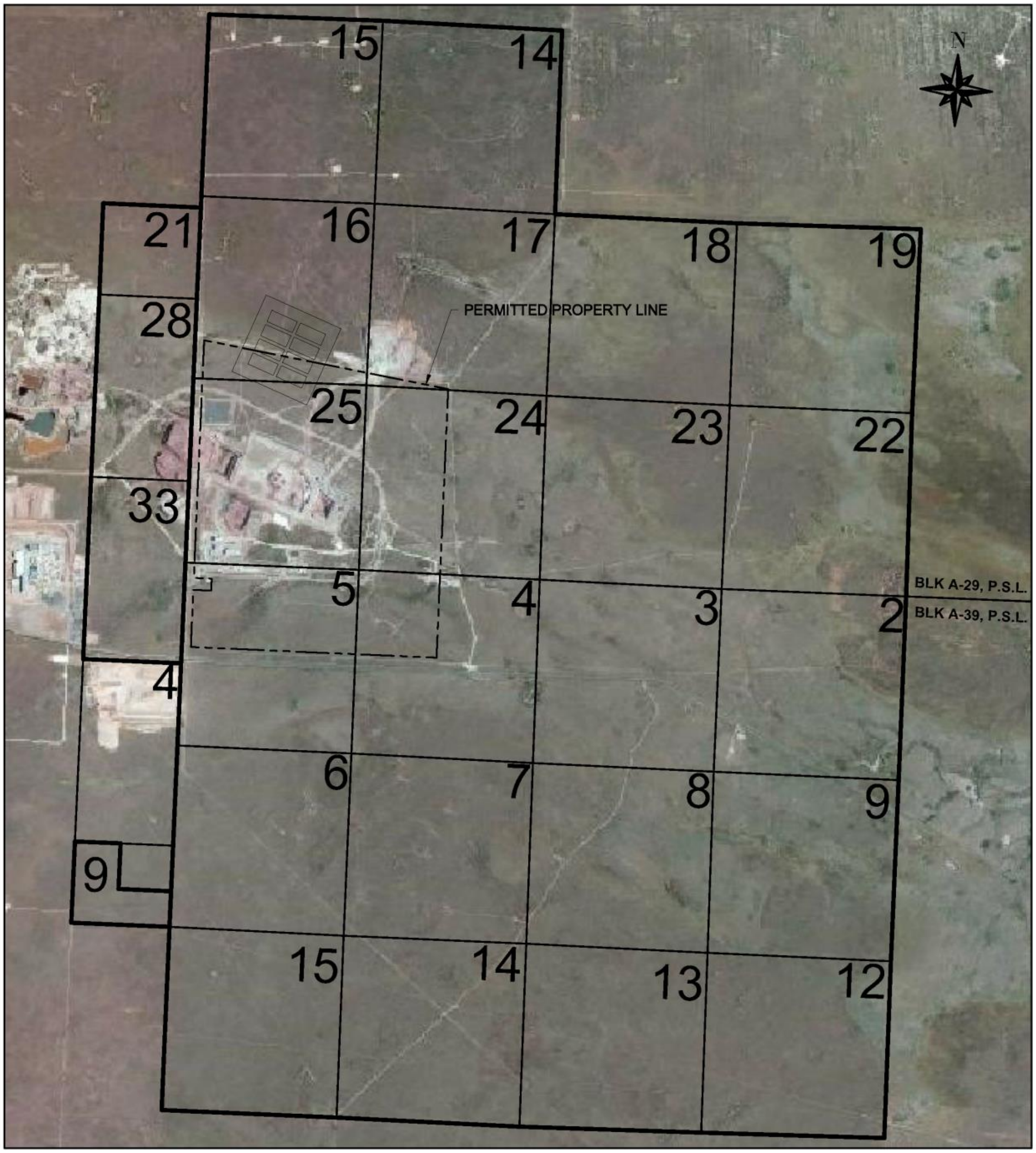


Figure 2.3-1
Alternative CISF Site Locations



REV.	DESCRIPTION	DATE
A	-	-

PROJECT:

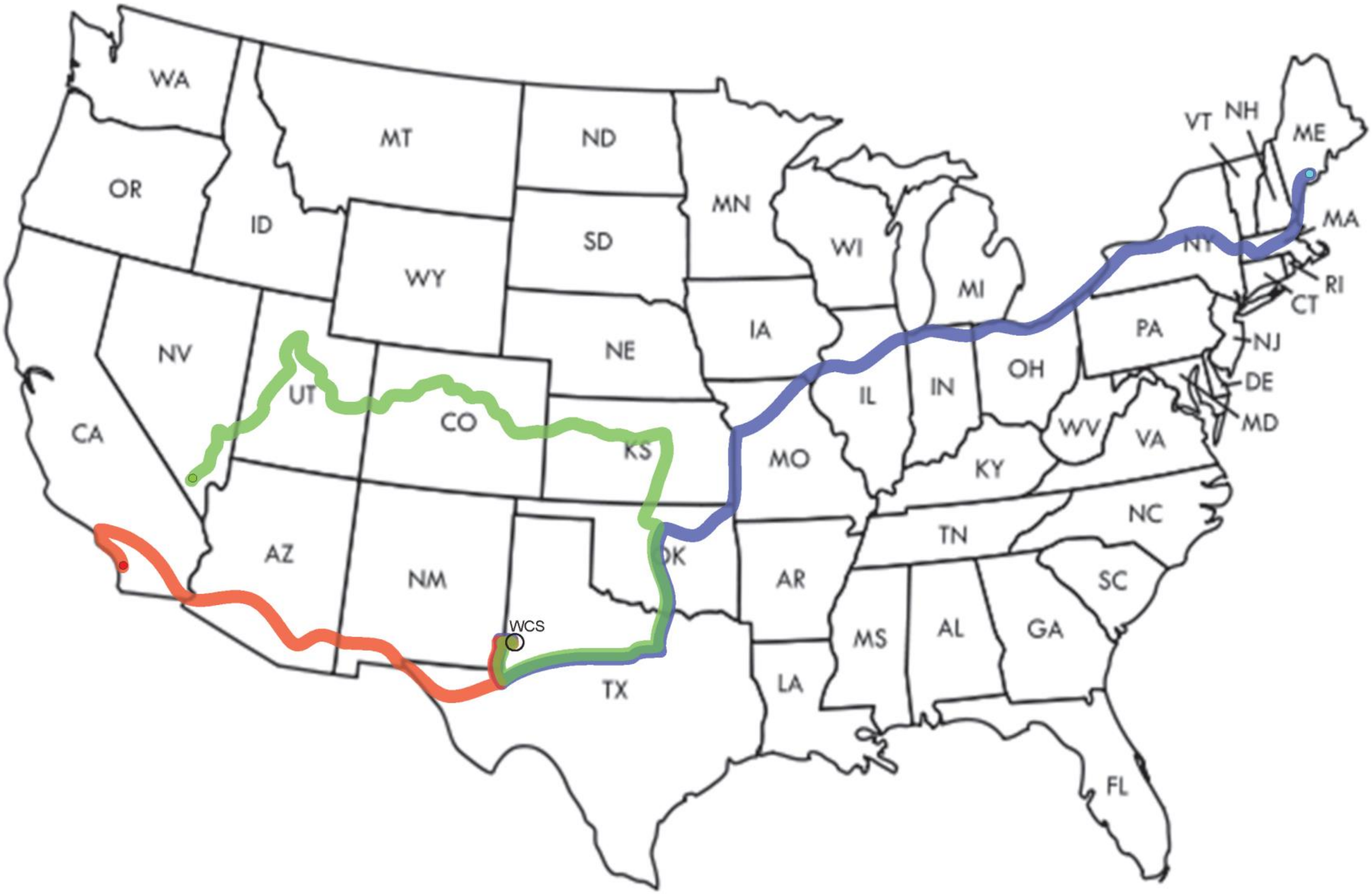
SECTION DETERMINATION

DRAWING:

FIGURE 2.3-2

WASTE CONTROL SPECIALISTS LLC
P.O. BOX 1129
ANDREWS, TX. 79714

DRAWN BY:	UO
CHECKED BY:	BM
DATE:	12/15/15
SCALE:	NTA
FILE:	N/A
DRAWING NO.:	N/A
PROJECT NO.:	N/A



Title:
Figure 2.6-1
Transportation Routes

Explanation:
- Maine Yankee to WCS
- WCS to Yucca Mountain
- San Onofre to WCS

CHAPTER 3

DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.0 DESCRIPTION OF THE AFFECTED ENVIRONMENT

This chapter provides information and data for the affected environment at the proposed CISF and surrounding vicinity. Topics include land use (3.1), transportation (3.2), geology and soils (3.3), water resources (3.4), ecological resources (3.5), meteorology, climatology, and air quality (3.6), noise (3.7), historic and cultural resources (3.8), visual and scenic resources (3.9), socioeconomics (3.10), environmental justice (3.11), public and occupational health (3.12), and waste management (3.13).

3.1 LAND USE

This section describes land uses near the proposed CISF. It also provides a discussion of off-site areas and the regional setting and includes a map of major land use areas. Major transportation corridors are identified in Section 3.2.

ISP joint venture member Waste Control Specialists controls approximately 5,666 ha (14,000 acres) of land in northwestern Andrews County. Within this property boundary, Waste Control Specialists currently operates a commercial waste management facility on approximately 541 ha (1,338 acres) of land (the existing facility). The CISF would be located north of and adjacent to the existing facility, approximately 300 m (984 ft) from the north edge of the rail loop as seen in Figure 3.1-1. The approximate coordinates for the centroid of Phase I of the CISF facility are Latitude 32° 27' 08" N and Longitude 103° 03' 35" W with an elevation of 1,043.587 m (3,423.843 ft) above mean sea level (msl). The portion of the Waste Control Specialists land on which the WCS CISF would be constructed and operated would be controlled by ISP through a long term lease from ISP joint venture member Waste Control Specialists.

The proposed CISF would be a *133.4 ha (330 acre) facility* situated within Andrews County, north of Texas State Highway 176, about 0.6 km (0.37 mi) from the Texas/New Mexico state line (Figure 3.1-1). It is located north of Waste Control Specialists' existing radioactive waste storage, processing, and disposal facilities and is surrounded by Waste Control Specialists' controlled property. The proposed CISF is currently unfenced, except for a gravel-covered road and a railroad spur that borders the south side of the property, and it is undeveloped.

The CISF would be located near the boundary between the Southern High Plains Section (Llano Estacado) of the Great Plains Province to the east and the Pecos Plains Section to the west. The boundary between the two sections is the Mescalero Escarpment, locally referred to as Mescalero Ridge. This part of Andrews County is a gently southeastward sloping plain with a natural slope of about 2.4 to 3 m (8 to 10 ft) per mi as seen on the topographic map in figure 3.1-2. The Elliott Littman oil field is to the northwest, the Freund and Nelson oil fields are to the south, the Paddock South and Drinkard oil fields are to the southwest, and the Fullerton oil field is to the east. *Figures 3.1-5, 3.1-6, and 3.1-7 show oil and gas wells within a 10 km radius of the proposed CISF. Figure 3.1-8 shows existing oil and gas leases within a 10 km radius of the proposed CISF.* On-site soils are primarily of the undulating Blakeney and Conger soil association (76%), the Triomas and Wicket soil association (8%), the Ratliff soil association (14%), and the Jalmar-Penwell association (2%). These soils consist of well drained, fine sandy loam and fine sand underlain by gravelly loam and cemented material. On-site soils are common to areas used for rangeland and wildlife habitat; see section 3.5, Ecological Resources in this ER for more information.

The ISP joint venture member Waste Control Specialists controlled property contains several permitted and licensed facilities. Waste Control Specialists has two approved RCRA permits from the TCEQ and a TSCA authorization from the EPA. Waste Control Specialists also possesses Radioactive Material Licenses (RML) for the management and disposal of Low-Level Radioactive Wastes (LLRW) and uranium Byproduct Material License, respectively.

Land uses within a few miles of the CISF include agriculture, cattle ranching, drilling for and production from oil and gas wells, quarrying operations, uranium enrichment, municipal waste disposal, and the surface recovery and land farming of oil field wastes. *The United States Geological Survey (USGS) National Land Cover Database has data from 2016 that provides land uses in the project area. Table 3.1-1 below shows the land use types that appear within an 8 km (5 mile) radius of the project site, along with estimated acreages by land cover type. Table 3.1-2 shows the land use types that appear within the Study Area (these totals are a subset of the information shown in Table 3.1-1).*

According to Table 3.1-1, approximately 97 percent of the land cover in the five-mile radius (more than 58.7k acres) is Shrub/Scrub. Developed, Open Space constitutes 1.5 percent of the land cover (902 acres) and all other land use categories that occur in this radius comprise less than one percent of the land cover.

In the Study Area, Table 3.1-2 shows that more than 99 percent of the land cover (322 acres) is Shrub/Scrub with just over one acre (0.4 percent) of barren land (rock/sand/clay).

Table 3.1-1, Land Cover within Five-Mile Buffer

Land Cover Gridcode (Legend)	Land Cover - Class	Acres	% of Total
11	Open Water	73.8	0.1%
21	Developed, Open Space	902.0	1.5%
22	Developed, Low Intensity	229.2	0.4%
23	Developed, Medium Intensity	128.1	0.2%
24	Developed, High Intensity	49.8	0.1%
31	Barren Land (Rock/Sand/Clay)	300.0	0.5%
52	Shrub/Scrub	58,714.8	97.0%
71	Grassland/Herbaceous	99.8	0.2%
82	Cultivated Crops	17.8	0.0%
90	Woody Wetlands	7.3	0.0%
	Total	60,522.7	100.0%

Table 3.1-2, Land Cover within Five-Mile Buffer

Land Cover Gridcode (Legend)	Land Cover - Class	Acres	% of Total
31	Barren Land (Rock/Sand/Clay)	1.2	0.4%
52	Shrub/Scrub	321.8	99.6%
	Total	323.0	100.0%

The attached Figure 3.1-4 depicts where these various land use types occur. The land cover that is Developed, Open Space occurs west of the study area near Eunice, New Mexico. Construction of the proposed facility would primarily convert Shrub/Scrub land to developed land uses.

The Permian Basin Materials sand and gravel quarry and a large spoil pile are located west of the proposed CISF. Approximately 1.6 km (1 mi) west and adjacent to the quarry is the Sundance Services oil recovery and solids disposal facility. DD Landfarm, a non-hazardous oilfield waste disposal facility that closed in August 2013 and is undergoing decommissioning and post-closure monitoring, is located approximately 4 km (2.5 mi) west of the proposed CISF. Vacant land situated immediately to the north and east supports oil and gas production. Cattle are not allowed to graze on land controlled by Waste Control Specialists; however, cattle grazing on other nearby properties occur throughout the year. Approximately 2.5 km (1.6 mi) southwest of the proposed CISF, in Lea County, New Mexico, is the URENCO NEF. This plant enriches natural uranium by centrifuge for the commercial nuclear power industry. The Lea County Sanitary Waste Landfill is located approximately 3 km (1.8 mi) south/southwest of the proposed CISF, across New Mexico Highway 176, just across the Texas-New Mexico state line. Land further north, south and west has been mostly developed by the oil and gas industry. *Table 3.1-3 provides information on the depth and thickness of oil and gas producing geologic formations within a 10 km (6 mi) radius of the proposed CISF.* Land further east is ranchland.

Table 3.1-3, Oil and gas production intervals within a 10 km radius of the proposed CISF.

Although various crops are grown within Andrews County, Texas and Lea County, New Mexico, local and county officials report there is no agricultural activity in the vicinity of the proposed CISF, except for domestic livestock ranching. The principal livestock for both Andrews and Lea counties is cattle. Milk cows comprise a substantial portion of the cattle in Lea County; however, the nearest dairy farms are about 32 km (20 mi) northwest of the proposed CISF, near the city of Hobbs, New Mexico. There are no milk cows in Andrews County, Texas. The number of farms and acres of farmland decreased slightly within Lea County between 1992 and 1997, whereas the number of farms in Andrews County increased during this same timeframe.

Land use classification in the vicinity of the CISF is primarily rangeland, built-up land, and barren land. Rangeland is an extensive area of open land on which livestock graze and includes herbaceous rangeland, shrub and brush rangeland, and mixed rangeland. Built-up land and barren land constitute the other two land use classifications in the vicinity of the proposed CISF. The above indicated land use classifications are identical to those used by the USGS. No special land use classifications (e.g., Native American reservations, national parks, prime farmland) are within the vicinity of the proposed CISF.

Except for the proposed construction of the CISF, Eddie Lea County Alliance for a proposed CISF in Hobbs and the siting of the International Isotopes, Inc. depleted uranium hexafluoride de-conversion and fluorine extraction facility approximately 24 km (15 mi) west of Hobbs, New Mexico, there are no other known current, future, or proposed land use plans, including staged plans, for the proposed CISF or immediate vicinity. Similarly, as the proposed CISF is not subject to local or county zoning, land use planning, or associated review process requirements, there are no known potential conflicts with land use plans, policies, or controls.

The only industrial facilities located within 1.6 km (1 mi) of the proposed CISF boundary are URENCO USA, Permian Basin Materials and Sundance Services, Inc (Figure 3.1-3). There are no transportation or military facilities within 6.4 km (4 mi) of the proposed CISF. The closest transportation facility is the Lea County Airport, which is approximately 29 km (18 mi) from the proposed CISF. Cannon Air Force Base is the closest military facility at a distance of approximately 217 km (135 mi).

There are three counties (Andrews County, Texas Gaines County, Texas and Lea County, New Mexico) within a 24 km (15 mi) radius of the CISF. Andrews is the largest city within Andrews County. The City of Andrews has a small population with no substantial growth forecasted and is outside the 24 km (15 mi) radius. Hobbs is the largest city in Lea County and is the nearest population center of 25,000 or more. Hobbs is experiencing recent population growth rates on the order of 2% for 2013 to 2014; however, no substantial growth is expected. Hobbs is about 28.2 km (17.5 mi) northwest of the proposed CISF and thus is outside the 24 km (15 mi) radius. The 24 km (15 mi) radius area around the proposed CISF has a very low population supported by oil and gas production, some industry, and ranching. There is very little seasonal variation in the population. The nearest residences are situated approximately 6.1 km (3.8 mi) west of the CISF. Beyond is the city of Eunice, New Mexico which is approximately 8 km (5 mi) to the west of the CISF.

Except for a historical marker and picnic area approximately 5.5 km (3.3 mi) from the CISF at the intersection of New Mexico Highways 234 and 18, there are no known public recreational areas or state or federal parks within 8 km (5 mi) of the proposed CISF.

Ecosystems in and around the proposed CISF are typical of the much larger region of west Texas and adjacent areas of New Mexico. The terrain is gently rolling and characterized by shallow washes, some of which are bordered by trees. Soil texture ranges from clay loam to fine sand. Natural vegetation in the region consists primarily of low desert grassland with scattered shrubs and cacti. With few exceptions, the flora and fauna in and around the proposed CISF area consist of species that occur widely throughout the region.

Most of the area has been grazed in the past. Areas of pristine habitat do not exist near the facilities area. Cattle and other livestock have grazed the region in the past, when the area was primarily ranchland. As in other areas of desert grassland, overgrazing has reduced the importance of many native grasses and increased shrub cover. Yucca and snakeweed, which are species indicative of overgrazing, are present over much of the area, as are invasive exotic weeds.

Construction and operation of the industrial facilities described above have removed or altered some of the previously available habit in the vicinity of the proposed CISF. Remaining areas of habitat have been fragmented by the construction of roads and other rights-of-way. In spite of past and ongoing disturbances, the resulting mosaic of land use supports the types of flora and fauna typical of the region.

Known sources of water in the proposed CISF vicinity include the following: a man-made pond on the adjacent quarry property to the west that is stocked with fish for private use; Baker Spring, a seasonally intermittent surface water feature situated west of the CISF; several cattle watering holes where groundwater is pumped by windmill and stored in above ground tanks; a well about 4 km (2.5 mi) to the east; and Monument Draw, a natural, shallow drainage way situated west and southwest of the CISF. Several longtime, local residents indicated that Monument Draw contains water for only a short period of time following a significant rainstorm. There are also three "produced water" lagoons for industrial purposes on the adjacent quarry property to the west and a man-made pond at the Eunice Municipal Golf Course approximately 16 km (10 mi) west of the CISF. There are no commercial fisheries or invertebrate catches.

3.2 TRANSPORTATION

Transportation services to the CISF would include the delivery of equipment, supplies, and staff, including contractors needed to work and provide miscellaneous maintenance activities at the CISF. The mode of transportation for these types of services would be by road. The transportation of solid and radioactive waste generated at the CISF would also be by road, respectively, to the Lea County Municipal Landfill or to one of Waste Control Specialists existing licensed disposal facilities (i.e., the Federal Waste Disposal Facility or the RCRA Landfill).

The DOE or the SNF Title Holder(s) would be responsible for transporting spent nuclear fuel (SNF) from existing commercial nuclear power reactors to the CISF. SNF would be transported to the CISF by rail. Approximately *3,400* canisters are expected to be transported *to the WCS CISF.* SNF would be shipped in transportation packages licensed pursuant to 10 CFR Part 71 and in compliance with requirements established by the U.S. Department of Transportation (DOT). Spent fuel received at the CISF would be stored until such time that a geologic repository for its disposal is constructed and operable as required under the Nuclear Waste Policy Act of 1982.

3.2.1 Connected Environmental Impacts Associated with SNF Transport from Shutdown Decommissioned Reactors

The DOE or the SNF Title Holder(s) are is also responsible for the transportation of SNF from the shutdown and decommissioned reactors across the country. Studies have been performed by the DOE to determine the level of work that would be needed to improve the infrastructure that would be required to remove SNF currently in storage at 12 shutdown and decommissioned reactors for transport to an ISFSI or a geologic repository. The evaluated shutdown sites include: Maine Yankee, Yankee Rowe, Connecticut Yankee, Humboldt Bay, Big Rock Point, Rancho Seco, Trojan, La Crosse, Zion, Crystal River, Kewaunee, and San Onofre . The locations of the shutdown decommissioned reactor sites are depicted in Figure 3.2-1.

These sites have no operating nuclear power reactors. NRC has received notification that their reactors have permanently ceased power operations and that nuclear fuel has been permanently removed from their reactor vessels. Shutdown reactors at sites also having operating reactors are not included in this evaluation.

Not all of the shutdown reactor sites have rail access to transport SNF to an interim storage facility or geologic repository. Such sites would either require upgrades to provide rail access or transport by heavy haul truck to an intermodal rail transfer facility. Because of the size and weight of the licensed shipping casks, shipment by rail is the practical cross-country transportation option for SNF to be delivered to an ISFSI or a geologic repository. Transport by heavy haul trucks to an intermodal rail transfer facility could occur at a shutdown and decommissioned reactor site that does not have rail access. In that case, a heavy-haul transfer truck typically traveling at speeds between 16 to *40* km/hr (10 to *25* mph) could be used to move SNF relatively short distances to a rail transfer facility as discussed in NUREG-1714 . Moreover, SNF could also be transported by barge to another rail transfer facility where the SNF would subsequently be transported by rail to the CISF.

The environmental impacts to the affected areas would be attributable to radiation doses received by members of the public along the transportation routes. Over the next several years, the DOE is expected to commission new transportation systems needed to transport SNF from existing commercial reactor sites, including the shutdown reactor sites, to a CISF or geologic repository. Other environmental impacts would be attributable to upgrades that would be required to the railroad lines leading from the former reactor sites to a CISF or geologic repository. The connected environmental impacts potentially associated with the transportation of SNF and upgrades required to support the removal of SNF from the shutdown and decommissioned reactor sites are discussed in Section 4.2.

3.2.2 Transportation Corridor

The transportation corridor for delivery of equipment and supplies, as well as for workers and contractor hired to provide services at the CISF within the region-of-interest are primarily Texas State Highway 176 in Andrews County, Texas and New Mexico State Highways 18 and 8 in Lea County, New Mexico.

SNF would be transported from existing commercial nuclear power facilities across the U.S. using rail lines operated primarily by the Union Pacific Railroad to Monahans, Texas (Figure 3.2-2). SNF would subsequently be transported by rail from Monahans, Texas, approximately 169 km (105 mi) north through Eunice, New Mexico to the CISF. The transportation of SNF from Monahans, Texas to the CISF would be on existing rail owned and operated by the TNMR. The

transportation corridor represents the rail operated by the TNMR from Monahans, Texas to the CISF (Figure 3.2-3).

The TNMR recently upgraded the rail lines (Class 1) to accommodate heavier loads expected to be transported to Waste Control Specialists. The TNMR rail lines are sufficient to transport SNF to the proposed CISF.

3.2.3 Rail Spur to the Proposed CISF

ISP joint venture member Waste Control Specialists operates a rail track from Eunice, New Mexico that encircles its facilities in Andrews County, Texas. SNF would be transported along the transportation corridor from Monahans, Texas to Eunice, New Mexico. Waste Control Specialists would transport the SNF along its rail track via a locomotive to the Transfer Facility at the CISF.

ISP would construct a rail sidetrack, approximately *2* km (*1.25* mi) in length, from the existing rail spur leading into the *Cask Handling Building* at the CISF (Figure 3.2-4).

SNF would be receipt inspected prior to acceptance at the CISF. After acceptance, the dual-purpose canisters would be offloaded in compliance with requirements specified in the license.

3.3 GEOLOGY AND SOILS

This section identifies the geological, seismological, and geotechnical characteristics of the CISF and its vicinity.

Some areas immediately adjacent to the proposed CISF have been thoroughly studied in recent years in preparation for construction of other facilities such as the Waste Control Specialists byproduct material (11e2) disposal unit, the Texas Compact LLRW disposal unit, the FWF unit, the radioactive waste storage and processing facility, the NEF in New Mexico, the International Isotopes, Inc. uranium hexafluoride de-conversion facility in New Mexico, and the former Atomic Vapor Laser Isotope Separation (AVLIS) site in New Mexico. Data are available from these investigations in the form of various reports . These documents and related materials provide a substantial database and description of geological conditions for the CISF.

In addition, additional field investigations have been performed, where necessary, to confirm site-specific conditions. The site subsurface conditions were explored with eighteen soil borings

(SAR Chapter 2, Geotechnical Engineering report from GEOservices in Attachment E). The boring locations and depths were selected by GEOservices and surveyed by Waste Control Specialists personnel (SAR Chapter 2, Attachment E Figures 3, 4, and 5). N-values were recorded in the field and noted on the boring logs. Soil samples collected during drilling were sent to a lab for visual classification and laboratory testing including: Atterberg Limits; Natural Moisture Content; Particle Size Analysis; Resistivity of Soil; Consolidated Undrained Triaxial Test; Standard Proctor Moisture-Density Tests; California Bearing Ratio; and Consolidation.

3.3.1 Regional Geology

This section discusses the regional geology ascending from a depth of approximately 427 m (1,400 ft), which includes the lowermost underground source of drinking water, to the ground surface. Figure 2-14, of the SAR, shows surficial lithological exposures, topography, infrastructure, and governmental boundaries in the area surrounding the Waste Control Specialists permitted area, consisting of 542 ha (1,338 acres). Two cross sections in the vicinity of the proposed CISF were created using boring logs from former site investigations. The locations of the cross sections are shown in Figure 3.3-1 and the North-South and East-West Cross Sections are shown in Figures 3.3-2 and 3.3-3.The associated boring logs are included in Attachment 3-1.

The geologic formations of concern beneath the CISF comprise, from oldest to youngest; the Triassic Dockum Group, the Cretaceous Trinity Group Antlers Formation, the Late Tertiary stratigraphic equivalent of the Ogallala Formation, the Late Tertiary/Quaternary Gatuña Formation or Cenozoic Alluvium (note that the Gatuña Formation and Cenozoic Alluvium are sometimes used interchangeably), the Pleistocene windblown sands of the Blackwater Draw Formation, and Holocene windblown sands, and playa deposits. A regional hard caliche pedisol, termed the Caprock caliche, developed on all pre-Quaternary formations before the Blackwater Draw sands were deposited. A stratigraphic column for the above units is provided in Figure 3.3-4. This stratigraphic column adopts the nomenclature of Lehman for the Dockum Group and includes the entire stratigraphic sequence typical of the Central Basin Platform of the west Texas Permian Basin .

3.3.2 Basic Geologic and Seismic Information

The proposed CISF would be located over the north-central portion of a prominent subsurface structural feature known as the Central Basin Platform. The Central Basin Platform is a deep-

seated horst-like structure that extends northwest to southeast from southeastern New Mexico to eastern Pecos County, Texas. The Central Basin Platform is flanked on three sides by regional structural depressions known as the Delaware Basin to the southwest and the Midland Basin to the northeast, and by the Val Verde Basin to the south. From the Cambrian to late Mississippian, west Texas and southeast New Mexico experienced mild structural deformation that produced broad regional arches and shallow depressions . The Central Basin Platform served intermittently as a slightly positive feature during the early Paleozoic . During the Mississippian and Pennsylvanian, the Central Basin Platform uplifted between ancient lines of weakness , and the Delaware, Midland, and Val Verde Basins began to subside, forming separate basins. Late Mississippian tectonic events uplifted and folded the platform and were followed by more intense late Pennsylvanian and early Permian deformations that compressed and faulted the area . Highly deformed local structures formed ranges of mountains oriented generally parallel to the main axis of the platform . This period of intense late Paleozoic deformation was followed by a long period of gradual subsidence and erosion that stripped the Central Basin Platform and other structures to near base-level , forming the Permian Basin. The expanding sea gradually encroached over the broad eroded surfaces and truncated edges of previously deposited sedimentary strata. New layers of arkose, sand, chert pebble conglomerate, and shale deposits accumulated as erosional products along the edges and on the flanks of regional and local structures.

Throughout the remainder of the Permian, the Permian Basin slowly filled with several thousand feet of evaporites, carbonates, and shales. From the end of the Permian until late Cretaceous, there was relatively little tectonic activity except for periods of slight regional uplifting and downwarping. During the early Triassic, the region was slowly uplifted and slightly eroded. These conditions continued until the late Triassic, when gentle downwarping formed a large land-locked basin in which terrigenous deposits of the Dockum Group accumulated in alluvial flood plains and as deltaic and lacustrine deposits . In Jurassic time, the area was again subject to erosion. A large continental shelf sea submerged a large part of the western interior of North America (including west Texas and southeastern New Mexico) during the Cretaceous Period. A thick sequence of Cretaceous rocks was deposited over most of the area. Locally, the Cretaceous sequence of sediments was comprised of a basal clastic unit (the Trinity, Antlers, or Paluxy sands) and overlying shallow marine carbonates. Uplift from the west and southward and eastward–retreating Cretaceous seas were coincident with the Laramide Orogeny, which formed the Cordilleran Range west of the Permian Basin.

The Laramide Orogeny uplifted the region to essentially its present position, supplying sediments for the nearby late Tertiary Ogallala Formation. The major episode of Laramide folding and faulting occurred in the late Paleocene. There have been no major tectonic events in North America since the Laramide Orogeny, except for a brief period of minor volcanism during the late Tertiary in northeastern New Mexico and in the Trans-Pecos area. Hills (1985) suggests that slight Tertiary movement along Precambrian lines of weakness may have opened joint channels, which allowed the circulation of groundwater into Permian evaporite layers. The near-surface regional structural controls may be locally modified by differential subsidence related to groundwater dissolution of Permian salt deposits .

There is no volcanic activity near the site. There is no evidence of volcanic activity near the site in the recent past.

3.3.3 Vibratory Ground Motion

The CISF lies in a region with crustal properties that indicate minimum risk due to faulting and seismicity. Crustal thickness is the most reliable predictor of seismic activity and faulting in intracratonic regions. Crustal thickness in the vicinity of the CISF site is approximately 50 km (30 mi), one of the three thickest crustal regions in North America . In comparison, the crustal thickness of the Rio Grande Rift is as little as 12 km (7.5 mi) in places.

In 2016, a Probabilistic Seismic Hazard Evaluation was completed using NRC guidance for the CISF site. The Seismic Hazard Evaluation (SAR Chapter 2 Attachment D) was prepared under the technical supervision of Dr. Ivan Wong, head of Seismic Hazards Group, AECOM, Oakland, CA and the analysis was performed consistent with the professional standards of the Texas Board of Professional Geoscientists and under the supervision of Cynthia K. Crain (P.G. #1585).

The objectives of the Seismic Hazard Analysis were to (1) estimate the levels of ground motions that could be exceeded at a specific annual frequency (or return period) at the site by performing a probabilistic seismic hazard analysis (PSHA), (2) incorporate the site-specific effects of the near-surface geology on the ground motions, and (3) develop Design Response Spectra (DRS) at the ground surface for the site and corresponding histories.

Significant earthquakes (moment magnitude [**M**] $\geq$ 5.0), however have occurred in the site region including the 1992 **M** 5.0 Rattlesnake Canyon earthquake about 30 km from the CISF

site. Some occurences of induced seismicity have also proven to be spatially correlated to active hydrocarbon production in the region. Typical of the central U.S., there is a marked absence of Quaternary faults and few of the known earthquakes can be associated with a specific geologic structure. In the 2014 U.S. Geological Survey (USGS) National Hazard Maps, the site area was characterized as one of relatively low seismic hazard.

Spectral-analysis-of-surface-wave (SASW) surveys were performed at the CISF site by the University of Texas at Austin to obtain shear-wave velocity (V_s) profiles down to the Trujillo sandstone at a depth of about 600 feet.

To estimate ground motions, four Next Generation of Attenuation (NGA)-West2 ground motion prediction models for the western U.S. (WUS) and the EPRI (2013) models for the central and eastern U.S. (CEUS) were utilized. For the NGA-West2 models, a time-averaged shear wave velocity (Vs) in the top 100 ft (Vs30) of 760 m/sec was used. The EPRI (2013) ground motion models are defined for hard rock or a Vs30 of 2,830 m/sec and greater. To address the epistemic uncertainty on which models are appropriate, both the NGA-West2 and EPRI (2013) models were used in the PSHA weighted 0.60 and 0.40, respectively.

Based on the PSHA and the inputs of the seismic source model and ground motion models, seismic hazard curves for both firm and hard rock were calculated. The absence of late-Quaternary faulting and the low to moderate rate of background seismicity, even that associated with petroleum recovery activities, results in relatively low seismic hazard at the CISF site. The largest contributor to the hazard at the CISF site is the background seismicity (the Southern Great Plains seismic source zone and Gaussian smoothing).

A site response analysis was performed to estimate ground motions at the CISF site incorporating the site-specific geology. The hazard curves were weighted based on the weights assigned to the NGA-West2 and EPRI (2013) ground motion models and a 10,000 year return period horizontal Uniform Hazard Spectrum (UHS) was calculated. A 10,000-year return period vertical UHS was also calculated using the NRC V/H ratios. On Table 3 in Attachment D is the horizontal and vertical UHS for a return period of 10,000 years. The ground surface design response spectrum peak horizontal acceleration for 0.01 seconds is 0.25 g and the vertical is 0.175 g.

Historic and recent seismic activity for the Texas regional area from 1973 to 2015 can be seen on Figure 3.3-5.

3.3.4 Faulting

Two types of faulting were associated with early Permian deformation. Most of the faults were long, high-angle reverse faults with several hundred feet of vertical displacement that often involved the Precambrian basement rocks . The second type of faulting is found along the western margin of the Central Basin Platform where long strike-slip faults, with displacements of tens of miles, are found . All of the major faulting in the vicinity of the Central Basin Platform occurred in response to tectonic forces active before the global plate tectonic reorganization that created the North American continent . The Paleozoic faults exhibit low natural microseismicity as a result of passive response to relatively low levels of tectonic stress in the trailing edge of the westward-drifting North American plate. The closest Quaternary faults are in the Guadalupe Mountains , about 161 km (100 mi) southwest of the CISF site.

The large structural features of the Permian Basin are reflected only indirectly in the Mesozoic and Cenozoic rocks, as there has been virtually no tectonic movement within the basin since the Permian . The Central Basin Platform is located approximately 2,134 m (7000 ft) beneath the present land surface and the Permian and Triassic sediments drape over the top of the Platform structure. The faults that uplifted the platform do not appear to displace the younger Permian sediments. The northernmost fault, located at the Matador Uplift, terminates in lower Wolfcampian sediments.

A further comparison of the structure of the Devonian Woodford Formation to the structure of the younger Upper Guadalupe Whitehorse Group (Permian) indicates that the faults in the Devonian section do not continue upward into the overlying Permian Guadalupe Whitehorse Group. The regional geologic and tectonic information does not indicate the presence of significant post-Permian faulting within the regional study area.

Two regional stratigraphic cross sections constructed in the vicinity of the CISF site using oil and gas well logs are shown as Figures 3.3-6 and 3.3-7. The locations of the cross sections are also shown on the figures. These cross sections depict the major stratigraphic units that occur within about 610 m (2,000 ft) below ground surface in the vicinity of the site. The stratigraphic units depicted on Figures 3.3-6 and 3.3-7 include the upper OAG unit of a few tens of feet in thickness, the underlying Triassic red beds of the Dockum Group with a thickness of 305 to 457 m (1,000 to 1,500 ft), the underlying Permian Dewey Lake Formation red beds, and the Permian evaporites of the Rustler and Salado Formations. These cross sections do not indicate the

presence of significant faulting in the upper 610 m (2,000 ft) of sediments within 3 to 4 miles of the CISF.

The closest areas of faulting that affect Quaternary strata are faults associated with the Basin and Range physiographic province. Tectonically, Basin and Range faulting is associated with crustal extension and thinning in southwestern North America due to right lateral shear between the Pacific plate and the North American plate. This extension is the cause of the Rio Grande Rift, which is an area with numerous Quaternary faults located approximately 200 miles west of the CISF.

The closest Quaternary faults listed in the USGS Quaternary Fault and Fold Database (http://earthquakes.usgs.gov/qfaults) are faults that are associated with the range-front of the Guadalupe Mountains and are located along the southwestern base of the mountain range. The closest Quaternary fault is an unnamed fault at the base of the Guadalupe Mountains, listed as fault No. 907 in the database and located approximately 167 km (104 mi) southwest of the CISF in Guadalupe Mountains National Park in Culberson County, Texas. This fault is a down-to-the-west range-bounding normal fault, with the most recent deformation estimated at less than 1.6 million years ago (Ma) (http://earthquakes.usgs.gov/qfaults). A second fault associated with this region is the Guadalupe Fault listed as fault No. 2058 and located 174 km (108 mi) west of the CISF in Chaves and Otero Counties, New Mexico. This fault may be the re-activation of a late Tertiary Basin and Range fault. The age of the faulted deposits have not been studied, but the oldest faulted strata are believed to be as old as the penultimate glaciation based on the stratigraphic sequence present, placing the oldest age of deformation at approximately 130 thousand years ago (ka). The most recent deformation of this fault is believed to be less than 15 ka. There are additional Quaternary faults located south of the two faults listed, along the southwestern base of the Guadalupe Mountains in Texas. The next closest area of Quaternary faulting listed on the USGS Quaternary Fault and Fold Database is the Alamogordo fault, which is divided into three sections. The sections of the Alamogordo fault closest to the CISF are fault Nos. 2045b and 2045c on the USGS Quaternary Fault and Fold Database. These faults are located approximately 274 km (170 mi) west of the CISF in Otero County, New Mexico. The Alamogordo fault is the range-bounding structure of the Sacramento Mountains. The faults are down-to-the west faults, much like those associated with the Guadalupe Mountain range. The most recent deformation is listed as less than 130 ka in the USGS Quaternary Fault and Fold Database. There is no surface evidence of quaternary faulting within the CISF.

During landfill excavation activities at ISP joint venture member Waste Control Specialists an apparent southward-dipping reverse fault in a sandstone in the upper portion of the Triassic red beds of the original RCRA landfill excavation was located in 2004. Since regulatory criteria address the age of faults and the age of any geologic units affected or displaced by faulting, a geologic investigation of the fault was undertaken. The southeast wall of the RCRA landfill was extended about 61 m (200 ft) to the southeast in May and June 2004, yielding about 18 m (60 ft) of vertical geologic exposure along a length of about 122 m (400 ft). Two benches with subvertical walls were exposed. The relationship between faulting in the Triassic red beds and the overlying Cretaceous Antlers Formation was carefully evaluated to determine if any displacement of the younger Cretaceous deposits had occurred. The Triassic red beds are separated from the overlying Cretaceous Antlers Formation sands and gravels and from a layer of reworked altered clay by a distinct and mappable parting near the top of the gray altered layer of red beds. None of the observed fault planes or slip surfaces in the Triassic red beds in the extensively mapped section cross or offset the parting. In addition, the bedding in the Antlers Formation is continuous where observable and not calichified, and in particular, there are no indications that the Cretaceous-aged Antlers Formation was affected by the faulting in the Triassic red beds. Photos, figures and further details are included in the Waste Control Specialists LLRW License.

3.3.5 Salt Dissolution and Sink Holes

The proposed WCS CISF would be located over Permian-age halite-bearing formations, and the possibility of dissolution and its effects on the long-term performance of the CISF have to be considered. Robert M. Holt, PhD and Dennis W. Powers, PhD developed three conceptual hydrologic models of dissolution processes (shallow, deep and stratabound) based on experience and features found in the Delaware Basin west of the CISF. Investigations showed that no features in the study area at and around the CISF and Waste Control Specialists site indicated any past dissolution, and the hydrologic systems at the site limit the potential for future dissolution and/or sinkholes. The full discussion and results of the study are detailed in “Evaluation of Halite Dissolution in the Vicinity of Waste Control Specialists Disposal Site, Andrews County, TX” and the report is located in Attachment F in Chapter 2 of the SAR.

3.3.6 Soils

Geotechnical and site boring investigations confirm a thin layer of loose sand at the surface that overlies about 12 m (40 ft) of silty sand and sand and gravel cemented with caliche. Beneath that are the Triassic red bed clays extending to depths of 396 m (1,300 ft) to 427 m (1,400 ft).

The USDA soil survey indicates the proposed CISF surface soils consist primarily of Blakeney and Conger soils, Ratliff soils, Triomas and Wickett Soils, and Jamlar-Penwell association (Figure 3.3-8). All soil mapping units were described as gently undulating by the USDA soil survey. The parent materials for the Blakeney and Conger soils are loamy eolian deposits in the Blackwater Draw formation of Pleistocene age overlying calcareous loamy alluvium in the Ogallala formation of Miocene-Pliocene age. The parent materials for the Ratliff soils are calcerous, loamy eolian deposits from the Blackwater Draw formation of Pleistocene age. The parent materials of the Triomas are sandy eolian deposits from the Blackwater Draw and the parent materials of the Wickett soils are sandy eolian deposits overlying calcareous, loamy alluvium in the Ogallala formation of Miocene-Pliocene age. The parent materials of the Jalmar are sandy eolian deposits of Holocene age over loamy eolian deposits from the Blackwater Draw formation of Pleistocene age. The parent materials of the Penwell soils are sandy eolian deposits of Holocene age. Sloping ranges from 0 to 8%.

The Soil Survey of Andrews County, Texas by the USDA is included in Attachment 3-2.

3.4 WATER RESOURCES

The surface water drainage feature nearest to the WCS CISF is Monument Draw in Lea County, New Mexico, a southward-draining ephemeral draw about 4.8 km (3 mi) west of the CISF boundary. The draw does not have through-going surface water drainage and, due to encroachment of Cenozoic alluvial and eolian deposits, loses surface expression after it enters Winkler County, Texas. (Note: there are two surface drainage features named Monument Draw in the vicinity: Monument Draw, New Mexico, a south-flowing ephemeral stream in Lea County, New Mexico, and Monument Draw, Texas (same name), an east-flowing ephemeral stream in Andrews County, Texas).

The CISF is on the southwestern slope of the surface water drainage divide between the Pecos River and the Colorado River. In the immediate vicinity of the CISF, the slope is southwest toward Monument Draw, New Mexico at about 9.5 m per km (50 ft per mi). The maximum and

minimum elevations in the vicinity of the CISF are 1,067 m (3,500 ft) and 1,041 m (3,415 ft) msl, respectively.

In this part of west Texas, the Cenozoic Alluvium aquifer is considered a major aquifer and the Triassic Dockum Group aquifer is considered a minor aquifer. Groundwater will not be used, as a potable water source, at the proposed WCS CISF. Potable water would come from the existing potable water system at ISP joint venture member Waste Control Specialists.

3.4.1 Surface Hydrology

The CISF site would be located in western Andrews County, Texas nearly at the Texas – New Mexico border, just north of Texas State Highway 176 approximately 50 km (31 mi) west of Andrews, Texas and 8 km (5 mi) east of Eunice, New Mexico. There are no maps of special flood hazard areas for this location published by the FEMA. The Site Location and Surrounding Topography Map, SAR Chapter 2 Attachment B Figure 1.1-1, shows the CISF site location with respect to the surrounding topography and drainage features and the ISP joint venture member Waste Control Specialists property boundary.

From a surface water perspective, the general area is characterized by ephemeral drainages, sheet flow, minor gullies and rills, internally-drained playas, and a salt lake basin (identified in Figure 1.1-1 as a Depression Pond in the SAR Chapter 2 Attachment B). The salt lake basin is the only naturally-occurring, perennial (year-round) water body located near the CISF site; the internally drained salt lake basin is located approximately 8 km (5 mi) from the eastern boundary of the CISF site and rarely has more than a few inches of water at scattered locations within the bottom footprint. Surface drainage from the CISF does not flow into this basin. Other perennial surface water features are man-made, including various stock tanks (often replenished by shallow windmill wells) located across the area and the feature denoted as the Fish Pond on SAR Chapter 2 Attachment B Figure 1.1-1, which is located at the Permian Basin Materials quarry (formerly Wallach Concrete) west of the CISF site and is also replenished by well water. In addition, Sundance Services, LLC operates the Parabo Disposal Facility for oil and gas waste west of the site. Water collects periodically in excavated and/or diked areas at this disposal facility and in the active quarry areas at this property adjacent to and west of the ISP joint venture member Waste Control Specialists property in New Mexico. *ER Figure 3.4-1 illustrates the USFSW classification of wetlands on the WCS facility and at neighboring facilities in New Mexico. The majority of the mapped features are classified as palustrine, seasonally or*

temporarily flooded over a few days to a few weeks. The palustrine classification system includes all nontidal wetlands dominated by trees, woody scrub shrubs, persistent emergent, and mosses or lichens. The palustrine features on the WCS facility are natural playas or localized impounded catchments. All of the palustrine features on the quarry of Permian Basin Materials and commercial recycling facilities in New Mexico are classified as seasonally flooded man-made excavations.

Average annual precipitation is approximately 15.3 inches (SAR Table 2-3). Precipitation is typical of a semi-arid climate with high intensity, short duration rainfall events generally during the months of July, August, and September, when precipitation is generally highest (SAR Table 2-3). When precipitation rates exceed infiltration capacity there is occasional ponding in the small, closed-drainage playas, which are typically a few acres or less in size. Ponded water depth in the playas is between a few inches and a few feet, with the water evaporating and infiltrating normally within a few days or weeks. The playas are typically dry throughout the year. A somewhat larger playa basin of about 30 acres occurs east of the Waste Control Specialists property approximately 3.5 miles to the east of the CISF (SAR Attachment B Flood Plain Report Figure 1.1-1 identified as a Depression Pond). Water depth in this larger playa basin, mapped as intermittent water by the USGS on the Jumbo Hill Quadrangle, is generally less than a few inches, and it is often dry throughout the year (USGS, 1971).

There is no permanent surface water in the vicinity. A sample of intermittently ponded surface water from the catchment at Baker Spring, west of the CISF in New Mexico, indicated a total dissolved solids content of 96 mg/L, pH of 7.46, total alkalinity (as CaCO3) of 77.6 mg/L and biochemical oxygen demand of 3.7 mg/L (WCS, 2007).

The nearest surface water drainage feature to the CISF is Monument Draw in Lea County, New Mexico, a reasonably well-defined, southward-draining draw about 5 km (3 mi) west of the CISF. The draw does not have through-going drainage and loses surface expression after it enters Winkler County, Texas. (Note: there are two surface drainage features named Monument Draw in the vicinity: Monument Draw, New Mexico, a south-flowing ephemeral stream in Lea County, New Mexico, and Monument Draw, Texas (same name), an east-flowing ephemeral stream in Andrews County, Texas). East of Monument Draw, New Mexico and south of the CISF is a local topographic high known as Rattlesnake Ridge. This poorly defined ridge parallels the Texas-New Mexico border and crests about 38 m (125 ft) higher than Monument Draw, New Mexico .

The Waste Control Specialists permitted area is on the southwestern slope of the drainage divide between the Pecos River and the Colorado River. In the immediate vicinity of the Waste Control Specialists permitted area, the slope is southwest toward Monument Draw, New Mexico at about 15 m (50 ft) per mi. The maximum and minimum elevations of the permitted area are about 1,064 m (3,490 ft) and 1,041 m (3,415 ft) msl, respectively.

Small surface depressions (buffalo wallows) and a few established playa basins are present within a 10 km (6.2 mi) radius of the CISF. The largest of the surface depressions within the permitted area is a small playa about 6 ha (15 acres) in size approximately 0.8 km (0.5 mi) northeast of the existing RCRA landfill. Remnant deposits of a filled and now partially covered playa or salt lake basin are found about 4.8 km (3 mi) east of the permitted area. Surface drainage from the area north and east of the CISF flows eastward into this basin.

Baker Spring is a manmade feature located at a historic quarry on Waste Control Specialists property about 2,510 ft west of the CISF site in Lea County, New Mexico. This feature was formed by excavation of the caliche caprock to the top of the underlying red bed clays. After periods of rainfall, the depression may hold water for an extended period; during dry cycles, the depression may be dry for extended periods.

The National and Oceanic and Atmospheric Administration's NWS Office for Hobbs, New Mexico indicates that the minimum average annual precipitation recorded is 2.01 inches in 2011 and the maximum average annual precipitation recorded is 32.19 inches in 1941. The annual precipitation on average is approximately 14 inches.

The CISF site is located on the southwest-facing slope that transitions from the Southern High Plains to the Pecos Valley physiographic section. The Southern High Plains is an elevated area of undulating plains with low relief encompassing a large area of west Texas and eastern New Mexico. In Andrews County, the southwestern boundary of the Southern High Plains is poorly defined, but in this report is considered to be where the caprock caliche is at or relatively close to the surface, such as on and near the CISF site.

The main surface water drainage in the area is Monument Draw, an ephemeral stream about 4.8 km (3 mi) west of the CISF in New Mexico. Ephemeral streams or drainage ways flow briefly only in direct response to precipitation in the immediate locality. Monument Draw is a reasonably well-defined, southward draining features (although not through-going) that is

identified on the USGS topographic maps that serve as the base map source for Attachment B Figure 1.1-1, of the SAR Chapter 2.

An ephemeral drainage feature, referred to as the Ranch House Draw crosses the Waste Control Specialists property from east to west, generally to the south of the CISF site, as shown in Figure 1.1-1 in Attachment B, of the SAR Chapter 2. This feature is discernible from the topographic relief depicted on Figure 1.1-1 in Attachment B of the SAR Chapter 2, although it is much less pronounced than Monument Draw. This drainage feature is a relict drainage way that is choked with windblown sand and is not through-going to Monument Draw. Most of the drainage from the area of the CISF site is down slope toward the Ranch house Draw, with a small portion of the drainage from this area toward the southwest. Surface water eventually infiltrates into the windblown sands and dune fields to the south and southwest of the CISF site. There are no ephemeral drainages that cross the CISF site. Most of the immediate area of the CISF is drained from northwest to southeast by sheet flow. Sheet flow is a term describing overland flow or down slope movement of water taking the form of a thin, continuous film.

Playas, or small, internally-drained basins, occur on the Waste Control Specialists controlled property. The playas are dry most of the time. Some of the playas occasionally hold water after relatively large precipitation events; however, the ponded water rapidly dissipates through infiltration, evaporation, and plant uptake. An established playa basin is present on the eastern edge of the CISF site. Surface topography maps indicate approximately 10 ft of relief in the playa.

The combination of low annual precipitation, relatively high potential evapotranspiration, permeable surficial soils down gradient of the CISF site, and topographic relief results in well-drained conditions. The engineering design and construction of the CISF site would eliminate areas that might promote ponding. Diversion berms and a collection ditch would direct stormwater from upstream drainage areas around the CISF.

There are no public or private surface water drinking-water supplies in the site vicinity. Potable water supply for the Waste Control Specialists facility and eventual CISF is provided by existing potable water system at Waste Control Specialists. There are scattered windmills in the general area that take water from isolated pockets of groundwater perched on top of the red bed clay. This water is utilized primarily for livestock watering.

The CISF site is located on the southwest-facing slope that transitions from the Southern High Plains to the Pecos Valley physiographic section.

There are no natural or man-made surface bodies of water at the proposed CISF. The proposed CISF would not located in wetlands per the National Wetlands Inventory (Figure 3.4-1). A floodplain analysis performed for the adjacent properties indicates that the proposed CISF is not within the 100-year floodplain (SAR Chapter 2 Attachment B).

3.4.2 Hydrologic Description

The Waste Control Specialists permitted area is on the southwestern slope of the drainage divide between the Pecos River and the Colorado River. In the immediate vicinity of the Waste Control Specialists permitted area, the slope is southwest toward Monument Draw, New Mexico at about 9.5 m per km (50 ft per mi). The maximum and minimum elevations of the permitted area are 1,064 km (3,490 ft) and 1,041 m (3,415 ft) msl, respectively.

The nearest surface water drainage feature to the proposed CISF is Monument Draw in Lea County, New Mexico, a reasonably well-defined, southward-draining draw about 0.9 km (3 mi) west of the CISF. The draw does not have through-going drainage and loses surface expression after it enters Winkler County, Texas. East of Monument Draw, New Mexico and south of the CISF is a local topographic high known as Rattlesnake Ridge. This poorly defined ridge parallels the Texas-New Mexico border and crests about 38 m (125 ft) higher than Monument Draw, New Mexico .

Small surface depressions (buffalo wallows) and a few established playa basins are present within a 10 km (6.2 mi) radius of the CISF. The largest of the surface depressions within the permitted area is a small playa about 6.07 ha (15 acres) in size approximately 0.80 km (0.5 mi) northeast of the existing RCRA landfill. Remnant deposits of a filled and now partially covered playa or salt lake basin are found about 6 km (3.7 mi) east of the permitted area. Surface drainage from the area north and east of the proposed CISF flows eastward into this basin. Local topographic features outside the permitted area include Baker Spring to the west, small depressions or solution pans between Baker Spring and the permitted area, and a spring about 4.8 km (3 mi) to the east on the western side of the playa or salt lake basin discussed above*, which is identified on USGS topographic maps as Scratch Spring (USGS Jumbo Hill Quadrangle, 2019). Brune (1981) states the spring was dry in 1923 when the then-current landowner arrrived*.

Baker Spring is located in Lea County, New Mexico, about 0.58 km (0.36 mi) west of the Waste Control Specialists permitted area. Two minor unnamed surface draws empty into the Baker Spring depression. Baker Spring is *not an aquifer-sourced spring, hence the name is somewhat of a misnomer. It is an area where surface runoff is impounded in a shallow excavation in the red bed clays, a remnant of a former quarry at the base of a caprock erosional bench.*

In this part of west Texas, the Cenozoic Alluvium aquifer is considered a major aquifer and the Triassic Dockum Group aquifer is considered a minor aquifer .

3.4.3 Floods

The CISF would not be located in the 100-year floodplain. Attachment B of the SAR Chapter 2, presents the Flood Plain Study for the CISF and Figure II.F.4 in Appendix 2.4.1 in that report identifies the 100-year floodplain at the location of the proposed CISF. The 100-year floodplain extends across the southern portion of the Waste Control Specialists property area along the ranch house drainage. The northernmost limit of the 100-year floodplain is approximately 1,219 m (4,000 ft) southeast of the CISF site while the northernmost limits of the 500-year and PMP floodplains are 1,209 m and 1,187 m (3,965 ft and 3895 ft) southeast of the CISF site respectively.

3.4.4 Flood History

The climate of the area is classified as semiarid, characterized by dry summers and mild, dry winters. Annual precipitation on average is approximately 14 inches and annual evaporation exceeds annual precipitation by nearly five times. The area is subject to occasional winter storms, which produce snowfall events of short duration.

Rainfall records from July 2009 through December 2015, provided by Waste Control Specialists from a weather station near the CISF site, indicate an average annual rainfall of 12.6 inches and a maximum twenty-four hour rainfall total of 3.62 inches (Attachment A of the SAR). According to ISP joint venture member Waste Control Specialists personnel, surface water runoff has not overflowed roads or existing drainage features at the Waste Control Specialists facility during this time frame.

3.4.5 Flood Design Considerations

There has been no history of flooding at the site and the site is not located in the 100-year floodplain. Almost all of the surface water runoff from the storage area would leave the CISF site just north of the southeast corner of the storage area and would drain into the large playa southeast of the site. A small amount of surface water runoff from the parking lot of the CISF would drain southwest. Flow arrows on Figure 1.1.2-2 in the SAR Chapter 2 in Attachment B, Developed Drainage Area Map, provide the detailed drainage patterns for the CISF site.

The Centralized Interim Storage Facility Drainage Evaluation and Floodplain Analysis (SAR Chapter 2 Attachment B) models the probable maximum flood flow over the existing railroad and the proposed CISF rail side track. At analysis Point 1, the peak discharge resulting from all modeled storm events flows over State Line Road. The maximum depth of flow over the road (during the 500-year and ARC III) is approximately 0.8 ft. which is equivalent to elevation 3487.3 ft. msl. The maximum depth of water on the CISF storage pad for a 500-year flood is 1.1 inches and the velocity is 1.7 ft/s.

The peak discharge resulting from all modeled storm events flows over the railroad tracks at Analysis Point 2. The maximum depth of water over the rail (during 500-year and ARC III) is approximately 1.4 ft. which is equivalent to elevation of 3466.4 ft. msl.

3.4.6 Effects of Local Intense Precipitation

The Floodplain Study in the SAR Chapter 2 Attachment B includes calculations for a Probable Maximum Precipitation using a 500-year frequency storm event and the limits of the flood plain. The results from modeling these additional storms describe a flood plain that is still shallow and wide, and that is too distant from the CISF to ever impact the CISF.

3.4.7 Probable Maximum Flood on Streams and Rivers

There are no streams or rivers on or in the vicinity of the CISF. Monument Draw, an ephemeral stream, is the closest main surface water drainage and is about 4.8 km (3 mi) west of the site in New Mexico, so the CISF would be unaffected by flooding on streams of rivers. While Monument Draw is typically dry, the maximum historical flow occurred on June 10, 1972 and measured 36.2 cubic meters per second (1,280 cubic ft per second).

3.4.8 Potential Dam Failures (Seismically Induced)

There are no dams on or in the vicinity of the site. The Waste Control Specialists RCRA and LLRW facilities currently have five (5) manmade evaporation ponds which are partially above-grade. If a seismic event were to cause slope failure the ponds are designed so all water released would flow south away from the CISF.

3.4.9 Probable Maximum Surge and Seiche Flooding

Surges and seiches are typically observed on lakes or seas. There are no surface bodies of water on or near the proposed CISF where such a phenomenon would be a safety concern at the site. There are currently five (5) manmade evaporation ponds at the Waste Control Specialists site and they are designed with spillways on the south side so any seiche or surge would flow south away from the CISF.

3.4.10 Probable Maximum Tsunami Flooding

The WCS CISF is located about 805 km (500 mi) from the coast. The proposed CISF is sufficient distance from the coastline that tsunami flooding is not a hazard.

3.4.11 Ice Flooding

The proposed CISF would not be located in an area where ice flooding is a concern. There are no streams or rivers on or in the vicinity of the site. Monument Draw, an ephemeral stream, is the closest main surface water drainage and is about 4.8 km (3 mi) west of the proposed CISF in New Mexico, so the CISF would be unaffected by ice blockage and ice flooding.

3.4.12 Flood Protection Requirements

The CISF is not located in an area where flooding protection is required. There are no maps of special flood hazard areas for this location published by the FEMA.

3.4.13 Environmental Acceptance of Effluents

There are no radioactive or other effluent releases associated with the proposed CISF facility. Stormwater runoff is not expected to contain any radiological effluents and facility stormwater runoff would be directed to the natural drainage system. Domestic wastes would be directed to

above ground tanks on-site and the tanks would be periodically drained and all wastes would be transported offsite for disposal.

3.4.14 Subsurface Hydrology

The High Plains Aquifer of west Texas, the principal aquifer in west Texas, consists of water-bearing units within the Tertiary Ogallala Formation and underlying Cretaceous rocks . In terms of hydrogeology, the High Plains aquifer is viewed as a single, hydraulically connected aquifer system, and groundwater exists under both unconfined and confined conditions. The term Ogallala aquifer is used interchangeably with the High Plains aquifer since, regionally, the Ogallala Formation is the primary component of the High Plains aquifer . Regionally the sands, gravels and sandstones that have been variously ascribed to the Tertiary Ogallalla Formations, the Tertiary aged sections of the Gatuña Formation, and the Cretaceous Antlers Formation are distinct and independent. Locally, these units are situated in the same stratigraphic interval and hydrogeologically they represent a single hydrostratigraphic unit overlying the Triassic red beds, the distinctive red and purple mudstones, siltstones, and sandstones of the Triassic Dockum Group. The hydrostratigraphic unit of undifferentiated sands and sandstones of the Ogallala/Antlers/Gatuña is locally referred to as the OAG unit. However, the Ogallala and Cretaceous aquifers are evaluated independently in the literature and would be addressed individually in the discussion below. In this part of west Texas, the Cenozoic Alluvium aquifer is considered a major aquifer and the Triassic Dockum Group aquifer is considered a minor aquifer; both will be addressed below .

The shallowest water bearing zone *at the neighboring Waste Control Specialist facility is located in a siltstone/sandstone lense at a depth of approximately 225 feet below ground surface.* Figure 3.4-2 is a groundwater contour map indicating the OAG unit is largely unsaturated beneath the WCS CISF. The nearest downgradient drinking water well identified in the hydrogeologic unit is located approximately 6.5 miles to the east of the proposed CISF at a residence on the Letter B Ranch. The method of storage (dry cask), the nature of the storage casks, the extremely low permeability of the red bed clay and the depth to groundwater beneath the site preclude the possibility of groundwater contamination from the operation of the facility.

There is an extensive network of monitoring wells in the vicinity of the CISF that are monitored semi-annually . During each well's monitoring event, the depth to water would be gauged, and groundwater samples would be collected when sufficient water is present. Samples collected

from the monitor wells would be analyzed for radiological and non-radiological constituents . Waste Control Specialists and the CISF are zero discharge facilities so it is anticipated there would be no future impacts to groundwater from the CISF or other Waste Control Specialists permitted facilities.

3.4.14.1 Ogallala Aquifer

The Ogallala Formation aquifer is the primary freshwater aquifer within the regional study area and serves as the principal source of groundwater in the Southern High Plains . The southern and eastern limits of the Ogallala aquifer lie to the north and east of the Waste Control Specialists property. Regionally, the Ogallala aquifer thickens to the north and east of the proposed CISF as shown in cross sections in Figures 3.4-3 and 3.4-4. The saturated thickness of the Ogallala aquifer ranges from a few meters to approximately 91 m (300 ft) in the Southern High Plains . Groundwater within the Ogallala aquifer is typically under water table conditions, with a regional hydraulic gradient toward the southeast ranging from approximately 2 m/km (10 ft/mi) to 2.8 m/km (15 ft/mi). The average hydraulic conductivity of the Ogallala aquifer is about 3.05 m/day (10 ft/day) with higher values preferentially distributed in depositional channels. Assuming an average hydraulic gradient of 2.4 m/km (12.5 ft/mi) and a porosity of 0.20, the average rate of flow in the regional Ogallala aquifer is 13 m/year (43 ft/year).

The primary sources of recharge to the Ogallala aquifer are playas, headwater creeks, and irrigation return flow . Regionally, the recharge rate to the Ogallala aquifer is estimated to be of the order of 0.9 cm/year (0.35 in/year) . Blandford et al., (2003) estimated predevelopment recharge at less than 0.2 cm/year (0.083 in/year). In a 2003 numerical model of the Ogallala aquifer, prescribed recharge beneath irrigated lands was on the order of 3.18 cm/year (1.25 in/year) to 5.72 cm/year (2.25 in/year), and recharge beneath non-irrigated agricultural lands ranged from 0.64 cm/year (0.25 in/year) to 5.1 cm/year (2.0 in/year) .

Groundwater discharge from the Ogallala aquifer occurs naturally through springs, underflow, evaporation, and transpiration, but is also removed artificially through pumping. Throughout much of the Southern High Plains, groundwater discharge from the Ogallala aquifer exceeds recharge, and water levels have consistently declined over time. In some regions, however, water levels remained reasonably stable between 1960 and 2000 or even increased, indicating that recharge is the same or greater than discharge/pumping .

Water quality data for three Ogallala aquifer wells, located within 3.2 km (2 mi) of the proposed CISF, were obtained from a review of Texas and New Mexico state records for western Andrews County, Texas and eastern Lea County, New Mexico. Review of the water quality data indicates that the local Ogallala aquifer contains fresh to slightly saline water (TDS ≤ 3000 mg/L). Samples of OAG water have stable isotopes consistent with modern precipitation. The ^{18}O and ^{2}H concentration of samples indicate paleorecharge temperatures several degrees Celsius cooler than modern precipitation, which is consistent with the late Pleistocene ages of the water in the 55 m and 69 m (180 ft and 225 ft) zones .

The Ogallala Formation, if present, is not water bearing in the Waste Control Specialists permitted area, consisting of 542 ha (1,338 acres).

3.4.14.2 Cretaceous Aquifer (Antlers Formation)

The Cretaceous aquifer of the Southern High Plains is also considered part of the High Plains Aquifer . The regional hydraulic gradient of the Cretaceous aquifer is toward the southeast, similar to the overlying and often hydraulically interconnected Ogallala aquifer. The Cretaceous aquifer of the Southern High Plains consists of a basal unit (Trinity or Antlers Formation sandstone), an intermediate unit (Edwards Formation limestone), and an upper unit (Kiamichi/Duck Creek Formation sandstone and limestone). Where present and water bearing in the subsurface, the Cretaceous aquifer in the Southern High Plains is used as a source of groundwater .

The Cretaceous Antlers Formation has been identified in the vicinity of the CISF and in the subsurface immediately below the CISF; however, it is unsaturated but for a few isolated perched lenses.

3.4.14.3 Triassic Dockum Group Aquifer

There are no borings into the sandstone/siltstone lenses of the Dockum Group within the CISF footprint.

The Dockum Group regionally consists of Triassic fluvial and lacustrine clays, shales, siltstones, sandstones, and conglomerates. The Dockum Group consists of five formations, the lowermost of which is the Santa Rosa Formation, followed by the Tecovas, the Trujillo, the Cooper Canyon, and the Redonda Formations. Only the Santa Rosa, Tecovas, Trujillo, and Cooper

Canyon Formations are present in the vicinity of the proposed CISF. Water from the Dockum Group aquifer is used as a replacement for, or in combination with, the Ogallala aquifer as a regional source for irrigation, stock, and municipal water . There are two water-bearing sandstone formations in the Dockum Group in the vicinity of the proposed CISF. Both yield non-potable water with less than 5,000 mg/L total dissolved solids. The Santa Rosa Formation sandstone at the base of the Dockum Group is about 76 m (250 ft) thick and is considered the best aquifer within the Dockum Group . The top of the Santa Rosa Formation sandstone is at 347 m (1,140 ft) below ground surface at the proposed CISF.

The Trujillo Formation sandstone, the other Dockum Group water-bearing formation in the area, is about 30.5 m (100 ft) thick. The top of the Trujillo Formation is about 183 m (600 ft) below ground surface. Approximately 137 m (450 ft) of very low permeability Dockum Group fluvial and lacustrine clays separate the two formations. The lower Dockum Group aquifer is recharged by precipitation where Dockum Group sediments are exposed at land surface . However, most of the recharge to the sandstones in the lower Dockum Group (comprising the Santa Rosa and Trujillo Formation sandstones) is considered to have occurred during the Pleistocene some 15,000 to 35,000 years before present . Topographically controlled groundwater basin divides were developed during the Pleistocene by the erosion of the Pecos and Canadian River valleys. Prior to the development of these groundwater basin divides, the lower Dockum aquifer was recharged by precipitation on its outcrop area in eastern New Mexico. However, since the development of the Pecos and Canadian River valleys, the lower Dockum aquifer in Texas has been cut-off from its recharge area. Without recharge, the lower Dockum aquifer experiences a net loss of groundwater from withdrawal by wells and by seepage . The regional hydraulic gradient of the lower Dockum aquifer is toward the southeast at approximately 2.8 m/mi (15 ft/mi). Based on water levels encountered during logging of two deep wells at the existing CISF, water levels in the lower Dockum aquifer range from 869 m (2,852 ft) msl (Santa Rosa Formation) to 967 m (3,172 ft) msl (Trujillo Formation). Transmissivities of the lower Dockum aquifer ranges from 295 square m/day (3,180 ft^2/day) to about 0.93 square m/day (10 ft^2/day) and storativity, based on two values, is 0.0001 and 0.002 . Based on the transmissivity values noted above, an average thickness of 107 m (350 ft) of combined Santa Rosa and Trujillo Formation sandstones, a porosity of 0.15, and a gradient of 2.8 m/mi (15 ft/mi), the rate of groundwater flow is estimated to be between 5.2 m/year (17 ft/year) and 0.18 m/year (0.6 ft/year).

The upper portion of the Dockum Group (Cooper Canyon Formation) serves as an aquitard in the regional and local study area . This is supported by the fact that the hydraulic head of the lower Dockum aquifer is significantly lower than that of the overlying Ogallala aquifer throughout much of the regional study area. This relative head difference, approximately 61 m (200 ft) to 91 m (300 ft) in western Andrews County, suggests that the lower Dockum aquifer is receiving essentially no recharge from cross-formational flow . The primary limiting factors on recharge to the Dockum Group aquifer include the low-permeability aquitard characteristics of the upper Dockum Group and cut-off by the Pecos River Valley of historical recharge areas in eastern New Mexico.

3.4.14.4 Cenozoic Alluvium Aquifer

The Cenozoic Alluvium aquifer, also referred to as the Cenozoic Pecos Alluvium aquifer , is regional in extent, but is not present in the vicinity of the CISF.

3.4.14.5 General Geochemical Characteristics of Groundwater

The groundwater in the 69 m (225 ft) zone has significantly higher total dissolved solids than groundwater in the OAG unit. The groundwater in the OAG unit is a calcium/magnesium bicarbonate type of water with total dissolved solids in the range of 278 to 767 mg/L. The groundwater in the 69 m (225 ft) zone is a sodium sulfate type of water with total dissolved solids in the range of about 3,800 to 4,700 mg/L. Groundwater which has evolved to sulfate-type water is generally considered to have been in the subsurface for a longer time than bicarbonate-type water. The difference between the groundwater in the OAG unit and the groundwater in the 69 m (225 ft) zone suggests both a much longer residence time (i.e. much older groundwater) for the 69 m (225 ft) zone groundwater, as well as distinct separation of the shallower OAG unit from the 69 m (225 ft) zone. If groundwater from the shallow, unconfined OAG unit were readily reaching the 69 m (225 ft) zone, then it would be expected that the general water chemistry between the two zones would be similar. .

3.5 ECOLOGICAL RESOURCES

This section describes the terrestrial and aquatic communities of the proposed CISF. This section is intended to provide a baseline characterization of the ecology at the CISF prior to any disturbances associated with construction or operation of the CISF. The impacts on ecology at the CISF from prior environmental disturbances (e.g., roads and existing radiological facilities)

not associated with the proposed CISF are considered when describing the baseline condition. The plant and animal species associated with this major community are identified and their distributions are discussed. Those species that are considered important to the ecology at the CISF are described in detail. To the extent possible, these descriptions include discussions of the species' habitat requirements, life history, and population dynamics. Also, as part of the evaluation of important species at the CISF, pre-existing environmental conditions that may have impacted the ecological integrity of the CISF and affected important species are considered. Unless otherwise indicated, the information provided in this section is based on surveys conducted by ISP joint venture member Waste Control Specialists.

3.5.1 Prior Ecological Studies at the CISF

A complete ecological assessment of the proposed CISF area and adjoining areas was initially conducted in 1996-97 in conjunction with the proposed development of a LLRW processing and storage facility. That assessment was updated in 2003-04 and supplemented in 2006-07 to support further development of Waste Control Specialists existing treatment and radioactive waste disposal facilities to include additional facilities related to disposal of LLRW and uranium byproduct material. *Cox-Mclain Environmental Consulting completed the "Interim Storage Partners (ISP), Waste Control Specialists (WCS): Ecological Resources Report" in 2018 and 2019 and this report can be found in Attachment 3-6 of the ER.*

3.5.2 General Ecological Conditions of the CISF

Natural habitats in the study area, defined as the area within a 5 km (3.1 mi) radius of the proposed CISF, are mostly shrub land with grassy patches, which are typical of the larger surrounding region. Species observed in these areas are also typical of the region. Two species of concern, the Texas horned lizard (*Phyrnosoma cornutum*) and *dunes sagebrush lizard* (*Sceloporus arenicolus)*, occur within the area. The former is widespread in Texas and is considered threatened because of over-collecting, incidental loss, and habitat disturbance. The latter has a specialized habitat that occurs throughout much of the region of the proposed CISF. It is a *Species of Greatest Conservation Need* due to the loss of habitat, primarily due to spraying to remove shinnery oak (*Quercus havardii)* to improve grazing.

3.5.3 Description of Important Plant and Wildlife Species

3.5.3.1 Vegetation

The survey area is located within the Havard Shin-Oak-Mesquite Brush Vegetation Type of Texas (TPWD 2003). During field investigations, three distinct vegetation types were observed within the survey area. Identification of the vegetation types was based on species composition, canopy cover, and morphology. The Mesquite Thorn-Scrub observed vegetation type is mostly located within the central and southern extents of the survey area.). Approximately 230.5 acres of this vegetation type would be impacted by the proposed project.

This vegetation type provides potentially suitable habitat for an array of migratory bird species as well as the state-listed Texas horned lizard. Animal species observed within this vegetation type during the October 2018 and/or April 2019 site visits included, but are not limited to: black-tailed jackrabbit, eastern cottontail, mule deer, javelina, robber fly, red harvester ant (and mounds), six-lined racerunner, and various bird species and inactive nests. The Havard Oak Dunes observed vegetation type is mostly located within the northern extent of the survey area. Approximately 76.0 acres of this vegetation type would be impacted by the proposed project. This vegetation type provides potentially suitable habitat for an array of migratory bird species, dunes sagebrush lizard (Species of Greatest Conservation Need (SGCN)), and lesser prairie-chicken (SGCN). Animal species observed within this vegetation type during the October 2018 and/or April 2019 site visits included, but are not limited to western box turtle, queen butterfly, and various bird species and inactive bird nests. The Maintained Grassland observed vegetation type is mostly located within the central extent of the survey area along the maintained roadway and graded area. Approximately 17.8 acres of this vegetation type would be impacted by the proposed project.

This vegetation type provides potentially suitable habitat for an array of migratory bird species as well as the state-listed Texas horned lizard. Animal species observed within this vegetation type during the October 2018 and/or April 2019 site visits included, but are not limited to eastern cottontail, various bird species, and inactive bird nests.

See ER Attachment 3-5, Section 5.0 for information on vegetative species.

All areas suffer from some level of human-induced disturbance. *The survey area primarily consists of vacant, undeveloped land. Surrounding land use is also primarily undeveloped land*

with heavy industrial sites in the vicinity of the survey area. The vegetative species observed are addressed in Section 5.0.

3.5.3.2 Wildlife

The mourning dove is the most abundant and widespread bird species observed. *Other bird species include Grasshopper Sparrow, Red-tailed Hawk, Swainson's Hawk, Lark Bunting, Cactus Wren, Northern Cardinal, Pyrrhuloxia, Hermit Thrush, Lark Sparrow, Norther Harrier, Northern Bobwhite, American Crow, Ladder-backed Woodpecker, Kark-eyed Junco, Loggerhead Shrike, Lincoln's Sparrow, Song Sparrow, Northern Mockingbird, Ash-throated Flycatcher, Vesper Sparrow, Great-tailed Grackle, Ruby-crowned Kinglet, Yellow-rumped Warbler, Dickcissel, Chipping Sparrow, Field Sparrow, Western Meadowlark, Curve-billed Thrasher, Scissor-tailed Flycatcher, Western Kingbird, Barn Owl, and White-crowned Sparrow.*

Scientific names are included in Section 6.0 of the Ecological Resources Report.

The only mammals observed or positively identified in the study area from sign were black-tailed jackrabbit (*Lepus californicus*) *and mule deer.* Previous surveys have identified a variety of rodents [e.g., Ord's kangaroo rat (*Dipodomys ordii*), silky pocket mouse (*Perognathus flavus*), deer mouse (*Peromyscus maniculatus*), northern grasshopper mouse (*Onchomys leucogaster*), southern plains woodrat (*Neotoma micropus*), and plains harvest mouse (*Reithrodontomys montanus*)] . Collared peccaries (*Tayasu tajacu*) have been observed east of the CISF. Rodent tracks are abundant, particularly in sandy areas.

No evidence of amphibians has been found at the *playas* located north and south of the CISF.

Reptiles observed in the study area include *the six-lined racerunner and Western box turtle (CMEC, 2019).*

Common invertebrate species have been observed at various locations *including the Robber fly, Queen butterfly, dung beetle, red harvester ant, and darkling beetle*. Grasshoppers are abundant, and most CISF harbor one or more ant species. Flies and mosquitoes are also common.

3.5.3.3 Birds

Birds were surveyed through observation and by call at the proposed CISF and its vicinity to document species, potential breeding species, seasonal migrants, and winter residents. A barn owl (*Tyto alba*) was observed at Baker Spring during the March 2004 survey. A recently dead specimen was found in the same area during the June 2006 surveys. The species is common in all four southwestern deserts. Barn owls hunt for rodents along desert washes, where trees are present. Suitable habitat exists at Baker Spring and southeast of the CISF. No washes or trees are present in areas of proposed CISF development. *Bird species observed in 2018 and 2019 are in Section 3.5.3.2.*

All bird species encountered on and near the proposed CISF are consistent with the range information provided in *the "Ecological Assessment of the Low Level Waste Depository, Andrews County, TX" by the Ecology Group in Appendix 2.9.1 of the Waste Control Specialists License Application for the LLRW (WCS, 2007)* and references cited therein and with other records from the vicinity near the CISF. It is likely many of the summer resident species breed and raise their young on or in the vicinity of the CISF.

The US Fish & Wildlife Service (FWS) listed the lesser prairie chicken as "threatened" in 2014. However, the FWS de-listed the species in July 2016, to comply with a court order. The FWS currently is conducting a more detailed review of the status of the species, and lists the species as "under review." Historically, a Waste Control Specialists ranch manager reported seeing a female lesser prairie chicken (*Tympanuchus pallidicinctus*) near the CISF but the sighting was never verified. Although the CISF is outside the known range of the species, areas of suitable habitat (e.g., shinnery oak) are present within a 5 km (3.1 mi) radius of the CISF. No active leks or prairie chickens have been detected during the 2004 Lyons surveys . Surveys were conducted by a researcher who was familiar with standard techniques used to census this species in New Mexico and Texas.

New Mexico's Department of Game and Fish completed a lesser prairie chicken survey in 2000, examining the northern portion of Lea County, along with portions of Chavis, Roosevelt, and De Baca counties . The New Mexico report did not include the area adjacent to the CISF; however, more recent surveys for the lesser prairie chicken conducted in September 2003 and April 2004 in support of the licensing of the nearby NEF indicated the species does not occur on land of the

proposed CISF. No visual sightings or aural detections were made and the researchers concluded there is little potential habitat in the survey area.

A LPC survey was conducted in Andrews County in 2004 that yielded negative results (Lyons 2004). Despite the negative results of the survey in 2004, a presence/absence survey for the LPC was conducted by CMEC within the survey area during the April 2019 field investigations after observing potentially suitable habitat in October 2018 in the Havard Oak Dunes vegetation type (approximately 76 acres) within the northern extent of the survey area (see Figure 6 of Attachment 3-6). The survey was conducted by Ryan Blankenship (who has completed WAFWA technical service provider (TSP) training in 2016) in accordance with the Western Association of Fish and Wildlife Agencies' LPC Survey Protocol for Project Clearance (Updated February 2016).

The survey was conducted over three days during the April 2019 site visit to verify the presence/absence of this species. Surveys were conducted in the morning hours, lasted approximately 1.5 hours, and consisted of utilizing seven fixed-point listening stations which were placed within the survey area and within a one-mile vicinity of the survey area (see Figure 8 of Attachment 3-6). This diurnal survey time is optimal for observing LPC that may occur within or adjacent to the survey area. The survey was conducted during the LPC survey timeframe outlined in the Western Association of Fish and Wildlife Agencies' LPC Survey Protocol for Project Clearance (Updated February 2016) survey protocol. Observers listened for audible calls and visually surveyed suitable habitat within a 5-minute time period at each fixed-point listening station each day. Attachment C of Attachment 3-6 includes the dates and times for each survey event and atmospheric conditions (temperature, wind speed, and cloud cover).

Although potentially suitable habitat for the LPC is located within the survey area, the April 2019 presence/absence survey did not locate any individuals of these species within the survey area. There are no recorded TXNDD Elements of Occurrence within 1.5 miles of the study area (see Figure 7 of Attachment 3-6). It is believed that the habitat located within the survey area is not occupied by these species at this time. A summary of the Lesser Prairie-Chicken survey effort is included in Table 5 of Attachment 3-6 and Attachment C of Attachment 3-6. The results of this survey effort are consistent with a statewide survey conducted in 2000 and a survey conducted within and adjacent to the survey area in 2004 (NMDGF 2000, Lyons 2004).

The USFWS currently lists the lesser prairie chicken as *a "de-listed"* species. Recent decline in population numbers of the lesser prairie chicken, a species that prefers shinnery oak habitat, has shifted concern on public lands towards protection of this habitat.

3.5.3.4 Aquatic

Aquatic ecological studies have not been conducted in the area because there are no permanent—and only occasionally ephemeral—sources of surface water available on or in the vicinity of the proposed CISF. These are insufficient to support aquatic species.

United States Army Corps of Engineers (USACE) has confirmed that no waters of the United States (including wetlands) are present within the survey area (see ER Attachment 3-3).

The TCEQ has confirmed that wetlands are not located in the vicinity of the proposed CISF. Pools of water are intermittently present in the vicinity of the Baker Spring outcrop, located approximately 0.58 km (0.36 mi) west of the proposed CISF. These pools may support amphibians [such as spadefoot toads (*Scaphiopus multiplicatus*) and the Texas toad (*Bufo speciosus*),)] and invertebrates adapted to take advantage of such locations.

3.5.4 Rare, Threatened, and Endangered Species Known or Potentially Occurring in the Project Area

Lists of rare, threatened, and endangered species maintained by the USFWS and TPWD were consulted to determine species of potential occurrence in the vicinity of the survey area. In all, 41 federally listed endangered, threatened, candidate species, or state-listed endangered, threatened species, or SGCNs were identified as having the potential to occur in Andrews County, TX. For more details, see Attachment 3-6, Section 6.0 of the ER.

3.5.5 Major Vegetation Characteristics

The general vegetation community type at the proposed CISF is classified as Plains-Mesa Sand Scrub characterized by the presence of significant amounts of the indicator species shinnery oak, a low growing shrub. The community is further characterized by the presence of forbs, shrubs, and grasses that are adapted to the deep sand environment that occurs in parts of western Andrews County, Texas. *See Attachment 3-6, Section 5.0 of the ER for more information on vegetation.*

3.5.6 Habitat Importance

Attachment 3-6, Section 6.2, Table 3 provides a complete list of the threatened, endangered, and other important species and whether the land around the proposed CISF provided suitable habitat for those species.

3.5.7 Location of Important Travel Corridors

None of the important wildlife species identified at the proposed CISF are migratory in this part of their range; therefore, these species do not have established migratory travel corridors. However, three of the species, mule deer, lesser prairie chicken, and scaled quail, are highly mobile and utilize a network of diffuse travel corridors linking base habitat requirements (i.e., food, water, cover, etc.). These travel corridors may change from season to season as well as from year to year for each species and can occur anywhere within the species' home range.

Mule deer and scaled quail utilize and often thrive in altered habitats and can and do live in close proximity to humans and human activities. For these two species, any travel corridors that would potentially be blocked by the proposed CISF would easily and quickly be replaced by an existing or new travel corridor linking base habitat requirements for these two species.

Field investigations conducted in October 2018 confirmed the potentially suitable habitat for the lesser-prairie chicken, although none were seen. See Attachment 3-6, Section 3.3 for more information.

The sand dune lizard is not a highly mobile species and is confined to small home ranges within the active sand dune-shinnery oak habitat type. Travel corridors are not important features of the lizard habitat. A field survey confirmed that the sand dune lizard is not present at the proposed CISF.

The black-tailed prairie dog is not highly mobile. Considering that prairie dogs dig extensive, deep, and permanent burrows (i.e., they do not migrate) and are not dependent on free water, travel corridors are not important features of the prairie dog habitat. A field survey found no evidence of black-tailed prairie dogs at the proposed CISF.

3.5.8 Important Ecological Systems

The proposed CISF contains fair to poor quality wildlife habitat. The Plains-Mesa Sand Scrub vegetative community has been impacted by past land use practices. The proposed CISF has previously been grazed by domestic livestock for over a hundred years, has a Texas state highway along the southern boundary, a rail line spur right-of-way borders the southern perimeter of the CISF, and a gravel access road runs north to south along the south and east perimeter of the CISF. The degraded habitat generally lacks adequate cover and water for large animal species, and annual grazing by domestic livestock impacts ground nesting bird species.

Based on recent field studies and the published literature, there are no onsite important ecological systems that are especially vulnerable to change or that contain important species habitats such as breeding areas, nursery, feeding, resting, and wintering areas, or other areas of seasonally high concentrations of individuals of important species. The species selected as important for the CISF are all highly mobile species, with the exception of the sand dune lizard and the black-tailed prairie dog, and are not confined to the CISF or dependent on habitats at the CISF. The Plains-Mesa Sand Scrub vegetation type covers hundreds of thousands of acres in western Andrews County Texas and is not unique to the proposed CISF.

Critical habitat for the lesser prairie chicken occurs in New Mexico northwest of the CISF. Field surveys for the lesser prairie chicken conducted in September 2003 and April 2004 *and October 2018 and April 2019* indicated the species does not occur on the proposed CISF.

Although the CISF does contain sand dune/shinnery oak communities, which could be potential sand dune lizard habitat, field surveys conducted in October 2003 and June 2004 *and October 2018 and April 2019* revealed that the sand dune lizards are not present on the CISF.

The high density of shrubs on the proposed CISF is not optimal prairie dog habitat. No prairie dogs were found onsite during the September 2003 *and October 2018 and April 2019 surveys.*

3.5.9 Characterization of the Aquatic Environment

The CISF contains no aquatic habitat. There is a shallow playa east of the proposed CISF that contains a small amount of water for several days following a major precipitation event. This feature does not support aquatic life, and no rare, threatened, or endangered species are present. There are no intermittent or perennial water bodies or jurisdictional wetlands on the CISF. There is no hydrological/chemical monitoring station onsite, and no data have been recorded in the past.

3.5.10 Location and Value of Commercial and Sport Fisheries

Due to the lack of aquatic habitat (no surface water), there are no commercial or sport fisheries located on the proposed CISF or in the local area. The closest fishery, the Pecos River and Lake McMillan located on the Pecos River near Carlsbad, New Mexico, is approximately 121 km (75 mi) west of the proposed CISF.

3.5.11 Key Aquatic Organism Indicators

Due to the lack of aquatic life known to exist on the proposed CISF, no key aquatic indicator organisms expected to gauge changes in the distribution and abundance of species populations that are particularly vulnerable to impacts from the proposed action can be identified.

3.5.12 Important Ecological Systems

There are no important aquatic ecological systems onsite or in the local area that are especially vulnerable to change or that contain important species habitats, such as breeding areas, nursery areas, feeding areas, wintering areas, or other areas of seasonably high concentrations of individuals of important species.

3.5.13 Significance of Aquatic Habitat

The proposed CISF contains no aquatic habitat; therefore, the relative regional significance of the aquatic habitat is low.

3.5.14 Description of Conditions Indicative of Stress

Pre-existing environmental stresses on the plant and animal communities at the proposed CISF consist of road and rail right-of-ways and domestic livestock grazing. The impact of road and rail

installation and maintenance of the right-of-way has been mitigated by the colonization of the disturbed areas by local plant species. However, the access road along the perimeter of the CISF is maintained and used by vehicles associated with the operation of the adjacent waste disposal facilities on a regular basis. The disturbed areas immediately adjacent to the road are being invaded by lower successional stage species (i.e., weeds). This pattern is expected to continue as long as the road and rail line are maintained.

Historical domestic livestock grazing and fencing of the CISF constitute a pre-existing and continuing environmental stress. Heavily grazed native grasslands tend to exhibit changes in vegetation communities that move from mature, climax conditions to mid-successional stages with the invasion of woody species such as honey mesquite and sagebrush. The proposed CISF has large stands of mesquite indicative of long-term grazing pressure that has changed the vegetative community from one dominated by climax grasses to a sand scrub community and the resulting changes in wildlife habitat.

Another periodic environmental stress is changes in local climatic and precipitation patterns. The proposed CISF would be located in an area of the Southern High Plains of Texas that experiences shifts in precipitation amounts that can affect plant community diversity and production on a short-term seasonal basis and also on a long-term basis that may last for several years. Below average precipitation that negatively impacts the plant community also directly alters wildlife habitat and may severely reduce wildlife populations.

Past livestock grazing, fencing, and the maintenance of access roads and pipeline right-of-ways represent the primary pre-existing environmental stress on the wildlife community of the CISF. The probable result of the past and current use of the proposed CISF is a shift from wildlife species associated with mature desert grassland to those associated with a grassland shrub community. Large herbivore species such as the pronghorn antelope (*Antilocapra americana*) that require large, open prairie areas with few obstructions such as fences have decreased. Other mammalian species that depend on open grasslands, such as the black-tailed prairie dog (*Cynomys ludovicianus*), are also no longer present in the immediate area. Bird species that depend on the mature grasslands for habitat, such as the lesser prairie chicken (*Tympanuchus pallidicinctus*), have decreased in the region and at the proposed CISF. Other species that thrive in a mid-successional plant community, such as the black-tailed jackrabbit (*Lepus californicus*), desert cottontail (*Sylvilagus audubonii*), and mule deer (*Odocoileus hemionus*),

have probably increased. No other environmental stresses on the terrestrial wildlife community (e.g., disease, chemical pollutants) have been documented at the proposed CISF.

3.5.15 Description of Ecological Succession

Long-term ecological studies of the proposed CISF are not available for analysis of ecological succession at this specific location. The property is located in a *Havard Shin-Oak Mesquite Brush* vegetation community, which is a climax community that has been established in western Andrews County for an extended period. The majority of the subject property is a mid-successional stage, primarily due to historic grazing of domestic livestock and climactic conditions.

Development of the proposed CISF would be limited to an access road for a neighboring property and faded two-track roads along the perimeter of the property; the two-track roads are probably used for fence maintenance. These areas contain some colonizing plants that are common to disturbed ground. An example of a disturbed ground colonizing species in western Andrews County is broom snakeweed (*Gutierrezia sarothrae*). The proposed CISF has been grazed for an unknown period of time, although regional grazing by domestic livestock has occurred for 150 years. Evidence of past grazing was also apparent from reduced amounts of standing vegetation. Moderately high densities of honey mesquite (*Prosopis glandulosa*) seedlings were observed during the vegetation survey. Reduced grass canopy from historic and contemporary livestock grazing may be contributing to the colonization of honey mesquite due to reduced competition. Honey mesquite is considered noxious on rangeland because of its ability to compete for soil moisture and its reproductive ability.

3.5.16 Description of Ecological Studies

Cox-McLain Environmental Consulting completed an Ecological Resources Report for the proposed CISF (Attachment 3-6). ISP partner WCS completed several ecological assessments for licensing activities starting in 1997. The reports included in the WCS License application for the LLRW Appendix 2.9.1 (WCS, 2007) are listed below:

1. *"Habitat Characterization and Rare Species Survey for the Proposed Low Level Waste Repository, Andrews County, TX;" Doug Reagan and associates (2004).*

2. *"Supplemental Survey to Ecological Assessment of the Low Level Waste Depository, Andrews County, Texas;" URS (2007).*

3. *"Ecological Assessment of the Low Level Waste Depository, Andrews County, TX;" Ecology Group (1997).*

4. *"Survey for the Active Lesser Prairie-Chicken Leks: Spring 2000;" New Mexico Department of Game and Fish (2000).*

5. *"Survey of Lesser Prairie Chickens at the Low Level Waste Depository, Andrews County, TX;" Eddie K. Lyons (2004).*

These additional ecological studies have been performed for the area adjacent to the proposed CISF:

1. *"Status and Habitat of the Sand Dune Lizard at National Enrichment Facility Project;" GL Environmental, Inc.; ADAMS Accession Number ML040850611 (2003).*

2. *"The Habitat and Geographic Range of the Sand Dune Lizard in Lea County, New Mexico in the vicinity of Section 32, Township 21S, Range 38E;" GL Environmental, Inc.; ADAMS Accession Number ML042170040 (2004).*

3. *"Environmental Assessment Report Prepared for Application for Renewal of Radioactive Material License R04971 Waste Control Specialists LLC Andrews County, Texas;" Waste Control Specialists (2008).*

3.5.17 Information on Rare, Threatened, and Endangered Species Sightings

No rare, threatened, or endangered species have been observed in the vicinity of the proposed CISF.

3.5.18 Agency Consultation

Consultation was initiated with all appropriate federal and state agencies and affected Native American Tribes. Consultation Documents are presented in Attachment 3-3 *and Attachment 3-6*.

3.5.19 Affects from Other Federal or State Projects on Rare, Threatened, and Endangered Species

The proposed CISF is not expected to negatively affect any rare, threatened, and endangered species or their habitats. ISP is not aware of other Federal and State projects within the region that are or could potentially affect the same threatened and endangered species or their habitats.

3.6 METEOROLOGY, CLIMATOLOGY, AND AIR QUALITY

3.6.1 Regional Climatology

The NOAA NWS, Weather Forecast Office at Midland (NWS Midland) covers the High Plains where the proposed CISF is located. The regional climate can best be described as “semi-arid continental” marked with four seasons. Summers are typically hot and dry with generally low relative humidity. July is the hottest month with high temperatures occasionally reaching above 100 degrees Fahrenheit. January is the coldest month, although the winters are not generally severe. Temperatures occasionally dip below 32 degrees Fahrenheit. Precipitation levels are generally low in this arid climate. The precipitation tends to be heavier in the summer and fall.

During the winter, the regional weather is often dominated by a high-pressure system in the central part of the western United States and a low-pressure system located over Arizona in the summer.

3.6.2 Site and Regional Meteorology

The Weather Forecast Office at Midland-Odessa, Texas covers the High Plains where the proposed site is located. In addition to the weather forecast office in Midland, climatological data for atmospheric variables such as temperature, pressure, winds, and precipitation are also collected at stations in Jal, New Mexico; Hobbs, New Mexico; and Andrews, Texas. Table 3.6-1 indicates the distances and directions of these stations from the site and the length of record for the reported data.

Table 3.6-1, Weather Stations Located Near the WCS CISF

Station	Distance and Direction from Proposed Site	Length of Record*	Station Elevation (meters)
Hobbs, New Mexico	32 kilometers (20 miles) north of site	29 (1981-2010)	1,115
Jal, New Mexico	50 kilometers (31 miles) south of site	29 (1981-2010)	947
Andrews, Texas	51 kilometers (32 miles) east of site	29 (1981-2010)	967
Midland-Odessa, Texas	103 kilometers (64 miles)southeast of site	29 (1981-2010)	1,118

* Years of compiled data for climatological analysis.

The Midland-Odessa monitoring station is the closest first-order National Weather Service station to the Waste Control Specialists site. First-order weather stations record a complete range of meteorological parameters for 24-hour periods, and they are usually fully instrumental and operated by the National Weather Service (http://www.ncdc.noaa.gov/homr/).

Meteorological data have been collected on the Waste Control Specialists property from the four onsite meteorological tower stations listed below:

- Tower 1 has been collecting data since March 2009 and has sensors at both the 2 m (6.6 ft) (lower) and 10 m (32.8 ft) (upper) height intervals. Data collected includes temperature, wind direction, wind speed, relative humidity at 2 (6.6 ft) and 10 m (32.8 ft), barometric pressure, solar radiation, and rain at 2 m (6.6 ft) only. Data averages, unless otherwise noted, are based on available historic records from 2009-2015.

- The ER Tower has been collecting data since July 2009 and has sensors at both the 2 m (6.6 ft) (lower) and 10 m (32.8 ft) (upper) height intervals. This tower measures temperature, wind direction, wind speed, relative humidity at 2 and 10 m (6.6 ft and 32.8 ft), barometric pressure, solar radiation, and rain at 2 m only. Data averages, unless otherwise noted, are based on available historic records from 2009-2015.

- The WeatherHawk West Tower has been collecting data since March 2009 and measures temperature, wind direction, wind speed, relative humidity, barometric pressure, solar radiation, and rain at roughly 3 m (10 ft). Data averages, unless otherwise noted, are based on available historic records from 2009-2015.

- The WeatherHawk East Tower has been collecting data since March 2009 and measures temperature, wind direction, wind speed, relative humidity, barometric pressure, solar radiation, and rain at roughly 3 m (10 ft). Data averages, unless otherwise noted, are based on available historic records from 2009-2015.

3.6.3 Maximum and Minimum Temperatures

The Western Regional Climate Center (WRCC) has historic temperature data for Andrews, Texas starting in 1914. Currently available temperature data spans the period from 1962 to 2010. The mean (average) maximum and minimum daily temperatures, the record high temperature and low temperature for each month, and the annual high and low temperature for these years is shown in Table 3.6-2. In Andrews, Texas the average annual maximum temperature is 77.5 degrees Fahrenheit and the average annual minimum temperature is 49.4 degrees Fahrenheit. Recent seasonal temperature data for Midland, Texas provided by the National Oceanic & Atmospheric Administration (NOAA) is provided in Table 3.6-3.

Table 3.6-2, Summary of Maximum and Minimum Temperatures for Andrews, Texas Period of Record 1962 to 2010

MONTH	MEAN MONTHLY TEMPERATURE		MEAN DAILY MAX. TEMPERATURE		MEAN DAILY MIN. TEMPERATURE		HIGHEST DAILY MAX. TEMPERATURE		LOWEST DAILY MIN TEMPERATURE	
	°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
January	6.7	44.1	14.5	58.1	-1.1	30.1	29.4	85.0	-17.8	0.0
February	9.2	48.6	17.2	63.1	1.1	33.9	31.7	89.0	-18.3	-1.0
March	13.3	56.0	21.8	71.3	4.8	40.6	36.1	97.0	-13.3	8.0
April	18.2	64.7	26.8	80.2	9.4	49.0	37.2	99.0	-5.0	23.0
May	22.7	72.9	31.0	87.8	14.5	58.1	41.7	107.0	0.6	33.0
June	26.6	79.8	34.3	93.8	18.7	65.7	45.0	113.0	8.3	47.0
July	27.5	81.5	34.8	94.6	20.2	68.3	43.9	111.0	13.9	57.0
August	26.7	80.0	33.9	93.0	19.5	67.1	41.1	106.0	12.2	54.0
September	23.3	73.9	30.4	86.8	16.1	61.0	40.0	104.0	3.3	38.0
October	18.3	64.9	26.1	79.0	10.4	50.8	38.3	101.0	-5.6	22.0
November	11.8	53.2	19.4	67.0	4.1	39.4	33.9	93.0	-11.7	11.0
December	7.6	45.6	15.3	59.5	-0.2	31.7	27.2	81.0	-17.2	1.0
Annual	**17.5**	**63.5**	**25.3**	**77.5**	**9.7**	**49.4**	**45.0**	**113.0**	**-18.3**	**-1.0**

Table 3.6-3, Monthly Seasonal Temperatures Midland, Texas for 2000-2015

MONTH	AVERAGE DAILY HIGH TEMPERATURE		AVERAGE DAILY LOW TEMPERATURE		AVERAGE DAILY TEMPERATURE		AVERAGE DAILY TWO-MONTH TEMPERATURE (MONTH PLUS PREVIOUS MONTH)	
	°C	°F	°C	°F	°C	°F	°C	°F
January	14.5	58.1	-0.6	31.0	6.9	44.5	7.1	44.7
February	16.7	62.0	1.2	34.2	9.0	48.1	8.0	46.3
March	21.9	71.4	5.7	42.3	13.8	56.8	11.4	52.5
April	27.1	80.8	10.8	51.5	19.0	66.1	16.4	61.5
May	31.1	88.0	15.9	60.6	23.5	74.3	21.2	70.2
June	34.9	94.9	20.8	69.4	27.8	82.1	25.7	78.2
July	34.8	94.7	21.8	71.2	28.3	82.9	28.1	82.5
August	34.9	94.9	21.4	70.5	28.2	82.7	28.2	82.8
September	30.8	87.4	17.5	63.5	24.1	75.5	26.2	79.1
October	25.6	78.0	11.7	53.0	18.6	65.5	21.4	70.5
November	19.1	66.3	4.4	39.9	11.7	53.1	15.2	59.3
December	14.5	58.1	-0.2	31.7	7.2	44.9	9.4	49.0
Annual	**25.5**	**77.9**	**10.9**	**51.6**	**18.2**	**64.7**	**18.2**	**64.7**

3.6.4 Winds, Extreme Winds and Atmospheric Stability

Regionally wind speeds are usually more moderate, although relatively strong winds often accompany occasional frontal activity during late winter and spring months and sometimes occur just in advance of thunderstorms. Frontal winds may exceed 13 meters per second (30 miles per hour) for several hours and reach peak speeds of more than 22 meters per second (50 miles per hour).

Wind speed and direction data measured at the onsite Waste Control Specialists meteorological stations from 2010 to 2015 is shown in wind rose diagrams in Figures 3.6-1 through 3.6-5. The

data used to create the wind rose diagrams is provided in Attachment A of the SAR Chapter 2. The wind roses show the percent of the time (rings) that the wind blows from each of the 16 directions (N, NNE, NE, NNW) by the length of the bars. The shading of the bars also indicates the frequency of occurrence of wind speeds within the wind speed classes shown in the figures. The onsite data indicates that for this period from 2010 to 2015 the average wind speed ranged from 6.07 knots to 10.53 knots. The wind direction is predominantly from the south. The diagrams indicate that wind gusts in excess of 22 mph generally blow from the southwest or northeast.

The neighboring NEF site analyzed wind speed and direction from the Midland-Odessa weather station for the years 1987 to 1991. Calculated annual mean wind speed was 5.1 meters per second (11.4 miles per hour), with prevailing winds from the south and a maximum 5-second wind speed of 31.2 meters per second (70 miles per hour). The Pasquill stability classes range from A to F with the most stable classes – E and F – occurring 18.9 and 13 percent of the time, respectively. The least stable classes, A and B, occur 0.3 and 3.5 percent of the time, respectively. NEF compared this data against data generated at Waste Control Specialists from October 1999 through August 2002 and found similar wind patterns and distribution of wind speed between Midland-Odessa and Waste Control Specialists locations (EIS for NEF, 2005).

3.6.5 Tornadoes

Two F2 Class (wind speed from 113 to 157 mph) tornadoes have been recorded in Andrews County, Texas between 1950 and 2015 according to data reported by NOAA . NOAA reports there were eight F1 Class (wind speed 73 to 112 mph) tornadoes recorded in Andrews County since 1950. Tornados are classified using the F-scale with classifications ranging from F0-F5 as follows:

- F0-classified tornados have winds of 64 to 116 kilometers per hour (40 to 72 miles per hour)
- F1-classified tornados have winds of 117 to 181 kilometers per hour (73 to 112 miles per hour)
- F2-classified tornados have winds of 182 to 253 kilometers per hour (113 to 157 miles per hour)

- F3-classified tornados have winds of 254 to 332 kilometers per hour (158 to 206 miles per hour)

- F4-classified tornados have winds of 333 to 419 kilometers per hour (207 to 260 miles per hour)

- F5-classified tornados have winds of 420 to 512 kilometers per hour (261 to 318 miles per hour)

The CISF is located about 805 kilometers (500 miles) from the coast. Because hurricanes lose their intensity quickly once they pass over land, a hurricane would most likely lose its intensity before reaching the CISF and dissipate into a tropical depression.

Blowing sand or dust may occur occasionally in the area due to the combination of strong winds, sparse vegetation, and the semi-arid climate. High winds associated with thunderstorms are frequently a source of localized blowing dust. Most episodes of dust prevail for only six hours or less, when visibility is restricted to less than 0.5 mile. Statistical information is lacking on seasonal distribution intensity and duration of dust storms for the region. Recent data in Lubbock, Texas (110 miles northeast of the site) indicates blowing dust an average of 12 times in the spring and 9 times during the remainder of the year (Bomar, 1995).

3.6.6 Precipitation Extremes

The WRCC has historic precipitation data for Andrews, Texas starting in 1914. The maximum observed 24-hour rainfall (between 1914 and 2012) amount at Andrews, Texas is 19.3 cm (7.6 in) in February 1914. The meteorological station in Andrews, Texas historic precipitation and snow data for Andrews, Texas can be found in Tables 3.6-4 and 3.6-5. ISP joint venture member Waste Control Specialists also has four on-site meteorological stations that monitor and record onsite precipitation and the data is included in Attachment A of the SAR Chapter 2.

Table 3.6-4, Andrews, Texas Period of Record Precipitation Data (1914-2006)

Precipitation cm (in)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
Average	1.24 (0.49)	1.50 (0.59)	1.70 (0.67)	2.41 (0.95)	4.19 (1.65)	4.88 (1.92)	5.74 (2.26)	4.78 (1.88)	5.72 (2.25)	3.78 (1.49)	1.58 (0.62)	1.35 (0.53)	38.86 (15.30)
Maximum	11.40 (4.49)	6.40 (2.52)	8.46 (3.33)	13.67 (5.38)	14.91 (5.87)	18.06 (7.11)	30.23 (11.90)	14.00 (5.51)	20.17 (7.94)	16.16 (6.36)	8.00 (3.15)	7.80 (3.07)	78.66 (30.97)
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.36 (0.14)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.36 (0.14)
Max 24 Hr	5.61 (2.21)	2.54 (1.00)	4.70 (1.85)	6.30 (2.48)	7.62 (3.00)	9.40 (3.70)	19.30 (7.60)	6.10 (2.40)	8.90 (3.50)	5.21 (2.05)	5.33 (2.10)	3.94 (1.55)	19.30 (7.60)

Table 3.6-5, Andrews, Texas Period of Record Snow Data (1914-2006)

Snow cm (in)	JAN	FEB	MAR	APR	MAY	JUNE	JULY	AUG	SEP	OCT	NOV	DEC	ANNUAL
Average	3.33 (1.31)	1.52 (0.60)	0.08 (0.03)	0.15 (0.06)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.08 (0.03)	1.45 (0.57)	1.98 (0.78)	8.59 (3.38)
Maximum	25.40 (10.00)	17.78 (7.00)	2.54 (1.00)	6.35 (2.50)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	2.54 (1.00)	35.56 (14.00)	13.97 (5.50)	52.07 (20.50)
Minimum	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Max 24 Hr	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Summer rains fall almost entirely during brief, but frequently intense thunderstorms. The general southeasterly circulation from the Gulf of Mexico brings moisture from these storms into the State of New Mexico, and strong surface heating combined with orographic lifting as the air moves over higher terrain causes air currents and condensation. Orographic lifting occurs when air is intercepted by a mountain and is forcefully raised up over the mountains, cooling as it rises. If the air cools to its saturation point, the water vapor condenses and a cloud forms.

As these storms move inland, much of the moisture is precipitated over the coastal and inland mountain ranges of California, Nevada, Arizona, and Utah. Much of the remaining moisture falls on the western slope of the Continental Divide and over northern and high-central mountain ranges. Winter is the driest season in New Mexico except for the portion west of the Continental Divide. This dryness is most noticeable in the Central Valley and on eastern slopes of the mountains. In New Mexico, much of the winter precipitation falls as snow in the mountain areas, but it may occur as either rain or snow in the valleys.

Data from the Midland-Odessa Weather Station indicate the relative humidity throughout the year ranges from 51.5 to 65 percent, with the highest humidity occurring during the early morning hours.

3.6.7 Thunderstorms and Lightning Strikes

The mean number of annual thunderstorm days for Hobbs, New Mexico and Midland, Texas is 25.5 and 36.4, respectively . No records are maintained for the frequency of thunderstorms and lightning at the proposed CISF; however, the actual number of events can be expected to be similar to these regional data.

3.6.8 Mixing Heights

Mixing height is defined as the height above the earth's surface through which relatively strong vertical mixing of the atmosphere occurs. G.C. Holzworth developed mean annual morning and afternoon mixing heights for the contiguous United States . According to Holzworth's calculations, the mean annual morning and afternoon mixing heights at the CISF site are approximately 436 meters (1,430 feet) and 2,089 meters (6,854 feet), respectively. Table 3.6-6 shows the average morning and afternoon mixing heights for Midland-Odessa, Texas.

Table 3.6-6, Average Morning and Afternoon Mixing Heights for Midland-Odessa, Texas

	Winter	Spring	Summer	Fall	Annual
Morning	290 meters (951 feet)	429 meters (1,407 feet)	606 meters (1,988 feet)	419 meters (1,375 feet)	436 meters (1,430 feet)
Afternoon	1,276 meters (4,186 feet)	2,449 meters (8,035 feet)	2,744 meters (9,003 feet)	1,887 meters (6,191 feet)	2,089 meters (6,854 feet)

Source:

3.6.9 Diffusion Estimates

This section is reproduced from WCS CSIF SAR Section A.11.3.4, "Atmospheric Dispersion Coefficients."

For normal and off-normal conditions, an atmospheric dispersion coefficient is calculated using D-stability and a wind speed of 5 m/sec and a 100 m (328 ft) distance to the controlled area boundary. The controlled area boundary is more than 100 m (328 ft) from the WCS CISF, so use of 100 m (328 ft) is conservative. For accident conditions, a dispersion coefficient is calculated using F-stability and a wind speed of 1 m/sec. These atmospheric conditions are consistent with the guidance of NUREG-1536 and NUREG-1567. The smallest vertical plane cross-sectional area of one horizontal storage module (HSM) is conservatively used as the vertical plane cross-sectional area of the building: area = HSM Width * HSM Height = 9 ft 8 in x 15 in = 20,880 in^2 = 13.47 m^2.

The atmospheric dispersion coefficients can be determined through selective use of Equations 1, 2, and 3 of Regulatory Guide 1.145 for ground-level relative concentrations at the plume centerline. For D-stability, 5 m/sec wind speed and a distance of 100 m (328 ft), the horizontal dispersion coefficient, σ_y, is 8 m per Figure 1 of . The vertical dispersion coefficient, σ_z, is 4.6 m per Figure 2 of . The correction factor at these conditions is determined to be 1.122 per Figure 3 of .

For F-stability, 1 m/sec wind speed and a distance of 100 m, the horizontal dispersion coefficient, σ_y, is 4 m per Figure 1 of . The vertical dispersion coefficient, σ_z, is 2.3 m per Figure 2 of . The correction factor at these conditions is 4 per Figure 3 of .

With the three values of χ/Q determined, the higher χ/Q value of the first two (Equation 1 and Equation 2) is compared with the last one (Equation 3) and the lower of those two is evaluated as the appropriate atmospheric dispersion coefficient per in Regulatory Guide 1.145 .

The parameters used and the calculated atmospheric dispersion coefficients are summarized in Table 3.6-7.

Table 3.6-7, Atmospheric Dispersion Coefficients

Parameter	Normal/Off-Normal	Accident
Stability	D	F
$\overline{U_{10}}$ (m/sec)	5	1
A (m^2)	13.47	13.47
σ_y (m)	8	4
σ_z (m)	4.6	2.3
M	1.122	4
Equation 1 of [3] (sec/m^3)	1.635E-03	2.806E-02
Equation 2 of [3] (sec/m^3)	5.766E-04	1.153E-02
Equation 3 of [3] (sec/m^3)	1.542E-03	8.650E-03
χ/Q (sec/m^3)	1.542E-03	8.650E-03

3.6.10 Air Quality

To assess air quality, the EPA has established maximum concentrations for pollutants that are referred to as the National Ambient Air Quality Standards (http://www3.epa.gov/ttn/naaqs/criteria).

In the table below the total annual emissions (tons per year) of Criteria Air Pollutants at Andrews County, TX compared to the State of Texas are shown (Table 3.6-8).

Table 3.6-8, 2014 Baseline Emissions and Lifetime Projections

	CO^1	$NO_X{}^1$	$PM_{10}{}^1$	$PM_{2.5}{}^1$	$SO_2{}^1$	VOC^2	HAP^2
2014 Andrews County Baseline	13,145	9,184	996	310	1,968	54,638	1,136
2014 Statewide Baseline	4,625,519	1,334,750	1,305,098	315,644	461,118	6,772,080	170,090
5-Year Incremental Increase	5.00%	5.00%	5.00%	5.00%	5.00%	17.66%	2.40%

Andrews County Emissions Increase Estimates (tpy)

	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAP
2019 Estimate	13,802	9,643	1,046	326	2,066	64,290	1,163
2024 Estimate	14,492	10,125	1,098	342	2,169	75,646	1,191
2029 Estimate	15,217	10,631	1,153	359	2,278	89,008	1,219
2034 Estimate	15,978	11,163	1,211	377	2,392	104,730	1,249
2039 Estimate	16,776	11,721	1,271	396	2,511	123,229	1,278
2044 Estimate	17,615	12,307	1,335	416	2,637	144,996	1,309
2049 Estimate	18,496	12,922	1,402	437	2,769	170,609	1,341
2054 Estimate	19,421	13,568	1,472	459	2,907	200,745	1,373
2059 Estimate	20,392	14,247	1,545	482	3,053	236,204	1,406

Statewide Emissions Increase Estimates (tpy)

	CO	NO_X	PM_{10}	$PM_{2.5}$	SO_2	VOC	HAP
2019 Estimate	4,856,795	1,401,488	1,370,353	331,426	484,174	7,968,296	174,172
2024 Estimate	5,099,634	1,471,562	1,438,871	347,998	508,383	9,375,811	178,353
2029 Estimate	5,354,616	1,545,141	1,510,814	365,398	533,802	11,031,949	182,634
2034 Estimate	5,622,347	1,622,398	1,586,355	383,667	560,492	12,980,626	187,017
2039 Estimate	5,903,464	1,703,517	1,665,672	402,851	588,517	15,273,516	191,506
2044 Estimate	6,198,637	1,788,693	1,748,956	422,993	617,943	17,971,421	196,103
2049 Estimate	6,508,569	1,878,128	1,836,404	444,143	648,840	21,145,882	200,810
2054 Estimate	6,833,998	1,972,034	1,928,224	466,350	681,282	24,881,078	205,630
2059 Estimate	7,175,698	2,070,636	2,024,635	489,668	715,346	29,276,057	210,565

CO = Carbon Monoxide; NO_X = Nitrogen Oxides; PM_{10} = Particulate Matter less than 10 microns; $PM_{2.5}$ = Particulate Matter less than 10 microns; SO_2 = Sulfur Dioxide; VOC = Volatile Organics Compound; HAP = Hazardous Air Pollutant.

NOTES:

1. *Historical trends for these pollutants have shown decreases in the evaluated dataset from 2002-2014. As a conservative estimation to account for industrial and population growth, assuming control technology remains constant, a 1% increase per year has been assumed.*
2. *Based on historical trends for these pollutants in the evaluated dataset from 2002-2014.*

See ER Section 4.6 for more information.

3.7 NOISE

Noise is defined as "unwanted sound." At high levels noise can damage hearing, because sleep deprivation, interfere with communication, and disrupt concentration. In the context of protecting the public health and welfare, noise implies adverse effects on people and the environment. The sound we hear is the result of a source inducing vibration in the air, creating sound waves. These waves radiate in all directions from the source and may be reflected and scattered or, like other wave actions, may turn corners. Sound waves are a fluctuation in the normal atmospheric pressure, which is measurable. This sound pressure level is the instantaneous difference between the actual pressure produced by a sound wave and the average, or barometric, pressure at a given point in space. This provides us with the fundamental method of measuring sound, which is in "decibel" (dB) units.

The dB scale is a logarithmic scale because the range of sound intensities is so great that it is convenient to compress the scale to encompass all the sound pressure levels that need to be measured. The sound pressure level is defined as 20 times the logarithm, to the base 10, of the ratio of the pressure of the sound measured to the reference pressure, which is 20 μPa (0.0002 dyne/cm^2). In equation form, sound pressure level in units of dB is expressed as:

$$dB = 20 \text{ Log10 } P/P_r$$

Where: P = measured sound pressure level μPa (dynes/cm^2)

P_r = reference sound pressure level 20 μPa (0.0002 dyne/cm^2)

Due to its logarithmic scale, if a noise increases by 10 dB, it sounds as if the noise level has doubled. If a noise increases by 3 dB, the increase is just barely perceptible to humans. Additionally, as a rule-of-thumb the sound pressure level from an outdoor noise source radiates out from the source, decreasing 6 dB per doubling of distance. Thus, a noise that is measured at 80 dB 15 m (50 ft) away from the source would be 74 dB at 30.5 m (100 ft), 68dB at 61 m (200 ft), and 62 dB at 122 m (400 ft). However, natural and man-made obstructions such as trees, buildings, land contours, etc. would often reduce the sound level further due to dissipation

and absorption of the sound waves. Occasionally buildings and other reflective surfaces may slightly amplify the sound waves through reflected and reverberated sound waves.

The rate at which a sound source vibrates determines its frequency. Frequency refers to the energy level of sound in cycles per second, designated by the unit of measurement Hertz (Hz). The human ear can recognize sounds within an approximate range of 16 Hz to 20,000 Hz, but the most predominant sounds we hear are between 1,000 Hz and 6,000 Hz (EPA, 1974). To measure sound on a scale that approximates the way it is heard by people, more weight must be given to the frequencies that people hear more easily. The "A-weighted" sound scale is used as a method for weighting the frequency spectrum of sound pressure levels to mimic the human ear. A-weighting was recommended by the EPA to describe noise because of its convenience and accuracy, and it is used extensively throughout the world .

For the purpose and scope of this report and sound level testing, all measurements would be in the A-weighted scale (dBA).

3.7.1 Extent of Noise Analysis

The Day-Night Average Sound Level (L_{dn}) is used to measure community noise levels. The L_{dn} is the A-weighted equivalent sound level for a 24-hour period. Due to the potential for sleep disturbance, loud noises between 10 p.m. and 7 a.m. are normally considered more annoying than loud noises during the day. This is a psychoacoustic effect that can also contribute to communication interference, distraction, disruption of concentration, and irritation. A 10 dB weighting factor is added to nighttime equivalent sound levels due to the sensitivity of people during nighttime hours . For example, a measured nighttime (10 pm to 7 am) equivalent sound level of 50 dBA can be said to have a weighted nighttime sound level of 60 dBA (50 + 10).

For the purposes of this report, the Equivalent Sound Level (L_{eq}) is used to measure average noise levels during the daytime hours. The L_{eq} is a single value of sound level for any desired duration, which includes all of the time-varying sound energy in the measurement period. To further clarify the relationship between these two factors, the daytime sound level equivalent averaged with the nighttime sound level equivalent equals the Day-Night Average:

L_{eq} (Day) averaged with L_{eq} (Night) = L_{dn}.

Because the nighttime noise levels are significantly lower than the daytime noise levels, the daytime L_{eq} is used alone, without averaging the lower nighttime value, to provide a more conservative representation of the actual exposure.

Measurements were made at the nearby NEF in New Mexico in September 2003 during the development of that facility. The results of those measurements showed higher noise levels resulting from vehicle traffic near New Mexico Highway 234, which is an extension of Texas State Highway 176, particularly heavy-duty tractor-trailer trucks. Other noise sources were low-flying aircraft operating out of the Eunice Airport and sudden high wind gusts. Average background noise levels ranged from 40.1 to 50.4 dBA. These noise levels are considered moderate, and are below the average range of speech, which ranges from 48 to 72 dBA .

ISP performed an acoustical analysis of the background sound levels in July of 2019 (Nelson Acoustics, 2019) in areas surrounding the proposed ISP CISF. Measurements were taken at and around the existing WCS facility and in and around the city of Eunice, NM. Roadway traffic is the primary noise contributor at all locations monitored.

In general it is found that the Noise Sensitive Areas (NSA) in Eunice, NM which are nearest to the proposed CISF are also very near to highways NM 176 and NM 18 as well as the Gas Plant located on the south side of the city. These Eunice NSA measurements possess elevated background levels above L_{dn} 55. At the current northeast corner of Eunice, NM, sound levels are more moderate. The EPA's 1974 recommendation for residential communities is L_{dn} 55. Sounds originating at the CISF are unlikely to be audible in Eunice and are not expected to exceed the EPA's recommended guideline.

NSAs along the western WCS property line are in the 30s and 40s L_{dn}. Construction is likely to be generally audible at these locations. Operations at the CISF are expected to be only audible from time to time. The EPA's 1974 recommendation for industrial sites, as well as for "Farm Land and General Unpopulated Land" is L_{dn} 70. Sounds originating at the CISF are not expected to exceed the EPA's recommended guideline.

3.7.2 Community Distribution

The area immediately surrounding the proposed CISF is unpopulated and used primarily for disposal of various waste products, for mining, and for intermittent cattle grazing. The nearest noise receptors are five businesses that are between 0.8 km (0.5 mi) and 2.6 km (1.6 mi) from

the CISF. The NEF is southwest of the CISF just across the Texas-New Mexico border. The Lea County Landfill is southwest, Sundance Specialists and Permian Basin Materials are west, and DD Landfarm is just west/southwest of the CISF. The nearest residential areas are due west of the CISF in the city of Eunice, New Mexico, which is approximately 8 km (5 mi) away. The closest residence from the center of the CISF would be approximately 6 km (3.8 mi) away on the east side of Eunice, New Mexico.

3.7.3 Background Noise Levels

Current point noise sources consist of operations at the Waste Control Specialists waste disposal facility to the south and the nearby NEF to the southwest; operating equipment at Wallach Concrete, Inc. northwest of the CISF, which includes bulldozers, cranes, and heavy-duty dump trucks and tractor-trailer trucks; and heavy-duty truck traffic at Sundance Specialists west of the CISF. The only line noise source is vehicle traffic along the southern border of the Waste Control Specialists property line on Texas State Highway 176.

3.7.4 Topography and Land Use

The CISF slopes gently to the south-southwest with a maximum relief of about 3 m (10 ft). The highest elevation is approximately 1,067 m (3,500 ft) msl in the northeast corner of the property (Figure 3.1-2). The lowest site elevation is approximately 1,064 m (3,490 ft) msl along the southwest corner of the CISF. With regard to noise mitigation, land contours with changes in elevation would help to absorb sound pressure waves that travel outward from a noise source. A flat surface would allow noise from a source to travel a greater distance without losing its intensity (perceived volume). Wooded areas, trees, and other naturally occurring items on the Waste Control Specialists property would also mitigate noise sources, provided those items are located between the noise and the noise receptor.

3.7.5 Meteorological Conditions

Noise intensities are affected by weather conditions for a variety of reasons. Snow-covered ground can absorb more sound waves than an uncovered paved surface that would normally reflect the noise. Operational noise can be masked by the sound of a rainstorm or high winds, where environmental noise levels are raised at the point of the noise receptor. Additionally, seasonal differences in foliage, as well as temperature changes, can affect the environmental

efficiency of sound wave absorption (i.e., a fully leafed tree or bush would mitigate more sound than one without leaves).

Because of those variables, the noise levels, both background and after the CISF is built, would be variable. However, even when such variations are taken into consideration, the background noise levels are well within the specified guidelines.

3.7.6 Sound Level Standards

Agencies with applicable standards for community noise levels include the U.S. Department of Housing and Urban Development and the EPA . The EPA has defined a goal of 55 dBA for L_{dn} in outdoor spaces, as described in the EPA Levels Document . HUD has developed land use compatibility guidelines for acceptable noise versus the specific land use. On the Waste Control Specialists property there are no city, county, or state ordinances or regulations governing environmental noise. In addition, there are no affected American Indian tribal agencies within the sensitive receptor distances from the CISF. Thus, the CISF is not subject to local, tribal, or state noise regulations. Nonetheless, anticipated CISF noise levels are expected to typically fall below the HUD and EPA standards and are not expected to be harmful to the public's health and safety, nor a disturbance of public peace and welfare.

3.8 CULTURAL RESOURCES

3.8.1 Historic Resources

The Area of Potential Effects (APE) for direct impacts to historic resources is the project footprint. Taking into consideration the height of the crane that would be required, the height of the potential above-ground facility, and the relatively flat surrounding terrain, the APE for indirect/visual impacts for historic resources is a 1.6 km (1 mi) radius from the proposed project footprint. ISP anticipates that the NRC would issue a Final Environmental Impact Statement and License by September 2020. Therefore, a historic-age date of 1974 (46 years prior to 2020) is proposed. The direct effects APE is contained entirely within the state of Texas, while the indirect effects APE extends into New Mexico.

A search of the Texas Historic Sites Atlas maintained by the THC was conducted for previously identified Official State Historical Markers (OSHM), Recorded Texas Historic Landmarks (RTHL), properties or districts listed on the National Register of Historic Places (NRHP), State

Antiquities Landmarks (SALs), cemeteries, or other cultural resources that may have been previously recorded. No such resources were identified within the APE for direct effects. The nearest previously identified resource is the OSHM for Andrews County, located approximately 27 km (17 mi) southeast of the project area.

According to a search of the New Mexico Cultural Resources Information System (NMCRIS), there are no previously-identified non-archeological historic resources located within the APE for direct or indirect impacts. The closest historic resource in New Mexico is “HCPI 37299” (building at 703 Ruth Circle, Eunice, Lea County), located approximately 7.2 km (4.5 mi) from the CISF.

3.8.2 Historical and Cultural Resource Analysis

In May 2015, a pedestrian archeological survey was completed in order to inventory and evaluate any archeological resources on private land within the footprint of the proposed spent nuclear fuel the CISF at the existing Waste Control Specialists waste disposal facility in western Andrews County, Texas *(Attachment 3-4)*. Because the project includes a host agreement with Andrews County, a political subdivision of the State of Texas, the project is considered subject to the Antiquities Code of Texas. The project would also be subject to Section 106 of the NHPA, as amended, due to oversight and licensing by the NRC.

Chris Dayton, PhD in Archeology and a Registered Professional Archeologist and Steven Schooler, MA in Anthropology/Archeology of CMEC carried out the survey on behalf of the County and Waste Control Specialists under Texas Antiquities Permit 7277.

3.8.3 Previous Investigations and Previously Identified Archeological Resources

Neighboring facility Waste Control Specialists completed a "Cultural Resource Survey of A Proposed Waste Facility Andrews County, Texas" in 1994. The 1994 survey and associated letters from the Texas Historical Commission are located in Attachment 3-5.

A data search of the Texas Archeological Sites Atlas maintained by the THC and the Texas Archeological Research Laboratory (TARL) was conducted in order to identify any previously recorded cemeteries, historical markers, NRHP properties or districts, SALs, archeological sites, and previous surveys in the archeological APE, which consisted of the footprint of the proposed expansion, and within 1.6 km or 1 mi of the APE. No records of previously documented resources were found.

The closest known resources, five prehistoric sites, are all located in New Mexico, just outside the 1.6 km (1 mi) study buffer. Sites LA140701, LA140702, LA140703, LA140704, and LA140705 are all surface and near-surface scatters of fire-cracked rock, flaking debris, and ground stone recorded in an aeolian dune field by Western Cultural Resource Management during a 2003 survey for the New Mexico State Land Office . These sites were excavated prior to destruction of the dune field by the construction of the NEF, a uranium processing plant run by URENCO USA. One of the sites, LA140704, contained four hearths from which radiocarbon samples were gathered, yielding occupation dates in the Late Archaic/Early Ceramic period (later centuries B.C./early centuries A.D.) .

3.8.4 Physical Extent of Survey

The physical extent of the survey was along the Texas/New Mexico state line, immediately north of an existing Waste Control Specialists site on the north side of Texas State Highway 176 and 8 km (5 mi) east of Eunice, New Mexico. The footprint of the planned CISF, and therefore the archeological APE, covers an area of approximately 87.7 ha (216.6 acres).

3.8.5 Description of Survey Techniques

CMEC personnel conducted a survey of the 87.7 ha (216.6 acre) APE in May 2015. Field methods were guided by THC/Council of Texas Archeologists (CTA) standards. Due to high ground surface visibility, extensive previous mechanical clearing, and thin soils over the local caliche cap (fragments of which were ubiquitous), no locations for productive shovel testing were found, and the survey consisted of examination of the surface via pedestrian transects. Because the investigation took place on private land, a non-collection policy (i.e., field documentation only) was in place during the survey, but proved to be moot due to the lack of finds. Per 13 Texas Admission Code §26.16 -17, field forms and other project records will be curated at the Center for Archaeological Studies at Texas State University in San Marcos. No historic or prehistoric artifacts or features were found during the survey.

3.9 VISUAL AND SCENIC RESOURCES

According to the U.S. Department of the Interior (DOI) and BLM, visual resources consist of landscape or visual character, and visual sensitivity and exposure. A study area’s landscape features include landform, vegetation, water resource features, color, adjacent scenery, scarcity, and cultural modifications (that either add to or detract from visual quality). The overall

impression of an area, composed of the elements above, is referred to as the “visual character.” For this analysis, the visual character of the area is focused on the perspective of residents living in close proximity to the proposed CISF who would be affected by the continued operations, and the perspective of the driving public (along roads within the visual resources study area). However, since the closest residence is approximately 6.1 km (3.8 mi) away from the CISF, the majority of the analysis is geared toward the driving public.

The environmental team analyzed whether the following features exist or are likely to exist within 24 km (15 mi) of the CISF:

- landforms (elevated views, hilltops, vegetation, woodlands)
- water (stream crossings, bridges, wetlands, pastoral scenes, wildlife viewing potential)
- scarcity (known scarcity of wildlife habitat, vegetation, or cultural resource)
- cultural modifications (urbanized areas, historic structures, visual detractors)

In accordance with DOI and BLM guidance, a photo inventory of the scenic qualities of the CISF was conducted on April 7 and 8, 2015. This study included views from as far as 24 km (15 mi) from the CISF. Views were captured to illustrate several zones: foreground, middle ground, background, and seldom-seen. This inventory replicated photos taken for the ISP joint venture member Waste Control Specialists licensing efforts in 2007 and 2008 for the LLRW disposal license. The study team was interested in learning what has changed in the landscape over the last seven years.

In the SIA (Appendix A), each photo (1-14) in Appendix C, ISP joint venture member Waste Control Specialists Scenic Resources Photo Inventory Figures C-1 and C-2, is labeled with the direction in relation to the CISF, whether it represents foreground, middle ground, background, or seldom-seen views, and approximate distance from the center point of the proposed CISF on the Waste Control Specialists controlled property.

The WCS CISF site was evaluated November 9, 2015 to November 10, 2015 by ISP joint venture member Waste Control Specialists using the BLM visual resource inventory process to determine the scenic quality of the site. The Waste Control Specialists site received a “C” rating and falls into Class IV. Refer to Table 4.9-1, Scenic Quality Inventory and Evaluation Chart.

The foreground and middle ground views are taken from locations less than 4.8 to 8 km (3 to 5 mi) from the CISF, with several mid-ground range photos just beyond the 8 km (5 mi) radius. This zone includes the road cut for Texas State Highway 176, which creates berms that intermittently obscure views beyond the roadway and then open up views to the various landfills in the vicinity and to the sole urbanized area of Eunice, approximately 8 km (5 mi) to the west of the CISF.

The background zone includes views from locations between 8 km (5 mi) and 16 km (10 mi) away (see photos 11 and 13 in Appendix C of Appendix A). These views are from generally flatter terrain allowing broader views across the landscape. These broader views take in oil-extraction structures (pump jacks, tanks, and fence lines) in the foreground and a combination of constructed landscape forms (e.g., landfill and extraction facility earth mound(s)) and naturally occurring swales). The seldom-seen views were from locations that are farther than 16 km (10 mi) away or otherwise hidden from view (see Photo 12 in Appendix C of Appendix A). The CISF is barely seen from this distance, with the most prominent features of the CISF (the red bed soil piles) hardly registering as more than an undulation in the horizon.

The local landscape is typified by cattle ranch land with gently undulating, brushy grassland broken by sporadic brush covered sand dunes that extend for many miles in all directions. The Mescalero escarpment, Monument Draw, Texas and Monument Draw, New Mexico are the only persistent geographic features in the area. The scenic quality is rather uniform topographically with few trees and topographic relief. Caliche service roads crisscross the landscape at random intervals. The Interstate electric transmission lines extend to the horizon to the north and the south while the local distribution lines service the industrial and cattle ranch infrastructure in the area. Within view of the facility, there is significant evidence of human development including a stone quarry, a hazardous waste and low-level radioactive waste landfill, a large power transmission substation, a county landfill, a uranium enrichment plant, and an aboveground oilfield waste disposal land farm.

Adjacent to the CISF to the west in New Mexico is a large uranium enrichment plant called the NEF, operated by URENCO. This facility was developed and constructed since the last visual resources inventory was conducted. This facility is the most substantial new structure on the visual landscape. The relationship of the CISF to other WCS operations and URENCO is shown in Figure C-1 in Appendix A. Photo locations are shown in Appendix A, Figure C-2 along with an 8 km (5 mi) radius and a 16 km (10 mi) radius around the CISF. The proposed CISF

activities would take place beyond the existing railroad spur on the Waste Control Specialists property, farthest from Texas State Highway 176 compared to other current activities at the CISF.

It was determined that the visual resources study area does not contain notable representations of any of the landscape features listed above, although the relative lack of visual obstructions to a vast view of this section of the west Texas/east New Mexico landscape could be considered the “visual character” of the area. With the exception of a roadside picnic area and historical marker, no recreational resources are identified in the immediate area of the site. Overall, the entire study area can be considered to have modest scenic quality that is pleasant to regard for its rural, undeveloped nature, but not dramatic, unique, or rare. Facilities geared towards resources extraction (the Lea County Landfill and oil well pump jacks) exist in the project area, in addition to the URENCO facility, all of which have an equal or higher impact on the visual landscape compared to the proposed CISF.

3.10 SOCIOECONOMICS

This section describes the current social and economic characteristics of the ROI surrounding the CISF *and describes ISP public outreach efforts to inform the communities and affected populations within the region of the proposed CISF about the storage and transportation of spent nuclear fuel*. Information is provided on population, including minority and low-income areas, economic trends, housing, and community services in the areas of education, health, public safety, and transportation.

The primary labor markets for the operation of the processing and storage facility will be Andrews County, Texas, and Lea County, New Mexico. The Andrews County seat is located in the City of Andrews, about 48 km (30 mi) east-southeast of the CISF. There are no population centers in Andrews County closer to the processing and storage facility. The surrounding area is very rural and semi-arid, with commerce in livestock production, agriculture (cotton, sorghum), and substantial oil and gas production, which represents most of the county’s wealth and income. Andrews County ranked sixth in oil producing counties in Texas in April 2014 (Railroad Commission of Texas 2015: http://www.rrc.state.tx.us/oil-gas/research-and-statistics/). Andrews County covers 3888 square km (1,501 square mi) and in 2010 its population density was 3.8 persons per square km (9.9 persons per square mi); this compares 37.2 persons per square km (96.3 persons per square mi) for Texas as a whole). Population projections are available from

the Texas Water Development Board for Texas counties from 2020 to 2070. In this 50-year timeframe, all Texas counties in the area of interest are expected to grow by varying degrees. Andrews is projected to grow by 107.3 percent, while Gaines is expected to grow by 120 percent

The City of Andrews has been in a period of large economic activity triggered by major industry investments, which have brought in hundreds of high-paying jobs and additional construction activity. Recent examples of new infrastructure and investments include (among others): the Performance Center, two new elementary schools, the City of Andrews Business and Technology Center, a Senior Citizens Activity Center, a new 90-bed Residential Care Facility, two new business parks (energy industry driven), the County Special Events Center, Andrews downtown streetscape improvements, and a new campus for the Permian Regional Medical Center. One library, two banks, three credit unions, and a biweekly newspaper serve the city of Andrews. Fraternal and civil organizations include the Lions Club, Rotary Club, United Way of Andrews, Knights of Columbus, and Girl Scouts of America. Local facilities serving the community of Andrews include 39 churches, a municipal swimming pool, a golf course, tennis courts, youth club/center/parks, and athletic fields.

The current socioeconomic conditions for Lea County are similar in most respects to Andrews County. Lea County is relatively large, covering 11,373 square km (4,391 square mi) in southeastern New Mexico. The county population density is 5.8 persons per square km (14.7 persons per square mi); this compares to 6.6 persons per square km (17 persons per square mi) for New Mexico as a whole. The Lea County community was initially agriculturally based, but the discovery of oil and gas in the mid-1920s has had a significant impact on the region. Today the county's agricultural heritage continues to have underlying influences on the county's development with farming and ranching. The oil and gas industry still has a strong effect on the local economy, in addition to a growing manufacturing sector. Five libraries, nine financial institutions, and two daily newspapers serve Lea County. Cities in Lea County that are within the ROI include Hobbs, Eunice, and Jal. In Lea County, there are five public school districts and four private schools. The closest school district is in Eunice, located 9.7 km (6 mi) to the west, with the other districts located in Hobbs, Jal, Lovington, and Tatum. The main campus of the University of the Southwest (USW) and New Mexico Junior College (NMJC) are located in and near Hobbs, New Mexico. NMJC's Training and Outreach Facility provides workforce training, online courses, and a center for legal studies.

There are two hospitals in Lea County, New Mexico. The Lea Regional Medical Center is located in Hobbs, New Mexico, about 32 km (20 mi) north of the CISF. In Lovington, New Mexico, 63 km (39 mi) north-northwest of the CISF, Covenant Medical Systems manages Nor-Lea Hospital, a 25-bed Medicare-certified Critical Access Hospital serving southeastern New Mexico.

Andrews County had a tax base (total certified net taxable value) in 2014 of over $7.2 billion dollars, a general fund tax rate of 0.2936 per $100, and a road and bridge tax rate of 0.0477 per $100 (Andrews County Appraisal District 2015). The county tax levy in 2014 for all funds amounted to almost $21,177,205. Total tax rates (per $100) in 2014 for jurisdictions within Andrews County Appraisal District include: Andrews Independent School District – a combined rate of $1.17000; City of Andrews - $0.18900; Andrews County - $0.2936; and, Andrews Hospital District - $0.29612 .

Finally, ISP has and continues to have strong community outreach to inform communities and affected populations within the region of the proposed CISF about the storage and transportation of spent nuclear fuel. ISP joint venture member Waste Control Specialists hosts regular tours for community members from Texas, New Mexico, and beyond. ISP provides a vast amount of information on their website in both English and Spanish to try and inform the public about the proposed facility. In addition, ISP launched a social media campaign to help educate the general public about radiation to include the storage and transportation of spent fuel. ISP joint members Waste Control Specialists and Orano both provide information on their websites about the WCS CISF. ISP and its joint venture members utilize the local media to keep the local communities updated on the license status and aspects of the project on a regular basis. ISP also participates in many industry conferences to inform not only the immediate area near the proposed facility but also the rest of the United States.

Additional information on socioeconomics can be found in the SIA provided in Appendix A .

3.11 PUBLIC AND OCCUPATIONAL HEALTH

This section describes existing public and occupational health issues that relate to the location and operations at the CISF. It begins with a description of the general radiological environment in the U.S., followed by a discussion of background levels and sources of radiation and historic exposures near the CISF. This section also presents public and occupational dose limits applicable to the CISF, and summarizes health effects studies related to the radiation exposure.

3.11.1 Radiological Environment

All members of the public are exposed to sources of ionizing radiation that occur naturally in the environment and as a result of human activities. Relative concentrations of radionuclides in different environmental media around the U.S. (e.g., air, soil, ground water) vary by geographic location.

Naturally occurring radionuclides in the environment are from two general sources, cosmogenic and primordial. Cosmogenic radionuclides are produced by interactions of cosmic radiation with atoms in the atmosphere or in the earth and include ^{3}H, ^{7}Be, ^{14}C, and ^{22}Na. Also, external radiation from space consists of solar energetic particles and cosmic rays . Primordial radionuclides are radionuclides that are found in the earth's soils and rocks and have been present since formation of the earth. Primordial radionuclides include those found in the decay series headed by ^{238}U (uranium series), ^{232}Th (thorium series), and ^{235}U (actinium series) . Radionuclides that are part of these series include ^{238}U, ^{234}Th, ^{234m}Pa, ^{234}U, ^{230}Th, ^{226}Ra, ^{222}Rn, ^{218}Po, ^{214}Pb, ^{214}Bi, ^{214}Po, ^{210}Pb, ^{210}Bi, ^{210}Po, and ^{206}Pb (uranium series); ^{232}Th, ^{228}Ra, ^{228}Ac, ^{220}Ra, ^{216}Po, ^{212}Pb, ^{212}Bi, ^{212}Po, ^{208}Th, and ^{208}Pb (thorium series); and ^{235}U (actinium series). Potassium-40 is a primordial radionuclide that is not part of a decay series.

Anthropogenic radionuclides (i.e., those resulting from human activities) occur in the environment as a result of atmospheric weapons testing, operations supporting the production of nuclear weapons, the nuclear fuel cycle for electricity generation, nuclear reactor accidents, and radionuclides used in medicine or research . Some important anthropogenic radionuclides are ^{137}Cs, ^{90}Sr, ^{60}Co, ^{99}Tc, ^{129}I, ^{131}I, ^{239}Pu, and ^{3}H.

Figure 3.11-1 shows the relative contributions of different classes of naturally occurring and anthropogenic radionuclides to the arithmetic mean total annual effective dose (ED) of 3.11 mSv (311 mrem) to the U.S. population . Isotopes of radon (primarily ^{222}Rn but also ^{220}Rn) contribute the largest percentage of the total dose, followed by primordial radionuclides, external radiation from space, and other sources (anthropogenic radionuclides).

Table 3.11-1, Detected concentrations of background radionuclides in samples collected in the vicinity of Waste Control Specialists during 2010 and 2011.

Sample Location	Sample type	Radionuclide	Min	Max	Mean	SD	Units	# samples
Note 1	Air	Cs-137	2.45E-04	1.19E-03	4.94E-04	2.07E-04	pCi/m3	18
	Air	GROSSA	4.36E-04	7.80E-03	1.68E-03	9.37E-04	pCi/m3	583
	Air	GROSSB	4.81E-04	3.67E-02	7.95E-03	3.33E-03	pCi/m3	624
	Air	K-40	1.78E-03	6.92E-03	3.64E-03	1.07E-03	pCi/m3	80
	Air	Pb-210	7.42E-04	1.23E-01	6.80E-03	6.21E-03	pCi/m3	759
	Air	Ra-226	2.44E-05	3.42E-03	1.47E-04	1.82E-04	pCi/m3	415
	Air	Ra-228	6.03E-05	4.93E-03	2.63E-04	4.46E-04	pCi/m3	270
	Air	Th-228	1.40E-05	2.43E-04	6.95E-05	2.96E-05	pCi/m3	265
	Air	Th-230	6.01E-06	2.93E-04	7.02E-05	3.23E-05	pCi/m3	354
	Air	Th-232	9.39E-06	2.51E-04	5.61E-05	2.67E-05	pCi/m3	325
	Air	Th-234	7.50E-03	9.53E-03	8.76E-03	1.10E-03	pCi/m3	3
	Air	U-233/234	5.49E-05	1.41E-03	1.54E-04	9.10E-05	pCi/m3	604
	Air	U-235/236	3.71E-06	7.29E-05	1.63E-05	1.04E-05	pCi/m3	135
	Air	U-238	3.84E-05	9.53E-03	1.94E-04	6.15E-04	pCi/m3	604

Sample Location	Sample type	Radionuclide	Min	Max	Mean	SD	Units	# samples
Note 2	Ground Water	GROSSA	1.36E+00	6.16E+01	1.15E+01	8.03E+00	pCi/L	677
	Ground Water	GROSSB	1.75E+00	1.12E+02	1.17E+01	1.02E+01	pCi/L	617
	Ground Water	K-40	4.08E+01	1.39E+02	8.56E+01	2.91E+01	pCi/L	9
	Ground Water	Pb-210	1.79E+00	6.42E+02	2.24E+01	9.45E+01	pCi/L	58
	Ground Water	Ra-226	1.25E-01	7.71E+00	5.93E-01	5.26E-01	pCi/L	567
	Ground Water	Ra-228	4.01E-01	4.16E+00	1.29E+00	6.28E-01	pCi/L	544
	Ground Water	Th-228	2.75E-02	2.03E-01	8.17E-02	3.89E-02	pCi/L	103
	Ground Water	Th-230	1.76E-02	3.07E-01	7.46E-02	4.35E-02	pCi/L	174
	Ground Water	Th-232	1.74E-02	1.36E-01	4.15E-02	2.45E-02	pCi/L	20
	Ground Water	Th-234	1.82E+02	1.82E+02	1.82E+02	NULL	pCi/L	1
	Ground Water	U-233/234	7.43E-02	3.73E+01	8.91E+00	6.95E+00	pCi/L	689
	Ground Water	U-235/236	4.23E-02	1.79E+00	2.97E-01	2.49E-01	pCi/L	415
	Ground Water	U-238	7.84E-02	1.82E+02	2.86E+00	7.43E+00	pCi/L	685
Note 3	Soil	Cs-137	1.29E-02	7.55E-01	1.07E-01	9.68E-02	pCi/g	441
	Soil	GROSSA	2.78E+00	2.27E+01	7.76E+00	2.90E+00	pCi/g	462
	Soil	GROSSB	3.14E+00	4.60E+01	1.28E+01	5.35E+00	pCi/g	489
	Soil	K-40	1.68E+00	1.89E+01	8.88E+00	3.24E+00	pCi/g	529

Sample Location	Sample type	Radionuclide	Min	Max	Mean	SD	Units	# samples
Note 3	Soil	Pb-210	1.92E-01	5.56E+00	1.17E+00	7.13E-01	pCi/g	355
	Soil	Ra-226	1.21E-01	1.29E+00	5.54E-01	1.79E-01	pCi/g	580
	Soil	Ra-228	1.07E-01	3.11E+00	6.35E-01	3.08E-01	pCi/g	628
	Soil	Th-228	2.06E-01	2.04E+00	6.85E-01	2.65E-01	pCi/g	293
	Soil	Th-230	1.21E-01	3.01E+00	6.72E-01	2.67E-01	pCi/g	890
	Soil	Th-232	1.73E-01	2.52E+00	6.53E-01	2.80E-01	pCi/g	376
	Soil	Th-234	1.48E-01	2.50E+00	7.49E-01	3.17E-01	pCi/g	275
	Soil	U-233/234	5.52E-02	1.09E+00	4.35E-01	1.64E-01	pCi/g	472
	Soil	U-235/236	1.63E-02	1.00E-01	4.55E-02	1.71E-02	pCi/g	133
	Soil	U-238	7.85E-02	2.50E+00	5.59E-01	2.73E-01	pCi/g	750

NOTES:

3. *Air Sample Locations are shown on Figure 4.12-7*
4. *Ground Water Sample Location are shown on Figure 4.12-8*
5. *Soil Sample Locations are shown on Figure 4.12-9*

3.11.1.1 Background Levels of Radiation at the CISF

ISP joint venture member Waste Control Specialists conducted pre-operational monitoring of the environment in 2010 and 2011 to develop a data set that could be used to characterize baseline levels of radiation and radioactivity prior to any LLRW disposal site operations, which began in 2012 . Pre-operational data, along with all subsequently collected data, are available through the RACER application. Available data for samples collected in 2010 and 2011 were obtained from the RACER database and are summarized in Table 3.11-1 to provide an indication of baseline radiological conditions in the vicinity of the Waste Control Specialists disposal facility. *Sample locations are shown on Figures 4.12-7, 4.12-8, and 4.12-9.* Table 3.11-1 shows the range of detected concentrations (min and max), along with the mean and standard deviation, for the background radionuclides expected to contribute most to radiation exposure in the CISF area. The CISF area is characterized as having relatively lower radon concentrations, consistent with other areas of Texas and the southwest U.S. and the levels of uranium and radium in the soil shown in Table 3.11-1 .

3.11.1.2 Current Radiation Sources and Exposure Levels at the CISF

Radiation sources at the CISF include the naturally occurring background radiation and the LLRW and uranium byproduct material waste that is received by the facility and prepared and stabilized for disposal. Natural background levels were discussed in the previous section. The CWF will accept only stabilized LLRW of Classes A, B, or C from commercial waste generators. Waste shipments are received in a variety of sealed containers such as 55-gallon drums, rectangular steel boxes, and shipping casks. Waste is stabilized before disposal in the facility using concrete containers and grout. The FWF also accepts Classes A, B, and C LLRW. The FWF allows for two different disposal methods, containerized waste and non-containerized waste in the In-Cell Non-Containerized Disposal Unit (IC NCDU). The containerized section of the FWF, similar to the CWF, grouts containerized waste in concrete canisters. The IC NCDU accepts federal Class A waste in larger volumes of bulk soil or soil-like debris, rubble, or a single uniform piece qualified for disposal under the facility's license. Waste packaging and stability requirements limit the amount of radionuclide particulates or gasses that may be suspended into the air during waste handling, including unloading of shipments, repackaging, and containerizing of waste for disposal. Thus, inhalation is not a large contributor to worker dose. Waste Control Specialists accepts remotely handled waste with exposure rates of up to

10 mR hr^{-1} at 2 m., workers in close proximity to this waste will incur external doses (Table 3.11-2).

Table 3.11-2, Summary of occupational exposures at Waste Control Specialists' existing facilities based on OSL measurements (mrem y^{-1})*

Year	Min[a]		Max		Mean	
	with zeroes	w/o zeroes	with zeroes	w/o zeroes	with zeroes	w/o zeroes
2010	0	1	22	22	1.8	5.5
2011	0	1	16	16	1.5	4.6
2012	0	0.2	393	393	50.6	66.2
2013	0	0.2	347	347	44.5	58.6
2014	0	0.1	884	884	58.3	78

[a] With zeroes = min and mean calculated using non-detect results (assumed to be zero), and w/o zeroes = min and mean calculated not using non-detect results.
*1mrem = 0.01mSv

Analysis of gross alpha and gross beta measurements for 2014 in ambient air environmental monitoring samplers showed that 13% of the gross alpha measurements and 28% of the gross beta measurements exceeded the pre-operational upper confidence level of 0.155 mBq m^{-3} (4.2 fCi m^{-3}) and 0.518 mBq (14 fCi m^{-3}), respectively. Of the samples that exceeded the preoperational levels, 1.6% of the gross alpha and 15% of the gross beta exceeded the background concentration measured at the same time at Station 9 (one of the background stations). Isotopic analysis indicated that most of the increase in activity concentration was from naturally occurring radionuclides presumably found in dust that was suspended during excavation activities. There was only one analytical result for an anthropogenic radionuclide (^{60}Co, 0.936 fCi m^{-3}), and that value exceeded the REMP investigation level of 0.266 fCi m^{-3}. This measurement occurred for the November 2014 monitoring period at Sampler 1, which is located south of the waste receiving facilities. However, subsequent data validation determined that this analytical result was a false positive, and not indicative of an IL exceedance.

External exposure to gamma rays and neutrons is the most significant pathway of exposure to workers. External dose to persons working onsite in 2014 as measured by OSLs ranged from 0 to 8.839 mSv (0 to 883.9 mrem) with the average of 0.5826 mSv (58.26 mrem) when OSLDs with zeros are included in the average, or 0.7799 mSv (77.99 mrem) when zeros are excluded from the average. Of the 166 OSLDs issued, 42 had readings of zero mSv. Because of distance and shielding, external exposure is not an important pathway of exposure to the public.

3.11.1.3 Historical Exposure to Radioactive Materials at the CISF

Both occupational and public external exposures at and around the CISF for the past five years are summarized in this section. These exposures are based on quarterly readings obtained from the thermoluminescent dosimeters (TLDs) and optically stimulated luminescent dosimeters (OSLs) worn by ISP joint venture member Waste Control Specialists site personnel and placed at various locations in the environment around the CISF. Table 3.11-2 summarizes occupational exposures for the past five years. Personnel exposures increased after operations began in 2012 because radioactive waste shipments for disposal commenced.

Table 3.11-3 summarizes environmental TLD and OSL measurements and calculated doses to the public for the past five years. *The sample locations are shown in Figure 4.12-10.* Background corrected doses are also shown based on subtraction of the pre-operational background dose as assumed by ISP joint venture member Waste Control Specialists as part of its annual REMP reporting (10 mrem). Averages including zero values (i.e., nondetects or values <= 0 after background subtraction) and excluding zero values are both shown. Doses measured during the pre-operational period of 2010–2011 are consistent with those measured during 2012–2014, and there is no evidence of an increase in external radiation exposure to the public after operations began in 2012. External radiation is not expected to be a significant source of exposure to members of the public due to distance and shielding from the materials managed at the CISF.

Table 3.11-3, Summary of environmental exposures at Waste Control Specialists' existing facilities based on TLD and OSL measurements (mean mrem y^{-1})[c]

Sample Location	Type	Year	Before background subtraction						After background subtraction					
			Annual total		Public dose (bounding)		Public dose (site-specific)		Annual total		Public dose (bounding)		Public dose (site-specific)	
			a	b	a	b	a	b	a	b	a	b	a	b
See Figure 4.12-10	OSLD	2010	8.7	8.7	2.0	2.0	0.4	0.4	2.1	7.1	0.5	1.6	0.1	0.4
	OSLD	2011	7.7	8.7	1.8	2.0	0.4	0.4	1.9	8.1	0.4	1.9	0.1	0.4
	OSLD	2012	6.7	9.1	1.5	2.1	0.3	0.5	2.0	8.6	0.5	2.0	0.1	0.4
	OSLD	2013	8.1	8.1	1.8	1.8	0.4	0.4	1.0	4.3	0.2	1.0	0.1	0.2
	OSLD	2014	7.3	11.3	1.7	2.6	0.4	0.6	2.4	9.2	0.5	2.1	0.1	0.5
	TLD	2010	16.8	16.8	3.8	3.8	0.8	0.8	7.2	9.0	1.6	2.1	0.4	0.5
	TLD	2011	16.3	16.3	3.7	3.7	0.8	0.8	6.9	8.6	1.6	2.0	0.3	0.4
	TLD	2012	12.2	12.2	2.8	2.8	0.6	0.6	4.2	7.9	1.0	1.8	0.2	0.4
	TLD	2013	6.1	6.1	1.4	1.4	0.3	0.3	1.0	3.8	0.2	0.9	0.0	0.2
	TLD	2014	14.7	14.7	3.4	3.4	0.7	0.7	7.4	12.1	1.7	2.8	0.4	0.6

a = with zero values included   b = without zero values included   c = 1mrem = 0.01mSv

ISP joint venture member Waste Control Specialists also estimates inhalation and immersion doses based on radionuclide releases from the Mixed Waste Treatment Facility stacks, the CWF Sampling Room Stack, and the FWF Sampling Room Stack and from meteorological information from the Midland/Odessa Airport. The maximum calculated effective dose equivalent[1] was 5.82×10^{-4}, 1.03×10^{-4}, and 1.74×10^{-5} mrem y^{-1} in 2012, 2013, and 2014, respectively .

3.11.2 Public and Occupational Dose Limits

This section provides the radiation standards and dose limits applicable to the CISF, describes occupational injury and fatality rates related to the CISF and summarizes health effects studies related to radiation exposure.

3.11.2.1 Applicable Standards and Dose Constraints

Radiation exposure limits for the workers and general public have been established by the NRC in 10 CFR Part 20 and by the EPA in 40 CFR Part 190. The NRC regulates the disposal of LLRW according to the rules in 10 CFR Part 61.

According to 10 CFR Part 20, the total effective dose equivalent (TEDE) to an individual member of the public from all licensed operations is not to exceed 1 mSv y^{-1} (100 mrem y^{-1}), excluding background radiation and medical exposure. The dose rate in any unrestricted area from external sources of radiation (excluding medical treatments) is not to exceed 0.02 mSv (2 mrem) in any one hour.

EPA standards for nuclear power generation (40 CFR Part 190) and treatment and management of spent nuclear fuel (40 CFR Part 191) are 0.25 mSv y^{-1} (25 mrem y^{-1}) dose equivalent to the whole body or any organ, and 0.75 mSv y^{-1} (75 mrem y^{-1}) to the thyroid.

Annual worker radiation dose standards in 10 CFR Part 20 are 50 mSv (5 rem) total effective dose equivalent, 0.5 Sv (50 rem) committed dose equivalent (CDE) to any organ, 0.15 Sv (15 rem) to the lens of the eye, 0.5 Sv (50 rem) to the skin, and 0.5 Sv (50 rem) to any extremity.

[1] The effective dose equivalent includes the 50-year committed effective dose equivalent (CEDE).

Annual public dose limits as given in 10 CFR Part 61 for the disposal of LLRW are 0.25 mSv (25 mrem) dose equivalent to the whole body, 0.75 mSv (75 mrem) dose equivalent to the thyroid, and 0.25 mSv (25 mrem) to any other organ. Radiation protection standards are summarized in Table 3.11-4.

Note that the units of the standards are different and reflect changes in the methods and terminology used to quantify radiation doses (Table 3.11-5). Radiation protection standards were originally written in terms of the terminology and quantities provided in the International Commission on Radiation Protection (ICRP) report 2 . Dose limits were based on the relative biological effect (RBE) dose to the whole body or critical organ. The RBE dose (termed dose or dose equivalent) is the absorbed dose (energy imparted per unit mass) times the RBE for radiation types. (RBE = 1 for gamma and beta emission, 20 for alpha particles, and 20 for recoil electrons). This dosimetry system is reflected in National Bureau of Standards Handbook (NBS) 69 that forms the basis for the current radionuclide drinking water standards in 40 CFR Part 191.

Table 3.11-4, Summary of radiation protection standards

Individual	Annual dose limit	Reference
Worker	50 mSv TEDE	10 CFR 20
	0.5 Sv CDE to any organ	10 CFR 20
	0.15 Sv DE lens of eye	10 CFR 20
	0.5 Sv DE skin	10 CFR 20
	0.5 Sv DE extremity	10 CFR 20
General Public	1 mSv TEDE all man-made sources	10 CFR 20
	0.02 mSv EDE in any 1-hour period	10 CFR 20
	0.25 mSv CDE whole body	40 CFR 190 and 10 CFR 61
	0.25 mSv CDE any organ	40 CFR 190 and 10 CFR 61
	0.75 mSv CDE thyroid	40 CFR 190 and 10 CFR 61
	0.25 mSv ED	Proposed 10 CFR 61 using current ICRP methodology and terminology

Table 3.11-5, Radiation dose quantities and terminology

Dose quantity	Reference documents
Dose equivalent (DE), whole body dose, critical organ dose	ICRP 2 (ICRP 1959), NBS Handbook 69 (NBS 1959)
Effective dose equivalent (EDE), committed effective dose equivalent (CEDE), committed dose equivalent (CDE), total effective dose equivalent (TEDE)	ICRP 30 (ICRP 1979, 1980, 1981), Federal Guidance Report 11 (EPA 1988), Federal Guidance Report 12 (EPA 1993)
Absorbed dose (D), Equivalent dose (H), Effective dose (ED)	ICRP 60 (1991) ICRP 72 (1996)

The ICRP revised and refined its dosimetry system in ICRP 26 and 30 and introduced the quantity *Effective Dose Equivalent* (EDE) and *Committed Effective Dose Equivalent* (CEDE) to replace the whole body and critical organ concept in ICRP 2 . The EDE is the sum of the organ dose equivalent from external sources times an organ-weighting factor. The CEDE is the sum of the organ dose equivalent from an intake of a radionuclide integrated out to 50 years times an organ-weighting factor. The total (EDE + CEDE) is termed the *Total Effective Dose Equivalent* (TEDE).

In ICRP 60 and 72, the terminology again changed . The TEDE is represented by the term *Effective Dose* (ED). Tissue and radiation weighting factors were also updated from ICRP 26/30.

ISP joint venture member Waste Control Specialists is regulated by TCEQ using the ICRP 26/30 methodology as implemented in Federal Guidance Report 11 and Federal Guidance Report 12 . Thus, the terms EDE, CEDE, and TEDE will be used to describe radiation doses.

3.11.2.2 Occupational Injury and Fatality Rates

Potential health impacts to workers during the construction and operation of the proposed CISF would be those normally associated with construction and industrial activities. The U.S. Bureau of Labor compiles annual data on nonfatal and fatal occupational injuries in various industries. Incidence rates of nonfatal occupational injuries in Texas are presented in Table 3.11-6 for 2009–2013 and fatal occupational injuries rates by industry in Texas are shown in Table 3.11-7.

A six-year safety summary for nonfatal injuries for ISP joint venture member Waste Control Specialists is presented in Table 3.11-8. When these rates are compared with other industries in Texas (Table 3.11-6), it is clear that ISP joint venture member Waste Control Specialists has a low incidence rate of nonfatal injuries. The days away from work rate (DART) at ISP joint venture member Waste Control Specialists in 2014 was 1.04 and 0.58 in 2013. For all industries in Texas in 2013, the DART was 1.4 (Table 3.11-6). ISP joint venture member Waste Control Specialists has had a good safety record since its operations began in 2012.

The Illness and Injury Surveillance Program, operated by the Oak Ridge Institute for Science and Education (ORISE) from 1990 through 2009, examined and analyzed the occupational health records of more than 125,000 workers at 14 participating DOE facilities . These analyses allowed DOE to assess the health of its workforce and identify groups that may be at increased risk of illness or injury. Injuries (those not the result of an occupational accident) were a leading cause of absence. Contractor service workers, line operators, and security and fire fighters had the highest rates of absence due to injuries.

The nonfatal occupational rate of injuries and illnesses among state and local government workers remains significantly higher than the private industry rate (Figure 3.11-2) .

Table 3.11-6, Incidence rates of nonfatal occupational injuries by industry in Texas[a]

Industry	2013	2012	2011	2010	2009
All industries	1.4	1.5	1.6	1.7	1.7
Agriculture-crop production	2.1	1.8	1.9	3.8	1.7
Agriculture-animal production	2.9	2.3	3.6	3.0	1.5
Construction	1.6	1.4	1.9	1.6	1.7
Mining (except oil & gas)	1.1[b]	1.2	1.3	0.9	1.3
Drilling (oil & gas)	1.0	0.8	0.6[c]	1.2	[d]

[a] Incidence rates represent the number of injuries and illnesses per 100 fulltime workers (working 40 hours per week, 50 weeks per year) reported as cases with days away from work, job transfer, or restriction rate (DART) (DOL 2013).

[b] Data for mining (Sector 21 in the *North American Industry Classification System*-U.S., 2007) include establishments not governed by the Mine Safety and Health Administration rules and reporting, such as those in oil and gas extraction and related support activities. Independent

mining contractors are excluded. These data do not reflect the changes the Occupational Safety and Health Administration made to its recordkeeping requirements effective January 1, 2002; therefore, estimates for these industries are not comparable to estimates in other industries.

[c] Oil and gas extraction.

[d] Not reported.

Table 3.11-7, Fatal occupational injuries rates by industry in Texas[a]

Industry	2013	2012	2011	2010	2009
All industries	4.4	4.8	4.0	4.4	4.6
Agriculture, forestry, fishing, and hunting	11.6	14.8	12.5	15.9	11.2
Construction	13.3	12.8	9.7	10.7	16.7
Mining	11.2	16.6	14.3	16.4	11.9
Manufacturing	2.3	2.1	2.6	2.6	2.8
Transportation and utilities	12.6	15.2	12.6	15.3	12.6

[a] From the U.S. DOL Bureau of Labor Statistics, in cooperation with state and federal agencies, Census of Fatal Occupational Injuries (http://www.bls.gov/iif/oshstate.htm#TX). The rate represents the number of fatal occupational injuries per 100,000 full-time equivalent workers and can be used to compare the risk among worker groups with varying employment levels.

Table 3.11-8, Waste Control Specialists worker safety statistics

Statistic	2014	2013	2012	2011	2010	2009
Hours worked	383,343	347,712	381,964	326,478	274,294	340,311
Recordable incidents	2	1	2	0	3	5
Days away / job transfer incidents	2	1	0	0	3	1
Total days away / job transfer days	132	35	66	0	114	1
Total recordable case rate (TRC)	1.04	0.58	1.05	0	2.19	2.94
Experience modifier rate (EMR)[a]	0.66	0.74	0.81	0.91	0.92	0.99
Days away from work rate (DART)	1.04	0.58	0	0	2.19	0.59

[a] Experience modifier rate (EMR) is a number used most commonly by insurance carriers to determine past and future risks. The lower the EMR, the lower the workers compensation premium; the higher the EMR, the higher the workers compensation premium.

3.11.3 Health Effects Studies

Knowledge of the effects of ionizing radiation comes primarily from studying groups of people who have received high doses. The risks associated with large doses of ionizing radiation like X-ray and gamma radiation are relatively well established and have been reported in numerous publications by national and international organizations . Epidemiology is the study of the distribution and causes of disease in humans. Some of the key epidemiological studies linking high doses of radiation with human cancer cover a long period beginning with Roentgen's discovery of X-rays in 1895 to the survivors of the atomic bombing of Hiroshima and Nagasaki, involving a population of 86,611 directly exposed at levels ranging up to more than 5,000 mSv (500 rem). From these data, ICRP and others estimate the fatal cancer risk as 5% per Sv exposure for a population of all ages—so one person in 100 exposed to 200 mSv (20 rem) could be expected to develop a fatal cancer some years later.

There are several studies of occupationally exposed persons, who generally receive low doses of ionizing radiation at low dose rates. For example, in the International Agency Research for Cancer 15-country study, average cumulative doses were 19.4 mSv (1940 mrem), and fewer than 5% of workers received cumulative doses exceeding 100 mSv (10 rem) . Radiation is a weak carcinogen, but undue exposure can certainly increase health risks. Radiation protection standards assume that any dose of radiation, no matter how small, involves a possible risk to human health. In 1990, the National Cancer Institute found no evidence of any increase in cancer mortality among people living near 62 major nuclear facilities . The overall relative risk of leukemia was higher before than after facilities began operating . An updated study of populations around nuclear facilities is currently being designed .

Radiation epidemiology has provided clear insights into radiation exposures and risks . A single radiation exposure can increase cancer risk for life and the young are more susceptible than the elderly. In utero, susceptibility to radiation-induced cancer is no greater than in early childhood, and females are more susceptible than males. Radiation cancer risks differ by organ and tissue and some sites have not seen a convincing increase after exposure. Radiation epidemiology is highly uncertain about low dose and low-dose rate risks. However, available scientific evidence

does not indicate any cancer risk or immediate effects at doses below 100 mSv (10 rem) per year. At low levels of exposure, the body's natural mechanisms repair radiation damage to cells soon after it occurs.

In the U.S., about 25% of the population dies from cancers each year from all causes, with smoking, dietary factors, genetic factors, and strong sunlight being among the main causes . The American Cancer Society reports that an estimated 115,730 new cancer cases were expected for the state of Texas in 2014, and more than 1.6 million new cases were expected for the entire U.S. during that time . Table 3.11-9 shows the cancer incidence rate for Texas and surrounding states for the period 2006–2010 for selected cancer sites.

The Texas Cancer Registry (TCR) is a statewide population-based registry that is the primary source of Texas cancer data. Texas Health Service Region 9 (HSR9) includes the WCS CISF and Andrews County, Texas. In 2014, the TCR estimated there would be 2,891 new cancer cases and 1,053 cancer deaths . A comparison of HSR9 and Texas for the period 2007–2011 shows similar cancer rates for the three leading body sites (Table 3.11-10).

Table 3.11-9, Incidence rates for selected cancers by state, 2006–2010[a]

All sites			**Lung**		**Breast**	**Prostate**	**Non-Hodgkins lymphoma**	
State	Male	Female	Male	Female	Female	Male	Male	Female
Texas	513.9	389.9	78.2	49.0	114.4	133.2	22.2	15.9
New Mexico	461.9	362.5	52.9	38.1	108.8	134.1	18.2	13.8
Oklahoma	552.2	422.0	96.1	62.7	121.7	148.4	22.4	17.1
Louisiana	603.4	413.6	99.6	57.7	119.7	169.3	24.5	16.5
Colorado	483.1	396.4	56.1	44.2	125.3	142.7	22.5	15.9

[a] From ACS 2014. Incidence rate per 100,000 age-adjusted to the 2000 U.S. standard population.

Table 3.11-10, Incidence Rates of Cancer in Andrews County Region (HSR9) and Texas 2007–2011

Rate per 100,000			Rate per 100,000		
Males	Region	State	Females	Region	State
All sites	497.1	504.6	All sites	378.9	387.1
Prostate	112.9	126.9	Breast	104.8	113.6
Lung	79.7	75.6	Lung	49.5	47.4
Colorectal	51.2	49.7	Colorectal	36.2	34.6

3.12 WASTE MANAGEMENT

Waste management for the CISF is divided into gaseous and liquid effluent, as well as solid waste. Descriptions of the sources and effluent systems for each of these waste streams are discussed in this section. *Waste volumes for CISF construction, operations (annual), and decommissioning life-cycle phases are provided in Tables 3.12-2, 3.12-3, and 3.12-4, respectively; lifetime cumulative waste volumes are provided in Table 3.12-5.* Disposal plans, waste minimization practices, and related environmental impacts are discussed in Section 4.13 of this report and Chapter 6 of the SAR.

3.12.1 Effluent Systems

Effluent systems are used to manage gaseous and liquid effluents to ensure that potential radiation doses to workers are compliant with the discharge limits specified in 10 CFR Part 20, maintain ALARA, and consistent with the philosophy of waste minimization, the term “waste” as used in this section refers to waste generated during operations at the CISF, and does not include SNF waste materials handled at the CISF.

These systems are described in more detail in Chapters 4 and 6 of the SAR.

3.12.1.1 Gaseous Effluents

Non-radiological air emissions would be generated primarily from diesel generators and engines used to provide electrical power and move equipment, including SNF, at the CISF. Non-

radiological emissions would be controlled in accordance with air quality standards and permits issued by the TCEQ.

Discrete or containerized gaseous wastes are not generated at the CISF. However, airborne particulate radioactivity may potentially be generated in the Transfer Facility. The potential emission sources include suspended radionuclide particulates attributable to contamination that could be present on the transportation casks received at the Transfer Facility and from potential leakage as a result of a failed seal. Only very low levels of airborne radioactivity are anticipated to be generated at CISF. Off-gas treatment and ventilation systems consisting of conventional HVAC in the Transfer Facility and a cask sampling system would be employed at the CISF. These systems would be employed to ensure that radiological air emissions from the CISF are well below the regulatory limits specified in 10 CFR 20, Appendix B and maintained ALARA.

These systems are described in detail in Chapters 4 and 6 of the SAR.

3.12.1.2 Liquid Effluents

There is the potential for non-radioactive wastewater effluents at the proposed CISF. There are no radioactive effluent releases associated with the proposed CISF.

3.12.1.2.1 Non-Radioactive Waste Water

Non-radioactive or conventional wastewater may potentially be generated at the CISF. Fire protection operations, building and equipment leakage, fuel tank leakage, equipment and floor washing, and general cleaning and equipment maintenance would generate wastewater. This wastewater may contain some or all of the following constituents.

- Suspended solids
- Dissolved solids
- Nutrients
- Acids and alkalis
- Heavy metals
- Fuel, oil, and grease

Only very low levels of the above constituents are expected in CISF conventional wastewater. The non-reactive liquid waste streams shall be managed and would potentially be released to the environment at the CISF only in accordance with federal and state requirements (e.g., a TPDES Permit issued by the TCEQ).

3.12.1.2.2 Sanitary Wastes

Sanitary wastes generated at the CISF include the effluents from facility drinking water fountains, water closets, lavatories, mop sinks, and other similar fixtures. Sanitary waste generated at the CISF would be transferred to aboveground holding tanks, prior to discharge in a permitted POTW.

3.12.1.3 Solid Wastes

LLRW*, hazardous,* and non-radioactive solid waste may be generated at the CISF. Mixed waste is not expected to be generated at the CISF.

3.12.1.3.1 Solid Low-Level Radioactive Waste

The CISF would be designed, and procedures developed, to minimize the volumes of solid LLRW generated at the CISF in accordance with 10 CFR 20.1406, *Minimization of Contamination*, and 10 CFR 72.130, *Criteria for Decommissioning*.

Solid radioactive wastes may be generated at the CISF as a result of cask contamination surveillance and decontamination activities. These wastes generally consist of paper or cloth swipes, paper towels, protective clothing, and other job control wastes contaminated with low levels of radioactivity. Expended HEPA filters from the transfer facility ventilation system along with job control waste associated with filter change-out, also may contribute to the generation of solid radioactive waste. Job control waste generated during filter change-out is collected and monitored along with other low-level wastes for off-site processing.

Solid radioactive wastes would be collected in containers and temporarily stored in the transfer facility. Small volumes of solid radioactive wastes are anticipated. These low activity wastes would be disposed of at Waste Control Specialists' permitted or licensed disposal facility. *A likely location for the low activity wastes would be the WCS Low-Level Radioactive Waste (LLRW) facility's Compact Waste Facility (CWF). This disposal facility, which opened in 2011, is currently in the first of nine planned phases of operation. The facility is licensed to dispose of 9,000,000 cubic feet of waste in its lifetime and its remaining disposal capacity is sufficient for the expected life of the CISF.*

3.12.1.3.2 Non-Radioactive Solid Waste

Solid non-radioactive waste may also be generated at the CISF. The majority of the solid non-radioactive waste is expected to be generated during fabrication of some of the SNF storage systems. Approximately 3,200 storage systems would be fabricated to store 40,000 MTUs of SNF and related GTCC waste over 20 years. However, some storage systems would be fabricated offsite, but assembled at the CISF.

Other non-radioactive solid wastes are expected to be generated as a result of routine maintenance, operations, and administrative support functions at the CISF. Prior to releasing solid materials for unrestricted release, radiological surveys would be conducted to ensure that any potential levels of radioactivity are below the limits specified in *Table 3.12-1. The release levels provided in Table 3.12-1 are taken from Table R.3 of NUREG-1556, Volume 9 and Table 2 of NRC Regulatory Guide 8.30. These limits are also consistent with 30 Texas Administrative Code 336.364 Appendix G.*

Non-radiological solid waste would be disposed of at a solid waste municipal landfill. *The Lea County Landfill near Euncie, NM would be the first option for non-radioactive and non-hazardous waste disposal. The facility was permitted in 1998 and has planned life of 80 years. The remaining capacity is sufficient for the expected life of the CISF.*

3.12.1.3.3 Hazardous and Mixed Waste

Mixed waste is not expected to be generated at the CISF. Hazardous waste potentially generated at the facility will be limited to small quantities as described in Section 1.3.2.4.

Hazardous waste generated by the CISF would be sent to the WCS Resource Conservation and Recovery Act (RCRA) Subtitle C Landfill. This landfill, which opened in 1995, is currently at approximately 32% of its permitted capacity of 62,370,000 cubic feet of waste. The remaining disposal capacity is sufficient for the expected life of the CISF.

Table* 3.12-1, *Acceptable Surface Contamination Levels for Uncontrolled Release of Material

NUCLIDE [a]	*AVERAGE* [b c]	*MAXIMUM* [b d]	*REMOVABLE* [b e]	*REFERENCE*
U-nat, U-235, U-238, and associated decay products	*5,000 dpm α / 100 cm^2*	*15,000 dpm α / 100 cm^2*	*1,000 dpm α / 100 cm^2*	*Table 2 of RG 8.30 (Revision 1)*
Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129	*100 dpm / 100 cm^2*	*300 dpm / 100 cm^2*	*20 dpm / 100 cm^2*	*Table R.3 of NUREG-1556, Volume 9 (Revision 2)*
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	*1,000 dpm / 100 cm^2*	*3,000 dpm / 100 cm^2*	*200 dpm / 100 cm^2*	*Table R.3 of NUREG-1556, Volume 9 (Revision 2)*
Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except Sr-90 and other noted above.	*5,000 dpm β-γ / 100 cm^2*	*15,000 dpm β-γ / 100 cm^2*	*1,000 dpm β-γ / 100 cm^2*	*Table R.3 of NUREG-1556, Volume 9 (Revision 2)*

NOTES:

a. *Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.*

b. *As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.*

c. *Measurements of average contaminate should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.*

d. *The maximum contamination level applies to an area of not more than 100 cm^2.*

e. *The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.*

Table** 3.12-2, **Estimated Initial Construction Waste Volume

Initial Construction Activity	***Non-Hazardous Solid Waste (tons)***	***Solid Low-Level Radioactive Waste (tons)***	***Hazardous Solid Waste (tons)***	***Sanitary Waste Water (gallons)***
Storage Pad Construction	*560*	*0*	*0.25*	
Storage Module Construction	*0*	*0*	*0*	
Building Construction	*47*	*0*	*0.33*	
Site Preparation, Fence, Admin, Finish Work, Rail Construction	*106*	*0*	*0.75*	
TOTAL	***713***	***0***	***1.33***	***450,000***

Table** 3.12-3, **Estimated Annual Operational Waste Volume

Annual Operations Activity	***Non-Hazardous Solid Waste (tons)***	***Solid Low-Level Radioactive Waste (tons)***	***Hazardous Solid Waste (tons)***	***Sanitary Waste Water (gallons)***
Standard Operations and Admin	*53*	*1.33*	*1.33*	
Storage Module Construction (160 per year average)	*2,336*	*0*	*0*	
Expansion (Storage Pads, Fence line, etc.) [1]	*232*	*0*	*0*	
TOTAL	***2,621***	***1.33***	***1.33***	***185,000***

Note:

1. *Averaged out per year*

Table 3.12-4, Estimated Decommissioning Waste Volume

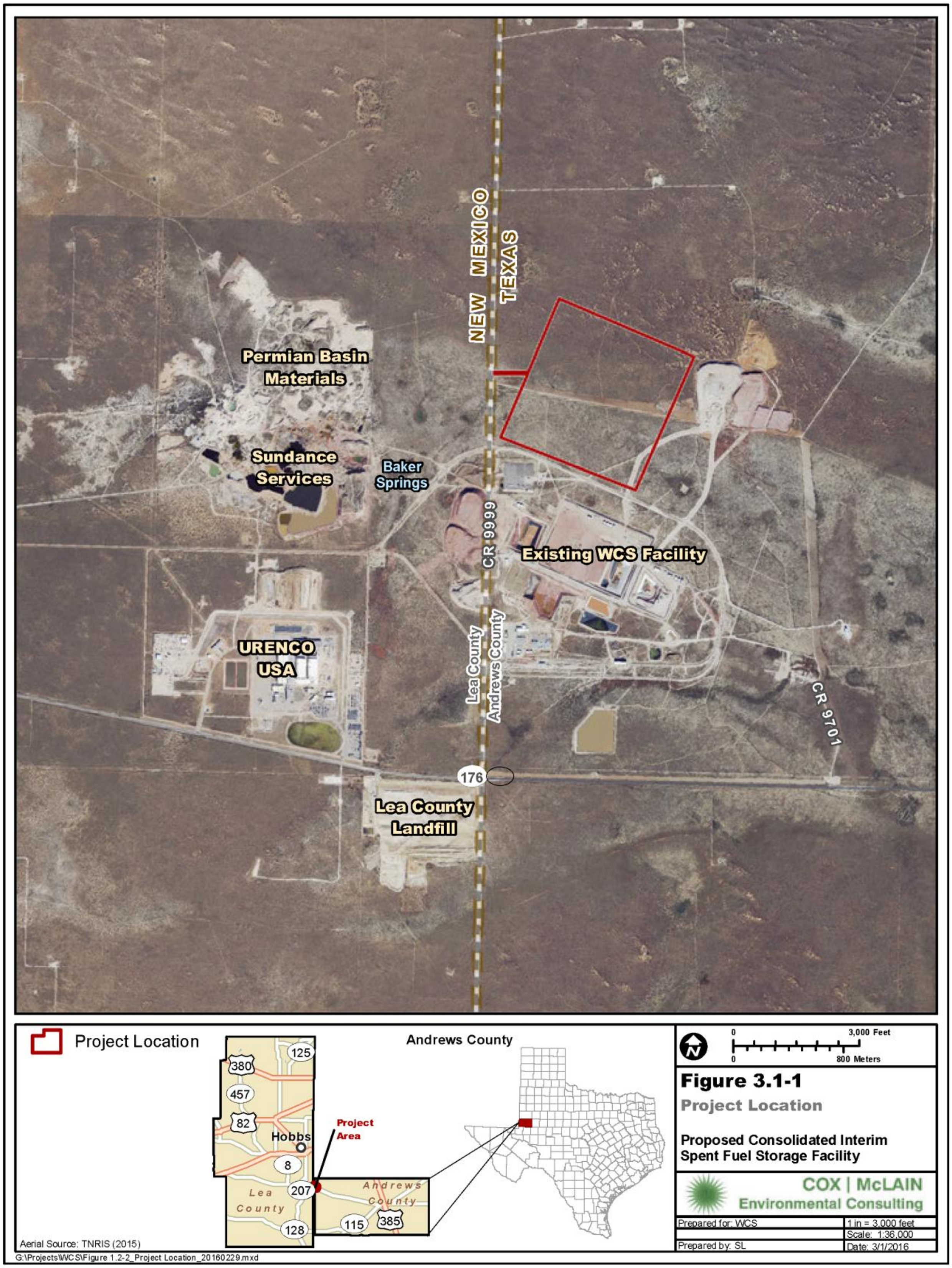
Decommissioning Activity	*Non-Hazardous Solid Waste (tons)*	*Solid Low-Level Radioactive Waste (tons)*	*Hazardous Solid Waste (tons)*	*Sanitary Waste Water (gallons)*
Survey, Decontamination, and Admin	*33*	*98.34* [1]	*1.0*	
Building Cleanout	*47*	*0*	*0.33*	
TOTAL	***80***	***98.34***	***1.33***	***190,000***

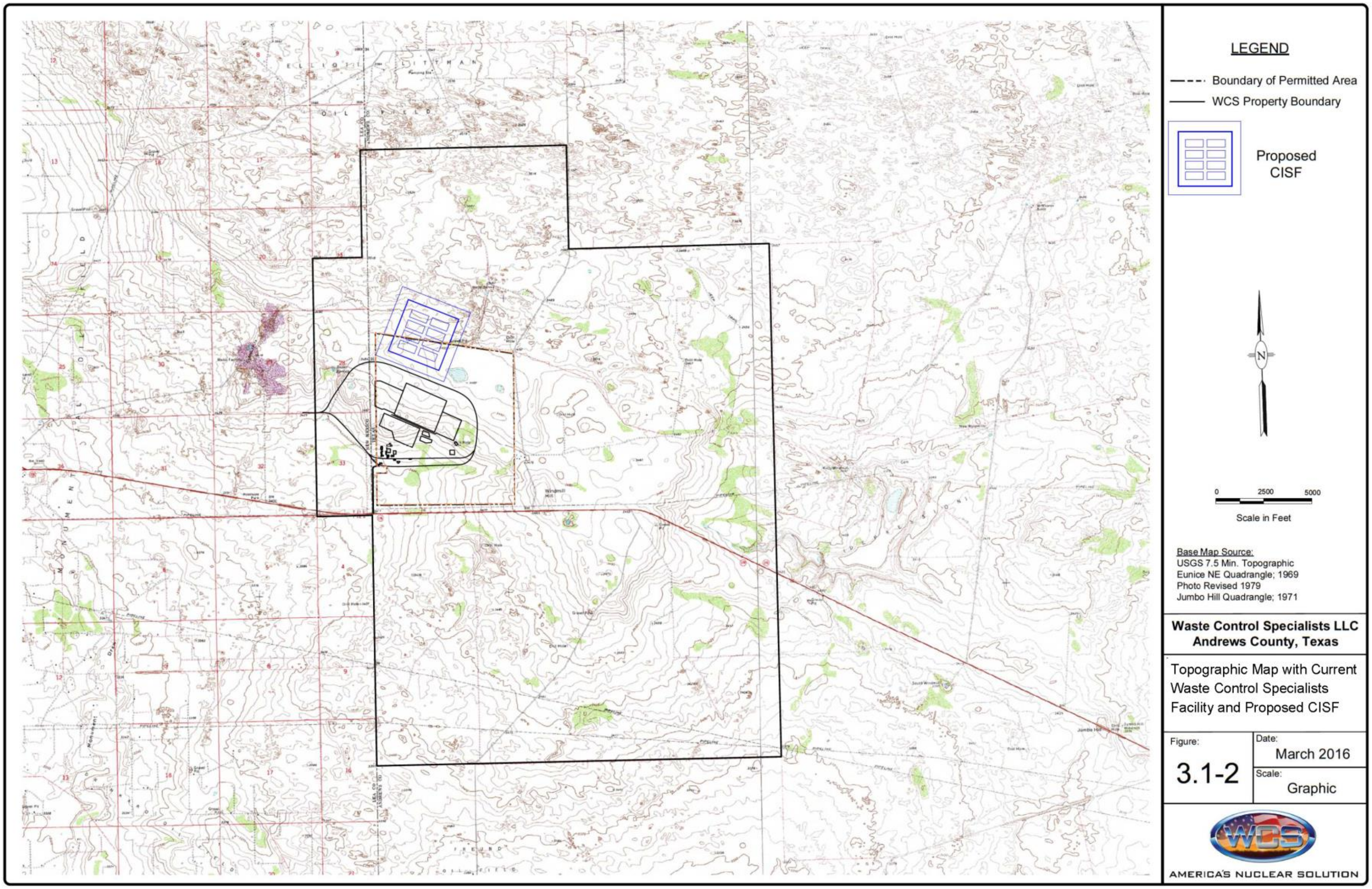
Note:

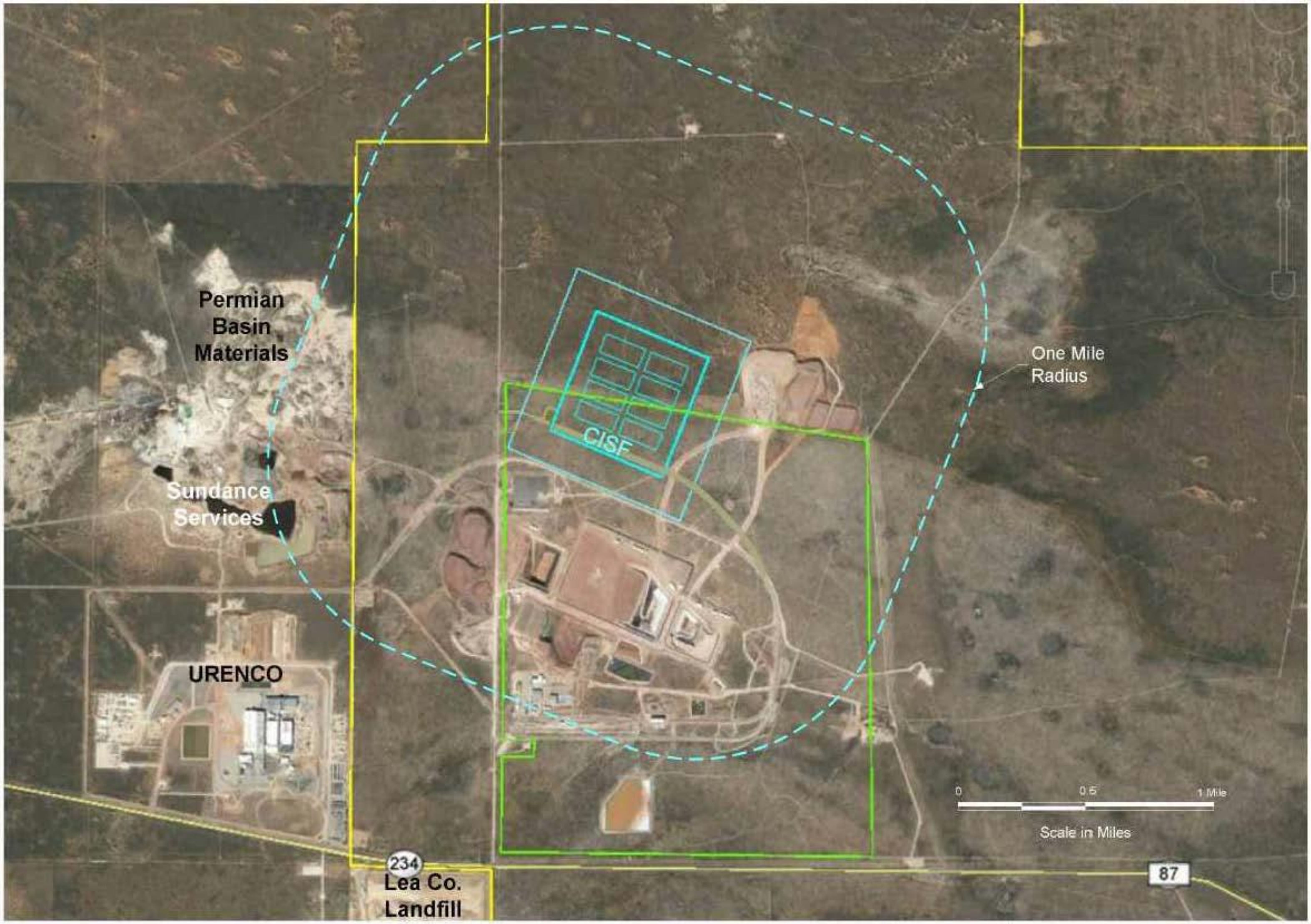
1. *Based on the Decommissioning Plan estimate of 60.7 cubic yards and an assumed density of 120 pounds per cubic foot.*

Table 3.12-5, Estimated Cumulative Waste Volume

CISF Facility Phase	*Non-Hazardous Solid Waste (tons)*	*Solid Low-Level Radioactive Waste (tons)*	*Hazardous Solid Waste (tons)*	*Sanitary Waste Water (gallons)*
Initial Construction	*713*	*0*	*1.33*	*450,000*
Operation (20 years)	*52,420*	*26.6*	*26.6*	*3,700,000*
Decommissioning	*80*	*98.34*	*1.33*	*190,000*
TOTAL	***53,213***	***124.94***	***29.26***	***4,340,000***


NEW MEXICO
TEXAS
Permian Basin Materials
Sundance Services
Baker Springs
Existing WCS Facility
CR 9999
URENCO USA
Lea County
Andrews County
CR 9701
176
Lea County Landfill
Project Location
Andrews County
125
380
457
82
Hobbs
8
207
128
Lea County
Project Area
Andrews County
115
385
0
3,000 Feet
800 Meters
Figure 3.1-1
Project Location
Proposed Consolidated Interim Spent Fuel Storage Facility
COX | McLAIN Environmental Consulting
Prepared for: WCS
Prepared by: SL
1 in = 3,000 feet
Scale: 1:36,000
Date: 3/1/2016
Aerial Source: TNRIS (2015)
G:\Projects\WCS\Figure 1.2-2_Project Location_20160229.mxd


LEGEND
Boundary of Permitted Area
WCS Property Boundary
Proposed CISF
N
0 2500 5000
Scale in Feet
Base Map Source:
USGS 7.5 Min. Topographic
Eunice NE Quadrangle; 1969
Photo Revised 1979
Jumbo Hill Quadrangle; 1971
Waste Control Specialists LLC
Andrews County, Texas
Topographic Map with Current Waste Control Specialists Facility and Proposed CISF
Figure:
3.1-2
Date:
March 2016
Scale:
Graphic
AMERICA'S NUCLEAR SOLUTION



Title: Proposed CISF 1-mile Radius	Figure: 3.1-3	Date: Feb 2016 Scale: Graphic

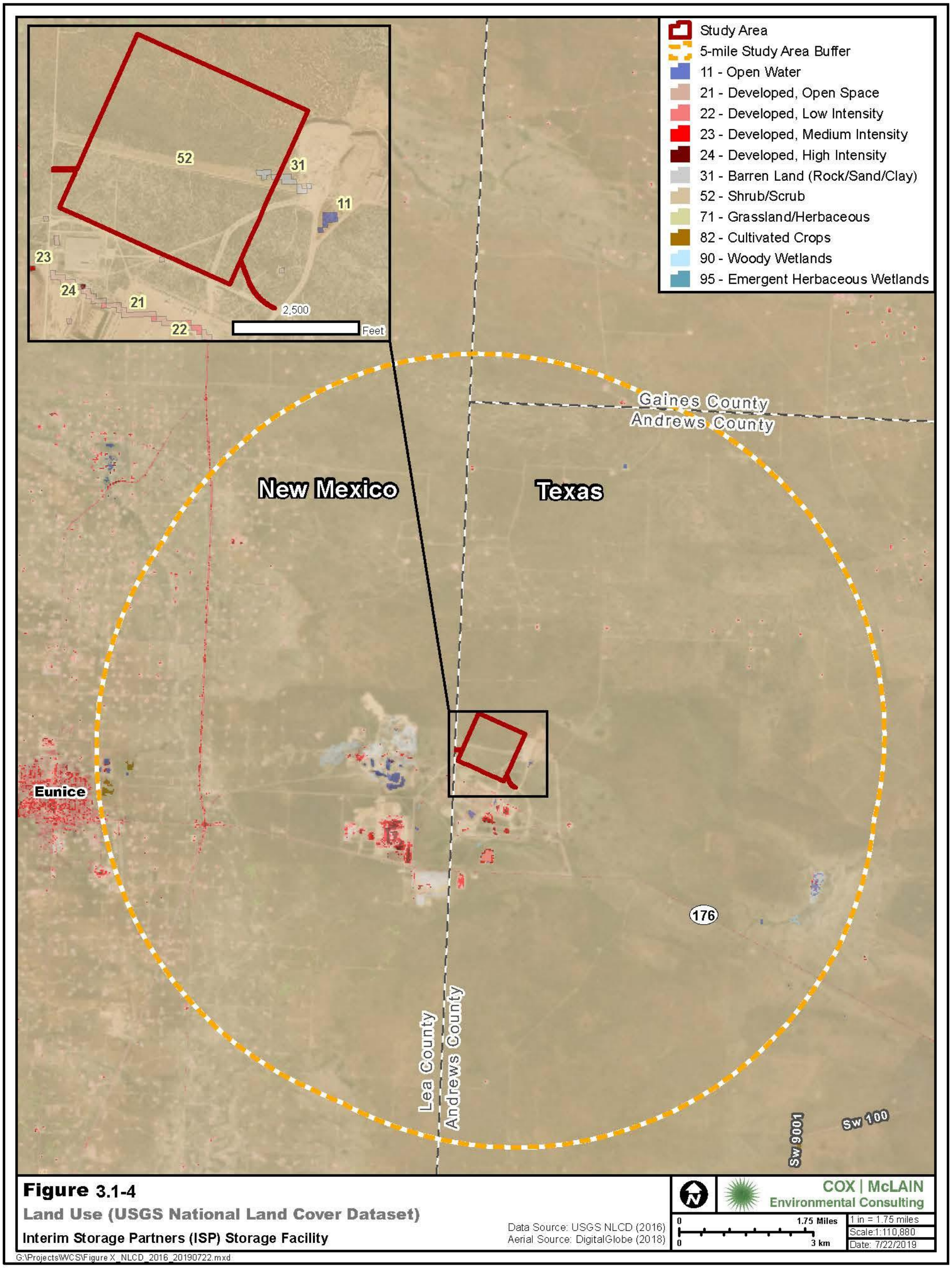
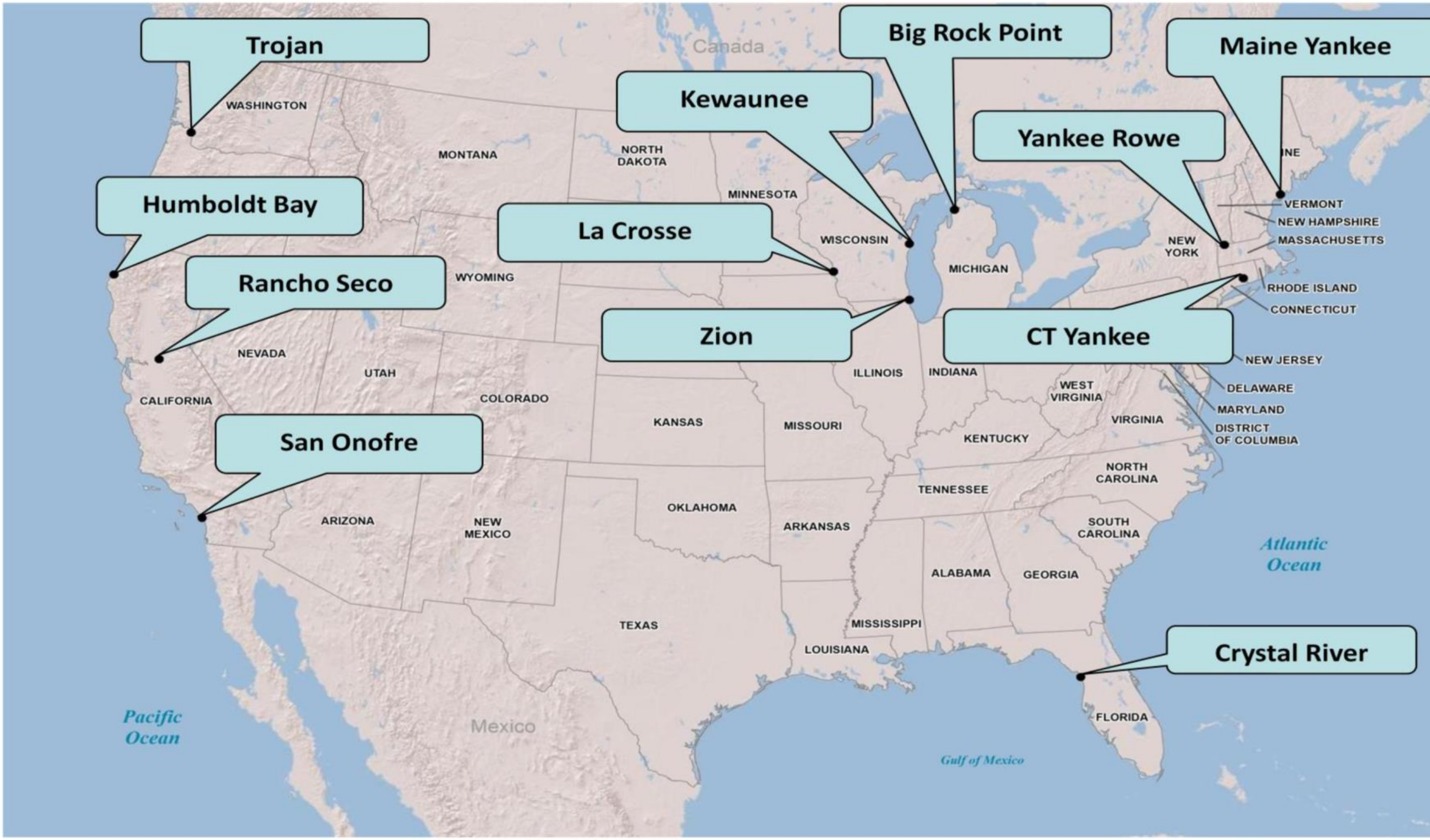


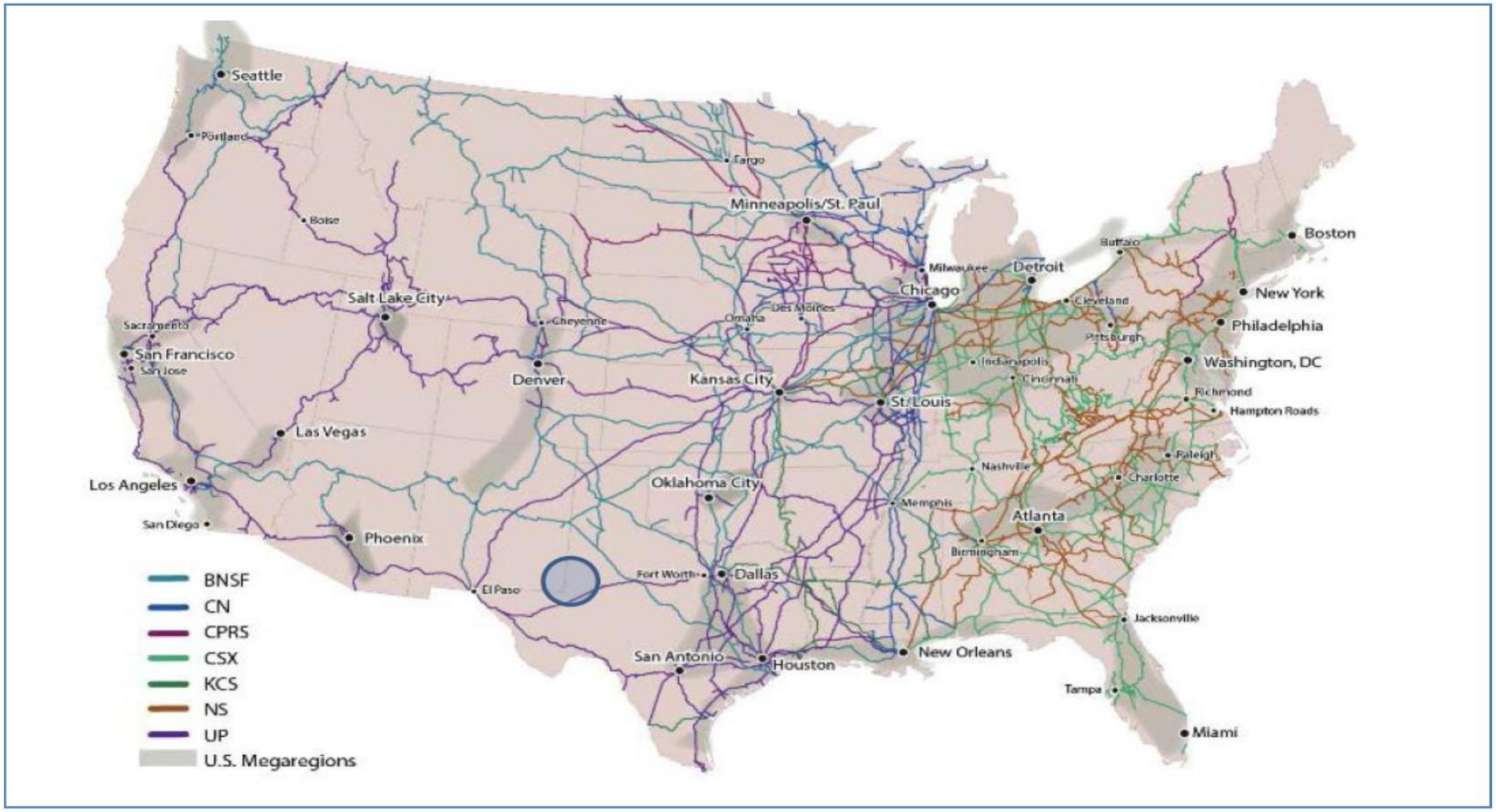
Figure 3.1-4
Land Use (USGS National Land Cover Dataset)
Interim Storage Partners (ISP) Storage Facility

Proprietary Information on Pages 3-96 through 3-99
Withheld Pursuant to 10 CFR 2.390



Title:	Figure:	Date:
DECOMMISSIONED REACTOR SITES LOCATION MAP	3.2-1	11/16/2015
		Scale: NONE

WCS ANDREWS, TEXAS



Title:	Figure:	Date:	
RAIL LINES MAP	3.2-2	11/16/2015	WCS ANDREWS, TEXAS
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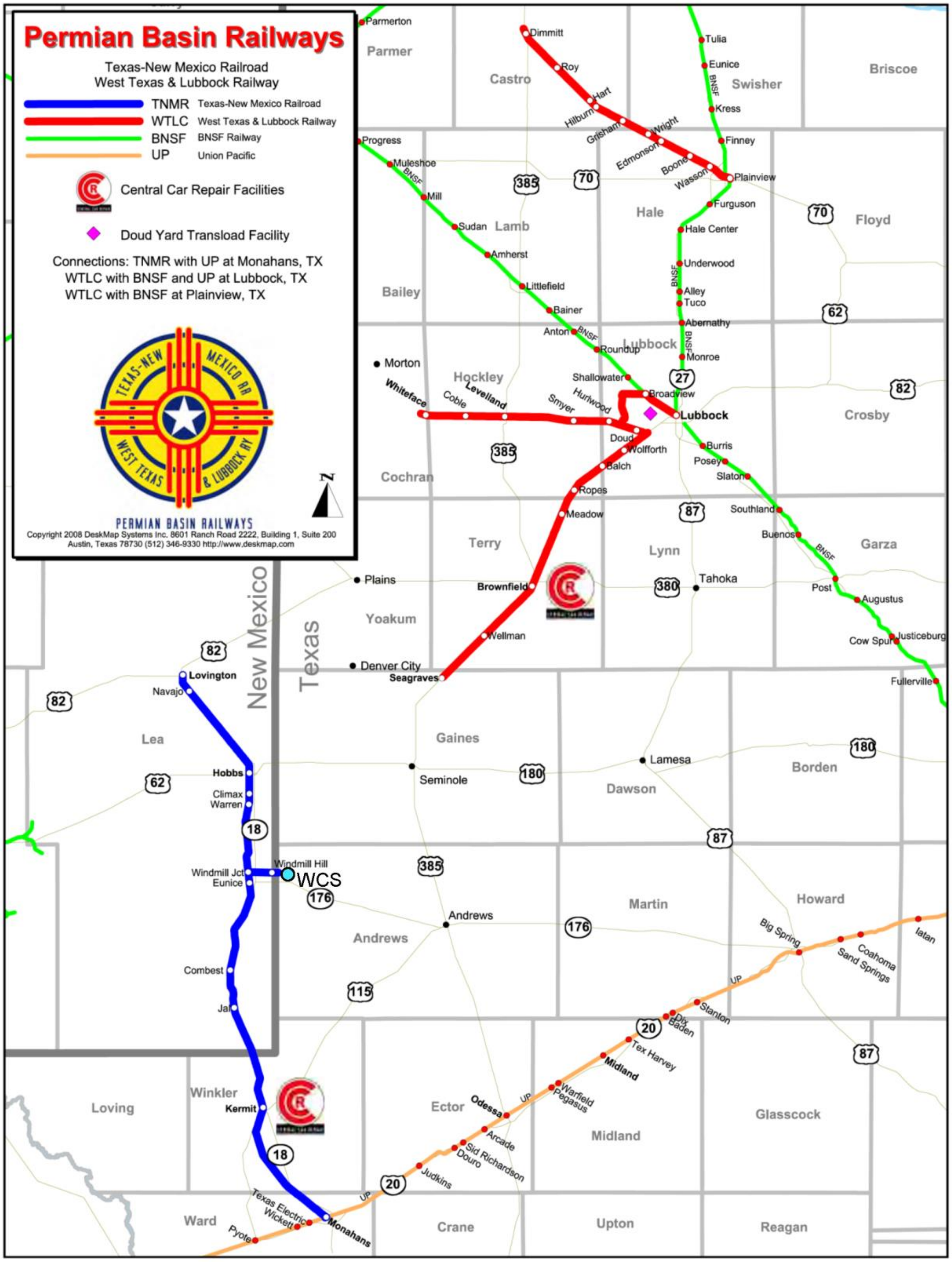


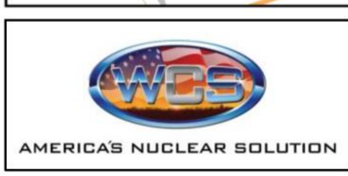
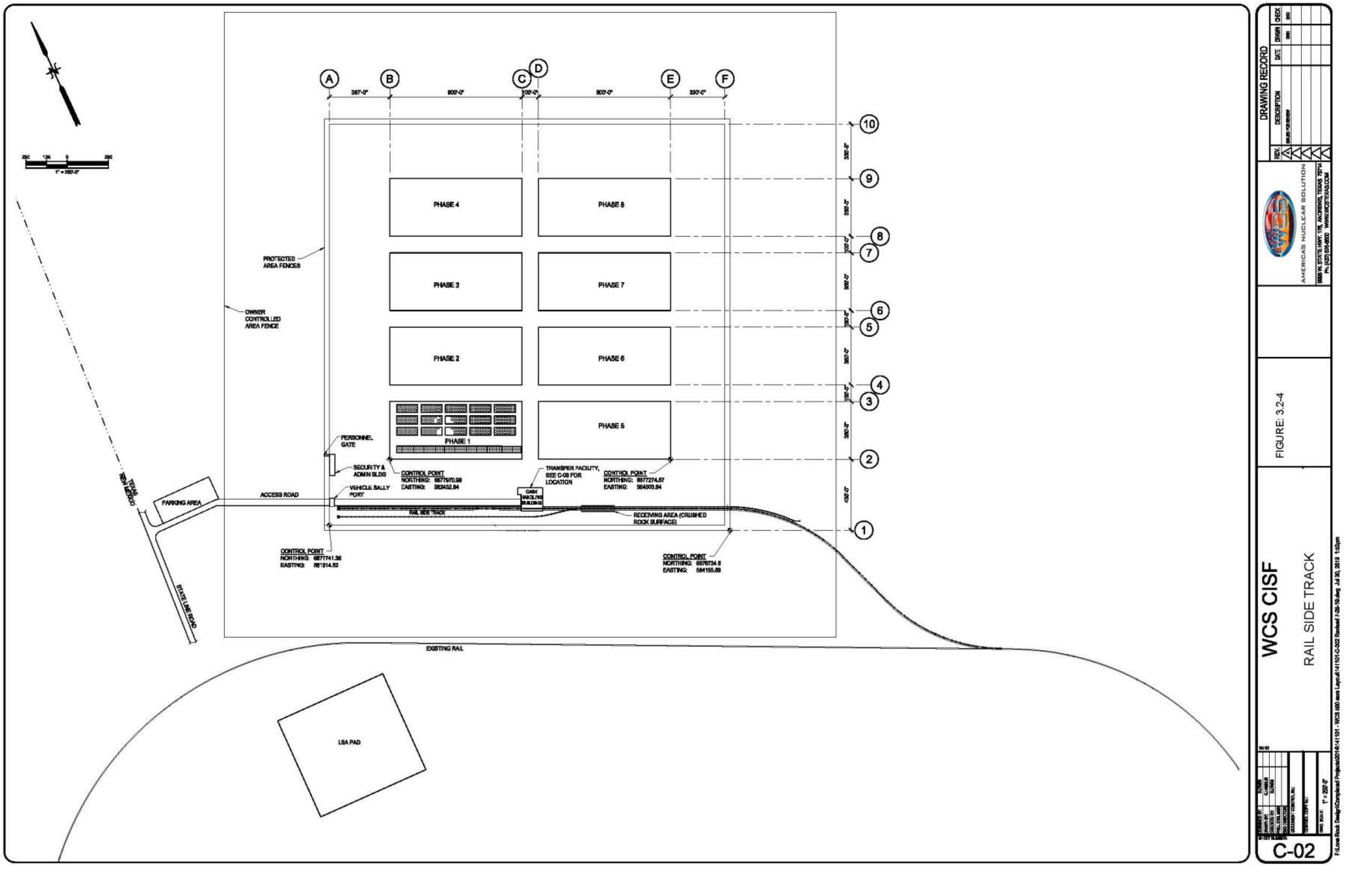


Figure 3.2-3
Rail Corridor


A
B
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10
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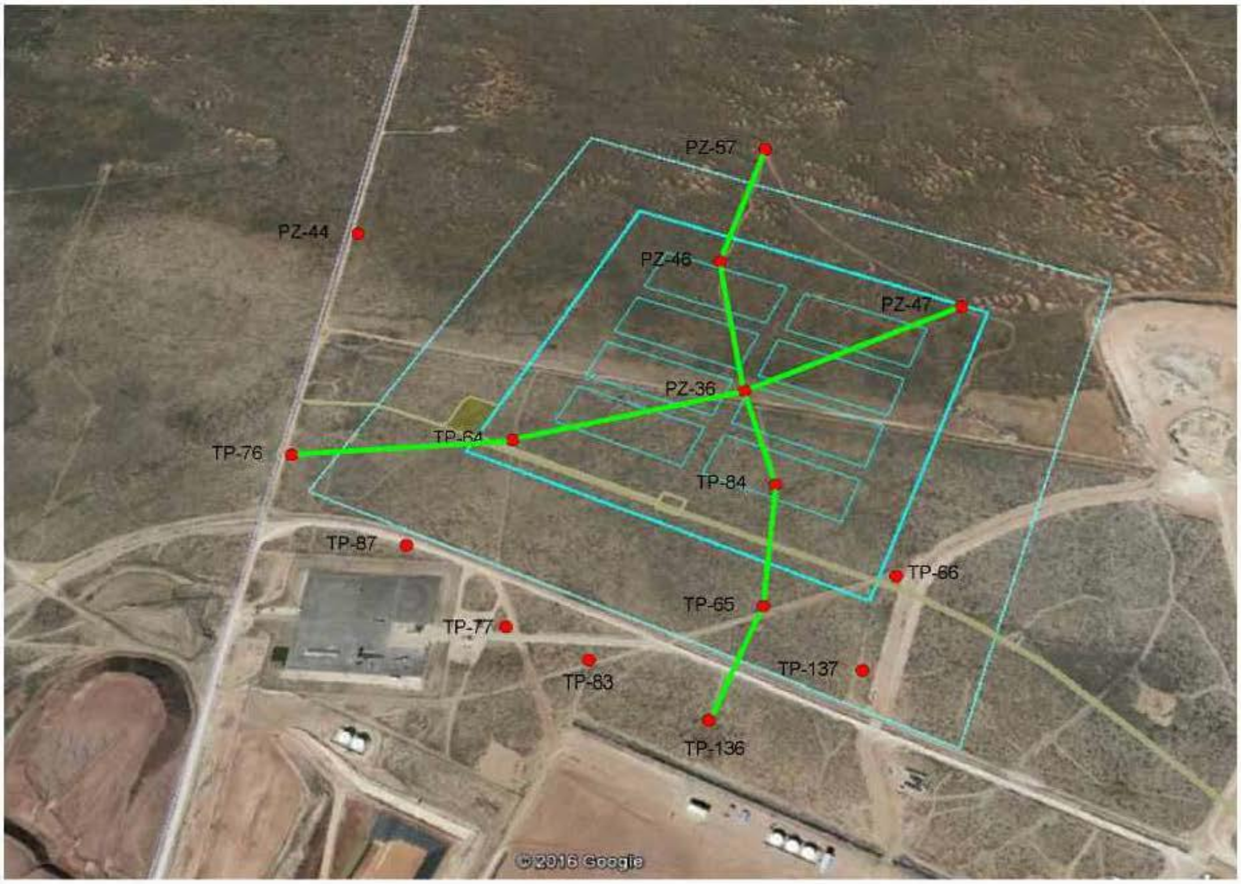
8
7
6
5
4
3
2
1
PHASE 4
PHASE 8
PHASE 3
PHASE 7
PHASE 2
PHASE 6
PHASE 1
PHASE 5
PROTECTED AREA FENCES
OWNER CONTROLLED AREA FENCE
PERSONNEL GATE
SECURITY & ADMIN BLDG
VEHICLE SALLY PORT
CONTROL POINT
ACCESS ROAD
PARKING AREA
RAIL SIDE TRACK
RECEIVING AREA (CRUSHED ROCK SURFACE)
STATE LINE ROAD
EXISTING RAIL
LSA PAD
DRAWING RECORD
AMERICA'S NUCLEAR SOLUTION
FIGURE: 3.2-4
WCS CISF
RAIL SIDE TRACK
C-02



Monitoring Well/ Piezometer Name	Date Drilled/ Completed	Total Depth Well (ft btoc)	Bottom of Well Elevation (ft msl)	Ground Elevation (ft msl)	Top of Casing Elevation (ft msl)	Depth to Top of Red Beds (ft bgs)	Top of Red Bed Elevation (ft msl)
PZ-36	7/20/05	78.98	3419.51	3494.79	3498.49	75.0	3419.79
PZ-44	1/22/08	82.98	3416.90	3496.59	3499.88	77.1	3419.49
PZ-46	1/23/08	93.83	3412.04	3502.38	3505.87	87.4	3414.98
PZ-47	1/24/08	92.22	3411.56	3500.60	3503.78	87.0	3413.60
PZ-57	1/23/08	99.56	3415.44	3511.79	3515.00	93.5	3418.29
TP-64	1/11/08	70.81	3433.99	3502.08	3504.80	65.3	3436.78
TP-65	1/11/08	57.68	3436.07	3490.40	3493.75	52.5	3437.90
TP-66	1/10/08	57.78	3430.88	3485.45	3488.66	51.0	3434.45
TP-76	2/7/08	53.42	3436.78	3487.06	3490.20	47.1	3439.96
TP-77	2/7/08	51.30	3436.09	3484.19	3487.39	45.4	3438.79
TP-83	2/11/08	55.55	3435.60	3487.77	3491.15	49.8	3437.97
TP-84	2/12/08	65.24	3429.59	3491.56	3494.83	58.7	3432.86
TP-87	3/15/08	49.02	3438.47	3484.17	3487.49	43.3	3440.87
TP-136	3/20/09	55.21	3438.01	3490.17	3493.22	50.5	3439.67
TP-137	3/20/09	56.46	3434.68	3488.00	3491.14	51.5	3436.50

AMERICA'S NUCLEAR SOLUTION

Figure 3.3-1
Location of Cross-Sections

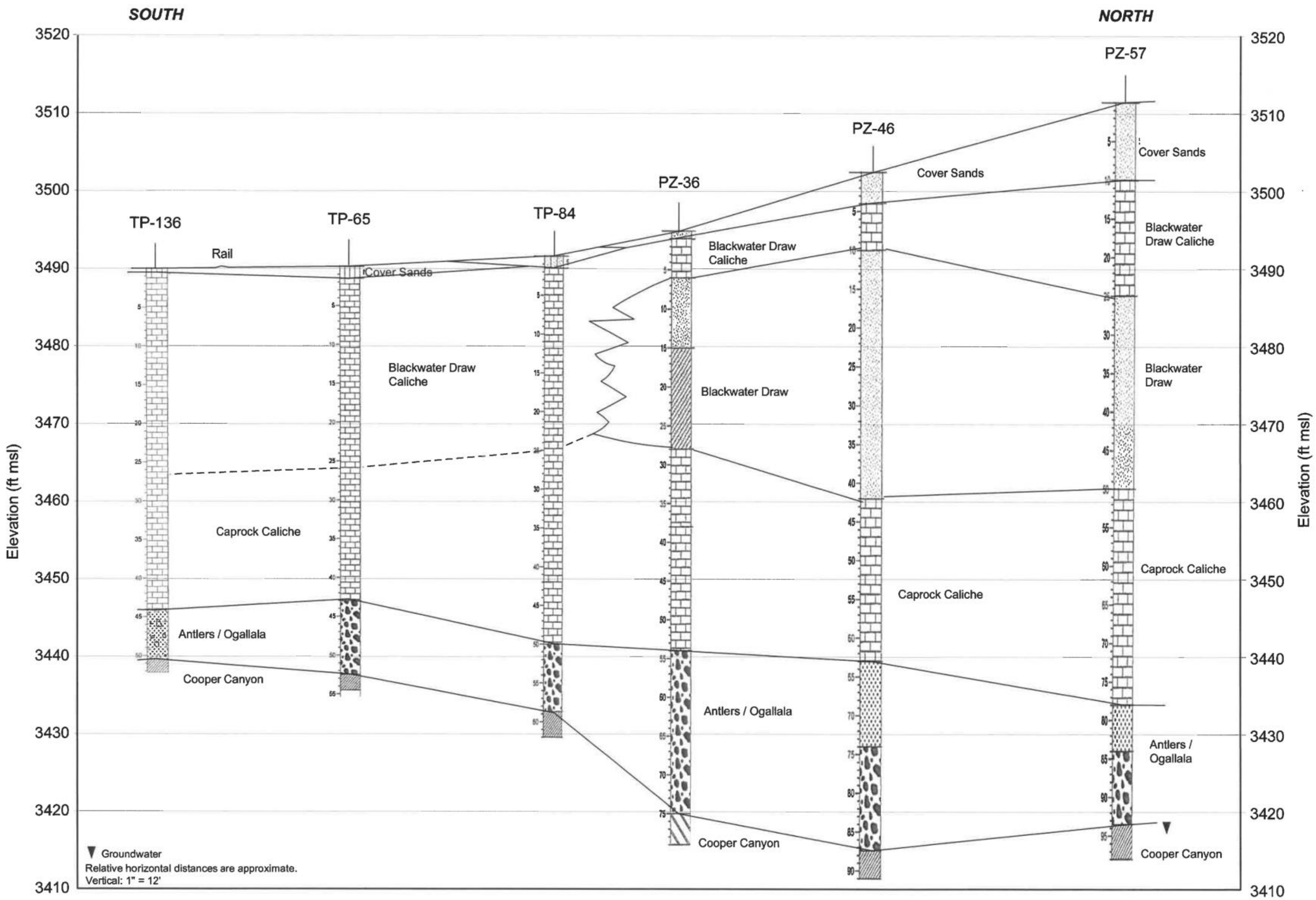


Figure 3.3-2 Cross Sections

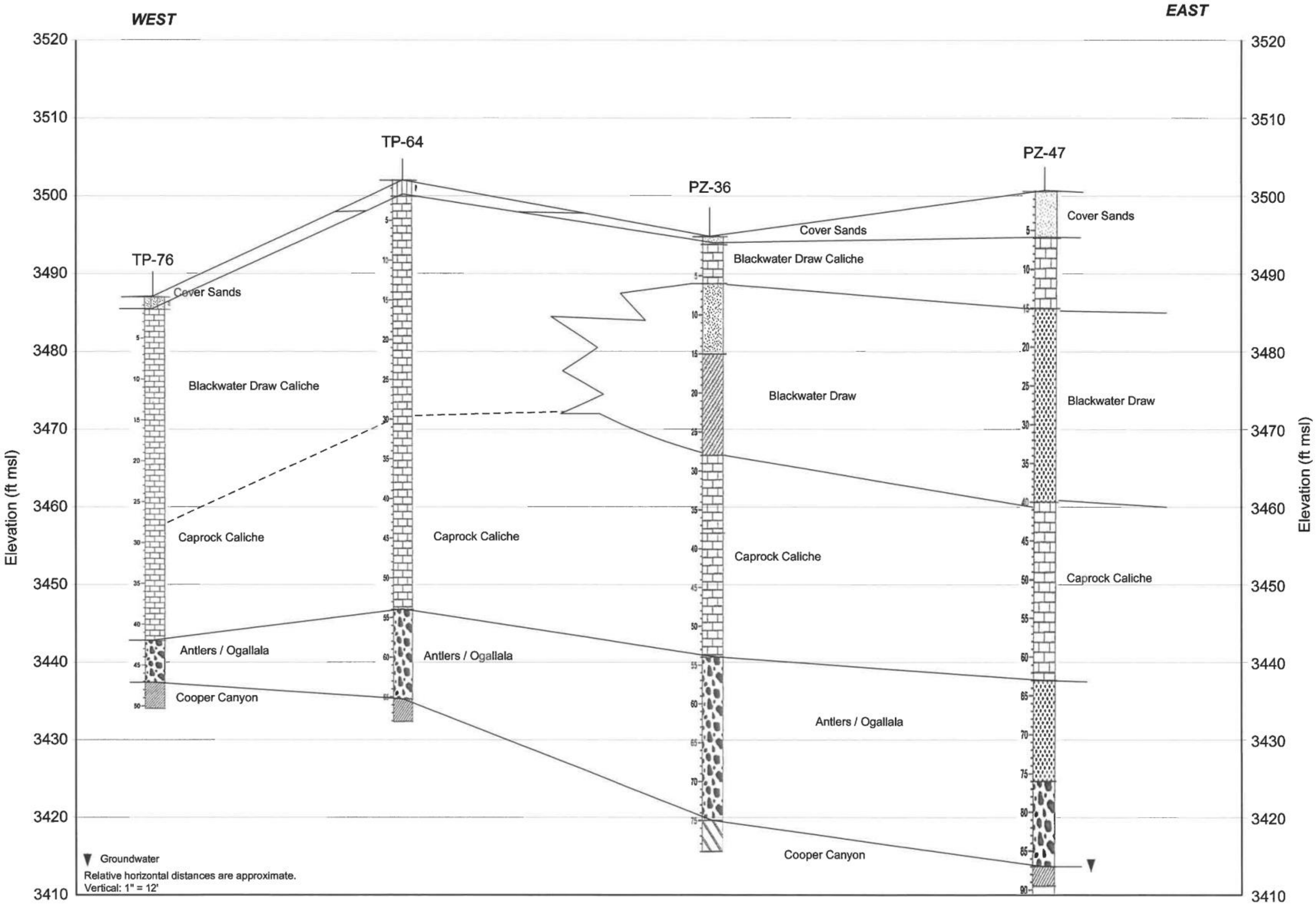
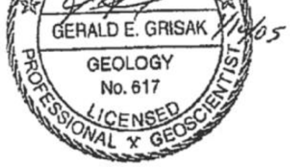


Figure 3.3-3 Cross Sections

Years BP (millions)	SYSTEM/SERIES		GROUP	FORMATION
0.01	QUATERNARY		RECENT/HOLOCENE	Windblown Sand / Playa Deposits
			PLEISTOCENE	Blackwater Draw or Tahoka / Playa Deposits
1.6	TERTIARY			Ogallala / Gatuna
66	CRETACEOUS		COMMANCHEAN	Duck Creek
				Kiamichi
				Edwards
				Comanche Peak
				Walnut
				Antlers
144	JURASSIC			
208	TRIASSIC		DOCKUM	Redonda
				Cooper Canyon
				Trujillo
				Tecovas
				Santa Rosa
245	PERMIAN	OCHOA		Dewey Lake
				Rustler
				Salado
		GUADALUPE	WHITEHORSE	Tansill
				Yates
				Seven Rivers
				Queen
				Grayburg
			SAN ANDRES	Glorieta
		LEONARD	CLEAR FORK	U. Clear Fork
				Tubb Sd.
				L. Clear Fork
			WICHITA	Wichita-Abo
		WOLFCAMP	WOLFCAMP	
286	PENNSYLVANIAN	CISCO	CISCO	
		CANYON	CANYON	
		STRAWN	STRAWN	
		ATOKA	ATOKA	
320	MISSISSIPPIAN	MERAMEC		Mississippian Lime
		KINDERHOOK	KINDERHOOK	
360	DEVONIAN	UPPER	WOODFORD	Woodford Shale
		LOWER	DEVONIAN	
408	SILURIAN	U. NIAGARAN		Upper Silurian Shale
		L. NIAGARAN	FUSSELMAN	
		ALEXANDRIAN		
438	ORDOVICIAN	UPPER	MONTOYA	
		MIDDLE	SIMPSON	
		LOWER	ELLENBURGER	
505	CAMBRIAN			
570	PRECAMBRIAN			Igneous and Metamorphic Rocks

------ Denotes Unconformity

Source: Modified from WTGS, 1976; Bebout & Meador, 1985



Date: 02/06/04
File: WCS_Fig6.2-2.ai

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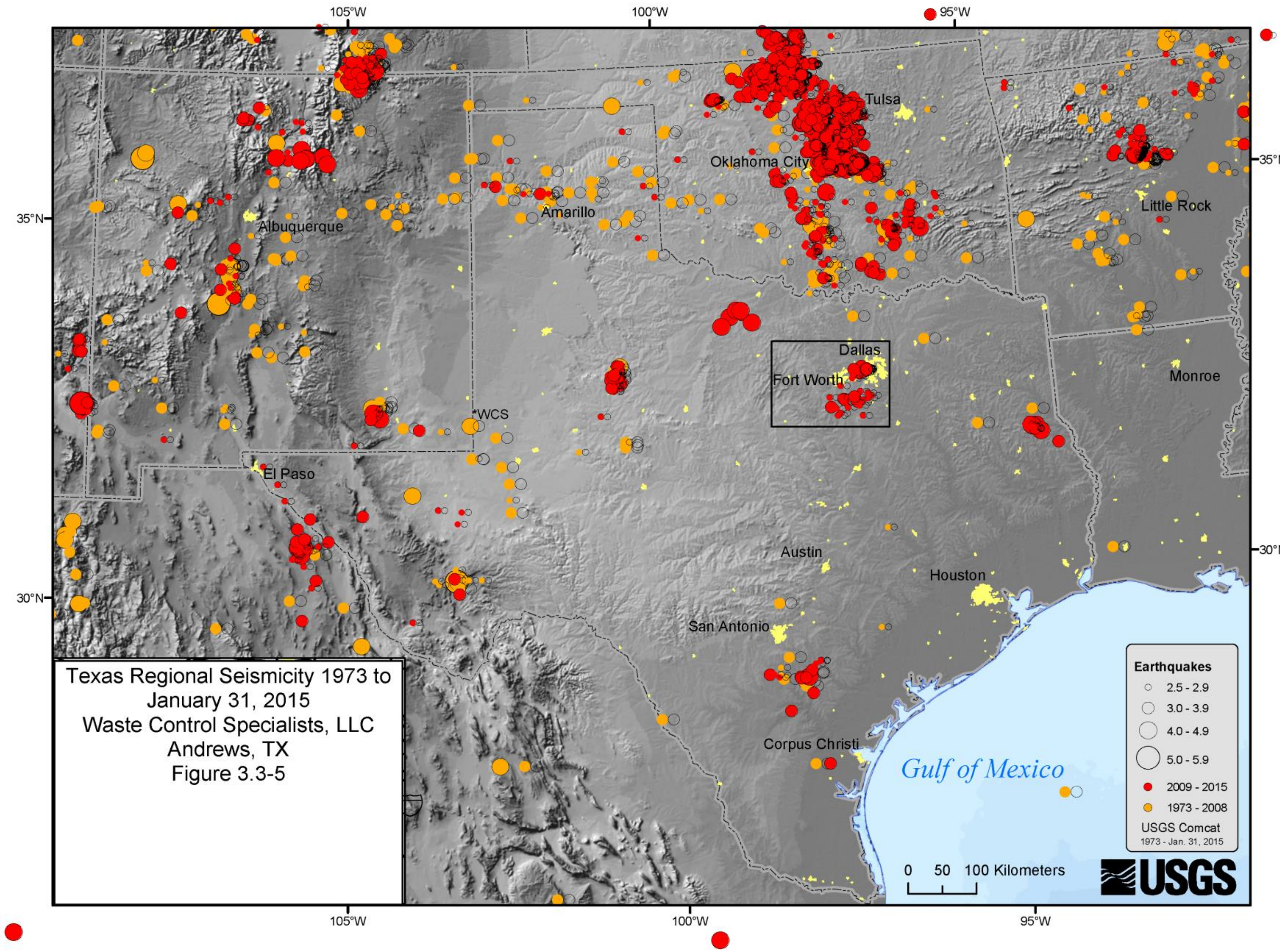
Austin, TX 78758

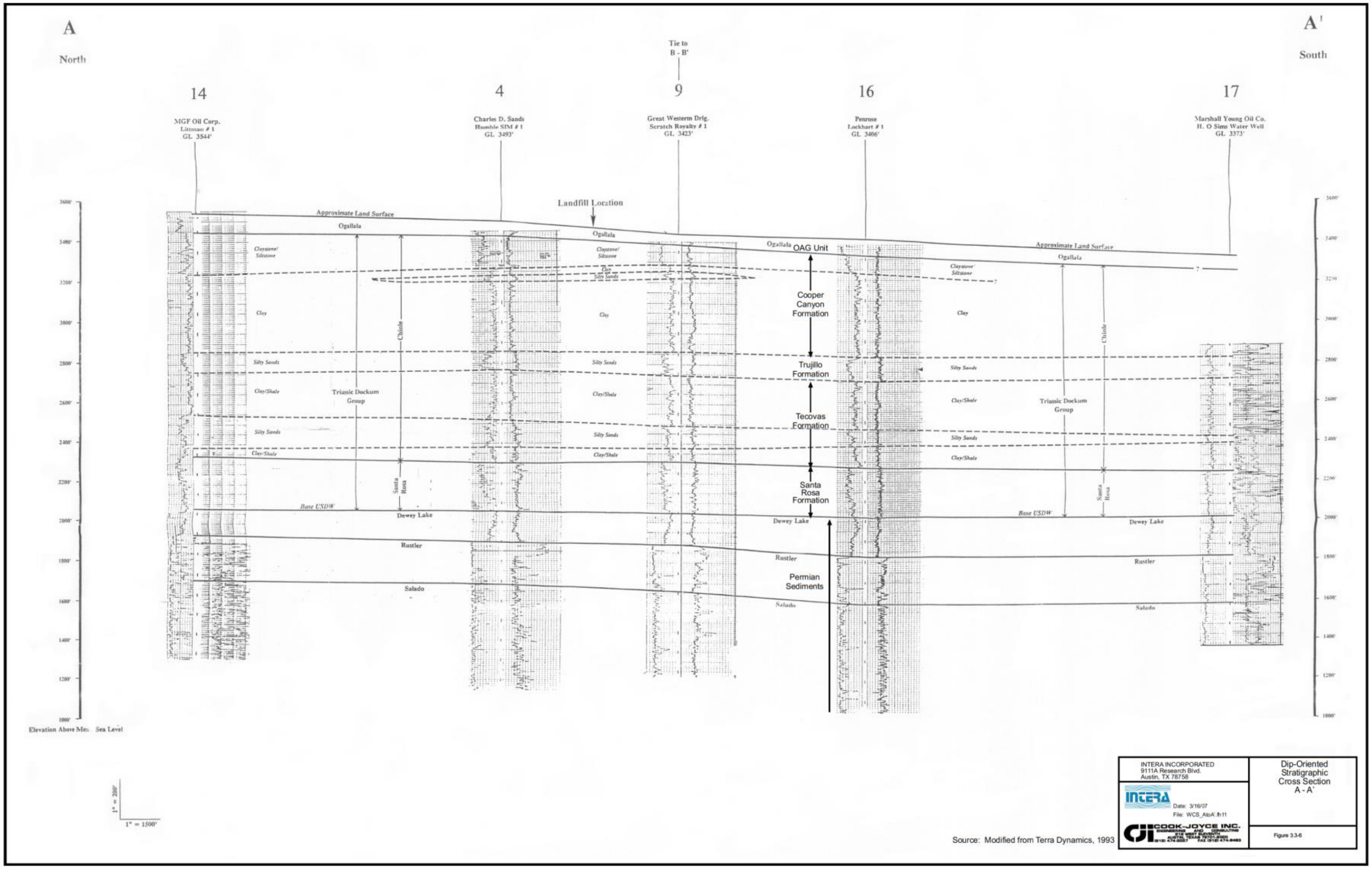
COOK-JOYCE INC.
ENGINEERING AND CONSULTING
812 WEST ELEVENTH
AUSTIN, TEXAS 78701-2000
(512) 474-9097 FAX (512) 474-8463

Stratigraphic Column
Central Basin Platform

Figure 3.3-4



Texas Regional Seismicity 1973 to January 31, 2015
Waste Control Specialists, LLC
Andrews, TX
Figure 3.3-5


A
North
A'
South
Tie to
B - B'
14
MGF Oil Corp.
4
Charles D. Sands
9
Great Western Drlg.
16
Penrose
17
Marshall Young Oil Co.
H. O Sims Water Well
Landfill Location
Approximate Land Surface
Ogallala
OAG Unit
Cooper
Canyon
Formation
Trujillo
Formation
Tecovas
Formation
Santa
Rosa
Formation
Permian
Sediments
Claystone/
Siltstone
Clay
Silty Sands
Clay/Shale
Triassic Dockum
Group
Chinle
Santa
Rosa
Base USDW
Dewey Lake
Rustler
Salado
Elevation Above Mean Sea Level
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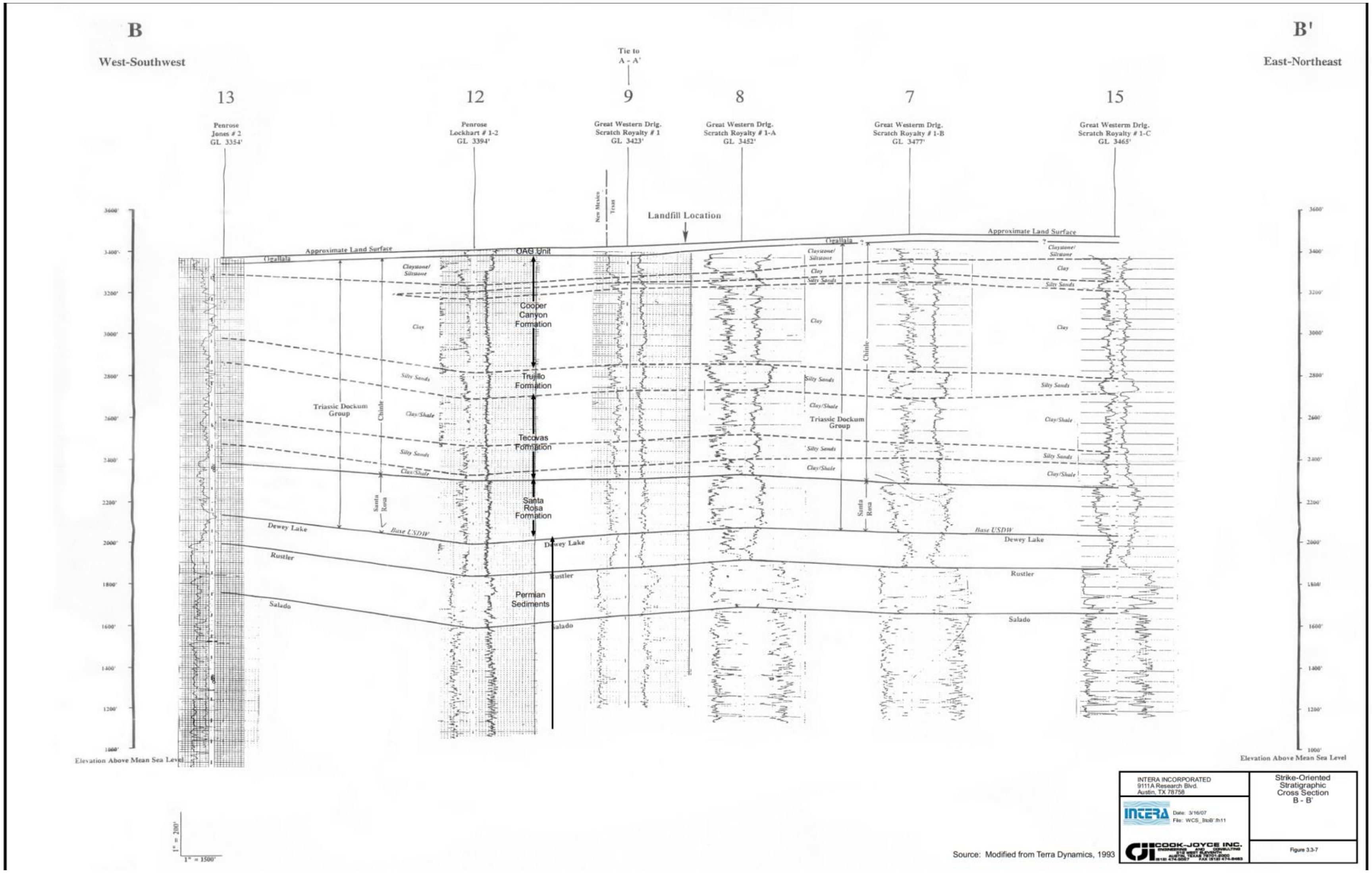
Date: 3/16/07
File: WCS_AtoA'.fh11
COOK-JOYCE INC.
Dip-Oriented
Stratigraphic
Cross Section
A - A'
Figure 3.3-6
Source: Modified from Terra Dynamics, 1993


B
West-Southwest
B'
East-Northeast
Tie to A - A'
13
Penrose Jones # 2 GL 3354'
12
Penrose Lockhart # 1-2 GL 3394'
9
Great Western Drlg. Scratch Royalty # 1 GL 3423'
8
Great Western Drlg. Scratch Royalty # 1-A GL 3452'
7
Great Western Drlg. Scratch Royalty # 1-B GL 3477'
15
Great Westerm Drlg. Scratch Royalty # 1-C GL 3465'
New Mexico
Texas
Landfill Location
Approximate Land Surface
Ogallala
OAG Unit
Cooper Canyon Formation
Trujillo Formation
Tecovas Formation
Santa Rosa Formation
Permian Sediments
Triassic Dockum Group
Chinle
Santa Rosa
Dewey Lake
Rustler
Salado
Base USDW
Elevation Above Mean Sea Level
1" = 200'
1" = 1500'
Source: Modified from Terra Dynamics, 1993
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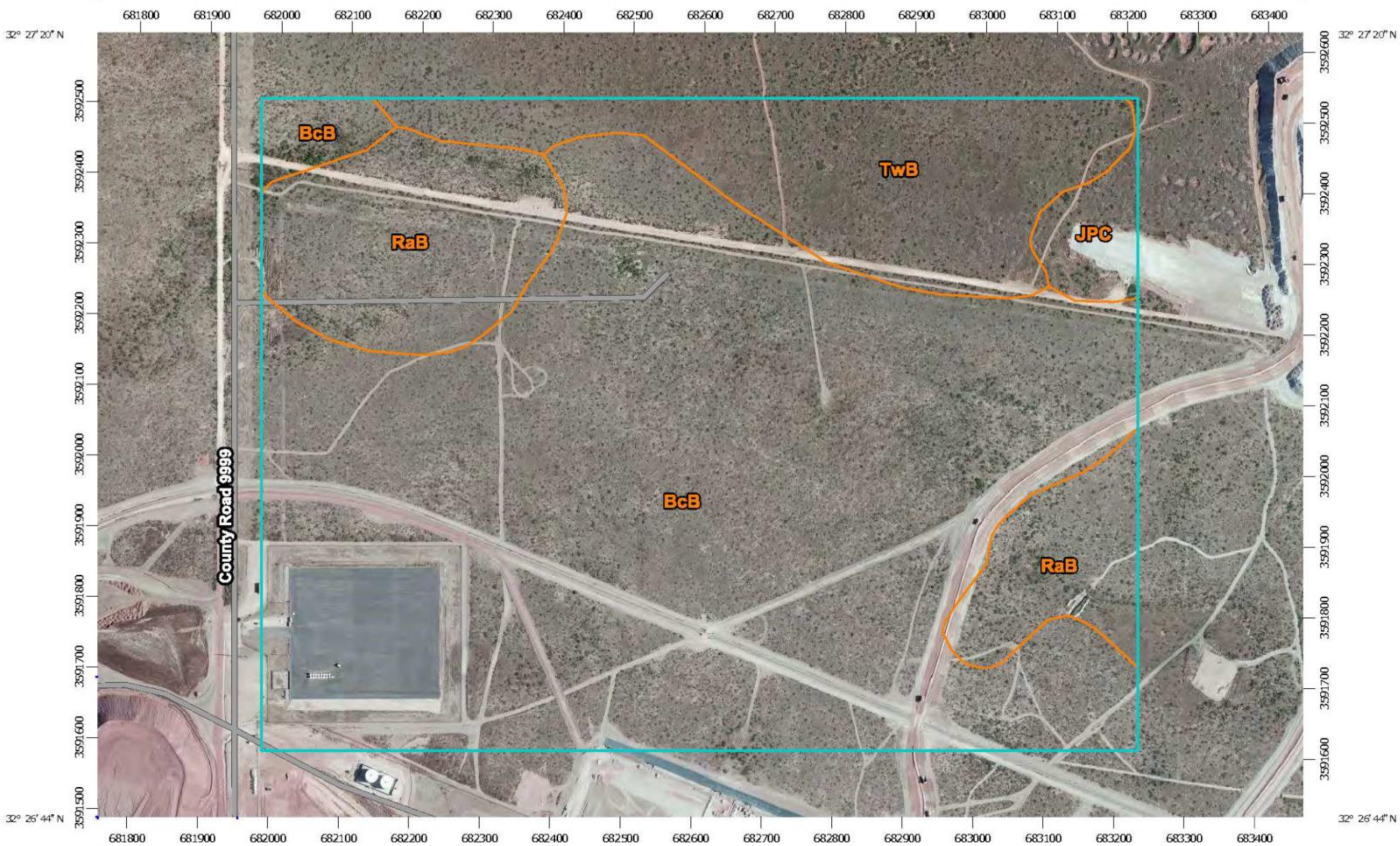
Austin, TX 78758
Date: 3/16/07
File: WCS_BtoB'.fh11
COOK-JOYCE INC.
Strike-Oriented Stratigraphic Cross Section B - B'
Figure 3.3-7

Title:	Figure:	Date:	
SOIL MAP - ANDREWS COUNTY, TX (Proposed DISF Facility)	3.3-8	7/15/2015	WCS ANDREWS, TEXAS
		Scale: AS SHOWN	

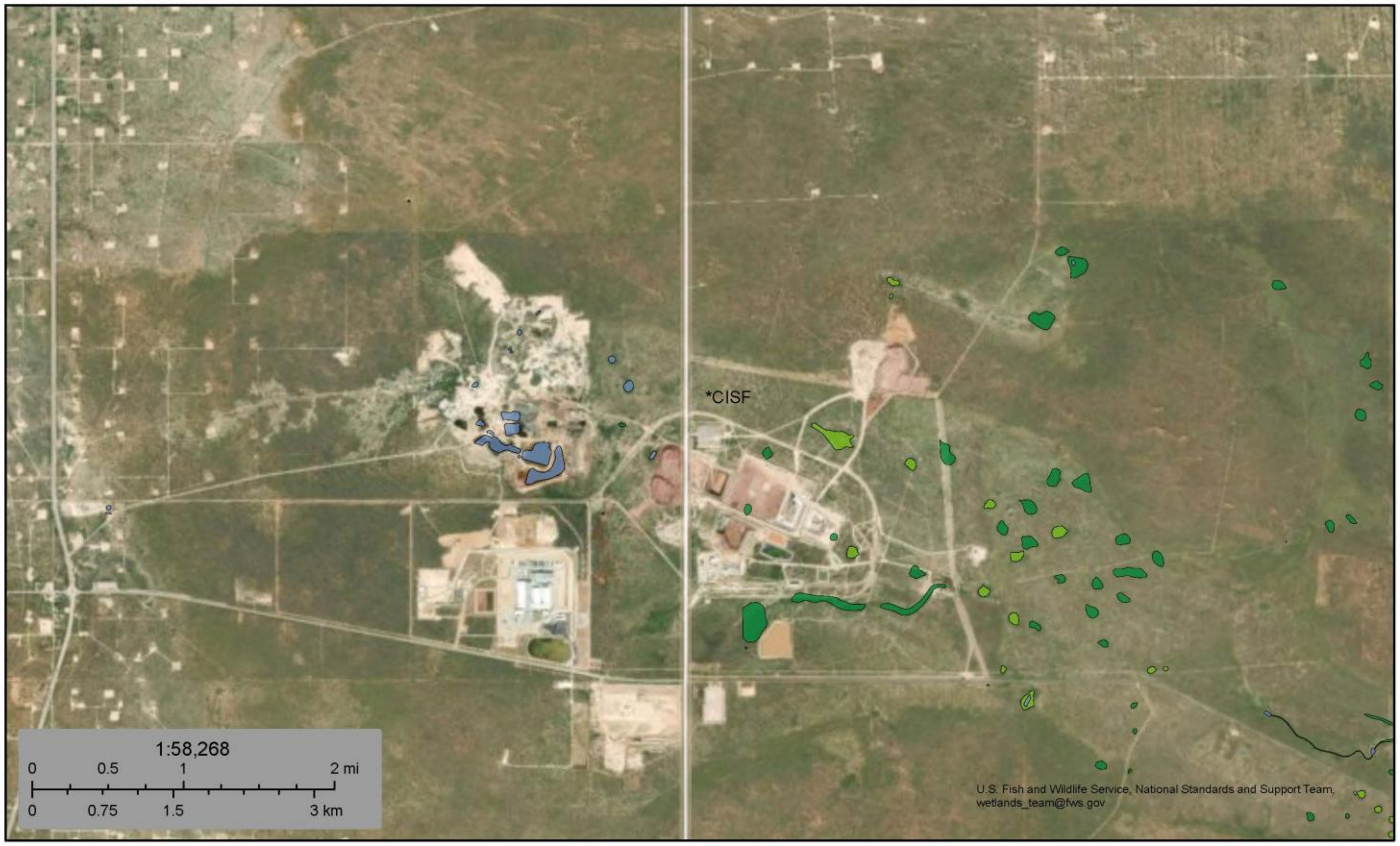


LEGEND	Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
Area of Interest (AOI)	BcB	Blakeney and Conger Soils,gently undulating	200.5	70.5%
Soils (Soil Unit Polygon)	JPC	Jalmar-Penwell association, undulating	6.0	2.1%
	RaB	Ratliff soils, gently undulating	39.3	13.8%
	TwB	Triomas and Wickett soils, gently undulating	38.7	13.6%

USDA Natural Resources Conservation Service — Web Soil Survey, National Cooperative Soil Survey — 7/15/2015

U.S. Fish and Wildlife Service
National Wetlands Inventory

Wetlands Map for WCS CISF Area



May 23, 2019

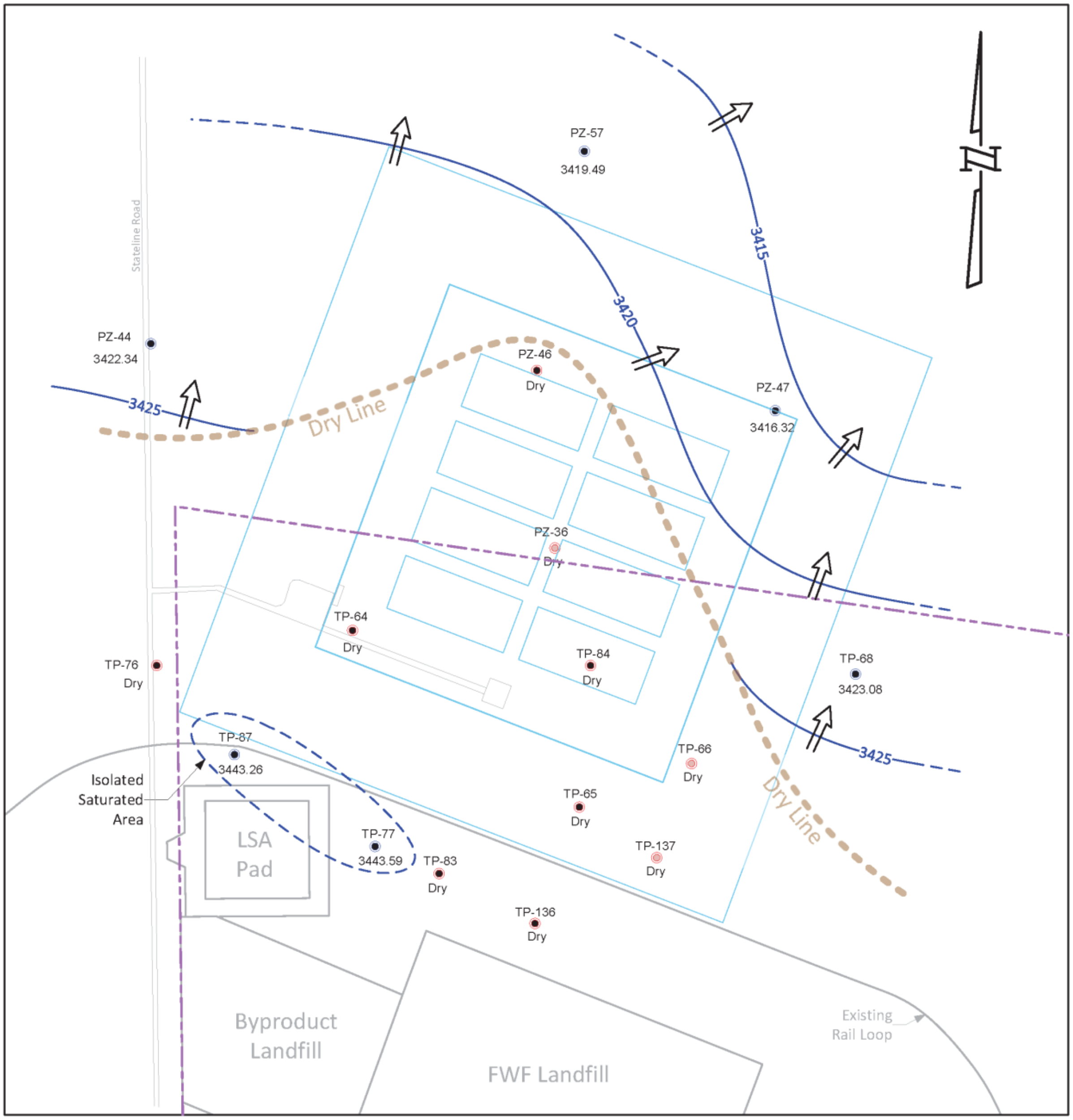
Wetlands

- Estuarine and Marine Deepwater
- Estuarine and Marine Wetland
- Freshwater Emergent Wetland
- Freshwater Forested/Shrub Wetland
- Freshwater Pond
- Lake
- Other
- Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper

Figure 3.4-1 Wetlands



Title:
OAG Groundwater Elevation Near the Proposed CISF

Figure: 3.4-2

Date: Mar. 2016

WCS
AMERICA'S NUCLEAR SOLUTION

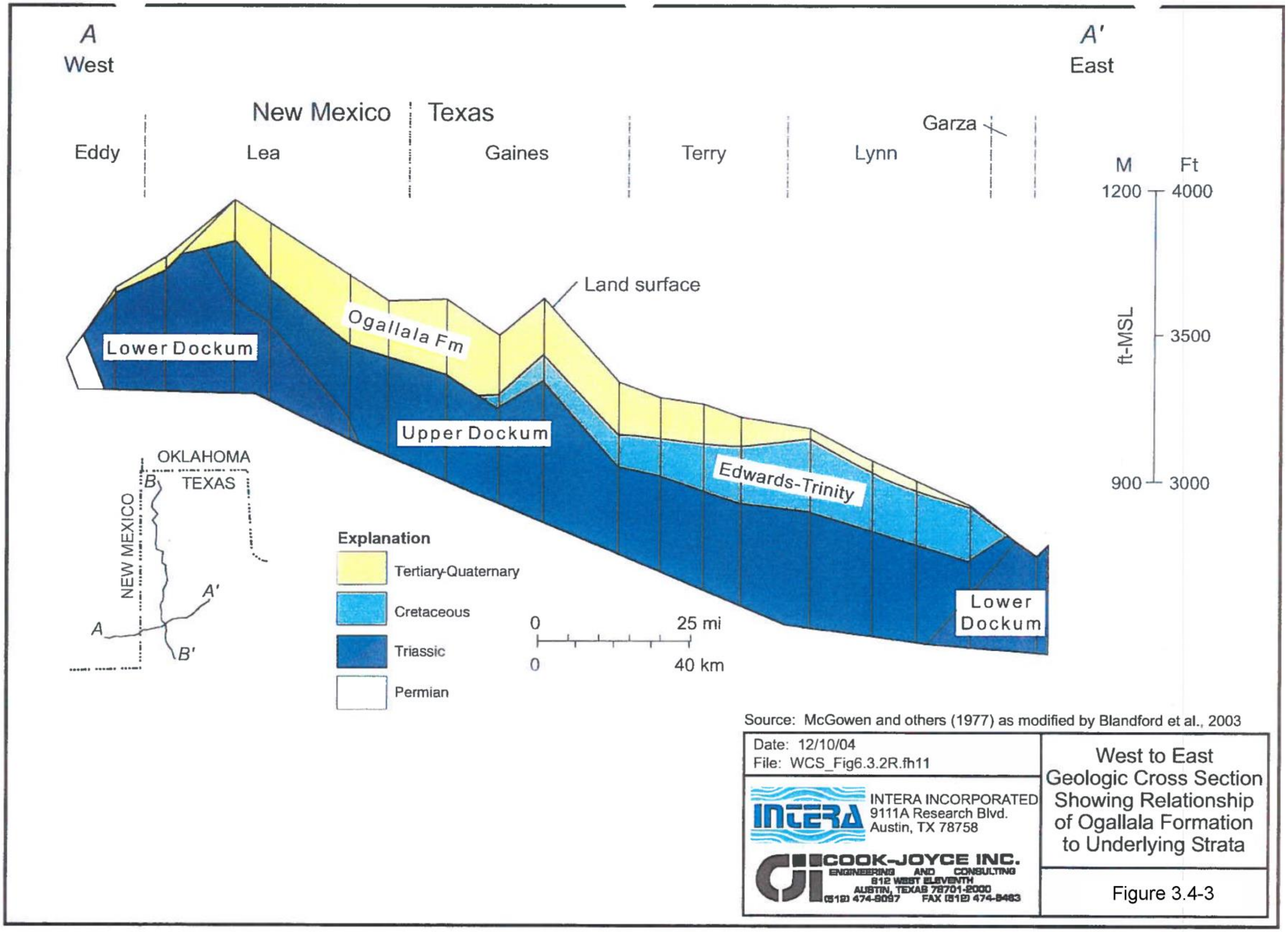
EXPLANATION:

- Saturated OAG Well
- Unsaturated OAG Well
- Dry OAG Well

Contour interval = 5 ft

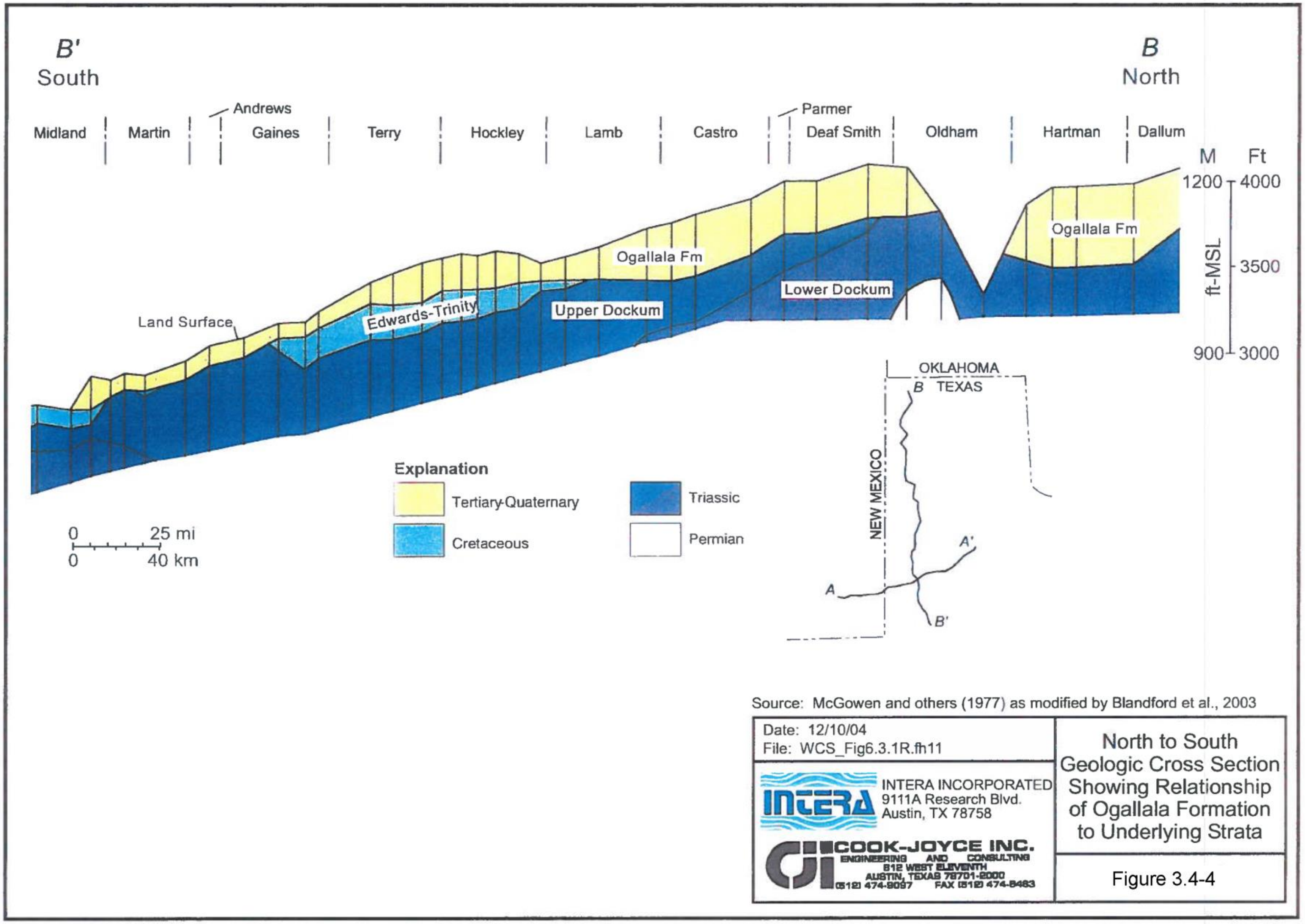
0 700 1400
Scale in Feet

- Permit Boundary
- Proposed CISF Footprint
- 3420 — OAG Groundwater Contour (Dashed where inferred) Wells gauged on 3-17-16.
- OAG Dry Line (Influenced by Dockum Grp. Surface)
- Groundwater Flow Direction (Saturated thickness increases to the north and northeast)



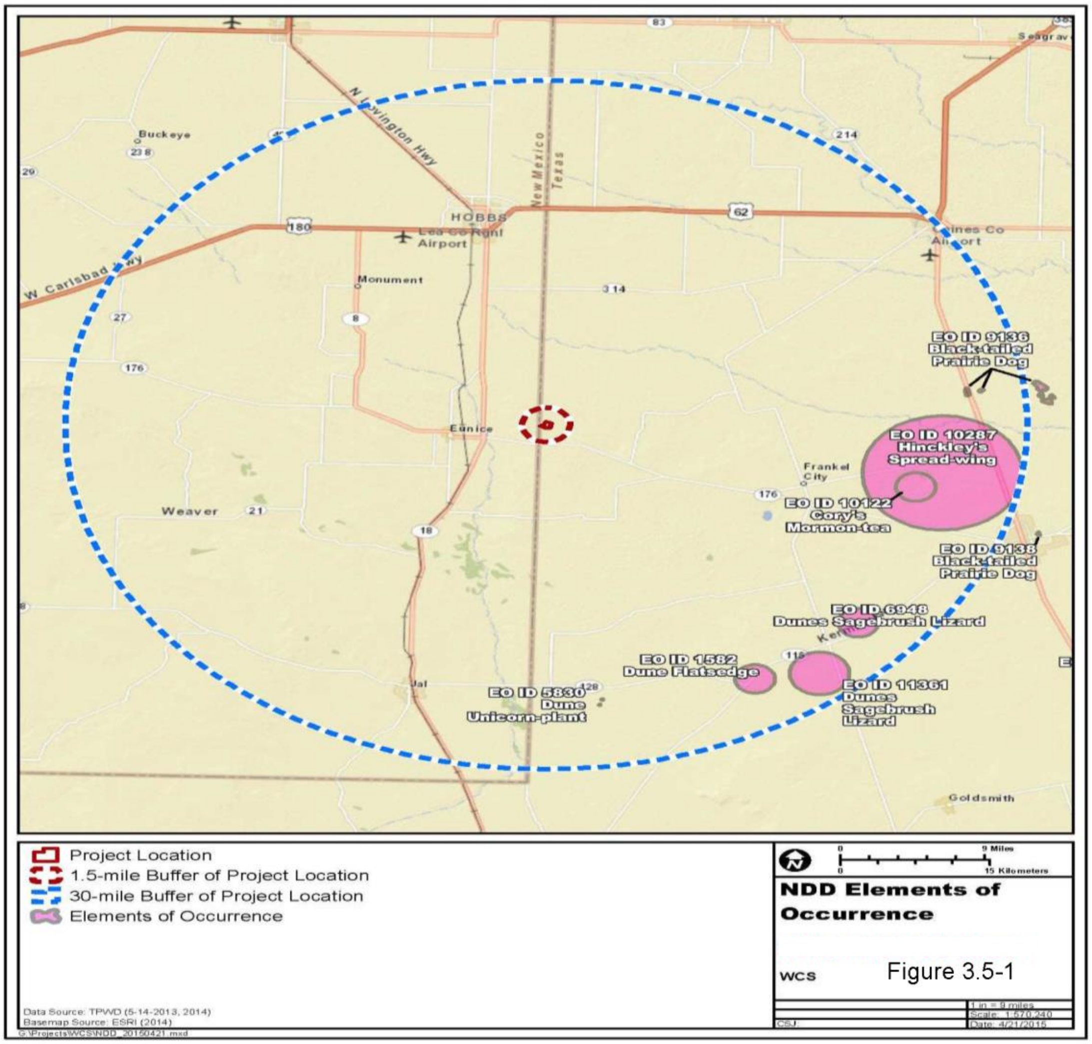
West to East Geologic Cross Section Showing Relationship of Ogallala Formation to Underlying Strata

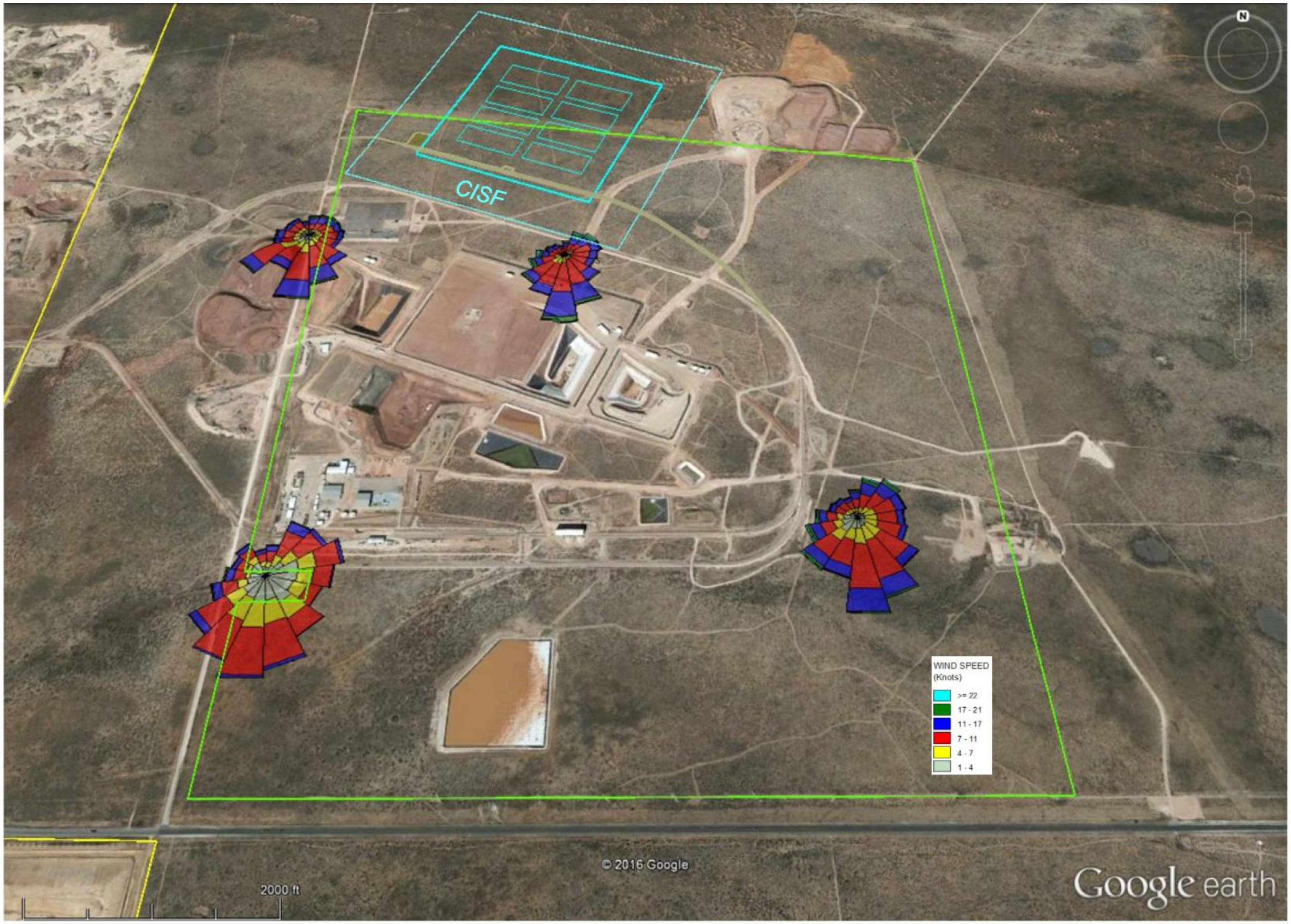
Figure 3.4-3



North to South Geologic Cross Section Showing Relationship of Ogallala Formation to Underlying Strata

Figure 3.4-4

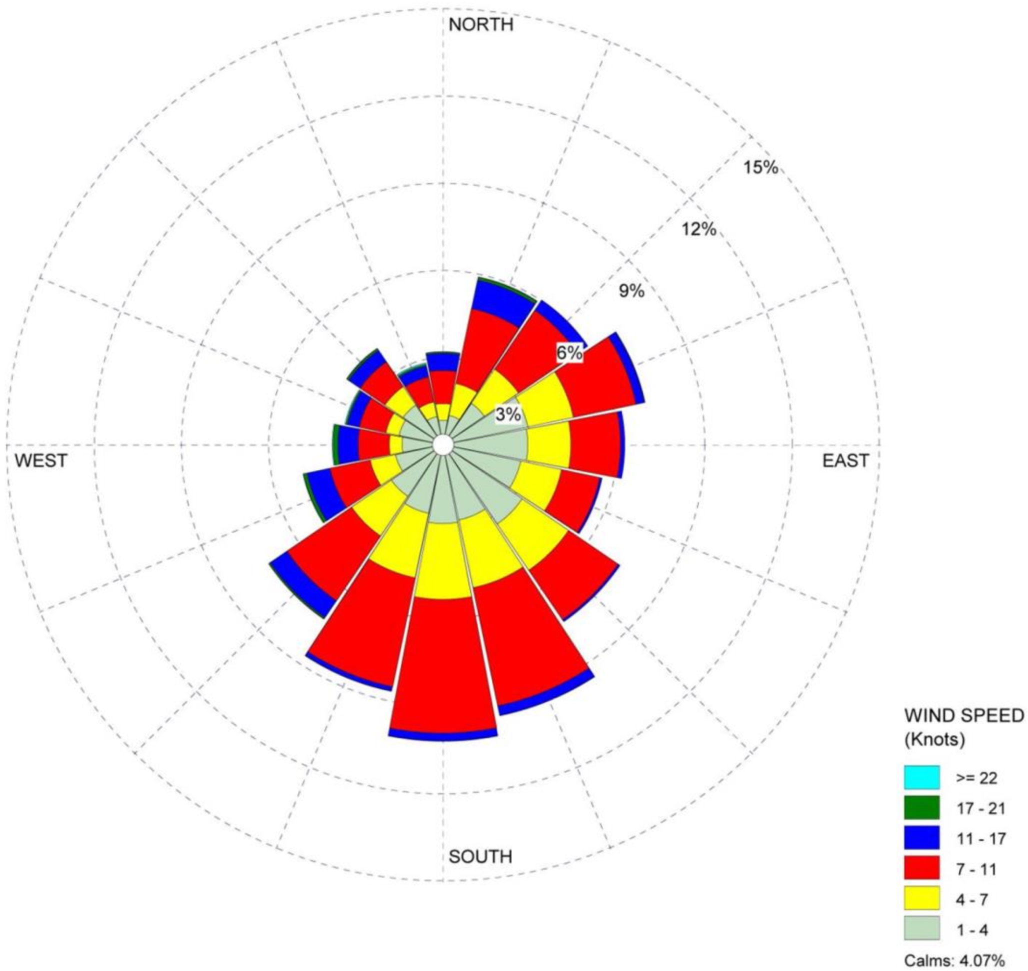

Project Location
1.5-mile Buffer of Project Location
30-mile Buffer of Project Location
Elements of Occurrence
EO ID 9136 Black-tailed Prairie Dog
EO ID 10287 Hinckley's Spread-wing
EO ID 10122 Cory's Mormon-tea
EO ID 9138 Black-tailed Prairie Dog
EO ID 6948 Dunes Sagebrush Lizard
EO ID 1582 Dune Flatsedge
EO ID 11361 Dunes Sagebrush Lizard
EO ID 5830 Dune Unicorn-plant
Buckeye
HOBBS
Lea Co Rgnl Airport
Monument
Eunice
Frankel City
Weaver
Jal
Goldsmith
Gaines Co Airport
W Carlsbad Hwy
N Lovington Hwy
New Mexico
Texas
9 Miles
15 Kilometers
NDD Elements of Occurrence
WCS
Data Source: TPWD (5-14-2013, 2014)
Basemap Source: ESRI (2014)
1 in = 9 miles
Scale: 1:570,240
Date: 4/21/2015
Figure 3.5-1



Title: Figure 3.6-1 Wind Rose Location Map	Date: 2/18/2016	WCS AMERICA'S NUCLEAR SOLUTION

WIND ROSE PLOT:
Tower 1
2m Instrument

DISPLAY:
Wind Speed
Direction (blowing from)

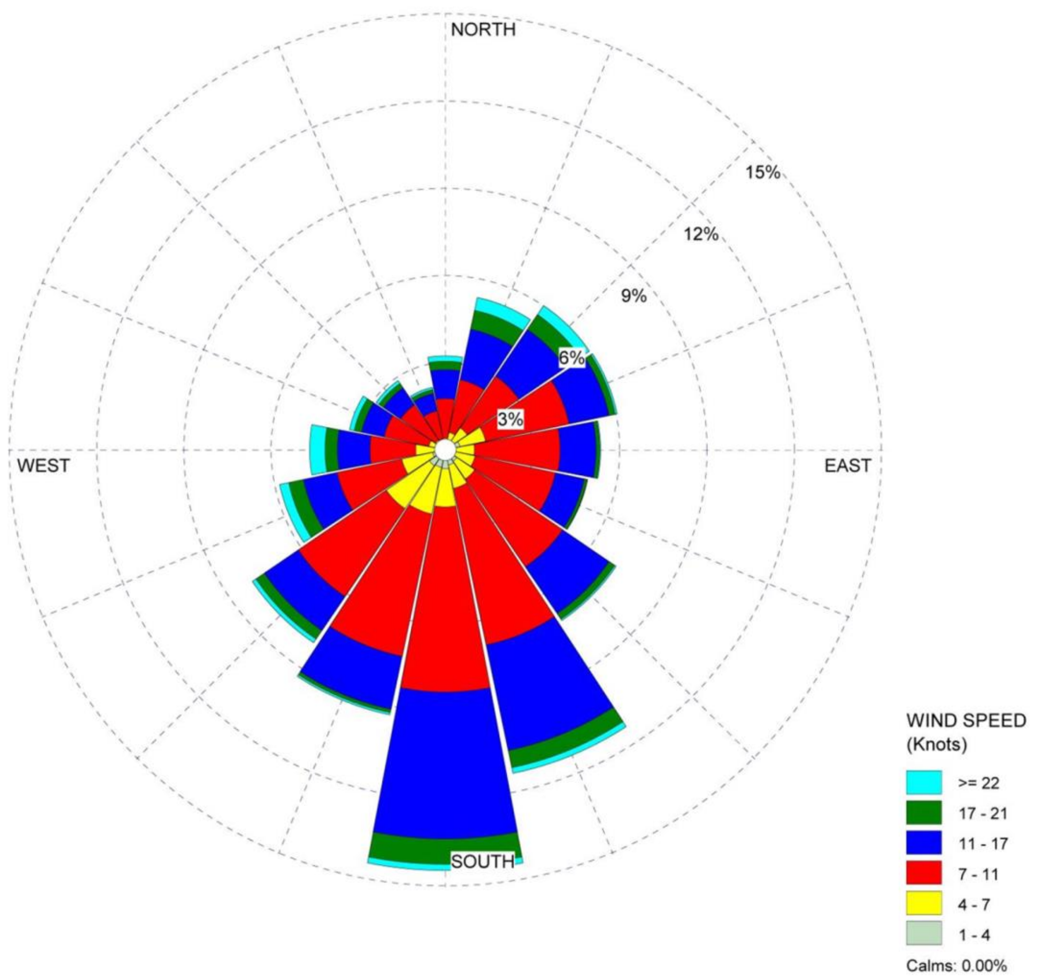


COMMENTS:	DATA PERIOD: **Start Date: 1/1/2010 - 00:00** **End Date: 5/31/2015 - 23:00**	COMPANY NAME: **Waste Control Specialists LLC**	
		MODELER: **J. R. Hultman**	AMERICA'S NUCLEAR SOLUTION
	CALM WINDS: **4.07%**	TOTAL COUNT: **29490 hrs.**	
	AVG. WIND SPEED: **6.07 Knots**	DATE: **2/18/2016**	FIGURE No: 3.6-2

WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:
ER Tower
2m Instrument

DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:

DATA PERIOD:
Start Date: 1/1/2010 - 00:00
End Date: 5/31/2015 - 23:00

COMPANY NAME:
Waste Control Specialists LLC

MODELER:
J. R. Hultman

AMERICA'S NUCLEAR SOLUTION

CALM WINDS:
0.00%

TOTAL COUNT:
48524 hrs.

AVG. WIND SPEED:
10.53 Knots

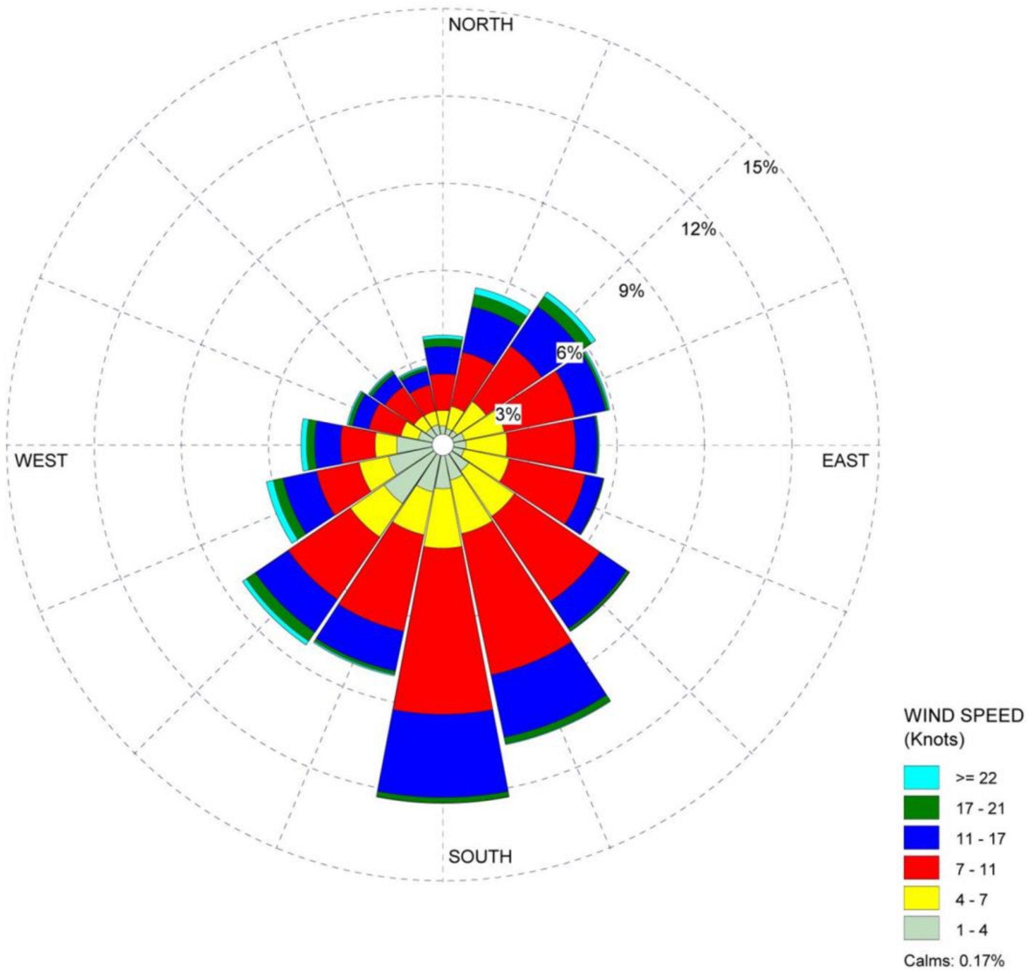
DATE:
2/18/2016

FIGURE No:
3.6-3

WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:
WeatherHawk East

DISPLAY:
Wind Speed
Direction (blowing from)

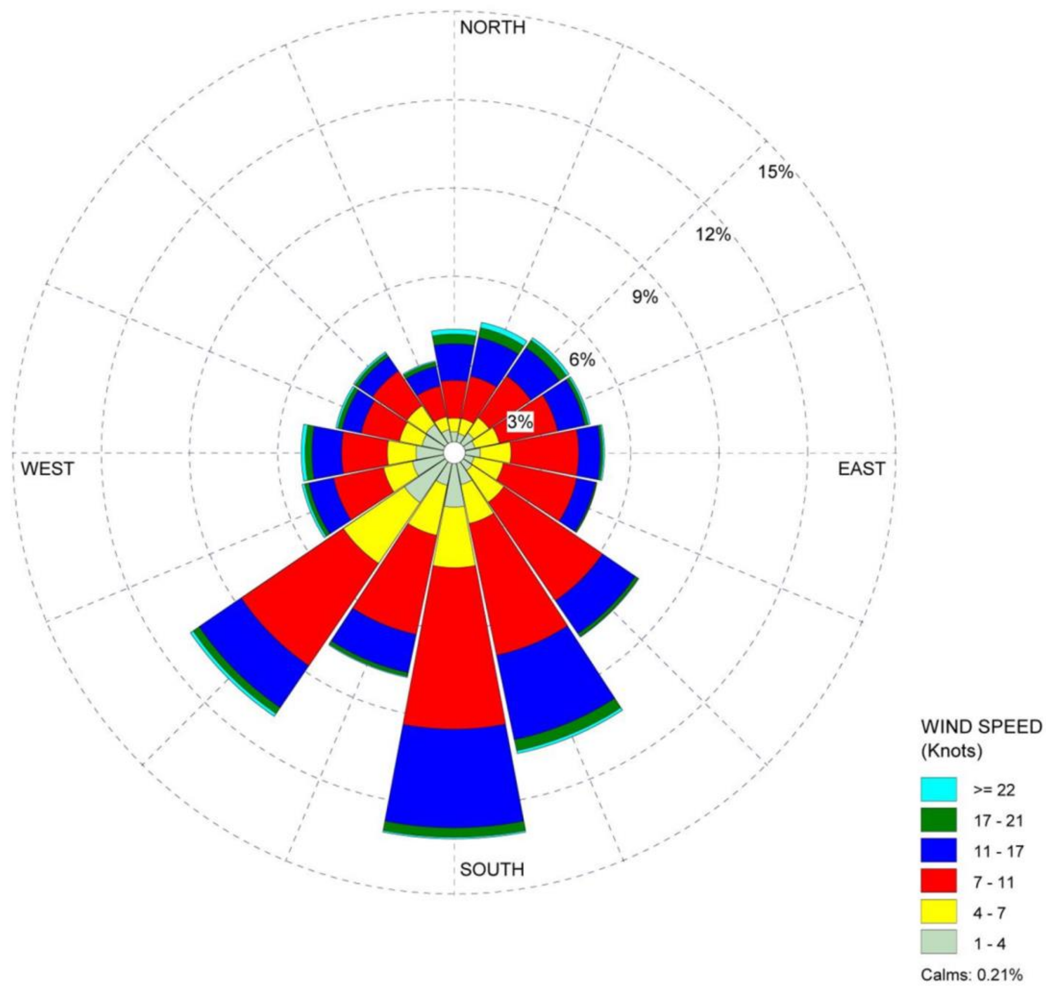


COMMENTS:	DATA PERIOD: **Start Date: 1/1/2010 - 00:00** **End Date: 5/31/2015 - 23:00**	COMPANY NAME: **Waste Control Specialists LLC**	
		MODELER: **J. R. Hultman**	AMERICA'S NUCLEAR SOLUTION
	CALM WINDS: **0.17%**	TOTAL COUNT: **45293 hrs.**	
	AVG. WIND SPEED: **8.73 Knots**	DATE: **2/18/2016**	FIGURE No: 3.6-4

WRPLOT View - Lakes Environmental Software

WIND ROSE PLOT:
WeatherHawk West

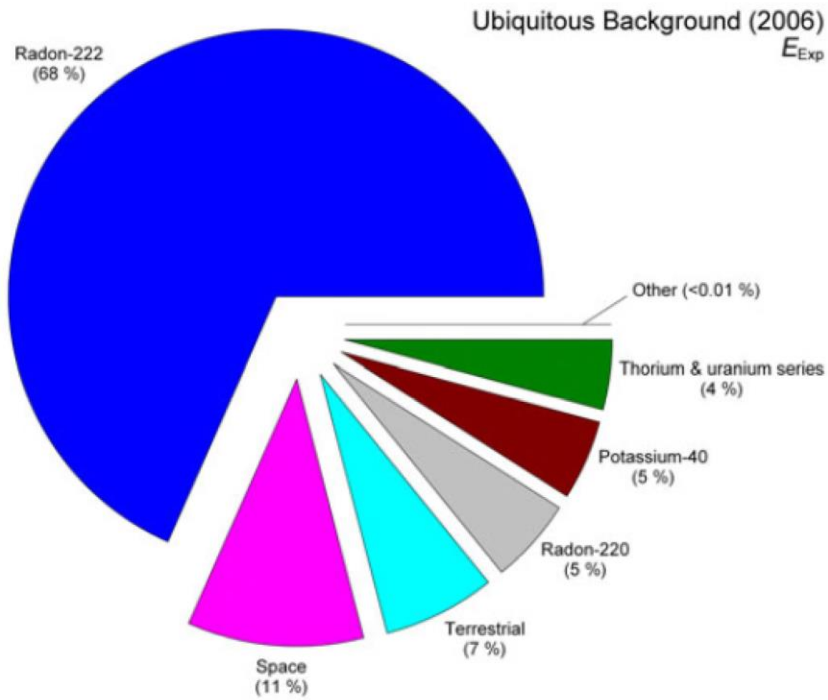
DISPLAY:
Wind Speed
Direction (blowing from)



COMMENTS:	DATA PERIOD:	COMPANY NAME:	
	Start Date: 1/1/2010 - 00:00 **End Date: 5/31/2015 - 23:00**	**Waste Control Specialists LLC**	
		MODELER: **J. R. Hultman**	AMERICA'S NUCLEAR SOLUTION
	CALM WINDS: **0.21%**	TOTAL COUNT: **48500 hrs.**	
	AVG. WIND SPEED: **8.81 Knots**	DATE: **2/18/2016**	FIGURE No: 3.6-5

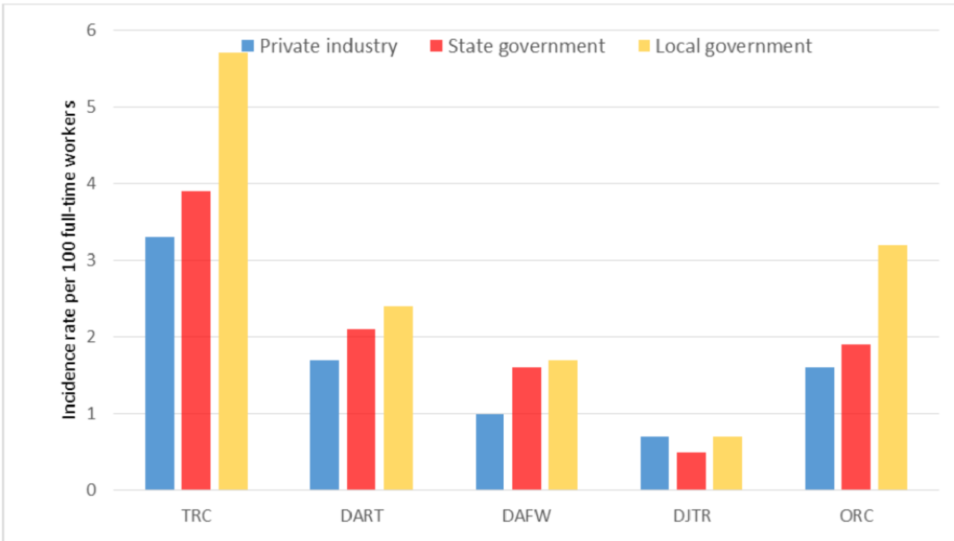
WRPLOT View - Lakes Environmental Software

Figure 3.11-1 Percent contribution of various sources of exposure to the annual effective dose (arithmetic mean = 311 mSv [311 mrem]) for ubiquitous background radiation in the U.S. population (NCRP 2009).



Title: PERCENT CONTRIBUTION OF RADIATION SOURCES	Figure: 3.11-1	Date: 12/17/2015	WCS ANDREWS, TEXAS
		Scale: NONE	

Figure 3.11-2 Nonfatal occupational injury and illness incidence rates by case type and ownership, 2013 (from DOL 2013).



Title:	Figure:	Date:
NONFATAL OCCUPATIONAL INJURY AND ILLNESS INCIDENCE RATES	3.11-2	12/17/2015
		Scale: NONE

CHAPTER 4

ENVIRONMENTAL IMPACTS

4.0 ENVIRONMENTAL IMPACTS

This chapter evaluates the potential environmental impacts associated with the construction, operation, and decommissioning of the proposed CISF. The chapter is divided into sections that assess the impact to each resource described in Chapter 3, Description of the Affected Area. These include land use (4.1), transportation (4.2), geology and soils (4.3), water resources (4.4), ecological resources (4.5), air quality (4.6), noise (4.7), historic and cultural resources (4.8), and visual and scenic resources (4.9), socioeconomics (4.10), environmental justice (4.11), public and occupational health (4.12), waste management (4.13)*, integrated environmental impacts (4.14), and cumulative impacts (4.15)*.

4.1 LAND USE IMPACTS

The proposed CISF would be built on land leased to Interim Storage Partners (ISP) by Waste Control Specialists LLC. The facility would be built in eight phases, with one phase being completed approximately every 2.5 years. Initial construction of Phase One would encompass approximately 63 ha (155 acres). Each phase would increase the overall footprint incrementally until the final footprint reaches approximately 130 ha (320 acres) with the completion of Phase Eight, of the owner controlled area. *In addition to the owner controlled area, there is an additional 0.6 ha (1.5 acres) of area for the new railroad side track which will be outside of the OCA and 1.2 ha (3 acres) of area for a new access road.* Because the site is currently undeveloped, potential land use impacts would primarily be from site preparation and construction activities. Approximately *1.6 ha (4 acres)* would be used for contractor parking and lay-down areas during facility construction. The total disturbed area would therefore be approximately *133.4 ha (330 acres)* including the contractor parking and lay-down area. The contractor lay-down and parking area would be restored after completion of facility construction.

During the construction phase of the CISF, conventional earthmoving and grading equipment would be used. *It is anticipated that excavation will be limited to the cover sands and Blackwater Draw caliche, however if hard caliche is encountered, heavy equipment with ripping tools may be utilized.* Soil removal work for foundations would be controlled to reduce over-excavation to minimize construction costs. In addition, loose soil and/or damaged caliche would be removed prior to installation of foundations for seismically designed structures.

ISP joint venture member Waste Control Specialists controls approximately 5,666 ha (14,000 acres) of land in the immediate proposed CISF vicinity, of which not more than 130 ha (320 acres) would be disturbed, affording wildlife on the site an opportunity to move to undisturbed onsite areas as well as additional areas of suitable habitat bordering the northern area of the CISF site. There would be no loss of pastureland because livestock grazing is not allowed within the Waste Control Specialists property.

The anticipated effects on the soil during construction activities are limited to a potential short-term increase in soil erosion. However, this would be mitigated by proper construction BMPs. These practices include minimizing the construction footprint to the extent possible, limiting site slopes to a horizontal to vertical ratio of three to one, or less, protection of undisturbed areas with silt fencing and straw bales as appropriate, and site stabilization practices such as placing crushed stone on top of disturbed soil in areas of concentrated runoff. In addition, onsite construction roads would be periodically watered down, if required, to control fugitive dust emissions. Water conservation would be considered when deciding how often dust suppression sprays would be applied. Environmental impacts for land uses are expected to be small.

After construction is complete, the site would be stabilized with natural, low water maintenance landscaping and pavement. Impacts to land and groundwater would be controlled during construction through compliance with the TPDES Construction General Permit obtained from Region 6 of the EPA. A SPCC plan would also be implemented during construction to minimize environmental impacts from potential spills and to ensure prompt and appropriate remediation. Potential spills during construction might possibly occur around vehicle maintenance and fueling locations, storage tanks and painting operations. The SPCC plan would identify sources, locations, and quantities of potential spills, as well as response measures. The plan would also identify individuals and their responsibilities for implementation of the plan and provide for prompt notifications of state and local authorities, as required.

BMPs would be used to minimize solid waste and hazardous materials. These practices include the placement of waste receptacles and trash dumpsters at convenient locations and the designation of vehicle and equipment maintenance areas for the collection of oil, grease, and hydraulic fluids. Where practicable, materials suitable for recycling would be collected. If external washing of construction vehicles is necessary, no detergents would be used, and the runoff would be diverted to onsite retention basins. Adequately maintained sanitary facilities would be provided for construction crews. ISP joint venture member Waste Control Specialists

would amend any existing solid waste and hazardous materials permits with the TCEQ, as needed, to accommodate these BMPs.

The CISF would require the installation of water, natural gas, and electrical utility lines. A new potable water supply line would be extended from the existing ISP joint venture member Waste Control Specialists potable water system. The new water supply lines would be installed along the existing roadways in order to minimize impacts to vegetation and wildlife and to minimize the impacts of short-term disturbances related to the placement of the tie-in line.

Electric service to the CISF would be provided by overhead power lines from existing power lines northeast of the site. A small transformer yard would be located on the site and distribution to onsite facilities would be via buried electrical lines. Similar to the new water supply lines, land use impacts would be minimized by placing associated support structures along the existing onsite right of ways, which are already disturbed.

Overall land use impacts to the proposed CISF and vicinity would be small considering that the majority of the site would remain undeveloped, the current industrial activity on neighboring properties, the nearby expansive oil and gas well fields, and the placement of most utility installations along highway easements. ISP is not aware of any Federal action that would have cumulatively significant land use impacts.

The CISF would be designed and constructed in a manner that would minimize the quantity of radioactive wastes and contaminated equipment, and facilitate the removal of radioactive wastes and contaminated materials at the time the CISF is permanently decommissioned pursuant to 10 CFR 72.130, *Criteria for decommissioning*. At the time of license termination, the site would be released for unrestricted use in accordance with 10 CFR 20, Subpart E. Therefore, the impact to land uses would be small.

4.2 TRANSPORTATION IMPACTS

Texas State Highway 176 is a two-lane highway with 3.6 m (12 ft) wide driving lanes, 2.4 m (8 ft) wide shoulders and a 61 m (200 ft) wide right-of-way easement on each side. Access to the site is directly off of Texas State Highway 176. An onsite, gravel covered, north-south oriented road currently runs along the west side of the proposed CISF location and an east-west gravel road running along the side of an existing rail spur borders the south side of the site.

No additional construction access roadways off of Texas State Highway 176 would be required to support construction. The materials delivery and construction worker access road would run north off of Texas State Highway 176 along the west side of the existing LLRW site. These roadways would eventually be converted to permanent access roads upon completion of construction. Therefore, impacts from new access road construction would be minimized.

4.2.1 Facility Construction Impacts

Impacts from construction transportation would include the generation of fugitive dust, changes in scenic quality, and added noise. Dust would be generated to some degree during the various stages of construction activity. The amount of dust emissions would vary according to the types of activity. The first 12 months of construction would likely be the period of highest emissions since approximately 63 ha (155 acres) would be involved, along with the greatest number of construction vehicles operating on an unprepared surface. However, it is expected that no more than 20 ha (50 acres) would be involved in this type of work at any one time.

See ER Section 4.6 for air quality impacts from construction.

4.2.1.1 Scenic Views

Although CISF construction would substantially alter the natural state of the landscape, impacts to scenic views are not considered to be significant, based on the absence of high quality scenic views in the area and the presence of currently developed industrial land uses on surrounding properties substantial. Construction vehicles would be comparable to trucks servicing neighboring facilities in terms of their impact on the scenic views.

During decommissioning, the site would be decommissioned to levels that would allow for the unrestricted release of the CISF pursuant to 10 CFR 20, Subpart E. Accordingly, the impact to scenic views during decommissioning would be small.

4.2.1.2 Noise

The temporary increase in noise along Texas State Highway 176 due to construction vehicles, earthmoving equipment, and other construction machinery is not expected to impact nearby receptors substantially since existing truck traffic currently uses this roadway.

The CISF would be designed and constructed in manner that would minimize the quantity of radioactive wastes and contaminated equipment, and facilitate the removal of radioactive wastes and contaminated materials at the time the CISF is permanently decommissioned pursuant to 10 CFR 72.130, “Criteria for decommissioning”. At the time of license termination, the site would be released for unrestricted use in accordance with 10 CFR 20, Subpart E. The impact from noise at the time of decommissioning is expected to be less than during construction therefore, the impact from noise is expected to be small.

4.2.2 Operational Impacts

Texas State Highway 176 provides direct access to the proposed CISF for personnel and for transporting materials and construction supplies to the CISF. Since this highway serves as a main east-west trucking thoroughfare for local industry, it is anticipated that SH 176 would be able to handle the small, incremental increase in capacity due to heavy-duty traffic increases. The existing dedicated turning lanes would help alleviate congestion that might otherwise occur from increased truck traffic.

The workforce at the CISF would be approximately 45 to 60 people, distributed among three shifts per day. Thus, the maximum potential increase to traffic due to the CISF workforce is 60 round trips per day. This is a highly conservative estimate since all workers do not work on any given day. Shift changes for CISF site personnel are estimated to average 15-20 vehicles per shift change. The range of vehicles per shift change is based on 3 shifts per day, 7 days per week. This yields a total of 21 shift changes per week.

At the current Waste Control Specialists facility (not including the proposed WCS CISF), the entire operational staff is approximately 185 employees who primarily work only day shifts Monday to Friday, with the exception of security personnel on nights and weekends. Thus, the average site population on a given weekday shift would be 185 personnel and 185 round trips per day. About half of the vehicles would likely travel west from the site onto New Mexico Highway 234, towards the city of Eunice, New Mexico; others would likely turn north onto New

Mexico Highway 18 towards the city of Hobbs, New Mexico. Others would travel east on Texas State Highway 176 toward Andrews, TX. Car-pooling would be encouraged to minimize the impact to traffic due to operational workers.

The current traffic at ISP joint venture member Waste Control Specialists due to operational deliveries and waste removal is an average of 1800 shipments per year or approximately 35 shipments per week or five round trips per day. These deliveries and/or waste removal are non-radiological. It is anticipated that once the CISF is operational, estimated shipments and waste delivery would not increase since operational and waste needs would tie into existing needs at the current Waste Control Specialists facility. The number of waste deliveries for disposal in 2015 was 530, which is an average of two shipments per day for a Monday to Friday work week. Once the CISF is operational, this number should not be impacted by the CISF since deliveries to the CISF are expected to be made via rail. This makes the total deliveries to the current Waste Control Specialists facility six roundtrips per day.

The total anticipated roundtrips per day to Waste Control Specialists and the CISF following the completion of CISF construction for employees and non-hazardous deliveries and waste removal is approximately 247 based on the 2015 records for Waste Control Specialists current operation and proposed needs for the CISF.

The maximum number of construction workers is 50 during the peak of the 30-month construction period. Thus the maximum potential increase to traffic due to construction workers is 50 round trips per day. The maximum potential increase to traffic due to construction and deliveries is 100 round trips per day over the site preparation and major building construction period. This value is based on the estimated number of material deliveries and construction waste shipments during the 30-month period of each of the eight phases of site preparation and major construction per phase of the project. Work shifts would be implemented and car-pooling would be encouraged to minimize the impact to traffic due to construction workers in the site vicinity.

The primary route into Waste Control Specialists' existing facilities and the CISF is Texas State Highway 176, which serves as a major east-west route connecting to New Mexico State Road 176 to the west and the city of Andrews, Texas, to the east. U.S. Route 385 and Ranch Road 181 are the main north-south routes in Andrews County. Both of these routes connect to Texas State Highway 176 east of Waste Control Specialists' existing facilities and the CISF. The

average daily traffic volume on the segment of Texas State Highway 176 west of the site to the state line was 2,700 vehicles per day in 2007 (TXDOT 2009). In 2004, the segment of New Mexico State Road 176 from the state line west toward New Mexico State Road 209 and the outskirts of Eunice had an average daily traffic volume of 2,250 vehicles per day (NMDOT 2009). The average daily traffic on Texas State Highway 176 was 3,000 vehicles per day to the east of the site approaching Ranch Road 181, and 2,700 vehicles per day from Ranch Road 181 approaching the city of Andrews, where it intersects U.S. Route 385. The average daily traffic volume on Ranch Road 181 was 650 vehicles per day north of Texas State Highway 176 and 1,150 south of 176 (TXDOT 2009). No significant new traffic burdens (e.g. schools, hospitals, major industrial facilities) have been added since these surveys.

A rail line services Waste Control Specialists and the CISF from the west that connects to the Texas—New Mexico Railroad approximately 10 kilometers (6 miles) west of the site near Eunice, New Mexico. This line connects to the Union Pacific line in Monahan's, Texas (Waste Control Specialists 2007b:10). For the rail line that services Waste Control Specialists from the west, Waste Control Specialists recorded 160 shipments between 1/1/15 and 7/1/2016 for an average of 0.42 shipments per day or 2.1 shipments per five day work week. The rail shipments received at Waste Control Specialists were radioactive waste and mixed waste. The rail transportation impacts from the CISF are discussed in section 3.2 of this ER.

The closest commercial airport to the CISF is the Lea County Regional Airport located in the city of Hobbs, New Mexico. This airport is operated by Lea County along with two general aviation facilities located adjacent to the cities of Jal and Lovington. There are two other general aviation airports in the region: the Andrews County Airport, owned and operated by Andrews County, and Gaines County Airport, owned and operated by Gaines County. The airport formerly operating in Eunice was closed in 2007 (NMDOT 2009). The construction and operation of the CISF will have no impact on the proximal airports due to most people visiting the CISF use the Midland International Air and Space Port.

Based on the average daily traffic on nearby roadways, the temporary increase in vehicle flow associated with onsite operations would occur for periods of short duration during shift changes with little effect on anticipated transportation impacts to the surrounding area. Integrated transportation impacts are small.

4.2.3 Mitigation Measures

To control fugitive dust production, reasonable precautions would be taken to prevent PM and/or suspended PM from becoming airborne. When necessary, water would be used to control dust on dirt roads, in clearing and grading operations, and during construction activities. Water conservation would be considered *for activities which are not essential to* dust suppression. See Section 4.4 for a discussion of water conservation measures. Mitigation measures would not be required during operations or decommissioning of the CISF.

4.2.4 Radioactive Material Transportation Impacts

Over the course of the 20-year operational life of the CISF, ISP would receive up to 40,000 MTUs of SNF and related GTCC waste from decommissioned commercial nuclear reactor sites and operating reactors. SNF would be transported exclusively by rail. All SNF would be transported approximately 169 km (105 mi) from Monahans, Texas to the CISF along the transportation corridor.

The DOE or nuclear plant owner(s) holding title to the SNF will be responsible for transporting SNF from existing nuclear power plants to the CISF by rail in transportation casks licensed by the NRC pursuant to 10 CFR 71. The preparation of such shipments will be conducted in accordance with written procedures prepared by the commercial nuclear power plant, the DOE, or their contractors. The DOE or private qualified logistics company will also be responsible for coordinating with federal agencies, such as the U.S. Department of Transportation, U.S. Department of Homeland Security, U.S. Environmental Protection Agency, and the Federal Emergency Management Agency, regarding transportation of SNF from the commercial nuclear reactor sites to the CISF.

If the DOE is the shipper, the federal government, through DOE, is responsible for providing emergency training to states, tribes, and local emergency responders along the transportation routes where SNF would be transported to the CISF. ISP joint venture member Waste Control Specialists has acquired considerable experience in responding to the potential transportation events given its relative proximity to the Waste Isolation Pilot Plant. Local fire fighters, law enforcement, and emergency medical staff have been trained to respond to put out fires and organizing any emergency response actions that may be needed to reduce the severity of events related to transportation incidents involving SNF.

4.2.4.1 Connected Transportation Impacts Associated with SNF Transport from Shutdown Decommissioned Reactors

Non-radiological environmental impacts connected to upgrades associated with the fabrication of new rail transport carriers and enhancements to rail infrastructure needed to remove SNF from the decommissioned reactors and transport to an ISFSI or geologic repository are discussed in a DOE report titled, *A Project Concept for Nuclear Fuels Storage and Transportation* .

ISP anticipates initially receiving up to approximately 5,000 MTUs of SNF and related GTCC waste from decommissioned reactor sites at 12 locations across the U.S. As discussed in Section 3.2, heavy-haul trucks may be needed to move SNF over short distances from a decommissioned reactor site to a rail transfer facility. The NRC previously analyzed the environmental impacts associated with using heavy haul trucks to transport SNF from a rail transfer facility to an interim storage facility in NUREG-1714 . The distances analyzed in the NUREG-1714 report transporting are much greater than the distances between the shutdown decommissioned reactor sites and the rail transfer facilities. Thus, the environmental impacts analyzed in NUREG-1714 are bounding.

The radiological impacts potentially affecting members of the public along the three transportation routes have been analyzed and are described below. The radiological environmental impacts attributable to the transport of SNF from the decommissioned reactor sites are insignificant.

4.2.5 Transportation Impacts to Air and Water Quality

SNF received at the main rail line in Eunice, New Mexico operated by the TNMR, would be placed on the existing rail side track controlled by ISP joint venture member Waste Control Specialists and transported approximately 8 km (5 mi) to the CISF. ISP would construct an additional side track approximately *2* km (*1.25* mi) in length to allow the transport of SNF to the Cask Handling Building at the CISF as described in Section 3.2.

During construction, fugitive dust emissions are expected and are authorized under a “Permit By Rule” by the TCEQ. Transportation impacts to air quality include emissions from employee automobiles and the diesel locomotive used to transport SNF along the transportation corridor to the Cask Handling Facility at the CISF. Air quality would also be impacted from emissions of

carbon monoxide, carbon dioxide and particulates from the combustion of diesel and other fuels used to construct, assemble and transport the spent fuel storage. The environmental impacts to air quality would not be significant. Additional information regarding the environmental impacts to air quality is provided in Sections 3.6 and 4.6.

ISP would obtain any needed storm water permit addressing potential runoff of sediments and required BMPs during construction of the rail side track. No significant environmental impacts to water quality are expected to be attributable to the transportation of SNF, to the CISF, including during construction of the rail sidetrack. Additional information regarding impacts to water quality during transportation is provided in Sections 3.4 and 4.4.

The CISF would be designed and constructed in manner that would minimize the quantity of radioactive wastes and contaminated equipment, and facilitate the removal of radioactive wastes and contaminated materials at the time the CISF is permanently decommissioned pursuant to 10 CFR 72.130, *Criteria for decommissioning*. At the time of license termination, the site would be released for unrestricted use in accordance with 10 CFR 20, Subpart E. Radioactive materials generated would be transported and disposed of at Waste Control Specialists LLRW Disposal Facilities. As such, the transportation impacts at the time of decommissioning would be small.

4.2.6 Radiological Impacts of Transportation

ISP *evaluated* the radiological impacts associated with the transport of SNF to the proposed CISF site from both operating and decommissioned sites. The *evaluation* used three sample rail routes to estimate bounding doses for normal (incident-free) transportation and potential accidents for both proposed rail shipments to the CISF, and for those from the CISF to a proposed repository. Dose estimates were computed using RADTRAN *6*, a computer code originally developed by Sandia National Laboratories under contract to the Nuclear Regulatory Commission. The doses *were also calculated for a representative number of* barge and heavy haul highway shipments *for several* decommissioned sites*. Barge and heavy haul* shipments may be required to move SNF from the decommissioned site to existing rail connections. *The heavy haul and barge shipments were evaluated to see what effect they had on a route's overall dose.*

The evaluation determined that the radiological impacts for both incident-free transportation and accidents for shipments to and from the CISF were small *and well below background doses. It further showed that barge and heavy haul shipments were not major contributors to overall collective dose.*

The *population, occupational, and accident doses* were also found to be consistent with previous studies conducted by the NRC, namely:

- *Spent Nuclear Fuel Transportation Risk*, NUREG-2125 (NRC, 2014)
- *Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation for the Skull Valley Band of the Goshute Indians and the Related Transportation Facility in Tooele County, Utah*
- *Reexamination of Spent Fuel Shipment Risk Estimates*, NUREG/CR-6672 (NRC, 2000)
- *Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes*, NUREG-0170 (NRC, 1977)

4.2.6.1 Scope and Methodology of the *ISP Evaluation*

Radiological impacts of transporting SNF to and from the proposed CISF were estimated using RADTRAN *6* (Weiner, et al, 2014). RADTRAN *6* models both risks of routine, incident-free transportation and transportation accidents. RADTRAN was developed by SNL for the NRC to calculate the radiological impacts of transporting radioactive materials in NUREG-0170. Since

publication of NUREG-0170, RADTRAN has been updated and used to estimate the risk of radioactive material transportation for environmental impact statements and risk assessments published by NRC, the U.S. Department of Energy (DOE) and other U.S. Federal and state agencies.

The methodology used *for ISP's evaluation* is similar to those used in NUREG-2125 *to address radiological impacts.* The population densities were computed using the WebTRAGIS software. The incident-free transportation doses were calculated for populations located within 800 meters (one-half mile) along *both* sides of the transportation routes using the RADTRAN software. Incident-free doses were calculated using *a Transport Index of 14, which is consistent with* the maximum dose rate allowed for exclusive use shipments under NRC regulations (10 CFR 71.47 (b) (3)). WebTRAGIS was used in this study to determine the route length and population density along each route segment. Table 4.2-2 lists specific routing parameters used in the *evaluation*. *A more detailed list of parameters can be found in Table 4.1-1 of Attachment 4-1.*

Table 4.2-2, *Route Parameters for Unit Risk Calculations*

PARAMETER	*VALUE*	*SOURCE*
Unit Risk Factor - Rural	*6.11E-08*	*Calculated by RADTRAN*
Unit Risk Factor - Suburban	*5.32E-08*	*Calculated by RADTRAN*
Unit Risk Factor -Urban	*1.85E-09*	*Calculated by RADTRAN*
Rural Train Speed (km/hr.)	*40.4*	*Maximum speed limit is 80 km/hr. per Association of American Railroads Circular OT-55-P*
Suburban Train Speed (km/hr.)	*40.4*	*Assumed Lower Speed for Suburban Areas*
Urban Train Speed (km/hr.)	*24.0*	*Assumed Lower Speed for Suburban Areas*
Barge Speed (km/hr.)	*12.8*	*Used in NUREG-2125*
Heavy Haul speed (km/hr.)	*32.2*	*Used in FEIS for Yucca Mountain*
Residential Shielding Factor	*1.0*	*RADTRAN Default*
Suburban Shielding Factor	*0.87*	*RADTRAN Default*
Urban Shielding Factor	*0.018*	*RADTRAN Default*

A more detailed description of the methodology used to assess the *radiological* impacts *for* transporting SNF *to the CISF* is presented in Attachment 4-1.

The assumptions related to the number of casks per shipment, number of casks shipped per year, total number of casks and shipments over the time used to determine the radiological impacts of transporting SNF in this evaluation are different that those used to calculate the Cost Benefits documented in Chapter 7. The assumptions used in herein are appropriate because they are bounding and conservative for determining bounding dose estimates.

4.2.6.2 Comparable NRC Analyses

The radiological impacts of transporting SNF have been extensively studied for nearly 40 years. Several Transportation risk studies have been published by NRC during this period of time; the most recent is *Spent Nuclear Fuel Risk Transportation, NUREG-2125 (NRC, 2014).* This study was *preceded by* Sprung, J.L., et al., *Reexamination of Spent Fuel Shipment Risk Estimates*, NUREG/CR-6672 (NRC,2000), which in turn was preceded by the *Final Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes,*" NUREG-0170.(NRC, 1977).

All of the NRC's *studies mentioned above* have concluded that the risk from radiation emitted from a transportation cask during routine, incident-free transportation is a small fraction of the radiation dose received from the natural background.

NUREG 2125, *Spent Fuel Transportation Risk Assessment,* that (NRC, 2014) *concluded that*:

1. The collective dose risks from routine transportation are very small. These doses are approximately four to five orders of magnitude less than the collective background radiation dose.
2. Radioactive material would not be released in an accident if the fuel is contained in an inner welded canister inside the cask.
3. *Rail* casks without inner welded canisters *could* release radioactive material, and only then in exceptionally severe accidents.
4. If there were an accident during a spent fuel shipment, there is only about one-in-a-billion chance that the accident would result in a release of radioactive material.
5. If there were a release of radioactive material in a spent fuel shipment accident, the dose to the maximally exposed individual (MEI) would be less than 2 Sv (200 rem) and would not result in an acute lethality.

6. The collective dose risks for the two types of extremely severe accidents (accidents involving a release of radioactive material and loss of lead shielding (LOS) accidents) are negligible compared to the risk from a no-release, no-loss of shielding accident.
7. The risk of gamma shielding loss from a fire is negligible.
8. None of the fire accidents investigated in this study resulted in a release of radioactive material.

The NRC has also analyzed the radiological impacts from transporting SNF in several EIS's supporting other licensing actions and found the radiological impacts to be small.

In licensing the PFS SNF Storage facility, the NRC analyzed the radiological impacts associated with transporting 40,000 MTUs of SNF from Maine Yankee to Goshute Indian Reservation near Salt Lake City, Utah. The radiological impacts attributable to transportation were not significant and served as a basis for issuance of the *Environmental Impact Statement for the Construction and Operation of an Independent Spent Fuel Storage Installation on the Reservation for the Skull Valley Band of the Goshute Indians and the Related Transportation Facility in Tooele County, Utah* .

In addition, the NRC relied upon the analysis done for the PFS facility in its Generic Environmental Impact Statement (NUREG-2157) to support its recent rulemaking titled, Continued Storage of SNF .

The NRC also analyzed the environmental impacts associated with transporting SNF from Maine Yankee to Deaf Smith County, TX, and found that the radiological impacts were not significant (NRC, 2014b, Table 2-6). *As described in Section 4.2.7.1, the doses from shipments from Maine Yankee to the CISF were the largest doses calculated for shipments to the CISF and are of the same magnitude as doses from Maine Yankee to Deaf Smith.*

4.2.7 Transportation Routes

Radiological impacts associated with transporting SNF *from 12 decommissioned reactor sites to the CISF* were analyzed. *ISP also analyzed shipments* from the CISF to the proposed repository at Yucca Mountain in Nye County, Nevada.

Since SNF *could be required* to be transported short distances by heavy haul trucks *or barge* to a rail transfer facility*, ISP analyzed a representative number of shipments to*

evaluate the dose effect of heavy haul and barge transport. The transportation modes that were analyzed for the shutdown reactor sites are *shown* in Table 4.2-3. *The routes represented in Table 4.2-3 are a representative sample of routes that could be used and are not intended to include all routes that could be used for shipments to the CISF.*

Table 4.2-3, Transportation Modes from Shutdown Reactor Sites.

Site	*Transportation Modes*	
Maine Yankee	*Direct Rail*	*Barge to Rail*
Yankee Rowe		*Heavy Haul to Rail*
Connecticut Yankee	*Barge to Rail*	*Heavy Haul to Rail*
Humboldt Bay		*Barge to Rail*
Big Rock Point		*Heavy Haul to Rail*
Rancho Seco	*Direct Rail*	
Trojan	*Direct Rail*	*Barge to Rail*
La Crosse	*Direct Rail*	*Barge to Rail*
Zion	*Direct Rail*	*Barge to Rail*
Crystal River	*Direct Rail*	
Kewaunee		*Heavy Haul to Rail*
San Onofre	*Direct Rail*	

4.2.7.1 Incident Free Transportation Doses

Radiation dose calculations were performed for each *of the 12 sites listed in Table 4.2-3. The methodology used to calculate population doses is explained in Attachment 4-1. The annual collective doses for the Maine Yankee to the CISF, San Onofre to the CISF, and CISF to Yucca Mountain shipments are shown in Table 4.2-4. The annual dose represents the exposure from shipping 200 casks over a one year period. The annual doses for shipment of 200 and 655 casks per year calculated in NUREG-0170 are shown for comparison.*

The total collective dose representing the environmental impact attributable to transporting *200 casks of SNF from Maine Yankee and San Onofre to the CISF are shown in Table 4.2-5 and Table 4.2-6. The dose for shipping a single cask from the CISF to Yucca Mountain is shown in Table 4.2-7. The difference between Table 4.2-4 and Table 4.2-5/ Table 4.2-6/Table 4.2-7 are that the doses in the latter tables are broken out by state.*

The radiological impacts are *0.0873* person-Sv *(8.73* person-rem) for transporting 200 canisters of SNF each year from the Maine Yankee NPP to the CISF. The collective radiation dose for transporting 200 canisters of SNF from SONGS to the CISF each year was estimated at *0.0184* person-Sv (*1.84* person-rem). Similarly, the impacts of transporting 200 canisters from the CISF to Yucca Mountain were estimated at *0.0157* person-Sv (*1.57* person-rem). Conclusions from these transportation analyses demonstrated that the estimated *annual* collective doses along each of the three transportation routes were *small and* comparable to those estimated in NUREG-0170 for the same number of shipments (200).

Table 4.2-4, Comparison of Annual Incident-free Transportation Impacts

Description	***Number of Rail Casks Shipped per Year***	***Collective Dose***	
		person-Sv	***person-rem***
Maine Yankee to WCS CISF	*200*	*0.0873*	*8.73*
San Onofre to WCS CISF	*200*	*0.0184*	*1.84*
WCS CISF to Yucca Mountain	*200*	*0.0157*	*1.57*
NUREG-0170	*655*	*2.90*	*290*
NUREG-0170	*200*	*0.31*	*31*

The doses calculated for San Onofre and Maine Yankee in Tables 4.2-5 and 4.2-6 assumed that all of the casks shipped in a year (200) originated at either the Maine Yankee or San Onofre site. In reality, casks shipped to the CISF in a year may originate from multiple sites; the two sites were chosen to illustrate doses that would be representative of the annual number of casks shipped to the CISF.

Table 4.2-5, ***Incident-Free Radiological Transportation Impacts Maine Yankee to the CISF (200 Casks per Year)***

State	Rural		Suburban		Urban		Total	
	person-rem	person-Sv	person-rem	person-Sv	person-rem	person-Sv	person-rem	person-Sv
ME	1.72E-02	1.72E-04	3.78E-01	3.78E-03	9.60E-03	9.60E-05	4.05E-01	4.05E-03
NH	4.09E-03	4.09E-05	1.48E-01	1.48E-03	4.45E-0	4.45E-05	1.56E-01	1.56E-03
MA	5.77E-03	5.77E-05	4.59E-01	4.59E-03	3.43E-02	3.43E-04	4.99E-01	4.99E-03
CT	7.43E-03	7.43E-05	9.99E-01	9.99E-03	6.81E-02	6.81E-04	1.07E+00	1.07E-02
NY	3.96E-02	3.96E-04	5.04E-01	5.04E-03	1.56E-01	1.56E-03	7.00E-01	7.00E-03
NJ	9.21E-03	9.21E-05	4.20E-01	4.20E-03	5.16E-02	5.16E-04	4.81E-01	4.81E-03
PA	1.03E-01	1.03E-03	1.14E+00	1.14E-02	3.14E-02	3.14E-04	1.28E+00	1.28E-02
WV	1.65E-03	1.65E-05	7.11E-03	7.11E-05	0.00E+00	0.00E+00	8.76E-03	8.76E-05
OH	6.29E-02	6.29E-04	2.87E-01	2.87E-03	5.17E-03	5.17E-05	3.55E-01	3.55E-03
IN	2.96E-02	2.96E-04	5.75E-01	5.75E-03	1.02E-02	1.02E-04	6.15E-01	6.15E-03
IL	2.90E-02	2.90E-04	4.43E-01	4.43E-03	1.12E-02	1.12E-04	4.83E-01	4.83E-03
MO	5.99E-02	5.99E-04	9.00E-01	9.00E-03	7.15E-03	7.15E-05	9.67E-01	9.67E-03
KS	1.15E-02	1.15E-04	1.15E-01	1.15E-03	0.00E+00	0.00E+00	1.27E-01	1.27E-03
OK	5.92E-02	5.92E-04	8.04E-01	8.04E-03	5.17E-03	5.17E-05	8.68E-01	8.68E-03
TX	8.30E-02	8.30E-04	6.09E-01	6.09E-03	1.94E-02	1.94E-04	7.11E-01	7.11E-03
						Total	8.73E+00	8.73E-02

Table 4.2-6, *Incident-Free Radiological Transportation Impacts San Onofre to WCS CISF (200 Casks per Year)*

State	Rural		Suburban		Urban		Total	
	person-rem	person-Sv	person-rem	person-Sv	person-rem	person-Sv	person-rem	person-Sv
CA	2.47E-02	2.47E-04	8.73E-01	8.73E-03	9.65E-02	9.65E-04	9.94E-01	9.94E-03
AZ	4.44E-02	4.44E-04	4.88E-01	4.88E-03	5.10E-03	5.10E-05	5.38E-01	5.38E-03
NM	8.48E-03	8.48E-05	6.59E-02	6.59E-04	0.00E+00	0.00E+00	7.44E-02	7.44E-04
TX	1.42E-02	1.42E-04	2.00E-01	2.00E-03	2.11E-02	2.11E-04	2.36E-01	2.36E-03
						Total	1.84E+00	1.84E-02

Table 4.2-7, *Incident-Free Radiological Transportation Impacts WCS to Yucca Mountain (200 Casks per Year)*

State	Rural		Suburban		Urban		Total	
	person-rem	person-Sv	person-rem	person-Sv	person-rem	person-Sv	person-rem	person-Sv
TX	1.85E-02	1.85E-04	4.14E-01	4.14E-03	2.22E-02	2.22E-04	4.55E-01	4.55E-03
NM	1.68E-02	1.68E-04	1.98E-01	1.98E-03	2.54E-03	2.54E-05	2.17E-01	2.17E-03
AZ	5.00E-02	5.00E-04	7.78E-01	7.78E-03	6.10E-02	6.10E-04	8.89E-01	8.89E-03
CA	7.02E-03	7.02E-05	4.16E-03	4.16E-05	0.00E+00	0.00E+00	1.12E-02	1.12E-04
NV	3.09E-04	3.09E-06	7.41E-04	7.41E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00
						Total	1.57E+00	1.57E-02

The doses for shipping a single cask from Maine Yankee to the WCS CISF is shown in Table 4.2-8. Maine Yankee represents the longest route that would be used during shipments to WCS CISF. Shipment of a single cask would result in a collective dose of 4.36E-4 person-Sv. This dose is small when compared to the normal background dose of 7.56 person-Sv and is consistent with the doses calculated in NUREG-2125 calculated for similar routes (e.g., the collective doses for a shipment from Maine Yankee to Deaf Smith County, Texas, NUREG-2125 in Table B-13).

Table 4.2-8, Incident-Free Radiological Transportation Impacts Maine Yankee NPP to the CISF (person-Sv)

State	Rural	Suburban	Urban	Total
CT	3.71E-07	4.99E-05	3.40E-06	5.37E-05
IL	1.45E-06	2.22E-05	5.59E-07	2.42E-05
IN	1.48E-06	2.87E-05	5.11E-07	3.07E-05
KS	5.73E-07	5.75E-06	0.00E+00	6.33E-06
MA	2.88E-07	2.29E-05	1.72E-06	2.49E-05
ME	8.59E-07	1.89E-05	4.80E-07	2.02E-05
MO	3.00E-06	4.50E-05	3.58E-07	4.83E-05
NH	2.05E-07	7.39E-06	2.22E-07	7.82E-06
NJ	4.60E-07	2.10E-05	2.58E-06	2.40E-05
NY	1.98E-06	2.52E-05	7.82E-06	3.50E-05
OH	3.15E-06	1.43E-05	2.58E-07	1.77E-05
OK	2.96E-06	4.02E-05	4.52E-07	4.36E-05
PA	5.14E-06	5.71E-05	1.57E-06	6.39E-05
TX	4.15E-06	3.04E-05	9.68E-07	3.56E-05
WV	8.27E-08	3.56E-07	0.00E+00	4.38E-07
			Total	4.36E-04

An additional *population* dose could result from the need to transport SNF *over* short distances by heavy haul truck *or barge* to a rail transfer facility. The effects of *using heavy haul or barge transport* were determined to be small. The results are summarized in Table *4.2-9* for the various shipment modes for the 12 shutdown reactor sites. *The estimates are based on three casks being transported per shipment. This over estimates the doses from heavy haul as only one cask is moved at a time.*

While all of the doses are of the same order of magnitude, the largest collective dose results for shipments from Maine Yankee. In summary, the collective doses for shipment from the sites shown in Table 4.2-9 are small. The use of barge or heavy haul transport for short segments of

the route do not significantly increase doses. The doses calculated for the twelve sites are on the same order of magnitude calculated in NUREG-2125 for similar routes.

Table 4.2-9, *Radiological Impacts from Transportation*

Transportation Impacts from 12 Shutdown Reactor Sites (Based on a single shipment of three casks)						
ORIGIN	***Population Dose (person-Sv)***			***Population Dose (person-rem)***		
	Rail	***Barge and Rail***	***Heavy Haul and Rail***	***Rail***	***Barge and Rail***	***Heavy Haul and Rail***
Maine Yankee	*1.32E-03*	*1.29E-03*		*1.32E-01*	*1.29E-01*	
Yankee Rowe			*8.85E-04*			*8.85E-02*
Connecticut Yankee		*1.09E-03*	*1.03E-03*		*1.09E-01*	*1.03E-01*
Humbolt Bay		*4.47E-04*			*4.47E-02*	
Big Rock Point			*6.74E-04*			*6.74E-02*
Rancho Seco	*4.04E-04*			*4.04E-02*		
Trojan	*6.27E-04*	*6.27E-04*		*6.27E-02*	*6.27E-02*	
La Crosse	*3.62E-04*	*8.28E-04*		*3.62E-02*	*8.28E-02*	
Zion	*4.96E-04*	*8.42E-04*		*4.96E-02*	*8.42E-02*	
Crystal River	*6.15E-04*			*6.15E-02*		
Kewaunee			*7.22E-04*			*7.22E-02*
San Onofre	*2.78E-04*			*2.78E-02*		

4.2.7.2 Incident Free Occupational Doses

The doses for the train crew, escorts, rail yard workers, cargo handlers, inspectors, and emergency personnel responding to an accident in which no release occurs are small and shown in Table 4.2-10.

Table 4.2-10, Occupational Doses per Shipment from Routine Incident-Free Transportation

TRAIN CREW IN TRANSIT 3 PEOPLE		DISTANCE km	TRIP DOSE Person-rem
Rural	7.78E-07	2984.18	2.32E-03
Suburban	7.78E-07	1712.18	1.33E-03
Urban	1.31E-06	346.54	4.54E-04
TOTAL			4.11E-03
RAIL YARD WORKERS		Hours	Dose person-rem
Classification Stop		27	1.65E-02
Railroad Transfer		4	2.44E-03
HANDLERS		Hours	Dose person-rem
5 PEOPLE		5	4.01E-01
ESCORTS		Hours	Dose person-rem
2 PEOPLE Escorts assumed to have 25% greater dose than crew NUREG 2125 (page B-52)		NA	3.42E-03
INSPECTORS		Hours	Dose person-rem
rem/inspection		2 meters for 4 hours	9.55E-02
FIRST RESPONDERS		Hours	Dose person-rem
person-rem/responder		3 meters for 10 hours	1.60E-01

The doses that train crews accrue during transit are determined by multiplying the unit risk factor (URF) for the crew link calculated RADTRAN by the route distance. Escorts are assumed

to receive 25% greater dose than crews because that have to be in line of sight to the SNF casks and have less shielding.

Doses to inspectors and first responders depend on the distance from the cask, exposure time, and number of inspectors or responders. The exposure scenarios are modelled in RADTRAN as stationary sources (train stops).

4.2.8 Impacts from Transportation Accidents

The radiological transportation impacts that could potentially occur during off-normal events were analyzed. Type B transportation casks licensed in accordance with 10 CFR Part 71 are constructed to withstand severe accidents so that most transport accidents would not result in damage to the cask body or seals that would result in a release. The *evaluation* looked at three types of potential accidents involving the transportation of SNF by rail, accidents involving no release, accidents involving a release and accidents resulting in a loss of shielding. The dose risk was found to be small for all three types of accidents, and is described in more detail in Attachment 4.1. The *conclusion* that the accident dose risk is small is consistent with previous studies conducted by the NRC.

4.2.8.1 No-Release Accident

The first type, which is the most common type of accident and typically comprises more than 99.99% of all accidents involving transportation of SNF, is an accident in which no release of radioactive material occurs. For this type of accident, the transportation cask remains intact, but members of the public along a segment of the transportation route may be exposed externally to radiation similar to exposure during routine transport of SNF. Based on experience with transporters of radioactive materials, when such an accident happens, the vehicle remains in place until either the entire vehicle or the cask can be moved. For modeling purposes, it is assumed that the transportation vehicle and cask remain in place for 10 hours.

4.2.8.2 Accident Involving the Release of Radioactive Materials

ISP evaluated severe transportation accidents that could result in the release of radioactive materials. In undertaking its evaluation, ISP assumed that the rail cask (MP197) that it modeled in RADTRAN was similar to the NAC-STC rail cask modelled in NUREG-2125. The casks have similar dimensions and are both lead shielded. ISP used the accident probabilities and release

fractions developed for the NAC-STC cask rail (NUREG-2125, Table E-16) in its RADTRAN analysis of potential releases from the MP197 cask. It is important to note that the probability and release fractions in NUREG-2125 were developed for SNF that is not contained in canisters that are welded shut. This approach is conservative for canisterized fuel because a major conclusion from NUREG-2125 is that no radioactive material would be released in an accident if the SNF is contained in an inner welded canister.

As shown in Section 5.2 of NUREG-2125, the probability of these type accidents is very small. The average accident rate for freight rail (between 1996 through 2007) was reported to be 1.10E-4 accidents per thousand rail-km (3.1E-3 accidents per thousand railcar miles) based on data from the U.S. Department of Transportation's Bureau of Transportation Statistics. Of the accidents that occur, only a small fraction could result in an impact so severe that the cask could release radioactive material. The fraction of accidents that could result in an accidental release was estimated in NUREG-2125 (Table E-16) to range from 1.13E-10 to 5.96E-12. This results in the overall probability of a release from a cask during rail transportation being of the order of 2.0E-17 (1.10E-4 x 1.13E-10).

The radioactive inventory that was used in the accident analysis is shown in Table 4.1-2 of Attachment 4-1. The radionuclides and values are based on a NUHOMS® 61BT canister containing sixty-one 7x7 BWR assemblies in the NUHOMS® MP197 shipping cask. The SNF has a burnup of 40,000 MWd/MTU, an initial average bundle enrichment of 3.3 weight percent, and is 10 year cooled. The source for this data is Table 4-1, Radionuclide Inventory, in NUHOMS® MP197 Transportation Package Safety Analysis Report, Revision 17 (TN Americas, April 2014).

ISP used RADTRAN 6 to calculate the internal and external doses to an MEI for the seven accident scenarios that NUREG-2125 determined could lead to an accidental release from a rail cask. Details on how the calculations were performed are given in Calculation Package WCS01-0506. The MEI doses are shown in Table 4.2-11.

Table 4.2-11, MEI Doses from Accidents that Involve a Release

Cask Orientation	Seal Type	Impact Speed kph	Conditional Probability	Inhalation Sv	Re-suspension Sv	Cloud-Shine Sv	Ground-shine Sv	Total Sv
End	metal	193	5.96E-12	7.49E-02	4.10E-04	9.94E-05	1.70E-03	7.71E-02
Corner	metal	193	3.57E-11	7.49E-02	4.10E-04	9.94E-05	1.70E-03	7.71E-02
Side	elastomer	193	1.79E-11	7.49E-02	4.10E-04	9.94E-05	1.70E-03	7.71E-02
Side	metal	193	1.79E-11	7.49E-02	4.10E-04	9.94E-05	1.70E-03	7.71E-02
Side	elastomer	145	3.40E-10	7.49E-02	4.10E-04	9.94E-05	1.70E-03	7.71E-02
Side	metal	145	3.40E-10	7.49E-02	4.10E-04	9.94E-05	1.70E-03	7.71E-02
Corner	metal	145	1.13E-10	3.40E-02	1.86E-04	4.58E-05	7.67E-04	3.50E-02

The internal dose consists of the inhalation and re-suspension doses. The external dose consists of the cloud shine and ground shine doses. The doses listed in Table 4.2-11 are consequences not risks. The dose to an MEI is not the sum of the doses as each only represents one accident can happen at a time.

The conditional dose risk to the MEI, shown in Table 4.2-12, is determined by multiplying the doses by the conditional probability of the accident scenario.

Table 4.2-12, MEI Conditional Dose Risks from Accidents that Involve a Release.

Cask Orientation	Seal Type	Impact Speed kph	Conditional Probability	Inhalation Sv	Re-suspension Sv	Cloud-Shine Sv	Ground-shine Sv	Total Sv
End	metal	193	5.96E-12	4.46E-13	2.44E-15	5.92E-16	1.01E-14	4.60E-13
Corner	metal	193	3.57E-11	2.67E-12	1.46E-14	3.55E-15	6.07E-14	2.75E-12
Side	elastomer	193	1.79E-11	1.34E-12	7.34E-15	1.78E-15	3.04E-14	1.38E-12
Side	metal	193	1.79E-11	1.34E-12	7.34E-15	1.78E-15	3.04E-14	1.38E-12
Side	elastomer	145	3.40E-10	2.55E-11	1.39E-13	3.38E-14	5.78E-13	2.62E-11
Side	metal	145	3.40E-10	2.55E-11	1.39E-13	3.38E-14	5.78E-13	2.62E-11
Corner	metal	145	1.13E-10	3.84E-12	2.10E-14	5.18E-15	8.67E-14	3.95E-12

The conditional dose risk to an individual is on the order of 1E-11. It represents the risk to an individual given that an accident has already occurred. When considering the probability that an accident has occurred (1.1E-4 accidents per thousand rail-km) the overall dose risk is on the order of 1.1E-18 per km.

Collective internal and external dose risks were also calculated for a Maine Yankee to WCS Shipment. The results are shown in Tables 4.2-13 and 4.2-14.

Table 4.2-13, Maine Yankee to the CISF Collective Internal Dose Risk (person-Sv)

Population	End 193 kpm metal	Corner 193 kpm metal	Side 193 kpm elastomer	Side 193 kpm metal	Side 145 kpm elastomer	Side 145 kpm metal	Corner 145 kpm metal
Rural	2.97E-12	1.78E-11	8.93E-12	8.93E-12	1.70E-10	1.70E-10	2.56E-11
Suburban	5.09E-11	3.05E-10	1.53E-10	1.53E-10	2.90E-09	2.90E-09	4.38E-10
Urban	7.85E-11	4.71E-10	2.36E-10	2.36E-10	4.48E-09	4.48E-09	6.76E-10

Table 4.2-14 Maine Yankee to the CISF Collective External Dose Risk (person-Sv)

Population	End 193 kpm metal	Corner 193 kpm metal	Side 193 kpm elastomer	Side 193 kpm metal	Side 145 kpm elastomer	Side 145 kpm metal	Corner 145 kpm metal
Rural	7.11E-14	4.26E-13	2.13E-13	2.13E-13	4.05E-12	4.05E-12	6.09E-13
Suburban	1.22E-12	7.28E-12	3.65E-12	3.65E-12	6.94E-11	6.94E-11	1.04E-11
Urban	1.12E-11	1.12E-11	5.64E-12	5.64E-12	1.07E-10	1.07E-10	1.61E-11

The total collective dose risk for the Maine Yankee to WCS CISF is shown in Table 4.2-15. Table 4.2-15 is the sum of the internal and external dose risks in Tables 4.2-13 and 4.2-14.

Table 4.2-15, Maine Yankee to the CISF Total Collective Dose Risk (person-Sv)

Population	End 193 kpm metal	Corner 193 kpm metal	Side 193 kpm elastomer	Side 193 kpm metal	Side 145 kpm elastomer	Side 145 kpm metal	Corner 145 kpm metal
Rural	3.05E-12	1.82E-11	9.15E-12	9.15E-12	1.70E-10	1.74E-10	2.62E-11
Suburban	5.21E-11	3.12E-10	1.57E-10	1.57E-10	2.97E-09	2.97E-09	4.48E-10
Urban	8.98E-11	4.82E-10	2.42E-10	2.42E-10	4.59E-09	4.59E-09	6.92E-10

In summary, the radiological impacts of an accident that could release radioactive material are small. These accidents occur at a very low frequency. The doses to a maximum exposed individual ranged from 3.5E-2 to 7.71E-2 Sv. The conditional dose risk to an individual is on the order of 1E-11. The collective dose risk along the longest shipping route, Maine Yankee to WCS CISF, is on the order of 1E-9 to 1E-10.

4.2.8.3 Loss-of-Shielding (LOS) Accidents

ISP evaluated accidents that could result in a loss of lead shielding (LOS). The methodology that ISP used to evaluate the LOS accidents is the same as that used by the NRC in NUREG-2125, Appendix E. Two types of accidents that could cause a lead shielded cask to lose part of its shielding were analyzed. The first type of LOS accident is where a cask is involved in an accident where the cask is either in or near a hot pool fire for over three hours. At

that point the temperature of the lead exceeds its melting point and the lead begins to liquefy. When the liquid lead cools and solidifies, it occupies the same volume, but the volume available between the inner and outer cask walls is larger because of the buckling of the inner cask wall leaving a gap. The second type of accident involves severe impact where the lead shield slumps. ISP analyzed twelve accident scenarios involving LOS from severe impact.

The results of the analysis are shown in Table 4.2-16 and Table 4.2-17. The first two columns in the table represent the reduction in lead shielding and the conditional accident probability for the accident scenario analyzed. The 12 different impact scenarios represent different cask speeds and orientation during impact. A more detailed description of the accident scenarios evaluated can be found in Section E.3.1 of NUREG 2125. The conditional accident probabilities and lead lost fractions that ISP used are found in Table E-2 for impact accidents and Section E.3.1.2 for fire accidents.

Table 4.2-16 provides the estimated one hour dose to a maximum exposed individual (MEI) at specified distance for each of the LOS accidents evaluated. The dose to the MEI at 5 meters from the cask is estimated to be 8.09E-3 Sv (0.809 rem). While LOS accidents involving a fire result in the highest doses to the MEI, LOS accidents involving a severe impact have an increased probability of occurrence which result in a higher dose risk for impact accidents. The dose risks for the MEI are shown in Table 4.2-17. As an example, the largest dose risk for the MEI for a severe impact scenario is estimated to be 4.21E-13 Sv (4.21E-11 rem) for a distance of 5 meters from the cask.

NUREG-2125 calculates dose and dose risk estimates for the MEI for transportation accidents. The doses and dose risks calculated above for the MEI are small and of the same order of magnitude as those presented in NUREG-2125 in Tables E-4 and E-5 for impact accidents and Table E-8 for fire accidents.

Table 4.2-16, Estimated Dose for Loss of Shielding Accidents

Dose (Sv) to MEI at Various Distances from a Cask that lost Gamma Shielding due to Fire								
Reduction of Lead Shielding	Conditional Probability	1m	2m	5m	10m	20m	50m	100m
2.01E-02	3.70E-07	1.04E-02	4.68E-03	1.62E-03	1.62E-05	3.87E-06	5.86E-07	1.41E-07
8.14E-02	8.70E-15	5.23E-02	2.34E-02	8.09E-03	1.68E-04	3.85E-05	5.50E-06	1.26E-06
Dose (Sv) to MEI at Various Distances from a Cask that lost Gamma Shielding due to Impact								
Reduction of Lead Shielding	Conditional Probability	1m	2m	5m	10m	20m	50m	100m
1.84E-05	6.34E-06	1.43E-04	7.14E-05	2.85E-05	8.06E-06	2.02E-06	3.23E-07	8.06E-08
2.80E-04	1.44EE-06	2.12E-04	1.02E-04	3.92E-05	8.06E-06	2.02E-06	3.23E-07	8.06E-08
3.37E-04	6.34E-06	2.30E-04	1.10E-04	4.19E-05	8.07E-06	2.02E-06	3.23E-07	8.06E-08
1.31E-03	6.34E-06	5.73E-04	2.64E-04	9.50E-05	8.09E-06	2.02E-06	3.23E-07	8.08E-08
3.16E-03	5.96E-11	1.34E-03	6.08E-04	2.14E-04	8.22E-06	2.05E-06	3.28E-07	8.18E-08
3.73E-03	1.44E-06	1.60E-03	7.23E-04	2.53E-04	8.29E-06	2.07E-06	3.30E-07	8.23E-08
4.26E-03	1.13E-09	1.84E-03	8.31E-04	2.91E-04	8.36E-06	2.08E-06	3.32E-07	8.28E-08
5.12E-03	1.44E-06	2.25E-03	1.01E-03	3.54E-04	8.50E-06	2.12E-06	3.37E-07	8.39E-08
1.70E-02	1.13E-09	8.61E-03	3.86E-03	1.34E-03	1.37E-05	3.31E-06	5.07E-07	1.23E-07
2.34E-02	1.13E-09	1.24E-02	5.56E-03	1.93E-03	1.93E-05	4.58E-06	6.86E-07	1.64E-07
6.34E-02	5.96E-11	3.90E-02	1.75E-02	6.06E-03	1.02E-04	2.34E-05	3.36E-06	7.75E-07
7.25E-02	5.96E-11	4.57E-02	2.05E-02	7.07E-03	1.33E-04	3.05E-05	4.37E-06	1.00E-06

Table 4.2-17, Estimated Dose Risk for Loss of Shielding Accidents

Conditional Dose Risk (person-Sv) to MEI at Various Distances from a Cask that lost Gamma Shielding due to Fire								
Reduction of Lead Shielding	**Conditional Probability**	**1m**	**2m**	**5m**	**10m**	**20m**	**50m**	**100m**
0.0201	3.70E-07	3.85E-09	1.73E-09	5.99E-10	5.99E-12	1.43E-12	2.17E-13	5.22E-14
0.0814	8.70E-15	4.55E-16	2.04E-16	7.04E-17	1.46E-18	3.35E-19	4.79E-20	1.10E-20
Conditional Dose Risk (person-Sv) to MEI at Various Distances from a Cask that lost Gamma Shielding due to Impact								
Reduction of Lead Shielding	**Conditional Probability**	**1m**	**2m**	**5m**	**10m**	**20m**	**50m**	**100m**
1.84E-05	6.34E-06	9.07E-10	4.53E-10	1.81E-10	5.11E-11	1.28E-11	2.05E-12	5.11E-13
2.80E-04	1.44EE-06	3.05E-10	1.47E-10	5.64E-11	1.16E-11	2.91E-12	4.65E-13	1.16E-13
3.37E-04	6.34E-06	1.46E-09	6.97E-10	2.66E-10	5.12E-11	1.28E-11	2.05E-12	5.11E-13
1.31E-03	6.34E-06	3.63E-09	1.67E-09	6.02E-10	5.13E-11	1.28E-11	2.05E-12	5.12E-13
3.16E-03	5.96E-11	7.99E-14	3.62E-14	1.28E-14	4.90E-16	1.22E-16	1.95E-17	4.88E-18
3.73E-03	1.44E-06	2.30E-09	1.04E-09	3.64E-10	1.19E-11	2.98E-12	4.75E-13	1.19E-13
4.26E-03	1.13E-09	2.08E-12	9.39E-13	3.29E-13	9.45E-15	2.35E-15	3.75E-16	9.36E-17
5.12E-03	1.44E-06	3.24E-09	1.45E-09	5.10E-10	1.22E-11	3.05E-12	4.85E-13	1.21E-13
1.70E-02	1.13E-09	9.73E-12	4.36E-12	1.51E-12	1.55E-14	3.74E-15	5.73E-16	1.39E-16
2.34E-02	1.13E-09	1.40E-11	6.28E-12	2.18E-12	2.18E-14	5.18E-15	7.75E-16	1.85E-16
6.34E-02	5.96E-11	2.32E-12	1.04E-12	3.61E-13	6.08E-15	1.39E-15	2.00E-16	4.62E-17
7.25E-02	5.96E-11	2.72E-12	1.22E-12	4.21E-13	7.93E-15	1.82E-15	2.60E-16	5.96E-17

4.2.9 Nonradiological *Impacts*

ISP evaluated the *nonradiological* impacts of *rail* accidents that may occur during the transport of SNF to the *WCS CISF*. A nonradiological *impact results from a rail* accident in which the property damage, injuries, or fatalities are caused by the force of the impact; no release of or exposure to radiological materials occurs as a result of the *rail* accident. Based on the *2013* accident rate data *compiled for freight rail by the Federal Railroad Administration Office of Safety Analysis,* the average rate of injury *for freight rail was 7.1E-5 per mile (4.4E-5 per km) and the average rate of fatality was 6.0E-6 per mile (3.7E-6 per km).*

On the basis of this data, along with the WebTRAGIS computer code route data, the projected number of nonradiological injuries and fatalities for rail transport was calculated for the routes from Maine Yankee and San Onofre to the CISF and from the CISF to Yucca Mountain. The results are given in Table 4.2.18 for a single shipment, annual shipment of 200 casks in 80 shipments, and for the 40 year licensing period (3200 shipments).

Table 4.2.18, Nonradiological Impacts of Transportation

Route	Distance km	Fatalities per km	Injuries per km	Fatalities per shipment	Injuries per shipment	Fatalities per year	Injuries per year	Fatalities 40 year	Injuries 40 years
						80 shipments		3200 shipments	
Maine Yankee to WCS CISF	*5042.91*	*3.73E-07*	*4.41E-05*	*0.002*	*0.22*	*0.15*	*17.80*	*6.02*	*711.93*
Rancho Seco to WCS CISF	*1752.35*	*3.73E-07*	*4.41E-05*	*0.001*	*0.08*	*0.05*	*6.18*	*2.09*	*247.39*
WCS CISF to Yucca Mountain	*1474.69*	*3.73E-07*	*4.41E-05*	*0.001*	*0.07*	*0.04*	*5.20*	*1.76*	*208.19*

ISP also estimated the potential human health effects of vehicle emissions from locomotives during rail transport of radioactive materials.

The Final Waste Management Programmatic Environmental Impact Statement for Management, Storage and Disposal of Radioactive and Hazardous Waste, DOE/EIS-0200-F (page E-32) developed risk factors to estimate the excess latent mortality from pollution inhalation for rail shipment. The risk factor for rail shipments was 1.3E-7 per km (2.1E-7 per mile). ISP estimated the excess latent mortality based on each shipment to the CISF and later to Yucca Mountain being about 6500 km (4040 miles). This is the combined distance between Maine Yankee and the CISF and the CISF and Yucca Mountain. Assuming 3200 shipments are made during the 40 year licensing period; this would result in a distance traveled of 20.8 million km (12 million miles) and a latent mortality of 2.7. The excess latent mortality for a single shipment would be 8.45E-4.

4.3 GEOLOGY AND SOILS IMPACTS

Geoservices advanced 18 boreholes in the CISF Phase I and facilities areas, logging the upper 5 ft as silty sand with caliche (WCS CISF SAR, Attachment E). These borings were all located within an area where Blakeney and Conger soils are inferred by the USDA Soil Survey (ER Figure 4.3-1). Table 3 of the USDA Soil Resources Report lists the percent of soil passing a No. 200 sieve for the Blakeney and Conger soils as ranging from 40 to 75 percent. The Geoservices Report in Appendix B of the SAR lists the material properties from soil samples taken from the upper 5 feet as having 35 to 48 percent passing a No. 200 sieve, which is mostly within range of what is expected for the Blakeney soils according to the USDA Soil Resource Report (ER Attachment 3-2). Previous onsite boring logs (WCS CSIF SAR, Attachment C) where the Blakeney and Conger soils occur (TP-64, TP-84, TP-76, PZ-36, and TP-65) note 1-2 ft of dry, tan sandy silt overlying caliche, which is in agreement with the USDA description of the Blakeney and Conger soils as 0-18 inches of brown, fine sandy loam underlain by white, strongly cemented caliche. Previous onsite boring logs where the Jalmar-Penwell association occurs (PZ-46 and PZ-47) indicate 4 to 6 ft of orangish-tan, well-sorted sand, consistent with the USDA description of Jalmar-Penwell soils as sand to sandy-loam ranging in color from brown to reddish-yellow and extending to depths around 85 inches. There are no onsite borings that verify the characteristics of either the Ratliff or Triomass and Wickett soils which together occupy about 38% of the proposed CISF footprint. Based on the consistency between the USDA and recent and previous onsite boring descriptions, these soils are likely similar to the loam and fine sandy clay loam descriptions in the USDA report.

Subsurface geologic materials at the CISF site generally consist of competent clay red beds. The clay red beds are covered with about 6.7 to 16 m (22 to 54 ft) of silty sand, sand, sand and gravel, and alluvium that are part of the *Ogallala* and/or Antlers Formation *overlain by the Blackwater Draw Formation.* Foundation conditions at the site are generally good and no potential for mineral development exists or has been found at the site.

The site terrain currently ranges in elevation from 1067, to 1052, m (3520, to 3482, ft) msl, respectively. *The existing proposed CISF area is undeveloped and the land surface is fairly flat with an average slope of 0.8% towards the southeast. The cut and fill activities proposed for the CISF will allow construction and operation of the facility and maintain overall grading and drainage in the same direction as the existing undeveloped area. Excavation and backfill activity will mostly be focused in the 133 acres of the Protected Area. A net volume of approximately 700,000 cubic yards is anticipated to be excavated and stockpiled. The majority of this material (approximately 650,000 cubic yards) will be excavated as a result of site grading. The remaining excavation will be a result of drainage berm and ditch construction, storage pad and building construction, and rail side track construction. Material will be stockpiled at the existing material stockpile northeast of the proposed CISF. Figures 2.26, 2.27, 2.28, 2.29, 2.30, 2.31, 2.32, and 2.33 of Chapter 2, "Site Characteristics," of the Safety Analysis Report (ISP 2019) show plans and profiles for the extent of excavation and backfill as part of construction and final grading.*

Surface storm water runoff for the permanent facility would be controlled by an engineered drainage system. Those controls would essentially eliminate any potential for significant discharge of runoff from the CISF site. Construction activities may cause some short-term increases in soil erosion at the site, although rainfall in the region is limited. Erosional impacts due to site clearing and grading would be mitigated by utilization of construction and erosion control BMPs *as detailed in Section 4.1 of the ER*. Disturbed soils would be stabilized as part of construction work. Earth berms, dikes, and sediment fences would be utilized as necessary during all phases of construction to limit runoff.

CISF construction and operation will require minimal disturbance to the subsurface and should be limited to the upper 3 m (10 ft). Construction and operation activities being limited to the upper 3 m (10 ft) will create little disruption to the subsurface and should not produce any induced seismic activity or affect subsurface faults in a way that may result in the accidental discharge of radioactive materials or other contaminants into the groundwater table and surrounding areas. *Effects of the site grading and excavation on stratigraphy will involve removal of the cover sands and part of the Blackwater Draw caliche.*

Much of the excavated areas would be covered by structures or paved, limiting the creation of new dust sources. Watering would be used to control potentially fugitive construction dust. Water conservation would be considered when deciding how often dust suppression sprays would be applied. The Andrews County Soils Survey describes soils found at the CISF site as

applicable for range, wildlife, and recreation areas, and not for any standard agricultural activities. The impact to soils during construction and operation of the CISF are small and are not anticipated to displace any potential substantial agrarian use. (Figure 4.3-1).

The CISF would be designed and constructed in a manner that would minimize the quantity of radioactive wastes and contaminated equipment, and facilitate the removal of radioactive wastes and contaminated materials at the time the CISF is permanently decommissioned pursuant to 10 CFR 72.130, *Criteria for decommissioning*. At the time of license termination, the site would be released for unrestricted use in accordance with 10 CFR 20, Subpart E. Therefore, the cumulative impact to soil would be small.

More information can be found in Section 5.6 of the SAR.

4.4 WATER RESOURCES IMPACTS

Water resources at the site are virtually nonexistent. There is no surface water body on the site and appreciable groundwater resources are at depths greater than approximately 340 m (1,115 ft). The site region has a semi-arid climate, with low precipitation rates and minimal surface water occurrence. Thus, the potential for negative impacts on surface water resources is very low due to lack of water presence and formidable natural barriers to any surface or subsurface water occurrences.

Groundwater at the site would not likely be impacted by any potential releases. The pathways for planned and potential releases are discussed below.

Permits related to water must be obtained for site construction and facility operation. The purpose of these permits is to address the various potential impacts on water and provide mitigation as needed to maintain state water quality standards and avoid any degradation to water resources at or near the site. These include:

- A TPDES General Permit for Industrial Storm Water: This permit is required for point source discharge of storm water runoff from industrial or commercial facilities to the waters of the state. All new and existing point source industrial storm water discharges associated with industrial activity requires a TPDES storm water permit from the TCEQ and an oversight review by the EPA, Region 6.

- TPDES General Permit for Construction Storm Water: Because construction of the CISF would involve the disturbance of no more than 40 ha (100 acres) of land, a TPDES Construction General Permit from the TCEQ and an oversight review by the EPA Region 6 is required. ISP would develop a SWPPP and file a NOI with the TCEQ in Austin, TX prior to the commencement of construction activities.
- Section 401 Certification: Under Section 401 of the federal Clean Water Act, states can review and approve, approve with conditions, or deny all federal permits or licenses that might result in a discharge to State waters, including wetlands. A 401 certification confirms compliance with the State water quality standards. Activities that require a 401 certification include Section 404 permits issued by the U. S. Army Corps of Engineers (USACE). The State of Texas has a cooperative agreement and joint application process with the USACE relating to 404 permits and 401 certifications. By letter dated *June 24, 2019*, the USACE notified ISP joint venture member Waste Control Specialists of its determination that there are no USACE jurisdictional waters at the Waste Control Specialists site *or the proposed CISF* and for this reason the project does not require a 404 permit. As a result, a Section 401 certification is not required.

Collection and discharge of storm water runoff would be directed to the natural drainage network. The overall site would be graded to match the existing natural drainage and to prevent standing water at the CISF. The storm water runoff would be directed away from the facility and toward *existing drainage patterns. A detailed site-specific topographic map with 1 ft contour intervals based on aerial survey flown May 29, 2014 is provided in Figure 4.4-1. The map illustrates the proposed CISF and the specific location of the surface water drainage divide between the Rio Grande (Pecos Valley) and Colorado River Basins and confirms the proposed CISF location is entirely within the Rio Grande River Basin. See the CISF Drainage Evaluation and Floodplain Analysis in SAR Chapter 2 Attachment B regarding runoff and drainage.*

Industrial construction at the CISF site would create a short-term risk with regard to a variety of operations and constituents used in construction activities. BMPs would assure storm water runoff related to construction activities would be detained prior to release to the surrounding land surface. BMPs would also be used for dust control associated with excavation and fill operations during construction. Impact from storm water runoff generated during plant operations is not expected to differ substantially from impacts currently experienced at the site. The water quality of the discharge from the site storm water would be typical of runoff from building roofs and paved areas from any industrial facility. Except for small amounts of oil and

grease typically found in runoff from paved roadways and parking areas, the discharge is not expected to contain contaminants.

Other potential sources for runoff contamination during plant operation include the cask storage pad containing SNF and associated components. This pad is a potential source of low-level radioactivity that could enter runoff, though such an occurrence is highly unlikely. The storage system design and construction, along with environmental monitoring of the storage pad, combine to make the potential for contaminant release through this system extremely low. An initial analysis of maximum potential levels of radioactivity in rainwater runoff due to surface contamination of the dry casks shows that any potential levels of radioactivity in discharges would be well below (two orders of magnitude or more) the effluent discharge limits of 10 CFR Part 20, Appendix B.

During construction and operation of the proposed WCS CISF, potable water will be supplied by *the* existing potable water system at ISP joint venture member Waste Control Specialists. *The Waste Control Specialists potable water system is supplied with water by Eunice, New Mexico via pipeline. Construction and operation of the proposed WCS CISF will not use potable groundwater resources from the Waste Control Specialists property and will not have any impact on groundwater resources at the Waste Control Specialists property, since the potable water is supplied by Eunice, NM. The total gallons of potable water supplied to ISP partner Waste Control Specialists by Eunice, NM for the neighboring Waste Control Specialists facilities for the years 2014 to 2018 ranged from 882,815 gallons (2016) up to 3,631,508 gallons (2018). The increase in 2018 was due to the expansion of the Waste Control Specialists landfill facilities. For construction and operation of the proposed WCS CISF, the potable water usage is expected to be minimal. Water needs during construction (5,000 gallons/day) and operation (1,800 gallons/day) of the WCS CISF are conservative. During operation, water usage would be similar to a light industrial facility with 24-hour a day security personnel. Highest water demand is associated with dust suppression and increased personnel during initial construction. Construction and operation of the WCS CISF will have little measurable off-site effects on water quality or levels from the City of Eunice.* There *is no permanent* surface water in the vicinity of the proposed CISF. The closest surface water conveyance is *Monument* Draw, New Mexico*, which is* located approximately 3 miles from the proposed WCS CISF. No adverse impacts to *groundwater or* surface water are anticipated during construction and operation of the proposed WCS CISF.

The proposed WCS CISF is not located in the 100 year floodplain (SAR Attachment B). There are no maps of special flood hazard areas for the location published by the Federal Emergency Management Agency (FEMA).

The CISF would be designed and constructed in manner that would minimize the quantity of radioactive wastes and contaminated equipment, and facilitate the removal of radioactive wastes and contaminated materials at the time the CISF is permanently decommissioned pursuant to 10 CFR 72.130, *Criteria for decommissioning*. At the time of license termination, the site would be released for unrestricted use in accordance with 10 CFR 20, Subpart E. Therefore, the cumulative impact to water resources would be small.

4.5 ECOLOGICAL RESOURCES IMPACTS

This section describes the ecological impacts on the terrestrial and aquatic communities of the proposed action and alternatives. Ecological resources are described in Chapter 3, Section 3.5.

4.5.1 Ecological Impacts of Proposed Versus Alternative Actions

The proposed action is the issuance to ISP of an NRC license under 10 CFR 72 authorizing the construction and operation of a CISF located on approximately 130 ha (320 acres) of land controlled by ISP joint venture member Waste Control Specialists and leased to ISP in Andrews County, Texas. As described in Chapter 2 of this ER, the alternatives to the proposed action include: (1) the “no action” alternative; (2) the alternative to available spent fuel and GTCC LLW storage technologies; (3) the design alternatives, and (4) alternative sites for the proposed CISF.

4.5.1.1 Ecological Impacts of the “No Action” Alternative

Under the “no action” alternative, ISP would not construct or operate the CISF and America’s shutdown decommissioned commercial reactors that have already undergone decommissioning would be required to continue to operate and expand their ISFSIs instead of returning the land to a green field condition and making it available for economic or recreational or potentially for development in a manner with benefit to ecological resources (e.g., into wetlands, wildlife sanctuary).

4.5.1.2 Ecological Impacts of the "Alternative Available SNF Technologies" Alternative

A change in WCS CISF use of Alternative Available SNF Technologies would have no adverse ecological impacts.

4.5.1.3 Ecological Impacts of the "Design Alternative" Alternative

A change in WCS CISF use of Design Alternative would have no adverse ecological impacts.

4.5.1.4 Ecological Impacts of "Alternative Sites" Alternative

As described in Chapter 2, the alternative sites are three proposed away from reactor ISFSIs located in: Lea County, New Mexico; Eddy County, New Mexico; and Loving County, Texas. Due to the alternative sites close geographical proximity, comparable ecological resources, and necessary analogous design components, with respect to the WCS CISF, the level of ecological impact of each should be essentially the same as that of the WCS CISF, which is small. The proposed Lea County facility's ecology, like the WCS CISF's, is highly comparable to that of the URENCO NEF. The NEF was extensively studied during its NRC licensing process. The Eddy County Facility is adjacent to the DOE's WIPP and was the subject of virtually unparalleled intense study during its regulatory review and authorization process. Though little is known of the Loving County site, the potential for variance in ecological impact of any significance between it and the WCS CISF can be expected to be small due to the homologous nature of the ecosystems and facility functions.

4.5.2 Documentation of Consultations with Agencies on Impacts to Species and Habitat

Consultation was initiated with all appropriate federal and state agencies. Consultation Documents are presented in Attachment 3-3.

4.5.3 Proposed Schedule of Activities

Design, licensing and construction of phase one of the CISF is scheduled for a five-year period from 2015 through 2020. Construction of the phase 1 storage pad and the site infrastructure would begin in the second half of 2019 and be completed by the end of 2020. Operations at the phase 1 storage pad would commence in early 2021. Subsequent phases 2 through 8 could be constructed thereafter continuously from 2021 to 2040; each phase will require approximately 2.5 years for construction and startup. The facility could operate from 2021 to 2059. Decommissioning and closure would require 2 years. *It is noted that the proposed schedule of activities outlined above is contingent on issuance of the Part 72 license for the WCS CISF and will therefore be adjusted based on the actual license issuance. However, the durations used in the evaluations and results included in this ER remain the same, only the start and subsequent dates move with the license issuance date.*

It is possible that the license will be renewed for an additional 20-year period. In that event, the operating lifetime of the facility could be extended to 2076. Decommissioning and closure could be completed in 2078.

4.5.4 Land Clearing and Area of Disturbance

The land to be cleared is the land within the CISF Owner Controlled Area as depicted in Figure 4.5-1. The total area of land to be disturbed is approximately *133.4 ha (330 acres)*. This area includes *1.6 ha (4 acres)* that will be used for contractor parking and lay-down areas. The ecological impacts of this land disturbance are expected to be small given the CISF area size, especially in relation to the vast amount of uninhabited and undisturbed land found throughout the region. The contractor lay-down and parking area will be restored after completion of plant construction. The CISF consists entirely of an upland area with no streams, ponds or other water environments to be cleared. There are no waste disposal areas present at the CISF.

4.5.5 Area of Disturbance by Habitat Type

The proposed CISF consists of one primary vegetation community type. The Plains-Mesa Sand Scrub vegetation community is identified by the dominant presence of deep sand tolerant and deep sand adapted plants. The Plains-Mesa Sand Scrub vegetation community is common in parts of the southeastern high plains. The density of specific plant species, quantified by individuals per acre, varies slightly across the proposed site. Differences in the composition of the vegetation community within the proposed site are accounted for by slight variations in soil texture and structure and small changes in aspect.

The Plains-Mesa Sand Scrub vegetation community is interrupted by a couple of access roads through the proposed CISF. These roads are devoid of vegetation. This area represents a small fraction of the total area and is not considered a habitat type. The majority of the proposed site is suitable for use by wildlife resources. The Plains-Mesa Sand Scrub provides potential habitat for an assortment of birds, mammals, and reptiles. The total area of disturbance proposed for the proposed CISF is approximately *133.4 ha (330 acres)* of the 5,668 ha (14,000 acres) ISP joint venture member Waste Control Specialists property. The disturbance would have a small impact on the Plains-Mesa Sand Scrub biota due to CISF construction, operations, and decommissioning.

4.5.6 Maintenance Practices

Roadway maintenance will be employed during the construction and operations and decommissioning of the CISF. However, because road maintenance is currently being employed along the existing access roads, this will not represent a substantial new impact to biota. The impacts to biota from maintenance practices during CISF construction, operations, and decommissioning will be small.

Maintenance practices, roadway maintenance, and clearing practices will be employed both during construction and plant operation. Herbicides may be used in limited amounts according to government regulations and manufacturer's instructions to control unwanted noxious vegetation during construction or operation of the facility. However, none of the practices are anticipated to permanently affect biota.

Brush clearing will be employed during construction of the CISF. The additional noise, dust, and other factors associated with the clearing will be short-lived in duration and will represent only a temporary impact to the biota of the CISF. Because *133.4 ha (330 acres)* in the owner controlled area of the 5,668 ha (14,000 acres) Waste Control Specialists property will be disturbed, biota will have an opportunity to move to undisturbed areas within the site as well as additional areas of suitable habitat bordering the site. Additionally, during operations, natural, low water consumption landscaping will be used and maintained.

4.5.7 Short Term Use Areas and Plans for Restoration

All areas to be used on a short-term basis during construction, including contractor parking and lay-down areas, will be limited to approximately *1.6 ha (4 acres)*. These areas will be re-vegetated with native plant species and other natural, low water consumption landscaping to control erosion upon completion of site construction and returned as close as possible to original conditions. Lay-down (short term use areas) will be selected to minimize the impacts to local vegetation and ensure that any adverse ecological impacts are as small as possible.

4.5.8 Activities Expected to Impact Sensitive Communities or Habitats

No communities or habitats that have been defined as rare or unique or that support threatened and endangered species have been identified on the CISF. Thus, proposed activities are not

expected to impact communities or habitats defined as rare or unique or that support threatened and endangered species within the *133.4 ha (330 acres)*.

Dune formations in combination with the Plains Sand Scrub vegetation community at the WCS CISF site have the potential to provide habitat for the sand dune lizard (*Sceloporus arenicolus*). Some dune formations are adjacent to the proposed area of disturbance. Surveys were conducted at the WCS CISF site in 2004 and at the NEF site in October 2003 and June 2004 to detect the presence of the sand dune lizard. No individuals were identified during the surveys and, although the area has some components of sand dune lizard habitat, various factors make it unsuitable. The closest known sand dune lizard population was approximately 4.8 km (3 mi) north of the NEF site. Areas to the west, south, and east of the site do not appear to have suitable habitat for the sand dune lizard within 16 to 32 km (10 to 20 mi).

In the general region of the CISF, there are several thousand acres of sand dune formation that would not be impacted by the project. Although black-tailed prairie dogs (*Cyonomys ludovicianus*) have expanded their range into shinnery oak and other grass-shrub habitats, they usually establish colonies in short grass vegetation types. The predominant vegetation type, Plains Sand Scrub, on the CISF is not optimal prairie dog habitat due to high-density shrubs. There have been no recorded sightings of black-tailed prairie dogs, active or inactive prairie dog mounds/burrows, or any other evidence, such as trimming of the various shrub species, at the CISF.

The Texas horned lizard is vulnerable to construction activities that could result in a direct loss of breeding habitat. Because the species has adapted to areas of human activities such as overgrazed pastures, plowed fields, and fencerows, it could potentially be present during the CISF operations phase. Decommissioning activities could have similar impacts on the lizard as the construction phase.

4.5.9 Impacts of Elevated Construction Equipment or Structures

The construction of new towers can create a potential impact on migratory birds, especially night-migrating species. Some of the species affected are also protected under the Endangered Species Act and the Bald and Golden Eagle Act. However, the estimate of the potential impacts of elevated construction equipment or structures on species is extremely low for the CISF.

The tallest proposed CISF structure is 23 m (75 ft), which is well under the 61 m (200 ft) threshold that requires lights for aviation safety. This avoidance of lights, which attract species, and the low above ground level structure height, also reduces the relative potential for impacts. Additionally, security lighting for all ground level facilities and equipment will be down-shielded to keep light within the boundaries of the site, also helping to minimize the potential for impacts.

4.5.10 Tolerances and Susceptibilities of Important Biota to Pollutants

The species indicated as important species are generally highly mobile species and may not be as susceptible to localized physical and chemical pollutants as other less mobile species such as invertebrates and aquatic species. Due to the lack of direct discharge of water, storm water management practices and the lack of aquatic systems at the CISF, no significant impacts to aquatic systems are expected. Additionally, the two identified species of concern in the general area, the Texas horned lizard and the sand dune lizard either do not occur on the CISF or are highly adaptable. The impacts to biota from localized physical and chemical pollutants during CISF construction, operations, and decommissioning will be small.

The mule deer has a relatively high tolerance to physical pollution such as noise, as do other smaller wildlife species such as rodents and coyotes that may inhabit the CISF.

4.5.11 Construction Practices

Standard land clearing methods, primarily the use of heavy equipment, will be used during the construction phase of the CISF. Erosion, runoff, and situation control methods both temporary and permanent will follow the BMPs.

When required, applications of controlled amounts of water will be used to control dust in construction areas. Water conservation will be considered when deciding how often dust suppression sprays will be applied.

After construction is complete, the site will be stabilized with native grass species, pavement, and crushed stone to control erosion. Furthermore, any eroded areas that may develop will be repaired and stabilized. BMPs will be followed to ensure the impacts to biota during CISF construction will be minimal.

4.5.12 Special Maintenance Practices Used in Important Habitats

No important habitats (e.g., marshes, natural areas, bogs) have been identified within the *133.4 ha (330 acres)* CISF. Therefore, no special maintenance practices are proposed.

4.5.13 Wildlife Management Practices

Several best management practices to limit or minimize impacts to existing wildlife habitat in association with the CISF will be included. These best management practices include:

- Use of design and BMPs to minimize the construction footprint to the extent possible
- Site stabilization practices to reduce the potential for erosion and sedimentation
- When possible, leave open areas undisturbed, including areas of native grasses and shrubs for the benefit of wildlife
- The use of native plant species to re-vegetate disturbed areas to enhance wildlife habitat

4.5.14 Practices and Procedures to Minimize Adverse Impacts

Several practices and procedures have been designed to minimize adverse impacts to the ecological resources of the proposed CISF. These practices and procedures include the use of BMPs, minimizing the construction footprint to the extent possible, avoiding all direct discharge (including storm water) to any waters of the U. S., the protection of all undisturbed naturalized areas, and site stabilization practices to reduce the potential for erosion and sedimentation. The use of native plant species to re-vegetate disturbed areas will enhance and maximize the opportunity for native wildlife habitat to be reestablished at the site.

4.6 AIR QUALITY IMPACTS

The greatest expected air quality impacts would be attributed to products of combustion from construction and earthmoving equipment and fugitive dust involved in site preparation and construction. Air quality impacts from construction site preparation for the proposed CISF were evaluated using AERMOD version 15181 to determine hourly impacts and emission rates quantified for these sources. Emission rates for products of combustion and fugitive dust were calculated using emission factors provided in AP-42, the EPA's Compilation of Air Pollutant Emission Factors (EPA, 1995), and the most recent emissions standards from the EPA with regard to on-road and non-road engines. Emission rates for construction activities were estimated for a 10-hour workday assuming peak construction activity levels were maintained for

approximately eight months of the year. The calculated impacts of emissions of products of combustion and fugitive dust are compared to the National Ambient Air Quality Standards (NAAQS) and are presented in Table 4.6-1 and Table 4.6-2 for construction activities and Table 4.6-3 for operations activities.

Fugitive dust emissions were estimated using an AP-42 emission factor for construction site preparation that was adjusted to account for dust suppression measures (per TCEQ's Rock Crushing Plant Emission Calculation Workbook) and the fraction of total suspended particulate that is expected to be in the range of particulates less than or equal to 10 micrometers (PM_{10}) in diameter and 2.5 micrometers ($PM_{2.5}$) in diameter. Emissions were modeled as a point source for engines and a series of volume sources for fugitive dust with emissions occurring 10 hours per day, 5 days per week, and 34.5 weeks per year. Emissions of criteria pollutants from construction activities are below the NAAQS.

Construction and operation emissions lifetime totals are shown in Table 4.6-4.

Air quality impacts are expected to be highest during phase 1 of construction, with subsequent phases of construction having less emissions. Operational emissions would be intermittent and would not be expected to contribute to an exceedance of any ambient air quality standard, as shown in Table 4.6-3. Visibility impacts during construction would be minimal and water spray dust suppressants would be used to help minimize visibility impacts. During operation, there are no anticipated visibility impacts. The proposed CISF would be designed and constructed in a manner that would minimize the quantity of radioactive wastes and contaminated equipment, and facilitate the removal of radioactive wastes and contaminated materials at the time the proposed CISF is permanently decommissioned pursuant to 10 CFR 72.130, Criteria for decommissioning. At the time of license termination, the site would be released for unrestricted use in accordance with 10 CFR 20, Subpart E, and the site would be abandoned in place. Therefore, the impact to air quality during decommissioning would be negligible, if any at all.

Table 4.6-1
NAAQS Compliance Demonstration – Phase 1
(6 pages)

1-Hour NO2, SO2, and CO NAAQS

Phase	Emissions Source	1-hr NOx Emission Rate (lb/hr)	1-hr SO2 Emission Rate (lb/hr)	1-hr CO Emission Rate (lb/hr)	NO2* AERMOD 1-hour Unit Impact ([µg/m³]/[lb/hr])	NO2** Background Concentration (µg/m³)	NO2 Total Impact (µg/m³)	1-hour SIL (µg/m³)	Meets SIL?	1-hour NAAQS (µg/m³)	Meets NAAQS?	SO2 AERMOD 1-hour Unit Impact ([µg/m³]/[lb/hr])	SO2*** Background Concentration (µg/m³)	SO2 Total Impact (µg/m³)	1-hour SIL (µg/m³)	Meets SIL?	1-hour NAAQS (µg/m³)	Meets NAAQS?	CO AERMOD 1-hour Unit Impact ([µg/m³]/[lb/hr])	CO**** Background Concentration (µg/m³)	CO Total Impact (µg/m³)	1-hour SIL (µg/m³)	Meets SIL?	1-hour NAAQS (µg/m³)	Meets NAAQS?
Earthwork	Heavy Haul Truck	0.62	2.87	9.35	3.73		2.30					4.15		11.91					4.15		38.79				
	Earth Mover	5.75	2.05	6.68	2.73		15.72					3.04		6.22					3.04		20.28				
						Total	**18.02**							**18.13**							**59.07**				
Cask Bldg	Pump Truck	0.18	0.82	2.67	3.29		0.58					3.65		3.00					3.65		9.77				
	Ready Mix Truck	0.18	0.82	2.67	3.29		0.58					3.65		3.00					3.65		9.77				
	Construction Equipment	4.60	1.64	5.34	3.29		15.14					3.65		5.99					3.65		19.53				
	Earth Mover	2.88	1.03	3.34	2.73		7.86					3.04		3.11					3.04		10.14				
						Total	**16.30**							**11.99**							**39.06**				
Admin Bldg	Pump Truck	0.18	0.82	2.67	3.29		0.58					3.65		3.00					3.65		9.77				
	Ready Mix Truck	0.18	0.82	2.67	3.29		0.58					3.65		3.00					3.65		9.77				
	Construction Equipment	4.60	1.64	5.34	3.29		15.14					3.65		5.99					3.65		19.53				
	Earth Mover	2.88	1.03	3.34	2.73		7.86					3.04		3.11					3.04		10.14				
						Total	**16.30**							**11.99**							**39.06**				
SNF Pad	Pump Truck	0.18	0.82	2.67	3.29		0.58					3.65		3.00					3.65		9.77				
	Ready Mix Truck	0.18	0.82	2.67	3.29		0.58					3.65		3.00					3.65		9.77				
	Earth Mover	5.75	2.05	6.68	2.73		15.72					3.04		6.22					3.04		20.28				
						Total	**16.88**							**12.22**							**39.81**				
Protected	Heavy Haul Truck	0.15	0.72	2.34	3.73		0.57					4.15		2.98					4.15		9.70				
Area	Earth Mover	5.75	2.05	6.68	2.73		15.72					3.04		6.22					3.04		20.28				
						Total	**16.29**							**9.20**							**29.97**				
Total*****						**26.2**	**33.17**	**7.50**	**NO**	**188**	**YES**		**22.80**	**23.98**	**7.80**	**NO**	**196**	**YES**		**343.60**	**78.13**	**2,000**	**YES**	**40,000**	**YES**

NOTES:
*AERMOD ARM2 NOx/NO2 method used to determine 1-hour unit impact.
**Based on 1-hour NO2 readings of monitoring data - TCEQ El Paso Ascarate Park SE Ambient Monitoring Station, monthly maximum, August 2019
***Based on 1-hour SO2 readings of monitoring data - TCEQ Big Spring Midway Ambient Monitoring Station, monthly average, August 2019
****Based on 1-hour CO readings of monitoring data - TCEQ El Paso Ojo De Agua Ambient Monitoring Station, monthly maximum, August 2019
*****Impacts take into account the maximum of General Earthwork, the sum of Cask and Admin Building operations, and the sum of SNF Pad and Protected Area construction, as these operations are not expected to take place during the same time period.

Table 4.6-1
NAAQS Compliance Demonstration - Phase 1

(6 pages)

3-Hour SO2 NAAQS

Phase	Emissions Source	1-hr SO2 Emission Rate (lb/hr)	SO2 3-hr Unit Impact ([μg/m³]/[lb/hr])	Background Concentration*	Total Impact (μg/m³)	3-hour SIL (μg/m³)	Meets SIL?	3-Hour NAAQS (μg/m³)	Meets NAAQS?
Earthwork	Heavy Haul Truck	2.87	2.42		6.95				
	Earth Mover	2.05	2.05		4.20				
				Total	**11.15**				
Cask Bldg	Pump Truck	0.82	2.29		1.88				
	Ready Mix Truck	0.82	2.29		1.88				
	Construction Equipment	1.64	2.29		3.76				
	Earth Mover	1.03	2.05		2.10				
				Total	**7.52**				
Admin Bldg	Pump Truck	0.82	2.29		1.88				
	Ready Mix Truck	0.82	2.29		1.88				
	Construction Equipment	1.64	2.29		3.76				
	Earth Mover	1.03	2.05		2.10				
				Total	**7.52**				
SNF Pad	Pump Truck	0.82	2.29		1.88				
	Ready Mix Truck	0.82	2.29		1.88				
	Earth Mover	2.05	2.05		4.20				
				Total	**7.97**				
Protected	Heavy Haul Truck	0.72	2.42		1.74				
Area	Earth Mover	2.05	2.05		4.20				
				Total	**5.94**				
Total**				**22.8**	**15.05**	**25.00**	**YES**	**1,300**	**YES**

NOTES:
*Based on 1-hour SO2 readings of monitoring data - TCEQ Big Spring Midway Ambient Monitoring Station, monthly average, August 2019
**Impacts take into account the maximum of General Earthwork, the sum of Cask and Admin Building operations, and the sum of SNF Pad and Protected Area construction, as these operations are not expected to take place during the same time period.

Table 4.6-1
NAAQS Compliance Demonstration - Phase 1
(6 pages)

8-Hour CO NAAQS

Phase	Emissions Source	1-hr CO Emission Rate (lb/hr)	CO 8-hr Unit Impact ([μg/m³]/[lb/hr])	Background Concentration*	Total Impact (μg/m³)	8-hour SIL (μg/m³)	Meets SIL?	8-hr NAAQS (μg/m³)	Meets NAAQS?
Earthwork	Heavy Haul Truck	9.35	1.46		13.70				
	Earth Mover	6.68	1.42		9.48				
				Total	**23.18**				
Cask Bldg	Pump Truck	2.67	1.43		3.83				
	Ready Mix Truck	2.67	1.43		3.83				
	Construction Equipment	5.34	1.43		7.66				
	Earth Mover	3.34	1.42		4.74				
				Total	**15.32**				
Admin Bldg	Pump Truck	2.67	1.43		3.83				
	Ready Mix Truck	2.67	1.43		3.83				
	Construction Equipment	5.34	1.43		7.66				
	Earth Mover	3.34	1.42		4.74				
				Total	**15.32**				
SNF Pad	Pump Truck	2.67	1.43		3.83				
	Ready Mix Truck	2.67	1.43		3.83				
	Earth Mover	6.68	1.42		9.48				
				Total	**17.14**				
Protected	Heavy Haul Truck	2.34	1.46		3.42				
Area	Earth Mover	6.68	1.42		9.48				
				Total	**12.91**				
Total**				**343.60**	**30.63**	**500.00**	**YES**	**10,000**	**YES**

NOTES:
*Based on 1-hour CO readings of monitoring data - TCEQ El Paso Ojo De Agua Ambient Monitoring Station, monthly maximum, August 2019
**Impacts take into account the maximum of General Earthwork, the sum of Cask and Admin Building operations, and the sum of SNF Pad and Protected Area construction, as these operations are not expected to take place during the same time period.

Table 4.6-1
NAAQS Compliance Demonstration - Phase 1

(6 pages)

24-Hour PM2.5 NAAQS

Phase	Emissions Source	1-hr PM2.5 Emission Rate (lb/hr)	PM2.5 24-hr Unit Impact ([µg/m³]/[lb/hr])	Background Concentration*	Total Impact (µg/m³)	24-hour SIL (µg/m³)	Meets SIL?	24-Hour NAAQS (µg/m³)	Meets NAAQS?
Earthwork	Heavy Haul Truck	0.03	0.78		0.02				
	Earth Mover	0.07	0.75		0.05				
				Total	**0.07**				
Cask Bldg	Pump Truck	0.01	0.78		0.01				
	Ready Mix Truck	0.01	0.78		0.01				
	Construction Equipment	0.05	0.78		0.04				
	Earth Mover	0.03	0.75		0.02				
				Total	**0.08**				
Admin Bldg	Pump Truck	0.01	0.78		0.01				
	Ready Mix Truck	0.01	0.78		0.01				
	Construction Equipment	0.05	0.78		0.04				
	Earth Mover	0.03	0.75		0.02				
				Total	**0.08**				
SNF Pad	Pump Truck	0.01	0.78		0.01				
	Ready Mix Truck	0.01	0.78		0.01				
	Earth Mover	0.07	0.75		0.05				
				Total	**0.06**				
Protected	Heavy Haul Truck	0.01	0.78		0.01				
Area	Earth Mover	0.07	0.75		0.05				
				Total	**0.06**				
General	Excavation	0.18	0.66		0.12				
Earthmoving				**Total**	**0.12**				
Total**				**7.6**	**0.47**	**1.20**	**YES**	**35**	**YES**

NOTES:
**Based on PM2.5 readings of monitoring data - TCEQ Socorro Hueco Ambient Monitoring Station, monthly average, August 2019*
***Impacts take into account the maximum of General Earthwork, the sum of Cask and Admin Building operations, and the sum of SNF Pad and Protected Area construction, as these operations are not expected to take place during the same time period.*

Table 4.6-1
NAAQS Compliance Demonstration - Phase 1

(6 pages)

24-Hour PM10 NAAQS

Phase	Emissions Source	1-hr PM10 Emission Rate (lb/hr)	PM10 24-hr Unit Impact ([μg/m³]/[lb/hr])	Background Concentration*	Total Impact (μg/m³)	24-hour SIL (μg/m³)	Meets SIL?	24-Hour NAAQS (μg/m³)	Meets NAAQS?
Earthwork	Heavy Haul Truck	0.03	0.78		0.02				
	Earth Mover	0.07	0.75		0.05				
				Total	**0.07**				
Cask Bldg	Pump Truck	0.01	0.78		0.01				
	Ready Mix Truck	0.01	0.78		0.01				
	Construction Equipment	0.05	0.78		0.04				
	Earth Mover	0.03	0.75		0.02				
				Total	**0.05**				
Admin Bldg	Pump Truck	0.01	0.78		0.01				
	Ready Mix Truck	0.01	0.78		0.01				
	Construction Equipment	0.05	0.78		0.04				
	Earth Mover	0.03	0.75		0.02				
				Total	**0.05**				
SNF Pad	Pump Truck	0.01	0.78		0.01				
	Ready Mix Truck	0.01	0.78		0.01				
	Earth Mover	0.07	0.75		0.05				
				Total	**0.06**				
Protected	Heavy Haul Truck	0.01	0.78		0.01				
Area	Earth Mover	0.07	0.75		0.05				
				Total	**0.06**				
General	Excavation	3.20	0.33		1.05				
Earthmoving				**Total**	**1.05**				
Total**				**20**	**1.28**	**5.00**	**YES**	**150**	**YES**

NOTES:
*Based on PM10 readings of monitoring data - TCEQ El Paso Riverside Ambient Monitoring Station, monthly average, March 2019
**Impacts take into account the maximum of General Earthwork, the sum of Cask and Admin Building operations, and the sum of SNF Pad and Protected Area construction, as these operations are not expected to take place during the same time period.

Table 4.6-1
NAAQS Compliance Demonstration - Phase 1
(6 pages)

Annual NO2 and PM2.5 NAAQS

Phase	Emissions Source	1-hr NOx Emission Rate (lb/hr)	NO2 Annual Unit Impact ([µg/m^3]/[lb/hr])	Background* Concentration (µg/m^3)	Annual** Impact Ratio (1,725 hours)	Total Annual Impact (µg/m^3)	Annual SIL (µg/m^3)	Meets SIL?	Annual NAAQS (µg/m^3)	Meets NAAQS?	1-hr PM2.5 Emission Rate (lb/hr)	PM2.5 Annual Unit Impact ([µg/m^3]/[lb/hr])	Background* Concentration (µg/m^3)	Annual** Impact Ratio (1,725 hours)	Total Annual Impact (µg/m^3)	Annual SIL (µg/m^3)	Meets SIL?	Annual NAAQS (µg/m^3)	Meets NAAQS?
Earthwork	Heavy Haul Truck	0.62	0.26		0.20	0.03					0.03	0.28		0.20	0.00				
	Earth Mover	5.75	0.24		0.20	0.27					0.07	0.27		0.20	0.00				
					Total:	**0.31**								**Total:**	**0.01**				
Cask Bldg	Pump Truck	0.18	0.25		0.20	0.01					0.01	0.28		0.20	0.00				
	Ready Mix Truck	0.18	0.25		0.20	0.01					0.01	0.28		0.20	0.00				
	Construction Equipment	4.60	0.25		0.20	0.23					0.05	0.28		0.20	0.00				
	Earth Mover	2.88	0.24		0.20	0.14					0.03	0.27		0.20	0.00				
					Total:	**0.38**								**Total:**	**0.01**				
Admin Bldg	Pump Truck	0.18	0.25		0.20	0.01					0.01	0.28		0.20	0.00				
	Ready Mix Truck	0.18	0.25		0.20	0.01					0.01	0.28		0.20	0.00				
	Construction Equipment	4.60	0.25		0.20	0.23					0.05	0.28		0.20	0.00				
	Earth Mover	2.88	0.24		0.20	0.14					0.03	0.27		0.20	0.00				
					Total:	**0.38**								**Total:**	**0.01**				
SNF Pad	Pump Truck	0.18	0.25		0.20	0.01					0.01	0.28		0.20	0.00				
	Ready Mix Truck	0.18	0.25		0.20	0.01					0.01	0.28		0.20	0.00				
	Earth Mover	5.75	0.24		0.20	0.27					0.07	0.27		0.20	0.00				
					Total:	**0.29**								**Total:**	**4.46E-03**				
Protected	Heavy Haul Truck	0.15	0.26		0.20	0.01					0.01	0.28		0.20	0.00				
Area	Earth Mover	5.75	0.24		0.20	0.27					0.07	0.27		0.20	0.00				
					Total:	**0.28**								**Total:**	**3.92E-03**				
General	Excavation										0.18	10.10		0.20	0.36				
Earthmoving														**Total:**	**0.36**				
Total				**26.2**		**1.65**	**1.00**	**NO**	**100**	**YES**			**7.6**		**0.39**	**0.20**	**NO**	**15**	**YES**

NOTES:
**Background concentrations for annual compliance have been conservatively assumed to be equal to be the same as those of shorter averaging periods.*
***Annual hours of operation are a total of 1,725 hours based on 10 hours per day, 5 days per week, 34.5 weeks of operations. This has been ratioed against 8,760 hours to determine the most appropriate annual impact.*

Table 4.6-2
NAAQS Compliance Demonstration - Phases 2-8 and Operations
(5 Pages)

1-Hour NO2, SO2, and CO NAAQS

Phase	Emissions Source	1-hr NOx Emission Rate (lb/hr)	1-hr SO2 Emission Rate (lb/hr)	1-hr CO Emission Rate (lb/hr)	NO2* AERMOD 1-hour Unit Impact ([µg/m³]/[lb/hr])	NO2** Background Concentration (µg/m³)	NO2 Total Impact (µg/m³)	1-hour SIL (µg/m³)	Meets SIL?	1-hour NAAQS (µg/m³)	Meets NAAQS?	SO2 AERMOD 1-hour Unit Impact ([µg/m³]/[lb/hr])	SO2*** Background Concentration (µg/m³)	SO2 Total Impact (µg/m³)	1-hour SIL (µg/m³)	Meets SIL?	1-hour NAAQS (µg/m³)	Meets NAAQS?	CO AERMOD 1-hour Unit Impact ([µg/m³]/[lb/hr])	CO**** Background Concentration (µg/m³)	CO Total Impact (µg/m³)	1-hour SIL (µg/m³)	Meets SIL?	1-hour NAAQS (µg/m³)	Meets NAAQS?
SNF Pad	Pump Truck	0.18	0.82	2.67	3.29		0.58					3.65		3.00					3.65		9.77				
	Ready Mix Truck	0.18	0.82	2.67	3.29		0.58					3.65		3.00					3.65		9.77				
	Earth Mover	5.75	2.05	6.68	2.73		15.72					3.04		6.22					3.04		20.28				
						Total	**16.88**							**12.22**							**39.81**				
Protected	Heavy Haul Truck	0.15	0.72	2.34	3.73		0.57					4.15		2.98					4.15		9.70				
Area	Earth Mover	5.75	2.05	6.68	2.73		15.72					3.04		6.22					3.04		20.28				
						Total	**16.29**							**9.20**							**29.97**				
Storage Module	Ready Mix Truck	0.18	0.82	2.67	3.29		0.58					3.65		3.00					3.65		9.77				
Construction						**Total**	**0.58**							**3.00**							**9.77**				
Storage Module	Module Transporter	2.01	0.72	2.34	3.73		7.52					4.15		2.98					4.15		9.70				
Transport						**Total**	**7.52**							**2.98**							**9.70**				
Total*****						**26.2**	**33.17**	**7.50**	**NO**	**188**	**YES**		**22.80**	**21.41**	**7.80**	**NO**	**196**	**YES**		**343.60**	**69.78**	**2,000**	**YES**	**40,000**	**YES**

NOTES:
**AERMOD ARM2 NOx/NO2 method used to determine 1-hour unit impact.*
***Based on 1-hour NO2 readings of monitoring data - TCEQ El Paso Ascarate Park SE Ambient Monitoring Station, monthly maximum, August 2019*
****Based on 1-hour SO2 readings of monitoring data - TCEQ Big Spring Midway Ambient Monitoring Station, monthly average, August 2019*
*****Based on 1-hour CO readings of monitoring data - TCEQ El Paso Ojo De Agua Ambient Monitoring Station, monthly maximum, August 2019*
******Impacts take into account the maximum of the sum of the sum of SNF Pad and Protected Area construction and the sum of Storage Module Construction and Transport emissions, as these operations are not expected to take place during the same time period.*

Table 4.6-2
NAAQS Compliance Demonstration - Phases 2-8 and Operations

(5 Pages)

3-Hour SO2 NAAQS

Phase	Emissions Source	1-hr SO2 Emission Rate (lb/hr)	SO2 3-hr Unit Impact ([μg/m³]/[lb/hr])	Background Concentration*	Total Impact (μg/m³)	3-hour SIL (μg/m³)	Meets SIL?	3-Hour NAAQS (μg/m³)	Meets NAAQS?
SNF Pad	Pump Truck	0.82	2.29		1.88				
	Ready Mix Truck	0.82	2.29		1.88				
	Earth Mover	2.05	2.05		4.20				
				Total	**7.97**				
Protected	Heavy Haul Truck	0.72	2.42		1.74				
Area	Earth Mover	2.05	2.05		4.20				
				Total	**5.94**				
Storage Module	Ready Mix Truck	0.82	2.29		1.88				
Construction				**Total**	**1.88**				
Storage Module	Module Transporter	0.72	2.42		1.74				
Transport				**Total**	**1.74**				
Total**				**22.8**	**13.91**	**25.00**	**YES**	**1,300**	**YES**

NOTES:

*Based on 1-hour SO2 readings of monitoring data - TCEQ Big Spring Midway Ambient Monitoring Station, monthly average, August 2019

**Impacts take into account the maximum of the sum of the sum of SNF Pad and Protected Area construction and the sum of Storage Module Construction and Transport emissions, as these operations are not expected to take place during the same time period.

8-Hour CO NAAQS

Phase	Emissions Source	1-hr CO Emission Rate (lb/hr)	CO 8-hr Unit Impact ([μg/m³]/[lb/hr])	Background Concentration*	Total Impact (μg/m³)	8-hour SIL (μg/m³)	Meets SIL?	8-hr NAAQS (μg/m³)	Meets NAAQS?
SNF Pad	Pump Truck	2.67	1.43		3.83				
	Ready Mix Truck	2.67	1.43		3.83				
	Earth Mover	6.68	1.42		9.48				
				Total	**17.14**				
Protected	Heavy Haul Truck	2.34	1.46		3.42				
Area	Earth Mover	6.68	1.42		9.48				
				Total	**12.91**				
Storage Module	Ready Mix Truck	2.67	1.43		3.83				
Construction				**Total**	**3.83**				
Storage Module	Module Transporter	2.34	1.46		3.42				
Transport				**Total**	**3.42**				
Total**				**343.60**	**30.05**	**500.00**	**YES**	**10,000**	**YES**

NOTES:

*Based on 1-hour CO readings of monitoring data - TCEQ El Paso Ojo De Agua Ambient Monitoring Station, monthly maximum, August 2019

**Impacts take into account the maximum of the sum of the sum of SNF Pad and Protected Area construction and the sum of Storage Module Construction and Transport emissions, as these operations are not expected to take place during the same time period.

Table 4.6-2
NAAQS Compliance Demonstration - Phases 2-8 and Operations

(5 Pages)

24-Hour PM2.5 NAAQS

Phase	Emissions Source	1-hr PM2.5 Emission Rate (lb/hr)	PM2.5 24-hr Unit Impact ([µg/m³]/[lb/hr])	Background Concentration*	Total Impact (µg/m³)	24-hour SIL (µg/m³)	Meets SIL?	24-Hour NAAQS (µg/m³)	Meets NAAQS?
SNF Pad	Pump Truck	0.01	0.78		0.01				
	Ready Mix Truck	0.01	0.78		0.01				
	Earth Mover	0.07	0.75		0.05				
				Total	**0.06**				
Protected	Heavy Haul Truck	0.01	0.78		0.01				
Area	Earth Mover	0.07	0.75		0.05				
				Total	**0.06**				
General	Excavation	0.00	0.66		0.00				
Earthmoving				**Total**	**0.00**				
Storage Module	Ready Mix Truck	0.01	0.78		0.01				
Construction				**Total**	**0.01**				
Storage Module	Module Transporter	0.02	0.78		0.02				
Transport				**Total**	**0.02**				
Total**				**7.6**	**0.12**	**1.20**	**YES**	**35**	**YES**

NOTES:
**Based on PM2.5 readings of monitoring data - TCEQ Socorro Hueco Ambient Monitoring Station, monthly average, August 2019*
***Impacts take into account the maximum of the sum of the sum of SNF Pad and Protected Area construction and the sum of Storage Module Construction and Transport emissions, as these operations are not expected to take place during the same time period.*

Table 4.6-2
NAAQS Compliance Demonstration - Phases 2-8 and Operations
(5 Pages)

24-Hour PM10 NAAQS

Phase	Emissions Source	1-hr PM10 Emission Rate (lb/hr)	PM10 24-hr Unit Impact ([µg/m³]/[lb/hr])	Background Concentration*	Total Impact (µg/m³)	24-hour SIL (µg/m³)	Meets SIL?	24-Hour NAAQS (µg/m³)	Meets NAAQS?
SNF Pad	Pump Truck	0.01	0.78		0.01				
	Ready Mix Truck	0.01	0.78		0.01				
	Earth Mover	0.07	0.75		0.05				
				Total	**0.06**				
Protected Area	Heavy Haul Truck	0.01	0.78		0.01				
	Earth Mover	0.07	0.75		0.05				
				Total	**0.06**				
General	Excavation	0.08	0.33		0.03				
Earthmoving				**Total**	**0.03**				
Storage Module	Ready Mix Truck	0.01	0.78		0.01				
Construction				**Total**	**0.01**				
Storage Module	Module Transporter	0.02	0.78		0.02				
Transport				**Total**	**0.02**				
Total**				**20**	**0.15**	**5.00**	**YES**	**150**	**YES**

NOTES:
*Based on PM10 readings of monitoring data - TCEQ El Paso Riverside Ambient Monitoring Station, monthly average, March 2019
**Impacts take into account the maximum of the sum of the sum of SNF Pad and Protected Area construction and the sum of Storage Module Construction and Transport emissions, as these operations are not expected to take place during the same time period.

Table 4.6-2
NAAQS Compliance Demonstration - Phases 2-8 and Operations

(5 Pages)

Annual NO2 and PM2.5 NAAQS

Phase	Emissions Source	1-hr NOx Emission Rate (lb/hr)	NO2 Annual Unit Impact ([µg/m³]/[lb/hr])	Background* Concentration (µg/m³)	Annual** Impact Ratio	Total Annual Impact (µg/m³)	Annual SIL (µg/m³)	Meets SIL?	Annual NAAQS (µg/m³)	Meets NAAQS?	1-hr PM2.5 Emission Rate (lb/hr)	PM2.5 Annual Unit Impact ([µg/m³]/[lb/hr])	Background* Concentration (µg/m³)	Annual** Impact Ratio (1,725 hours)	Total Annual Impact (µg/m³)	Annual SIL (µg/m³)	Meets SIL?	Annual NAAQS (µg/m³)	Meets NAAQS?
SNF Pad	Pump Truck	0.18	0.25		0.20	0.01					0.01	0.28		0.20	4.85E-04				
	Ready Mix Truck	0.18	0.25		0.20	0.01					0.01	0.28		0.20	4.85E-04				
	Earth Mover	5.75	0.24		0.20	0.27					0.07	0.27		0.20	3.49E-03				
					Total	**0.29**								**Total**	**4.46E-03**				
Protected	Heavy Haul Truck	0.15	0.26		0.20	0.01					0.01	0.28		0.20	4.32E-04				
Area	Earth Mover	5.75	0.24		0.20	0.27					0.07	0.27		0.20	3.49E-03				
					Total	**0.28**								**Total**	**3.92E-03**				
General	Excavation										0.00	0.24		0.20	2.28E-04				
Earthmoving														**Total**	**2.28E-04**				
Storage Module	Ready Mix Truck	0.18	0.25		0.29	0.01					0.01	0.28		0.29	7.03E-04				
Construction					**Total**	**0.01**								**Total**	**7.03E-04**				
Storage Module	Module Transporter	2.01	0.26		0.29	0.15					0.02	0.28		0.29	1.87E-03				
Transport					**Total**	**0.15**								**Total**	**1.87E-03**				
Total				**26.2**		**0.73**	**1.00**	**YES**	**100**	**YES**			**7.6**		**0.01**	**0.20**	**YES**	**15**	**YES**

NOTES:

*Background concentrations for annual compliance have been conservatively assumed to be equal to be the same as those of shorter averaging periods.

**Annual hours of operation are a total of 1,725 and 2,500 hours based on 10 hours per day, 5 days per week, 34.5 weeks of construction and 10 hours per day, 5 days per week, 50 weeks per year of operations. This has been ratioed against 8,760 hours to determine the most appropriate annual impact.

Table 4.6-3
NAAQS Compliance Demonstration – Operations
(4 Pages)

1-Hour NO2, SO2, and CO NAAQS

Phase	Emissions Source	1-hr NOx Emission Rate (lb/hr)	1-hr SO2 Emission Rate (lb/hr)	1-hr CO Emission Rate (lb/hr)	NO2* AERMOD 1-hour Unit Impact ([$\mu g/m^3$]/[lb/hr])	NO2** Background Concentration ($\mu g/m^3$)	NO2 Total Impact ($\mu g/m^3$)	1-hour SIL ($\mu g/m^3$)	Meets SIL?	1-hour NAAQS ($\mu g/m^3$)	Meets NAAQS?	SO2 AERMOD 1-hour Unit Impact ([$\mu g/m^3$]/[lb/hr])	SO2*** Background Concentration ($\mu g/m^3$)	SO2 Total Impact ($\mu g/m^3$)	1-hour SIL ($\mu g/m^3$)	Meets SIL?	1-hour NAAQS ($\mu g/m^3$)	Meets NAAQS?	CO AERMOD 1-hour Unit Impact ([$\mu g/m^3$]/[lb/hr])	CO**** Background Concentration ($\mu g/m^3$)	CO Total Impact ($\mu g/m^3$)	1-hour SIL ($\mu g/m^3$)	Meets SIL?	1-hour NAAQS ($\mu g/m^3$)	Meets NAAQS?
Storage Module	Ready Mix Truck	0.18	0.82	2.67	3.29		0.58					3.6549		3.00					3.65		9.77				
Construction						**Total**	**0.58**							**3.00**							**9.77**				
Storage Module	Module Transporter	2.01	0.72	2.34	3.73		7.52					2.42131		1.74					4.15		9.70				
Transport						**Total**	**7.52**							**1.74**							**9.70**				
Total						**26.2**	**8.10**	**7.50**	**NO**	**188**	**YES**		**22.80**	**4.73**	**7.80**	**YES**	**196**	**YES**		**343.60**	**19.46**	**2000.00**	**YES**	**40,000**	**YES**

NOTES:
**AERMOD ARM2 NOx/NO2 method used to determine 1-hour unit impact.*
***Based on 1-hour NO2 readings of monitoring data - TCEQ El Paso Ascarate Park SE Ambient Monitoring Station, monthly maximum, August 2019*
****Based on 1-hour SO2 readings of monitoring data - TCEQ Big Spring Midway Ambient Monitoring Station, monthly average, August 2019*
*****Based on 1-hour CO readings of monitoring data - TCEQ El Paso Ojo De Agua Ambient Monitoring Station, monthly maximum, August 2019*

Table 4.6-3
NAAQS Compliance Demonstration – Operations

(4 Pages)

3-Hour SO2 NAAQS

Phase	Emissions Source	1-hr SO2 Emission Rate (lb/hr)	SO2 3-hr Unit Impact ([µg/m³]/[lb/hr])	Background Concentration*	Total Impact (µg/m³)	3-hour SIL (µg/m³)	Meets SIL?	3-Hour NAAQS (µg/m³)	Meets NAAQS?
Storage Module	Ready Mix Truck	0.82	2.29		1.88				
Construction				**Total**	**1.88**				
Storage Module	Module Transporter	0.72	2.42		1.74				
Transport				**Total**	**1.74**				
Total				**22.8**	**3.62**	**25.00**	**YES**	**1,300**	**YES**

NOTE:
**Based on 1-hour SO2 readings of monitoring data - TCEQ Big Spring Midway Ambient Monitoring Station, monthly average, August 2019*

8-Hour CO NAAQS

Phase	Emissions Source	1-hr CO Emission Rate (lb/hr)	CO 8-hr Unit Impact ([µg/m³]/[lb/hr])	Background Concentration*	Total Impact (µg/m³)	8-hour SIL (µg/m³)	Meets SIL?	8-hr NAAQS (µg/m³)	Meets NAAQS?
Storage Module	Ready Mix Truck	2.67	1.43		3.83				
Construction				**Total**	**3.83**				
Storage Module	Module Transporter	2.34	1.46		3.42				
Transport				**Total**	**3.42**				
Total				**343.60**	**7.25**	**500.00**	**YES**	**10,000**	**YES**

NOTE:
**Based on 1-hour CO readings of monitoring data - TCEQ El Paso Ojo De Agua Ambient Monitoring Station, monthly maximum, August 2019*

Table 4.6-3
NAAQS Compliance Demonstration – Operations
(4 Pages)

24-Hour PM2.5 NAAQS

Phase	Emissions Source	1-hr PM2.5 Emission Rate (lb/hr)	PM2.5 24-hr Unit Impact ([μg/m³]/[lb/hr])	Background Concentration*	Total Impact (μg/m³)	24-hour SIL (μg/m³)	Meets SIL?	24-Hour NAAQS (μg/m³)	Meets NAAQS?
Storage Module	Ready Mix Truck	0.01	0.78		0.01				
Construction				**Total**	**0.01**				
Storage Module	Module Transporter	0.02	0.78		0.02				
Transport				**Total**	**0.02**				
Total				**20**	**0.02**	**1.20**	**YES**	**150**	**YES**

NOTE:
*Based on PM10 readings of monitoring data - TCEQ El Paso Riverside Ambient Monitoring Station, monthly average, March 2019

24-Hour PM10 NAAQS

Phase	Emissions Source	1-hr PM10 Emission Rate (lb/hr)	PM10 24-hr Unit Impact ([μg/m³]/[lb/hr])	Background Concentration*	Total Impact (μg/m³)	24-hour SIL (μg/m³)	Meets SIL?	24-Hour NAAQS (μg/m³)	Meets NAAQS?
Storage Module	Ready Mix Truck	0.01	0.78		0.01				
Construction				**Total**	**0.01**				
Storage Module	Module Transporter	0.02	0.78		0.02				
Transport				**Total**	**0.02**				
Total				**20**	**0.02**	**5.00**	**YES**	**150**	**YES**

NOTE:
*Based on PM10 readings of monitoring data - TCEQ El Paso Riverside Ambient Monitoring Station, monthly average, March 2019

Table 4.6-3
NAAQS Compliance Demonstration – Operations

(4 Pages)

Annual NO2 NAAQS

Phase	Emissions Source	1-hr NOx Emission Rate (lb/hr)	NO2 Annual Unit Impact ([µg/m3]/[lb/hr])	Background* Concentration (µg/m3)	Annual** Impact Ratio	Total Annual Impact (µg/m3)	Annual SIL (µg/m3)	Meets SIL?	Annual NAAQS (µg/m3)	Meets NAAQS?	1-hr PM2.5 Emission Rate (lb/hr)	PM2.5 Annual Unit Impact ([µg/m3]/[lb/hr])	Background* Concentration (µg/m3)	Annual** Impact Ratio	Total Annual Impact (µg/m3)	Annual SIL (µg/m3)	Meets SIL?	Annual NAAQS (µg/m3)	Meets NAAQS?
Storage Module	Ready Mix Truck	0.18	0.25		0.29	0.01					0.01	0.28		0.29	7.03E-04				
Construction					**Total**	**0.01**								**Total**	**7.03E-04**				
Storage Module	Module Transporter	2.01	0.26		0.29	0.15					0.02	0.28		0.29	1.87E-03				
Transport					**Total**	**0.15**								**Total**	**1.87E-03**				
Total				**26.2**		**0.16**	**1.00**	**YES**	**100**	**YES**			**7.8**		**2.57E-03**	**0.20**	**YES**	**100**	**YES**

NOTES:
*Background concentrations for annual compliance have been conservatively assumed to be equal to be the same as those of shorter averaging periods.
**Annual hours of operation are a total of 2,500 hours based on 10 hours per day, 5 days per week, 50 weeks per year of operations. This has been ratioed against 8,760 hours to determine the most appropriate annual impact.

Table 4.6-4
Construction and Operations Emissions - Lifetime Totals

	PHASE 1			PHASE 2		PHASE 3				PHASE 4		PHASE 5		
	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Pollutant	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)
NOx	26.38	0.34	0.34	10.75	0.34	10.75	0.34	0.34	0.34	10.75	0.34	10.75	0.34	0.34
CO	45.59	2.37	2.37	21.14	2.37	21.14	2.37	2.37	2.37	21.14	2.37	21.14	2.37	2.37
SOx	13.99	0.73	0.73	6.49	0.73	6.49	0.73	0.73	0.73	6.49	0.73	6.49	0.73	0.73
PM_{10}	1.08	0.01	0.01	0.18	0.01	0.18	0.01	0.01	0.01	0.18	0.01	0.18	0.01	0.01
$PM_{2.5}$	0.38	0.01	0.01	0.14	0.01	0.14	0.01	0.01	0.01	0.14	0.01	0.14	0.01	0.01
CO_2	7,849.33	408.25	408.25	3,639.75	408.25	3,639.75	408.25	408.25	408.25	3,639.75	408.25	3,639.75	408.25	408.25
HAP	0.18	0.01	0.01	0.08	0.01	0.08	0.01	0.01	0.01	0.08	0.01	0.08	0.01	0.01
VOC	16.86	0.88	0.88	7.82	0.88	7.82	0.88	0.88	0.88	7.82	0.88	7.82	0.88	0.88

	PHASE 6		PHASE 7				PHASE 8							
	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048
Pollutant	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)
NOx	10.75	0.34	10.75	0.34	0.34	0.34	10.75	0.34	0.34	0.34	0.34	0.34	0.34	0.34
CO	21.14	2.37	21.14	2.37	2.37	2.37	21.14	2.37	2.37	2.37	2.37	2.37	2.37	2.37
SOx	6.49	0.73	6.49	0.73	0.73	0.73	6.49	0.73	0.73	0.73	0.73	0.73	0.73	0.73
PM_{10}	0.18	0.01	0.18	0.01	0.01	0.01	0.18	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$PM_{2.5}$	0.14	0.01	0.14	0.01	0.01	0.01	0.14	0.01	0.01	0.01	0.00	0.01	0.01	0.01
CO_2	3,639.75	408.25	3,639.75	408.25	408.25	408.25	3,639.75	408.25	408.25	408.25	408.25	408.25	408.25	408.25
HAP	0.08	0.01	0.08	0.01	0.01	0.01	0.08	0.01	0.01	0.01	0.01	0.01	0.01	0.01
VOC	7.82	0.88	7.82	0.88	0.88	0.88	7.82	0.88	0.88	0.88	0.88	0.88	0.88	0.88

	2049	2050	2051	2052	2053	2054	2055	2056	2057	2058	2059	2060	2061
Pollutant	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)	Annual Emissions (tpy)
NOx	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34	0.34
CO	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37	2.37
SOx	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73	0.73
PM_{10}	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
$PM_{2.5}$	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
CO_2	408.25	408.25	408.25	408.25	408.25	408.25	408.25	408.25	408.25	408.25	408.25	408.25	408.25
HAP	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
VOC	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88

4.7 NOISE IMPACTS

Sources of noise during facility construction and operation would be related to traffic entering and leaving the facility and to construction equipment. Ambient background noise sources in the area include vehicular traffic along New Mexico Highway 234, the concrete quarry to the north of the site, the landfill to the south of the site, the waste facility to the south of the site, train traffic along the tracks located on the south border of the site, low flying aircraft traffic from Eunice Airport, birds, cattle, and wind gusts.

4.7.1 Predicted Noise Levels

The EPA's recommended Day-Night Average Sound Level (LDN) for industrial sites, as well as "Farm Land and General Unpopulated Land" is 70 dBA . ISP performed an acoustical analysis of the background sound levels in July of 2019 in areas surrounding the proposed CISF (Nelson Acoustics, 2019). This formed the basis for determining estimates of noise levels that would be generated during construction and operation of the proposed CISF. Estimates were performed for nine Noise-Sensitive Areas (NSA) around the proposed CISF and the city of Eunice, NM. Figures 4.7-1 and 4.7-2 provide the locations for each of the NSAs.

Noise levels during construction and operations were estimated based on noise levels from construction equipment and additional noise sources related to mechanical equipment associated with the Security and Administration Building and the Cask Handling Building. In addition, noise from vehicle backup alarms were added (Nelson Acoustics, 2019).

A-weighted Sound Power Level and temporal Usage Factors for construction vehicles were obtained from the Federal Highway Administration's Roadway Construction Noise Guide User's Manual (FHWA, 2005). Typical construction octave band spectral shapes and Sound Power Levels for other equipment were obtained from various resources as stated in the report (Nelson Acoustics, 2019). Noise emission levels from the Waste Control Specialists locomotive were extracted from direct measurements performed during the site visit. Factors for geometric divergence and excess attenuation due to air and ground absorption were computed in accordance with ISO 9613-2 (ISO, 1996), then applied to yield Sound Pressure Level estimates. No "credit" was taken for intervening terrain or material stockpiles that could further reduce offsite levels since occasional weather conditions can cause these barriers to be bypassed.

During construction, increased sound levels may be noticeable from directly neighboring facilities (URENCO, Sundance Services, and Permian Basin Materials), especially during Phase 1 construction. During operation of the facility, the nominal average sound levels increase primarily due to the potential of the passage of an additional train per day. The sound level, L_{dn} for construction and operation is well below the EPA guideline for industrial land use.

Residents of Eunice will be unable to hear construction activities during any phase of construction due to the relatively high level of traffic noise already in the area. During operation the nominal average sound levels increase primarily due to the potential passage of an additional train per day adjacent to Eunice. The L_{dn} at the proposed CISF during construction and operation are well below both the EPA guideline for residential properties and prevailing background levels.

Estimated L_{dn} values during construction and operation at the proposed CISF are provided in Tables 4.7-1, 4.7-2, and 4.7-3.

Table 4.7-1: Estimated Noise Impact at NSAs during Phase 1 Construction

NSA	Type	Approximate Distance and Direction Relative to the CISF	Estimated Ambient L_{dn} (dBA)	Estimated CISF Phase1 Construction L_{dn} (dBA)	Estimated Total L_{dn} During Construction (dBA)	EPA Recommended L_{dn} (dBA)	Potential Noise Increase (dBA)
1	Boundary	6100 ft. SW	47.9	43.2	49.1	70	1.3
2	Boundary	3900 ft. W	42.6	48.4	49.4	70	6.8
3	Boundary	4000 ft. WNW	41.6	48.6	49.4	70	7.8
4	CISF	SW Corner	39.1	69.9	69.9	---	30.8
5	WCS LSA Pad	NE Corner	39.8	60.0	60.1	---	20.3
6	Residential	3.8 mi. WSW	64.5	30.2	64.5	55	0.0
7	Residential	4.1 mi. WSW	58.9	29.6	58.9	55	0.0
8	Residential	5.3 mi. WSW	47.0	27.1	47.0	55	0.0
9	Residential	4.9 mi. WSW	55.5	27.9	55.5	55	0.0

Table 4.7-2: Estimated Noise Impact at NSAs during Phase 2-8 Construction

NSA	Type	Approximate Distance and Direction Relative to the CISF	Estimated Ambient L_{dn} (dBA)	Estimated CISF Phase 2-8 Construction L_{dn} (dBA)	Estimated Sound L_{dn} During Operation (dBA)	Estimated Total L_{dn} During Construction (dBA)	EPA Recommended L_{dn} (dBA)	Potential Noise Increase (dBA)
1	Boundary	6100 ft. SW	47.9	37.7	41.4	49.1	70	1.2
2	Boundary	3900 ft. W	42.6	43.0	39.9	46.8	70	4.2
3	Boundary	4000 ft. WNW	41.6	43.7	39.1	46.6	70	5.0
4	CISF	SW Corner	39.1	57.8	58.4	61.2	---	22.1
5	WCS LSA Pad	NE Corner	39.8	52.2	55.1	57.0	---	17.2
6	Residential	3.8 mi. WSW	64.5	25.0	33.3	64.5	55	0.0
7	Residential	4.1 mi. WSW	58.9	24.3	28.8	58.9	55	0.0
8	Residential	5.3 mi. WSW	47.0	21.8	34.5	47.2	55	0.3
9	Residential	4.9 mi. WSW	55.5	22.6	33.2	55.5	55	0.0

Table 4.7-3: Estimated Noise Impact at NSAs during CISF Operation

NSA	Type	Approximate Distance and Direction Relative to the CISF	Estimated Ambient L_{dn} (dBA)	Estimated CISF Operation L_{dn} (dBA)	Estimated Total L_{dn} CISF + Ambient (dBA)	EPA Recommended L_{dn} (dBA)	Potential Noise Increase (dBA)
1	Boundary	6100 ft. SW	47.9	41.4	48.7	70	0.9
2	Boundary	3900 ft. W	42.6	39.9	44.5	70	1.9
3	Boundary	4000 ft. WNW	41.6	39.1	43.5	70	1.9
4	CISF	SW Corner	39.1	58.4	58.5	---	19.4
5	WCS LSA Pad	NE Corner	39.8	55.1	55.3	---	15.5
6	Residential	3.8 mi. WSW	64.5	33.3	64.5	55	0.0
7	Residential	4.1 mi. WSW	58.9	28.8	58.9	55	0.0
8	Residential	5.3 mi. WSW	47.0	34.5	47.2	55	0.2
9	Residential	4.9 mi. WSW	55.5	33.2	55.5	55	0.0

The acoustic analysis report performed for ISP also estimated the maximum noise levels to workers that would occur during construction and operation of the proposed CISF. Personnel noise exposure is a function of the shift average sound pressure level $L_{A,EQ}$, identical to Time Weighted Average (TWA) as defined by the Occupational Safety and Health Administration (OSHA) for continuous noise sources, and slightly less for the sources contemplated in the report. OSHA regulations per 29 CFR 1910.95 require that personnel not receive an unprotected noise dose in excess of 100% in any given shift. This corresponds to 90.0 dBA for an 8 hour shift and 88.4 dBA for a 10 hour shift.

Estimated shift-average construction levels are high especially in the work areas for the buildings due to the amount of equipment active in a relatively small area. Levels are lower on the more extended areas (General Earthwork, Protected Area, Storage Pad Construction). Levels are dependent on the assumed source sound power levels and utilization percentages.

Tables 4.7-4, 4.7-5, and 4.7-6 provide estimated Shift-Average (TWA) and Shift-Maximum (L_{pA}) sound levels for construction and operation of the proposed CISF.

Based on the estimated noise levels, hearing protection is recommended for most of these activities (TWA>80 dBA). Noise reduction ratings (NRRs) of hearing protectors should be capable of reducing at-the-ear exposure to 85.0 dBA (8-hour, Operation) and 83.2 dBA (10-hour, Construction). For maximum sound levels (L_{pA}) there is not an explicit OSHA limitation. The maximum sound levels occur on rare occasions when everything at a facility/operation occurs at the exact same time. The TWA are based on the fact that noise producing activities are starting and stopping for the given utilization and the maximum sound levels are included in the TWA.

Table 4.7-4 Estimated Baseline Noise Exposure during Phase 1 Construction

Activity	*TWA (dBA)*	*Max L_{pA} (dBA)*
General Earthwork	*83*	*89*
Cask Handling Building	*92*	*99*
Security/Admin Building	*94*	*100*
Storage Pad	*88*	*96*
Protected Area	*83*	*89*

Table 4.7-5 Estimated Baseline Noise Exposure during CISF Operation

Activity	*TWA (dBA)*	*Max L_{pA} (dBA)*
Storage Module Construction	*92*	*103*
Cask Transport	*89*	*97*

Table 4.7-6 Estimated Baseline Noise Exposure during Phase 2-8 Construction Including Operation

Location	*TWA (dBA)*	*Max L_{pA} (dBA)*
Storage Pad	*87*	*97*
Protected Area	*78*	*89*

4.7.2 Potential Impacts

ISP performed an acoustical analysis of the background sound levels in July of 2019 (Nelson Acoustics, 2019) in areas surrounding the proposed CISF. Measurements were taken at and around the existing WCS facility and in and around the city of Eunice, NM. Roadway traffic is the primary noise contributor at all locations monitored.

In general it is found that the NSAs in Eunice, NM which are nearest to the proposed CISF are also very near to highways NM 176 and NM 18 as well as the Gas Plant located on the south side of the city. These Eunice NSA measurements possess elevated background levels above L_{dn} *55. At the current northeast corner of Eunice, NM, sound levels are more moderate. The EPA's 1974 recommendation for residential communities is* L_{dn} *55. Sounds originating at the CISF are unlikely to be audible in Eunice and are not expected to exceed the EPA's recommended guideline.*

Noise impacts resulting from the temporary increase in noise levels along Texas State Highway 176 due to construction vehicles are not expected to impact nearby receptors significantly. Noise from truck traffic already using the road is currently substantially louder than would be caused by the incremental increase in traffic related to the construction and operation of the CISF. The nearest commercial noise receptors are four businesses located within a 2.4 km (1.5-mi) radius of the proposed site. These four businesses are URENCO to the west just over the New Mexico border; Lea County Landfill, located to the southeast; Sundance Services, Inc.and Permian Basin Materials, located to the north. Potential impacts to local schools, churches, hospitals, and residences are not expected to be significant. The nearest residential noise receptor is located west of the site at a distance of approximately 4.3 km (2.63 mi). Due to its distance from the proposed CISF site, the residential receptor is not expected to perceive an increase in noise levels due to operational noise levels. The nearest school, hospital, church, and other sensitive noise receptors are located even farther away, thereby allowing the noise to dissipate and be absorbed, helping decrease the sound levels even further. Homes located near the construction traffic at the intersection of New Mexico Highway 234 and New Mexico Highway 18 would be affected by the vehicle noise, but due to existing heavy tractor trailer vehicle traffic, the change is expected to be minimal. No schools or hospitals are located at this intersection.

4.7.3 Cumulative Noise Impacts

ISP conducted background noise-level survey at four locations on and along the boundaries of the existing Waste Control Specialists facility and proposed CISF site on July 25-26, 2019 (Nelson Acoustics, 2019). The measured background noise levels at these locations ranged from between 36.3 and 40.7 decibels A-weighted, represent the nearest receptor locations for the general public.

Cumulative impacts from all site noise sources should be small and typically remain at or below HUD guidelines of 65 dBA L_d, and the EPA guidelines of 55 dBA L_{dn} during CISF construction, operation, and decommissioning. Residences closest to the site boundary would experience only minor impacts from construction noise, with the majority of the noise sources being from additional construction vehicle traffic. Since phases of construction include a variety of activities, there may be short-term occasions when higher noise levels would be present; examples include the use of backhoes and large generators.

The level of noise anticipated offsite is comparable to noise levels near a busy road and less than noise levels found in most city neighborhoods. Expected noise levels would mostly affect an area within a 1.6 km (1 mile) radius of the proposed CISF site. The cumulative noise of all site activities should have a minor impact and only on those receptors closest to the site boundary.

4.8 HISTORIC AND CULTURAL RESOURCE IMPACTS

Historic resources include buildings, structures, objects, and non-archaeological sites and districts that are important in the history of a community, a region, a state, or the nation. The NRC regulates the proposed licensing activities; therefore, the project is subject to Section 106 of the NHPA.

The APE for direct impacts is the project footprint. Taking into consideration the height of the crane that would be required, the height of the potential aboveground facility, and the relatively flat surrounding terrain, the APE for indirect/visual impacts is a 1.6 km (1 mi) radius from the proposed project footprint. The direct effects APE is contained entirely within the state of Texas, while the indirect effects APE extends into New Mexico.

4.8.1 Direct Impacts

A search of the Texas Historic Sites Atlas maintained by the THC was conducted for previously identified OSHM, RTHLs, properties or districts listed on the NRHP, SALs, cemeteries, or other cultural resources that may have been previously recorded. No such resources were identified within the APE for direct effects. The nearest previously identified resource is the OSHM for Andrews County, located approximately 27.4 km (17 mi) southeast of the project area.

No impacts to archeological sites would occur as a result of the proposed project within the 87.7 ha (216.6 acre) boundaries of the 2015 survey area, which was surveyed under Texas Antiquities Permit 7277. No further work was recommended for archeological resources, and the THC concurred on July 29, 2015. The New Mexico SHPO expressed no concerns provided all work takes place in Texas.

As the area containing the proposed project footprint is devoid of any standing structures, the proposed project would not result in a direct impact to any non-archeological historic resources.

4.8.2 Indirect Impacts

A search of the THC Atlas indicates that there are also no previously identified historic resources in Texas within the 1.6 km (1 mi) APE for indirect impacts would be undertaken and results would be provided at a future date. The nearest previously identified resource in Texas is the historical marker for Andrews County, located approximately 27.4 km (17 mi) southeast of the project area. According to a search of the NMCRIS, there are no previously-identified non-archeological historic resources located within the APE for direct or indirect impacts. The closest historic resource in New Mexico is “HCPI 37299” (building at 703 Ruth Circle, Eunice, Lea County), located approximately 7.2 km (4.5 mi) from the site. The area is surrounded by a high density of oil wells to the west and some oil wells to the north; there is little development to the south and east, excluding portions of the existing Waste Control Specialists facility.

The first development at the Waste Control Specialists facility was constructed in the late 1990s; none of the development is historic-age. Adjacent to the Waste Control Specialists facility to the west is a large uranium enrichment plant called the NEF, operated by URENCO. This facility was developed within the past 15 years. The proposed project area is located in a very remote

area of Texas with little development aside from the non-historic age Waste Control Specialists and URENCO facilities.

There do not appear to be any historic resources 45 years or older (dating to 1974 or earlier) within the 1.6 km (1 mi) indirect effects APE. The nearest developed area is Eunice, New Mexico, which is located approximately 8 km (5 mi) west of the proposed site. There are two large visual obstructions between viewers in Eunice and the proposed crane at the site: red soil mounds approximately 30.48 m (100 ft) in height on Waste Control Specialists property, and the URENCO facility. Based on information from Waste Control Specialists, the soil mounds would either be in place indefinitely or potentially utilized as fill. Excluding the crane, the CISF storage facility would be approximately 9.14 m (30ft) above the surface and less visible from Eunice than existing features and structures.

On June 1, 2015, THC concurred with the recommendation that no further survey is required for historic resources and that the project may proceed. In addition, a coordination letter was submitted to the New Mexico SHPO addressing both historic and archeological resources in New Mexico. The New Mexico SHPO concurred with the finding that no additional cultural resources identification efforts are necessary (provided that ground-disturbing and construction activities are confined to Texas) on August 12, 2015 .

4.8.3 Potential for Human Remains

There is low potential for human remains to be present on the CISF site. Based on previous work in the region, burials tend to occur in rock shelters and on sites with structures. Should an inadvertent discovery of such remains be made during construction, ISP would stop construction activities immediately in the area of discovery and notify the Texas SHPO. The SHPO would determine the appropriate measures to identify, evaluate, and treat these discoveries. If the remains are potentially from Native American sites, ISP would, in addition to the above actions, contact the federal agency that has primary management authority and the appropriate Native American tribe, if known or readily ascertainable. ISP would also make reasonable effort to protect the items discovered before resuming the construction activities in the vicinity at the discovery. The construction activity would resume only after the appropriate consultations and notifications have occurred and guidance has been received.

4.8.4 Minimizing Adverse Impacts

Accidental discovery procedures would be in place to minimize any potential impact on historical and cultural resources. In the event that any inadvertent discovery of human remains or other items of archeological significance is made during construction or decommissioning, the facility would cease construction activities immediately in the area of discovery and notify the Texas SHPO to make the determination of appropriate measures to identify, evaluate and treat these discoveries.

4.8.5 Cumulative Impacts

Given the small number of archaeological sites located in the study area, there would be no cumulatively significant impacts to cultural resources.

4.9 VISUAL/SCENIC RESOURCES IMPACTS

There are no existing structures on the CISF site. Scenic resources in the project area are not considered to be dramatic, unique, or rare. The proposed facility would add to other existing industrial facilities in the area, but would not have a substantial adverse effect on the current landscape for area viewers.

Northwestern Andrews County Texas and southeastern Lea County New Mexico is a developing industrial area. Urban development is relatively sparse in the vicinity of the proposed CISF site. The nearest city, Eunice, New Mexico is 8 km (5 mi) to the west; the proposed site is not visible from the city. The local landscape is typified by cattle ranch land with gently undulating, brushy grassland broken by sporadic brush-covered sand dunes that extend for many miles in all directions. The Mescalero escarpment, Monument Draw, Texas and Monument Draw, New Mexico are the only persistent geographic features in the area. The scenic quality is rather uniform topographically with few trees and little topographic relief. Caliche service roads crisscross the landscape in random patterns. Within view of the facility, there is significant evidence of human development including a stone quarry, a hazardous waste and LLRW landfill, a large power transmission substation, a county landfill, a uranium enrichment plant, and an aboveground oilfield waste disposal land farm. The nearest private residence is approximately 6 km (3.8 mi) west of the industrialized area. Stockpiles of soil materials, electric power transmission and distribution lines, the asphalt two-lane Texas State Highway 176, the caliche State Line Road, the railroad, and oil-field infrastructure dot the

nearby landscape. The interstate electric transmission lines extend to the horizon to the north and the south while the local distribution lines service the industrial and cattle ranch infrastructure in the area.

The visual resources study area does not contain notable representations of any landscape features, although the relative lack of visual obstructions to a vast view of this section of the west Texas/east New Mexico landscape could be considered the “visual character” of the area. Overall, the entire study area can be considered to have modest scenic quality that is pleasant to regard for its rural, undeveloped nature, but not dramatic, unique or rare. Facilities geared towards resources extraction, the Lea County Landfill, and oil well pump jacks exist in the project area, in addition to the URENCO facility, which have an equal or higher impact on the visual landscape compared to the proposed new CISF activities.

In accordance with DOI and BLM guidance, a photo inventory of the scenic qualities of the CISF was conducted on April 7 and 8, 2015. This study included views from as far as 24 km (15 mi) from the WCS CISF project. Views were captured to illustrate several zones: foreground, middle ground, background, and seldom-seen. This inventory replicated photos taken for the Waste Control Specialists licensing efforts in 2007 and 2008 for the low-level hazardous waste disposal license. The study team was interested in learning what has changed in the landscape over the last seven years.

In the SIA (Appendix A), each photo (1-14) in Appendix C, Waste Control Specialists Scenic Resources Photo Inventory Figures C-1 and C-2, is labeled with the direction in relation to the CISF, whether it represents foreground, middle ground, background, or seldom-seen views, and approximate distance from the center point of the proposed CISF on the Waste Control Specialists property.

4.9.1 Aesthetic and Scenic Quality Rating

The visual resource inventory process provides a means for determining visual values . The inventory consists of a scenic quality evaluation, sensitivity level analysis, and a delineation of distance zones. Based on these three factors, lands are placed into one of four Visual Resource Classes. These classes represent the relative value of the visual resources: Classes I and II being the most valued, Class III representing a moderate value, and Class IV being of least value. The classes provide the basis for considering visual values in the resource

management planning process. Visual Resource Classes are established through the resource management planning process.

The WCS CISF site was evaluated on November 9, 2015 and November 10, 2015 using the BLM visual resource inventory process to determine the scenic quality of the site, photos are provided in Appendix C of the SIA. The site received a “C” rating and falls into Class IV. Scenic Quality is a measure of the visual appeal of a tract of land which is given an A, B, or C rating (A-highest, C-lowest) based on the apparent scenic quality using the seven factors outlined in Table 4.9-1, Scenic Quality Inventory and Evaluation Chart.

Table 4.9-1, Scenic Quality Inventory and Evaluation Chart

KEY FACTORS	RATING CRITERIA AND SCORE[1]		
Landform	High vertical relief as expressed in prominent cliffs, spires, or massive rock outcrops, or severe surface variation or highly eroded formations including major badlands or dune systems; or detail features dominant and exceptionally striking and intriguing such as glaciers. Score: 5	Steep canyons, mesas, buttes, cinder cones, and drumlins; or interesting erosion patters or variety in size and shape or landforms; or detail features which are interesting though not dominant or exceptional. Score: 3	Low rolling hills, foothills, or flat valley bottoms; or few or no interesting landscape features. **Score: 1**
Vegetation	A variety of vegetative types as expressed in interesting forms, textures, and patterns. Score: 5	Some variety of vegetation, but only one or two major types. **Score: 3**	Little or no variety or contrast in vegetation. Score: 1
Water	Clear and clean appearing, still, or cascading white water, any of which are a dominant factor in the landscape. Score: 5	Flowing, or still, but not dominant in the landscape. Score: 3	Absent, or present but not noticeable. **Score: 0**
Color	Rich color combinations, variety or vivid color; or pleasing contrasts in the soil, rock, vegetation, water or snow fields. Score: 5	Some intensity or variety in colors and contrast of soil, rock and vegetation, but not a dominant scenic element. Score: 3	Subtle color variations, contrast, or interest; generally mute tones. **Score: 1**
Influence of Adjacent Scenery	Adjacent scenery greatly enhances visual quality. Score: 5	Adjacent scenery moderately enhances overall visual quality. Score: 3	Adjacent scenery has little or no influence on overall visual quality. **Score: 0**
Scarcity	One of a kind; or unusually memorable or very rare within region. Consistent chance for exceptional wildlife or wildflower viewing, etc. Score: 5	Distinctive, though somewhat similar to others within the region. Score: 3	Interesting within its setting, but fairly common within the region. **Score: 1**
Cultural Modifications	Modifications add favorably to visual variety while promoting visual harmony. Score: 2	Modifications add little or no visual variety to the area, and introduce no discordant elements. Score: 0	Modifications add variety but are very discordant and promote strong disharmony. **Score: -4**

Total Score : 2 Scenic Quality: A = 19 or more; B = 12-18; C = 11 or less
Scores in bold represent scores assigned to the WCS CISF site.
1 Ratings developed from BLM, 1984; BLM, 1986.

Class IV is of the least value and allows for the greatest level of landscape modification. The proposed use of the CISF site does not fall outside the objectives for Class IV, which are to provide for management activities that require major modifications of the existing character of the landscape. The level of change to the landscape characteristics would be moderate. These management activities would detract from the view and may draw the focus of viewer attention.

4.9.2 Significant Visual Impacts

It was determined that the visual resources study area does not contain notable representations of any of the landscape features listed above, although the relative lack of visual obstructions to a vast view of this section of the west Texas/east New Mexico landscape could be considered the “visual character” of the area. Overall, the entire study area can be considered to have modest scenic quality that is pleasant to regard for its rural, undeveloped nature, but not dramatic, unique or rare. Facilities geared towards resources extraction, the Lea County Landfill, and oil well pump jacks exist in the project area, in addition to the URENCO facility, which have an equal or higher impact on the visual landscape compared to the proposed new CISF activities.

4.9.2.1 Physical Facilities Out of Character with Existing Features

Given that the site is undeveloped, the proposed CISF might be considered “out of character” with current, onsite conditions. However, considering that the neighboring properties have been developed for industrial purposes (the URENCO facility, county landfill, quarry, and numerous oil and gas wells), the proposed plant structures are similar to existing, architectural features on surrounding land. Overall, the visual impact of the CISF would be minimal.

4.9.2.2 4.9.2.2 Structures Obstructing Existing Views

None of the proposed onsite structures would be taller than 22.9 m (75 ft). Due to the relative flatness of the site and vicinity, the structures may be observable from Texas State Highway 176 and New Mexico Highway 234 and from nearby properties, partially obstructing views of the existing landscape. However, considering that there are no high quality viewing areas and the presence of many existing, man-made structures (pump jacks, high power lines, industrial buildings, above-ground tanks) near the CISF, the obstruction of existing views due to the proposed structures would be comparable to current conditions.

4.9.2.3 Structures Creating Visual Intrusions

Although most proposed CISF structures would be set back a substantial distance from Texas State Highway 176 and New Mexico Highway 234, due to the relative flatness of the area, taller plant structures would likely be visible from the highway and adjacent properties, creating a visual intrusion. However, considering the existing structures associated with neighboring industrial properties to the north, east, and south (quarry, Waste Control Specialists facility, and county landfill, respectively) the nearby utility poles, the high power utility line to the east that runs parallel to the New Mexico/Texas state line, and the numerous pump jacks dotting the landscape to the north, south, and west, the proposed onsite structures would be no more intrusive than those already present.

4.9.2.4 Structures Requiring the Removal of Barriers, Screens or Buffers

None of the onsite structures would require removal of natural barriers, screens, or buffers. Any removal of natural barriers, screens, or buffers associated with road construction would be minimized. Additionally, natural landscape, using vegetation indigenous to the area, is planned to provide additional aesthetically pleasing screening measures.

4.9.2.5 Altered Historical, Archaeological, or Cultural Properties

All cultural or archaeological sites that were found within the proposed CISF site can either be avoided or successfully mitigated, if required. The results of the survey of the site were submitted to the Texas and New Mexico SHPO in 2015.

4.9.2.6 Structures That Create Visual, Audible, or Atmospheric Elements Out of Character with the Site

Although the proposed onsite structures are out of character with the natural setting of the site, they are comparable to those or less offensive than those existing on the surrounding industrial properties. None of the CISF structures or associated activities would typically produce significant noise levels audible from offsite or create significant atmospheric elements such as a large emission plume visible from offsite.

4.9.3 Visual Compatibility and Compliance

No local or county zoning, land use planning, or associated review process requirements have been identified. All applicable local ordinances and regulations would be followed during the construction and operation of the CISF. However, development of the site would meet federal and state requirements for nuclear and radioactive material sites regarding design, siting, construction materials, and monitoring.

4.9.4 Potential Mitigation Measures

Mitigation measures would be in place to minimize the impact to visual and scenic resources. These include the following items:

- The use of accepted natural, low-water consumption landscaping techniques to limit any potential visual impacts. These techniques would incorporate, but not be limited to, the use of landscape plantings. As for aesthetically pleasing screening measures, planned landscape plantings would include indigenous vegetation.
- Prompt re-vegetation or covering of bare areas would be used to mitigate visual impacts due to construction activities.

4.9.5 Cumulative Impacts to Visual/Scenic Quality

The cumulative impacts to the visual/scenic quality of the CISF site can be assessed by examining the proposed actions associated with construction of the CISF and development of surrounding properties. Proposed site development potentially impacting the visual/scenic quality of the CISF site includes:

- A Security/Administration building, a taller Cask Handling Building, and several acres of concrete pads with concrete cylinders stacked on them, all surrounded by a chain link fence
- Power lines
- New access roads

Existing development on surrounding properties impacting the visual/scenic quality of the site and vicinity includes:

- A railroad spur

- Industrial structures (buildings, aboveground tanks)
- Man-made earthen structures (industrial lagoons, stockpiled soil, landfill cavities)
- Dirt and gravel-covered roadways
- Power poles and a high-voltage utility line
- Pump jacks
- Barbed wire fencing along property perimeters

By considering both proposed onsite and nearby existing developments, modification to the subject site would not add significantly to its visual degradation. Therefore, there would be little cumulative impact on the visual/scenic quality of the CISF site.

4.10 SOCIOECONOMIC IMPACTS

The SIA details anticipated construction and operations phase impacts to the economy. With an initial investment, the analysis of economic impacts shows the construction would be beneficial to the region from a direct, indirect, induced, and value-added output perspective. When the CISF facility expands its storage capacity over time (eight phases are planned in total), there would be additional construction activities to build these future phases.

The IMPLAN model estimates that 122 person-years of employment would be created through the *construction* project's direct, indirect, and induced effects. Total 2013 employment in the three-county analysis region is 60,170 jobs. Therefore, the 0.2% increase to regional employment represents a Moderate Effect, according to the previously discussed criteria.

Overall, the socioeconomic model estimates that the CISF would create 912 person-years of employment over a ten-year period through the direct, indirect, and induced effects of the facility's operations. Over the ten-year period, the average annual direct, indirect, and induced total employment was 91.2 person-years of employment. Total employment in the three-county region of analysis was 60,170 in 2013. Therefore, the estimated 0.15% increase in employment represents a small positive effect. Some indirect and induced employment would likely go to existing local residents rather than new workers moving into the area. The proposed CISF would likely have a positive effect on land values in the overall area.

The existing journey-to-work patterns suggest that some workers who live up to 45 minutes away from the CISF facility might choose to commute there, if they obtained a job at the facility, rather than choosing to move closer to the facility. This may indicate that substantial in-

migration of population to the ROI would not be anticipated from the facility's operation-related job growth. Based on 2010 U.S. Census Bureau data, approximately 12.0% of total housing units were vacant in Lea County and 10.6% of housing units were vacant in Andrews County. It does not appear that there would be an unmet demand for housing in the ROI created by the new spent fuel CISF project.

Various tax benefits would accrue to state and local governments, based on the economic activity associated with the construction phase of the spent nuclear fuel CISF facility. Overall, anticipated state and local tax revenues that would result from the WCS CISF facility would have a small positive impact on the overall county tax revenues, based on recent data.

4.11 ENVIRONMENTAL JUSTICE

The data on minority and low-income populations in the 6.4 km (4 mi) radius study area does not indicate the presence of an environmental justice community of concern. No relocations or displacements would be required for the proposed CISF activities. Any noise or air quality considerations would be primarily limited to temporary impacts during the construction phase. Deliveries of storage casks would happen only a few times a week and transportation would be on rail cars, resulting in limited noise or air quality impacts. Economic impacts from construction and operations would result in small positive effects on the local and regional economy.

To achieve meaningful public involvement consistent with E.O. 12898 on Environmental Justice and E.O. 13166 on Limited English Proficiency, future public involvement activities would include populations within the ROI so that questions and concerns from those living within the larger ROI can be incorporated into the environmental process.

4.12 PUBLIC AND OCCUPATIONAL HEALTH IMPACTS

4.12.1 Nonradiological Impacts

During the construction, operation, and decommissioning of the CISF, there are several non-radiological pollutants that may be of concern to worker and public health. Figures 4.12-1 and 4.12-2 show the locations of key facilities within and outside the CISF boundary. The first group of pollutants of concern includes the criteria pollutants and dust (which is addressed in Section 4.6). With adequate control measures, such as the use of surfactants for dust suppression, etc. the impact on worker and public health would be expected to be small. There are no additional

potential health impacts to the public from the proposed project, since members of the general public would not be allowed on the proposed CISF site and the nearest resident is approximately 6 km (3.8 mi) away. Accordingly, no further analysis of these matters is necessary.

Potential health impacts to workers during construction and decommissioning of the CISF would be small and limited to the normal hazards associated with construction (i.e., no unusual situations would be anticipated that would make the proposed construction activities more hazardous than normal for a major industrial construction project). These normal hazards include fatal and nonfatal occupational injuries, which, for the construction industry, typically result from overexertion, falls, or being struck by equipment. Because there are no unusual situations anticipated to make the construction-related activities at the proposed site more hazardous than normal, there would be only small impacts to worker health and safety due to fatal and nonfatal occupational construction-related activities. The staff finds the non-radiological occupational health effects to be very small.

Analysis by a similar facility, the Independent Spent Fuel Storage Installation on the Reservation of the Skull Valley Band of Goshute Indians in Utah (2001) found that based on historical data from OSHA, it was estimated that less than 1 fatality would occur during the construction of each Phase (NRC, 2001).

There would be no liquid nonradioactive discharge to water or air. All sanitary waste is stored in above-ground containers and hauled offsite for disposal to a POTW. No other liquid effluents other than storm water runoff are anticipated and the chance of the runoff reaching the closest proximal surface water conveyance of Monument Draw is highly unlikely. The nonradiological cumulative impacts to the public would be minimal and cumulative occupational impacts would be small.

4.12.2 Radiological Impacts

This section describes the public and occupational impacts from the CISF. It includes site maps and facility layouts related to radioactive materials and calculated doses to the average member of the public and to the workforce.

4.12.2.1 Site Layout

The CISF is located adjacent to the Texas-New Mexico border, approximately 48.3 km (30 mi) west of Andrews, Texas, and 112.7 km (70 mi) east of the DOE WIPP, near Carlsbad, New Mexico. The licensed and permitted facilities are situated on approximately 541 ha (1,338 acres) of land on the north side of Texas State Highway 176 and are surrounded by approximately 5,665 ha (14,000 acres) controlled by ISP joint venture member Waste Control Specialists . Figures 4.12-1 and 4.12-2 show the locations of key facilities within and outside the CISF boundary.

In addition to these key sites shown in Figures 4.12-1 and 4.12-2, there are numerous oil and gas production wells located in the vicinity of the site; these can be a source of naturally-occurring radioactive materials. At some oil-field sites, pipes and tanks that handle large volumes of produced water can become coated with scale deposits that contain radium, and soil in the immediate vicinity of production sites may be unusually radioactive if affected by spills or leakage of produced water, or if contaminated by scale removed during pipe or tank cleaning operations . A 1989 American Petroleum Institute preliminary nationwide reconnaissance of measurable radioactivity at the exterior surfaces of oil-field equipment indicates that median radioactivity levels for oil and gas production facilities in southeastern New Mexico were at or marginally above background levels and below background in western Texas, see figure 4.12-3.

4.12.2.2 Review and Summary of Dose Calculations

A bounding evaluation of off-site doses for a 40,000 MTU facility loaded in eight phases was conducted. The evaluation looked at two scenarios: 1) eight phases consisting of NUHOMS® HSMs arranged in three rows of 144 back-to-back HSMs containing 5,000 MTU in each phase (See Figure 4.12-4) and 2) eight phases consisting of NAC Vertical Concrete Casks (VCC) arranged in nine 4 x 9 arrays of casks containing 5,000 MTU in each phase (See Figure 4.12-5).

The purpose of the dose calculations were to determine the impact to human health from radiation emitted from the HSMs and VCC containing up to 40,000 MTU of SNF and related GTCC waste. The design-basis of the HSMs and VCC where canisters containing SNF are welded and sealed prevent the release of radioactive materials into the environment. Accordingly, the only significant radiological exposure pathway impacting human health or the environment at the CISF during normal operations is from external sources of gamma-rays and neutrons resulting from radioactive decay of irradiated fuel. All other radiological pathways, such

as air, drinking water, soil ingestion, milk, and other foodstuff are not applicable. Additionally, no credible accidents were identified that result in a release of radioactive materials to the environment and thereby expose members of the public as discussed in Chapter 12 of the SAR. Therefore, no radiological impacts were identified that could affect drinking water sources or bioaccumulation of radioactive materials into foodstuff (crops, meat, or milk). Calculations were performed to estimate the radiation dose during normal operations to the nearest resident (i.e., the average member of the critical group) located approximately 3.8 miles west of the CISF. A map depicting the location of the nearest resident is provided in Figure 4.12-6.

The source terms assumed in the calculations are based on the Design Basis Source terms for the bounding Storage Overpack (HSM or VCC). The Design Basis Source terms are taken directly from the reactor licensing basis documents for each system under which the canisters were originally loaded. Therefore, the source terms do not account for the decay required to allow transport to the WCS CISF or the fact that most of the fuel to be stored has been sitting in storage for many decades at the reactor site prior to being transported to The CISF. These factors would result in significantly lower source terms at the WCS CISF.

The bounding site dose rates using the above assumptions were for the 2,592 VCCs shown in Figure 4.12-5.

The calculated dose rates as a function of distance from the center of the array are shown in Table 4.12-1. The site boundary is more than 1,006 m (3,300 ft) from the center of the array. Assuming full time occupation at the site boundary of 8,860 hours per year, the site boundary dose rate is less than 0.07 mSv/yr (7 mrem/yr).

Table 4.12-1, Calculated Dose Rates as a Function of Distance from the Center of the Storage Pads

Distance from Center of Array (ft)	X Direction(mrem/hr)*	Y Direction(mrem/hr)*
900	6.56E-01	9.69E-01
1,200	2.01E-01	2.77E-01
1,500	7.07E-02	9.33E-02
1,800	2.71E-02	3.50E-02
2,100	1.12E-02	1.42E-02
2,400	4.97E-03	6.24E-03
2,700	2.34E-03	2.92E-03
3,000	1.16E-03	1.44E-03
3,300	6.03E-04	7.46E-04
*1mrem = 0.01mSv		

The estimated dose rates are therefore less than the 10 CFR 72.104 limit of 0.25 mSv/yr (25 mrem/yr) thereby assuring that this dose evaluation is more than bounding for any future license amendments that would allow storage of up to 40,000 MTU and related GTCC waste at the WCS CISF and for the purposes of the Environmental Report evaluation.

The NAC VCC calculations are conservative in comparison to measured data. As an example, Duke McGuire has provided measured dose rate data for a VCC with a 30 kW payload. Measured dose rates at the VCC midplane were less than 0.031mSv/hr (3.1 mrem/hr). Using the data from the VCC evaluations dose rates at the same location are estimated to be 0.125mSv/hr (12.5 mrem/hr) or a factor of 4 times higher. In addition, as the various phases are loaded out, actual measured data boundary dose rate would be available for the WCS CISF which would necessarily take into account the actual age of the fuel being stored at the site.

During operations and decommissioning of the CISF, both radiation doses to occupational workers and members of the public would be mitigated by maintaining radiation doses to levels below the limits established under 10 CFR 20 and to levels that are ALARA. The maximum annual radiation dose to the nearest resident adjacent to the CISF attributable to storing 40,000 MTU of SNF and related GTCC waste was estimated at approximately 4.29E-4 mSv (4.29E-2 mrem). The maximum radiation dose to an individual occupational worker was estimated at 4.5 mSv/transfer (450 mrem/transfer). The maximum total occupation exposure per transfer is 11 mSv/transfer (1100 mrem/transfer).

The calculated collective occupational exposure for receiving and placing the canisters into storage at the WCS CISF is between 1.5 person-mSv/transfer (0.15 person-rem/transfer) and 11 person-mSv/transfer (1.1 person-rem/transfer) depending on the transportation cask and final storage overpack for each system evaluated. These occupational exposures are conservative based on industry experience for loading placing and fuel into storage in the same systems at reactor sites, where the majority of the dose comes from loading operations included loading of the fuel into the empty canisters, welding and vacuum drying of the canisters prior to transfer out to the storage pad.

Additional information regarding the estimated radiological impacts to workers and members of the public is provided in Sections 9.4 and 9.6 of the SAR.

4.12.2.3 Summary of Environmental Monitoring Program

ISP joint venture member Waste Control Specialists conducts a comprehensive environmental sampling and analysis program, commonly referred to as the consolidated REMP. Routine monitoring of work areas gives an early indication of any potential environmental concerns. The REMP serves as a primary confirmation of the adequacy of the active operational controls and the passive engineering and burial site controls for preventing releases beyond the design basis for the facilities. This program also provides environmental data to demonstrate compliance with radioactive effluent release standards contained in 10 CFR 20 Appendix B. The Waste Control Specialists facility REMP encompasses procedures and planning documents addressing the types, frequency, and methodologies employed to acquire the requisite data .

As part of the REMP, samples of media and effluents, including gases and vapor, air particulates, soil, sediment, fauna, vegetation, surface water, waste waters, and groundwater, are collected and analyzed. A monitoring network of TLDs and OSLs are also used to measure ambient gamma radiation. The sampling media and sampling locations included in the REMP provide a measure of the routine operations within and around the facility and monitor the potential impact of the facility operations on the off-site environment, including the general public. Sampling locations are selected to serve as both operational, early warning, and off-site environmental indicators .

Table 4.12-2 shows the key radionuclides measured for the REMP at Waste Control Specialists. These radionuclides were identified as important based on their radiological half-life, mobility in

the environment, radio-toxicity, and potential presence within wastes managed by Waste Control Specialists .

Table 4.12-2, Key radionuclides monitored by the REMP at Waste Control Specialists

Radionuclide	Source	Half-life
Uranium-235	Actinium decay series	7.1E10 y
Carbon-14	Cosmogenic	5730 y
Tritium	Cosmogenic	12.33 y
Cobalt-60	Nuclear reactors	5.27 y
Radium-228	Thorium decay series	5.75 y
Thorium-228	Thorium decay series	1.9 y
Thorium-232	Thorium decay series	1.4E10 y
Lead-210	Uranium decay series	22.3 y
Radium-226	Uranium decay series	1600 y
Radon-222	Uranium decay series	3.83 d
Thorium-230	Uranium decay series	7.7E4 y
Uranium-234	Uranium decay series	245500 y
Uranium-238	Uranium decay series	4.47E9 y
Iodine-129	Weapons testing fallout	1.57E7 y
Cesium-137	Weapons testing fallout, nuclear reactors	30 y
Strontium-90	Weapons testing fallout, nuclear reactors	29.12 y
Technetium-99	Weapons testing fallout, nuclear reactors	2.13E5 y

Figures 4.12-7 through 4.12-12 show the locations of the various types of environmental samples that are collected at Waste Control Specialists. One of the background locations (Station 9) is located in the bottom right corner of Figures 4.12-7, 4.12-9, 4.12-10 and 4.12-12.

4.13 WASTE MANAGEMENT IMPACTS

Waste management impacts associated with the construction, operations, and decommissioning at the CISF are expected to be small. The CISF would be designed to minimize the volumes of radiological waste generated during operations and at the time of license termination. The volumes of non-radiological solid waste would also be minimized to the extent practical. As such, the environmental impacts attributable to waste management are expected to be very low.

4.13.1 Effluent Controls

Effluent control systems would be used to reduce the concentrations of any radiological air emissions or liquid effluent discharges in the environment. Radiological air emissions and liquid effluent discharges would be well below the limits specified in 10 CFR Part 20, Appendix B and maintained ALARA.

Non-radiological air emissions would be generated primarily from diesel generators and engines used to provide electrical power and move equipment, including SNF, at the CISF. Non-radiological emissions would be controlled in accordance with air quality standards and permits issued by the TCEQ.

4.13.2 Sanitary Waste

Sanitary waste would be routinely discharged and collected in above-ground tanks prior to transport and disposal in a permitted POTW in compliance with regulatory and permit limits.

4.13.3 Solid Low-Level Radioactive Waste

Only very small quantities of solid LLRW are expected to be generated at the CISF. Solid waste containing low levels of radioactivity would be generated as a result of the decontamination or removal of residual contamination that may potentially be present on transportation casks received at the Transfer Building. Radiological surveys would also be performed on any equipment or items that would be released from the CISF in accordance with Regulatory Guide 1.86 (RG-186), *Termination of Operating Licenses for Nuclear Reactors.* Radioactive waste generated at the CISF, including items or equipment that exceed the criteria specified in RG-186 would be disposed of as low-level radioactive materials at a Waste Control Specialists' licensed or permitted facility.

4.13.4 Non-Radioactive Solid Waste

Non-radiological solid waste primarily resulting from the onsite fabrication of SNF Storage Systems is expected to be generated at the CISF. Approximately *3,400* SNF Storage Systems would be used at the CISF. However, some the SNF Storage Systems would not be fabricated onsite, only assembled. Additional small volumes of non-radiological solid waste are expected to be generated during routine, normal operations and decommissioning.

All solid waste generated at the CISF during operations and decommissioning would be disposed of in a Municipal solid waste landfill.

4.13.5 Hazardous and Mixed Waste

Hazardous or mixed wastes are not expected to be generated during operations at the CISF.

4.13.6 Waste Management Cumulative Impacts

Small quantities of waste are anticipated and would be controlled, stored and disposed of in compliance with 10 CFR Part 20. The cumulative impacts are expected to be small.

4.14 INTEGRATED ENVIRONMENTAL IMPACTS

ISP plans to license and construct the CISF in eight separate phases over the course of a 20 year period with operations beginning after the completion of Phase 1. Capacity for storage of approximately 5,000 MTUs of SNF and associated reactor related GTCC waste is planned in each of the eight phases. After the eighth phase is completed, approximately 40,000 MTUs of SNF and associated reactor related GTCC waste may be stored at the CISF. The cumulative impacts for storing 40,000 MTUs of SNF and associated reactor related GTCC waste were analyzed. This section evaluates the integrated impacts to the natural and human environment during periods when construction and operation are concurrent.

The cumulative environmental impacts for constructing and operating the CISF for all eight phases are analyzed throughout Chapter 4 of this Environmental Report. During Phase 1 of the project, the impacts from constructing the Security and Administration Building, Cask Handling Building, rail side track, and storage pads were analyzed. The highest volume of construction will be prior to operation when all access roads, parking, buildings, grading and drainage diversion berms are constructed. The environmental impacts associated with constructing Phase 1 of the CISF are bounding because the seven subsequent phases do not require construction of the Security and Administration Building, Cask Handling Building, and rail side track. The impacts of the seven subsequent phases would only include constructing the storage pads.

Once operation begins, the remaining canister storage pads will be constructed in several phases over the 20-year period. Integrated impacts would result from building pads while the facility is in operation. Integrated impacts are presented in Table 4.14-1 for areas in which there are potential impacts from construction affecting operations, and operations affecting construction.

The bounding case for integrated impacts assumes that every 2.5 years a phase is completed. The normal operational workforce is 10 people on average per shift. The construction workforce will range from 20 to 50 workers for 3 to 6 months at a time for a range of 20 to 50 construction workers building pads for 18 out of 30 months (60% of the 2.5 year period required to complete a phase).

Land Use

The impacts for land use due to construction and operation of the CISF and cumulative impacts are discussed in Section 4.1. ISP does not anticipate any additional integrated land use impacts due to the simultaneous construction and operation of different phases of the CISF.

Transportation

For transportation, the analysis in Section 4.2 considers impacts from construction and operation, including cumulative impacts from other nearby operations.

There are no anticipated integrated impacts to the rail since it will be used for transportation of canisters during operation but will not be used for construction of pads. There would be small integrated impacts to the local transportation system when construction and operation are concurrent due to the movement of operation workers commuting each day to the proposed CISF and due to the movement of construction workers commuting to the proposed CISF. It is anticipated the integrated impacts would be small since the construction will be on and off over the course of 20 years. The operations workforce is expected to have 30 workers distributed among 3 shifts per day using individual or light trucks. These workers could account for an increase of 60 vehicle trips per day on Texas Highway 176/ New Mexico Highway 234. The construction work force would be a maximum of 50 construction workers using individual vehicles, work trucks or cement trucks. These workers would account for an increase of 100 vehicle trips per day local roads for approximately 60% of one year or 7.2 months out of 12 months.

Soils

There would be limited integrated impacts to soils since the entire site will be excavated and graded with caliche prior to operation.

Seismic

There will be no integrated impacts that will affect seismic conditions at the site.

Water Resources: Surface

There will be no integrated impacts that will affect surface waters since there are no surface waters at or near the site.

Water Resources: Ground

There will be no integrated impacts that will affect ground water since ground water will not be used at the site for construction or operation. There are no anticipated integrated impacts to groundwater quality since the aquifer is very deep and beneath a thick clay confining layer, so it should be unaffected from the small amount of effluents that might be produced during construction and operation.

Ecological Resources: Vegetation

There would be small adverse impacts to ecological resources as the impacts from the proposed CISF would be restricted to the site, and the proposed CISF takes up a small percentage of the habitat surrounding the site, thereby not significantly altering the impacts already existing from other local and regional activities.

There will be very small integrated impacts to vegetation since the site will be cleared prior to operation. Over the course of the 20 year period, some minor clearing may be required prior to pad construction.

Ecological Resources: Wildlife

There could be small integrated impacts to wildlife due to the simultaneous construction and operation of the CISF phases due to changed facility boundaries and other activities.

Ecological Resources: Aquatic

There will be no integrated impacts to aquatic life since there are no surface waters or wetlands near the site.

Noise

There would be small noise impacts because noise from activities at the proposed CISF would not impact any sensitive offsite receptors.

There will be small integrated impacts to noise since the most noise would be generated during canister handling operations or moving fences and pad construction; although it is anticipated that the noise impacts would be very small and the sensitive offsite receptors would be too far away to be substantially impacted.

Air Quality

There would be small integrated impacts to air from fugitive dust emissions during construction activities. Mitigation measures can be used to suppress the amount of dust in the air during construction. Dust emission will be reduced once earth moving activities cease and paved roads are constructed.

Historic and Cultural Resources

There would be no integrated adverse impacts to cultural or historic resources. Evaluations conducted for the construction phase did not identify any archeological materials within the area of potential effects (APE), and no further work was recommended. Because the operations phase would not result in any new subsurface impacts, there would be no integrated impacts.

No historic resources were identified within the APE for indirect/visual impacts, which was buffered from the full project footprint. There would be no effects to historic resources in either the construction or operations phases; therefore there would be no integrated impacts to historic resources.

Visual and Scenic Resources

For visual/scenic resources, the analysis in Section 4.9 includes cumulative impacts from other nearby operations. ISP does not anticipate any additional integrated impacts to visual and scenic resources due to the simultaneous construction and operation of different phases of the CISF.

Socioeconomics

There would be minor socioeconomic integrated impacts. The input-output IMPLAN model used for the Socioeconomic Impact Analysis (SIA) for the proposed project evaluated the impacts of both the construction and operations phase. Although sequential construction campaigns would occur, the model used the initial investment of approximately $16.1 million (including all excavation and grading, fencing, and security system costs, plus building sufficient storage pads for the first 200 storage systems).

Impacts of both the construction and operations phase were found to be economically positive, resulting in additional jobs that would also be higher paying than the average for the waste disposal sector in the region. Total 2013 employment in the three-county analysis region was

60,170 jobs. The 122 jobs (person-years of employment) generated by the initial construction phase of the project and the 912 person-years of employment for the operations phase represent a relatively small portion of regional employment. For periods when construction and operations are concurrent, there are likely to be additional construction-related employment opportunities beyond those accounted for in the model, as the IMPLAN analysis modeled only the initial construction phase. It is possible that workers initially employed for construction-related tasks would transition to operations-phase positions, although to a limited extent, due to differing skill sets. To the extent that competition could develop between the two sectors during concurrent periods, this dynamic could further increase wages for in-demand workers, a positive effect. The SIA also analyzed the impact of additional employment on the housing market, for both the construction and operation phases and found that the estimated number of units of available housing exceeded demand by a large margin. For periods when construction and operations would be concurrent, it is expected that the additional demand for housing could be absorbed by the market. In the context of the regional economy, overall integrated impacts related to socioeconomics would be minimal.

Environmental Justice

There would be no integrated impacts to Environmental Justice populations. Based on the data analyzed and the NUREG-1748 guidance applicable to that analysis, no further evaluation of potential environmental justice concerns was necessary for the project, including integrated impacts.

Public and Occupational Health

Public and occupation health cumulative impacts are discussed in Section 4.12.

The incremental and radiological impacts associated with storing 5,000 MTUs of SNF during Phase 1 were analyzed. The results of the analysis are presented in Chapter 9, Section 9.4.1.2 and Tables 9-5 and 9-6 of the WCS CISF SAR. A separate analysis was also conducted to evaluate the radiological impacts associated with storing up to 40,000 MTUs. (NAC, 2015)

During construction of Phase 2, workers may be exposed to direct and scattered radiation from the SNF located on the Phase 1 storage pad. An analysis was performed to estimate the dose rate associated with storing 5,000 MTUs of SNF within the perimeter of Phase 1 Protected Area on workers constructing the next phase.

The WCS CISF includes NAC vertical concrete casks (VCCs) that would provide some shielding from the HSMs to dose points where the VCCs are between the HSM array and the dose point. No credit is taken for VCCs. The neutron and gamma source terms are based on the maximum source term allowed under the Certificate of Compliance or specific license for the HSMs and do not account for decay during storage or required prior to transportation at the originating site.

The analysis demonstrates that the dose rate approximately 600 ft from the center of Phase 1 was approximately 0.011 mSv/hr (1.1 mrem/hr). Thus, dose rates from the construction of Phase 2 after completion of Phase 1 would not be expected to exceed the dose rate limits of 0.02 mSv/hr (2 mrem/hr) for members of the general public at the perimeter of the Protected Area.

The anticipated dose rates during construction of Phases 3 through 8 are similar or less than those predicted to occur during construction of Phase 2, because the additional shielding provided by the loaded storage canisters and due to the increased distances from the loaded storage canisters and the storage pads under construction.

The results indicated that the maximum dose rates in the proximity of where the storage pads will be constructed during Phase 2 through Phase 8 are less than 0.02 mSv/hr (2 mrem/hr) as documented in WCS CISF SAR Chapter 9 Tables 9-5 and 9-6 and Figures 9-1 and 9-2. Accordingly, the analysis that was performed demonstrates that the interaction of workers that would be involved during the construction of Phase 2 through Phase 8 would not be exposed to direct radiation from SNF in storage at Phase 1 exceeding the 0.02 mSv/hr (2 mrem/hr) and 0.5 mSv/y (50 mrem/y) limit for members of the public, as specified in 10 CFR 20.1302(b)(2)(ii).

For these reasons, the integrated impacts to public and occupational health would most likely be small. Canister handling operations and construction would not be occurring concurrently if it was not guaranteed that the dose rates were below 2 mrem/hr at the construction location. Implementation of the Radiation Protection Program procedures ensures that occupational doses are below the limits required by 10 CFR 20.1201 and are ALARA in all parts of the CISF for construction workers and operational workers.

Waste Management

Waste management cumulative impacts are discussed in Section 4.13. ISP anticipates any additional integrated impacts for waste management due to the simultaneous construction and operation of different phases of the CISF would be small.

Summary of Integrated Impacts

Table 4.14-1 summarizes the integrated impacts for the WCS CISF due to simultaneous construction and operation of different phases of the facility. The table also summarizes the construction and operation impacts that are discussed throughout this Chapter 4. As shown in this table, the integrated impacts would be small and only present in some resource areas. These integrated impacts do not affect the cumulative effects analysis in Section 2.6 and the analysis of cumulative impacts throughout the remainder of Chapter 4.

Table 4.14-1 Integrated Impacts

	Construction	Operation	Integrated
Land Use	SMALL	SMALL	NONE
Transportation	SMALL	SMALL	SMALL
Soils	SMALL	SMALL	SMALL
Seismic	NONE	NONE	NONE
Water Resources : Surface	NONE	NONE	NONE
Water Resources : Ground	NONE	NONE	NONE
Ecological Resources : Vegetation	SMALL	SMALL	SMALL
Ecological Resources : Wildlife	SMALL	SMALL	SMALL
Ecological Resources : Aquatic	NONE	NONE	NONE
Noise	SMALL	SMALL	SMALL
Air Quality	MODERATE	SMALL	SMALL
Historic and Cultural Resources	NONE	NONE	NONE
Visual and Scenic Resources	MODERATE	MODERATE	NONE
Socioeconomics	SMALL	SMALL	SMALL
Environmental Justice	NONE	NONE	NONE
Public and Occupational Health	SMALL	SMALL	SMALL
Waste Management	SMALL	SMALL	SMALL

4.15 CUMULATIVE IMPACTS

Cumulative effects are defined by the Council on Environmental Quality (CEQ) as effects "on the environment which result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time" (40 Code of Federal Regulations [CFR] §1508.7).

The WCS Environmental Report currently discusses potential cumulative effects in Section 2.6 after the alternatives analysis. In this discussion, the Region of Interest (ROI) is a 30-mile radius. Based on information obtained from the Toole County Environmental Impact Statement (EIS) (NRC, 2001) and the EIS for the National Enrichment Facility (NRC, 2005b), plus analysis prepared for the WCS Low-Level Radioactive Waste Disposal Facility (TCEQ, 2008), the resources with the highest potential for cumulative effects were identified as air quality impacts and noise impacts during construction. Competition for use of aggregate and other mineral resources was cited as a non-radiological cumulative impact to resources.

Radiological environmental impacts are described in detail in Section 2.6.

Cumulative impacts to environmental resources from the full build out of the proposed project as well as other known pertinent sites are discussed by resource in Chapter 4 of this Environmental Report. Section 4.14 Integrated Environmental Impacts also analyzes potential integrated impacts when construction and operation are concurrent (see Table 4.14.-1). Figure 4.12-2 also illustrates other facilities ("key sites") considered in Chapter 4.

4.15.1 CURRENT AND REASONABLY FORESEEABLE ACTIONS

Current and reasonably foreseeable actions could be private developments, public initiatives by local, county, or federal government entities, and other development activities with the potential to result in environmental impacts. This discussion identifies activities within a Region of Influence (ROI) that extends for a 50-mile radius around the proposed CISF site for consideration of potential cumulative impacts. The timeframe considered is approximately 40 years into the future, consistent with the timeframe for the initial operating license for the CISF. Present and reasonably foreseeable activities are divided into nuclear and non-nuclear

activities. See Figure 4.15-1: Project Area – 50 Miles Region of Interest, Road Base and Aerial Base. See also Figure 4.15-2: Projects and Facilities in the 50-mile Region of Interest.

4.15.1.1 Non-Nuclear Activities in the Region of Influence

There are several non-nuclear activities in the 50-mile Region of Influence, many of them suited to the very low population density within the ROI. There are large areas of undeveloped scrub/shrub land. Developed uses include oil and gas related industry. Various disposal operations and surface material extraction land uses exist. One wind farm is proposed in the ROI. Outside the small population centers, there is little infrastructure to support more dense development.

Some projects and facilities are discussed below.

4.15.1.1.1 General Activities – Oil and Gas Activity, Ranching Activity, and Mining

Figure 4.15-3: Land Use in the 50-mile Region of Interest depicts land use within the 50-mile radius of the facility from the USGS National Land Cover Dataset. The majority of land within the 50-mile radius is shrub/scrub or grassland/herbaceous with approximately one-quarter of the land (primarily to the northeast) depicted as cultivated crops.

With regard to livestock/grazing activities, the five-mile radius land cover map does not show any pasture or hay land cover (See Figure 4.15-4); however, the majority of the land within five miles of the site has historically been used for ranching and grazing activities.

Oil and gas development is prominent near the CISF site. See Section 3.1 for further discussion.

4.15.1.1.2 Permian Basin Materials, LLC

Permian Basin Materials, LLC (PBM) operates an aggregates quarry and concrete ready mix facility in New Mexico near the CISF. PBM shares a property boundary with WCS and this boundary is approximately 4,000 feet from the CISF Protected Area.

4.15.1.1.3 Lea County – Eunice NM Solid Waste Landfill Facility

Lea County Landfill (LCLF) is operated by Waste Connections, Inc. and accepts solid waste primarily from Lea County. It is located at 3219 East State Road 234, Eunice, NM 88231. It is approximately 5 to 6 miles east of Eunice in Sections 4 and 9, Township 22 South, Range 38

East, NMPM. Operations began in 1999 and the facility is scheduled to close in 2048. Most of the waste delivered to the site is brought by haulers; 95% in 2012 (NMRC 2012). The facility accepts commercial, residential, construction, and demolition waste including tires, yard trimmings, and six special wastes: sludge, petroleum-contaminated soils (PCS), industrial solid waste (ISW), offal, spill of a chemical substance or commercial product (spill waste), and treated formerly characteristic hazardous waste (TFCH). Solid waste is placed and compacted in lined cells that are monitored by environmental control systems. At the end of each working day, the working face of the waste disposal area is covered with at least six inches of soil or an alternative daily cover approved by the Department.

LCLF received approximately 96,550 tons of MSW and 472 tons of special waste in 2018, or approximately 266 tons of solid waste per calendar day. LCLF estimates waste receipts of up to 100 tons per year each of TFCH, offal, sludge, and spill waste; up to 500 tons per year each of ISW, PCS, and solid waste – not otherwise specified (SWNOS); and up to 2,500 tons per year of asbestos waste.

On May 15, 2019 a public hearing was held at the Lea County Event Center for a permit renewal and modification (NMED 2019). The permit renewal and modification application seeks approval of a facility approximately 350.1 acres in size with approximately 252.7 acres designated for municipal solid waste (MSW) disposal, approximately 8.1 acres designated for construction and demolition (C&D) debris disposal, and approximately 8.1 acres designated for asbestos waste disposal.

The modification would allow construction of dedicated disposal cells for asbestos waste and C&D debris; vertical expansion of the solid waste disposal boundary to increase the final grade in the MSW disposal area by approximately 75 feet; and authorization for acceptance of two new special wastes (asbestos waste and SWNOS). Waste received at LCLF generally originates from Lea County but may originate from areas outside of Lea County, including out-of-state areas. Impacts could include emissions, truck traffic, and waste migration.

4.15.1.1.4 Renewable Energy Activities

The Jumbo Hill Wind Project is operated by ENGIE North America, who acquired it in 2018 from Infinity Power Partners, a joint venture between Infinity Renewables and MAP Energy (Kovaleski 2019). It is located in northwest Andrews County, Texas, approximately 7.5 miles from the city of Eunice, New Mexico and 2 miles from the New Mexico/Texas border.

The project, which consists of a wind farm with a total capacity of approximately 160 MW, is planned and is scheduled to be online by spring of 2020 (Froese 2019). In total, Jumbo Hill will use 57 GE Renewable Energy turbines with 127-meter rotors (Kovaleski 2019).

In general (from a programmatic level), noise, visual impacts, and avian/bat mortality are the primary potential environmental impacts caused by wind farms (BLM 2019). Specific environmental permitting studies were not located for this discussion.

4.15.1.1.5 Ochoa Sulphate of Potash (SOP) Mine, New Mexico

This mine is located in Lea County, New Mexico with a very small portion in Eddy County, New Mexico; 60 miles east of Carlsbad, New Mexico and less than 20 miles west of the Texas/New Mexico border. The project location totals more than 86,024 acres (GA 2016). It is a mineral mining (Polyhalite/Sulphate of Potash) and fertilizer production operation.

The project has been planned and the project construction has been approved by the Bureau of Land Management (BLM) as captured in the Record of Decision (BLM 2014). The project completed positive preliminary economic assessment (PEA) in November 2016 and is expected to start production in 2019 (Mining Technology 2019).

The Record of Decision states that:

- *The Preferred Alternative meets the purpose and need while minimizing potential conflicts with other land uses and mineral development.*
- *Implementation of this Decision will not cause unnecessary or undue degradation of the public lands and is consistent with other legal requirements.*
- *The potential visual impacts of the tailings stockpile will be minimized through early and frequent reclamation and the sale of marketable byproducts.*
- *The Decision will help maintain revenue for local and state government and will provide additional employment for the local economy.*
- *Monitoring and mitigation measures have been incorporated into the [Mine Plan of Operations] to support adaptive management and minimize environmental impacts as the project progresses.*

4.15.1.1.6 CK Disposal E & P Landfill and Processing Facility

CK Disposal, LLC proposes to develop a surface waste management facility consisting of a landfill, liquid processing area, and deep well injection. The CK Facility is located 0.05-miles south of State Highway 234, approximately 4.16-miles southeast of Eunice, New Mexico, in Lea County. The CK Facility will encompass 316.97-acres. The landfill will be 141.5 acres, the liquid processing will be 51.75 acres, and saltwater disposal will be 5.1 acres. Buffer areas, site structures, and access roads are a total of 118.62 acres. The six (6) waste cells will have a combined disposal capacity of approximately 24,585,056-cubic yards. Plans for the CK Facility evaporation ponds, tank holding area, stabilization, and solidification area have been designed by Parkhill, Smith and Cooper, Inc. (PSC) under New Mexico Registered Professional Engineer, Nicholas Ybarra. Landfill volumetric calculations include waste capacity analysis and the soil material balance. The CK Disposal facility has a gross airspace of approximately 24,585,056 cubic yards. Assuming a contingency of 15% for variation in waste density and other operational uses, the result is an estimated approximately 20,897,298 cubic yards of waste capacity remaining. Based on the daily tonnage received, the CK Facility landfill will have an active life between 38 years (for 1,500 cubic yards per day) and 115 years (for 500 cubic yards per day).

On November 6, 2015, CK Disposal, LLC (Applicant) submitted a draft application to the Oil Conservation Division (Division) for a permit to construct and operate a commercial surface waste management facility in Lea County, New Mexico (NMEMNRD 2016). On November 22, 2016, Louisiana Energy Services, LLC, dba Urenco USA (LES), which operates a uranium enrichment facility to the north of Applicant's proposed commercial surface waste management facility, filed a request for hearing pursuant to 19.15.36.10 (A) NMAC. In addition, several legislators requested that the Commission schedule a hearing. On January 9, 2017, in Eunice, New Mexico, the Commission accepted public comments regarding CK Disposal, LLC's application. The public has voiced concerns regarding hydrogen sulfide gas emissions, impacts to economic development, truck traffic, and the tracking of liquid and solid waste from the facility onto public roadways. The permit was approved on April 4, 2017. Several documents exist that appear to include some local opposition to the facility.

4.15.1.1.7 Sundance West, Inc. – Sundance West Surface Waste Management Facility, New Mexico

The proposed Sundance West Facility is located 3 miles east of Eunice, 18 miles south of Hobbs, and approximately 1.5 miles west of the Texas/New Mexico state line. The proposed location is within unincorporated Lea County, New Mexico. The site is situated on an approximately 320-acre tract of land as shown in Figure 4.15-5 from (GEI 2016).

The Sundance West Facility is a planned facility that will include a landfill and ancillary oilfield waste management infrastructure. An existing facility, Sundance Services, Inc. is located and currently operating adjacent to the location of the proposed facility. Sundance Services, Inc. has been operating in this location since approximately 1977. The intended purpose of the new Sundance West, Inc. facility is to replace the older Sundance Services, Inc. facility. The phased development of the Sundance West facility is estimated to take place approximately four years from the issuance of the final permit. A draft, tentative permit was released in January 2017.

The Sundance West is a non-nuclear facility that will include two main components: a liquid oil field waste Processing Area and an oil field waste Landfill. Oil field wastes are anticipated to be delivered to the Sundance West Facility from oil and gas exploration and production operations in southeastern NM and west Texas.

The intended use of the Sundance West Facility is the permanent disposal of exempt and non-exempt/non-hazardous oil field waste. Sundance West, Inc. is/will be responsible for terms and conditions of the New Mexico Oil Conservation Division (OCD) permit and in conformance with all pertinent rules and regulations under the Oil & Gas Act, to protect public health and the environment, prevent the waste of oil and gas, and prevent the contamination of fresh waters.

According to the draft permit (NMEMNRD 2017), the OCD regulates the disposition of water produced or used in connection with the exploration and production of oil and gas and directs disposal of that water in a manner which will afford reasonable protection against contamination of fresh water supplies pursuant to authority granted in the Oil & Gas Act (Chapter 70, Article 2 NMSA 1978). Under that Act, OCD also regulates the disposition of nondomestic wastes resulting from exploration, production, or storage of crude oil and natural gas to protect public health and the environment. Similarly, OCD regulates the disposition of nondomestic wastes resulting from the oil field service industry, the transportation of crude oil and natural gas, the

treatment of natural gas, and the refinement of crude oil to protect public health and the environment pursuant to jurisdiction and authority granted by the same Act.

4.15.1.1.8 Railroad Spur Underground Boring Easement

Rice Operating Company (ROC) Line Railroad Bore Easement (for saltwater disposal pipeline) is located in Lea County, New Mexico east of the city of Eunice. The location is from SE/SE of Section 25, Township 21S, Range 37E to the NE/NE of Section 36, Township 21 South, Range 37 East (WCS 2019).

The pipeline would be owned and operated/maintained by the Rice Operating Company (ROC). The easement would be approximately 250 feet long, and the pipeline would be located underground under an existing railroad, which received an easement from private landowners in 1962 and 1969 and is currently owned by WCS (WCS 2019).

This is a planned project: The easement was obtained July 2019 and construction is expected to start in 2019. This is a non-nuclear facility (saltwater disposal pipeline).

Saltwater would be ejected from wells (from an oil/gas fracking operation) through this pipeline to natural underground formations sealed within impenetrable rock to prevent the saltwater from escaping into surrounding soil and groundwater. The EPA regulates saltwater disposal systems. The Safe Water Drinking Act (1974) requires that the EPA maintain minimal federal requirements for the practice of saltwater disposal (Sunshine 2019). New Mexico Oil Conservation Division (OCD) regulates disposal wells as EPA delegated the Class II program to the OCD.

Additionally, The New Mexico Public Regulation Commission Pipeline Safety Bureau enforces federal and state pipeline safety regulations through the issuance of permits in order to provide for the safe operation of hazardous liquid facilities (such as saltwater disposal pipelines) (NMPRC 2019).

4.15.1.1.9 Sprint Andrews County Disposal Facility

This proposed Sprint Andrews County Disposal Facility site is approximately 30 miles west of Andrews on land owned by the applicant. The property is on the south side of SH 176 approximately 16 miles northwest of FM 181. The facility is about 165 acres of a 640-acre tract and is shown in Figure 4.15-6 from (BME 2019).

Land uses have been agriculture and oil exploration and production. There are currently no oil and gas wells and no water wells on the property and there are no community facilities nearby.

According to the permit application, the proposed Sprint Andrews County Disposal Facility would "receive, store, handle, treat, reclaim, and dispose on site of certain non-hazardous oil and gas waste subject to the jurisdiction of the Railroad Commission of Texas (RRC) including numerous specific processes associated with this type of permit as defined by Statewide Rule 57(b)(2)".

The permit application assesses environmental conditions such as wetlands, precipitation, floodplains, and a detailed groundwater analysis. The permit application describes the processes that would be used, the type of waste that would be accepted, documentation and monitoring commitments for permit compliance, closure plan, and other required components. The facility life is estimated to be approximately 36 years and the disposal capacity would be approximately 11.5 million cubic yards. Since the stamped drawings associated with the permit application show May 2019, it is assumed that the permitting process is still underway. This is a planned and reasonably foreseeable action.

4.15.1.1.10 OWL Landfill Services LLC Facility

The OWL Landfill Services LLC Facility will accept oil field waste for processing and disposal from oil and gas exploration and production operations in southeastern New Mexico (NM) and west Texas. The proposed OWL site is located approximately 22 miles northwest of Jal, adjacent and to the south of NM State Route 128 in Lea County, NM. The OWL site is comprised of a 560-acre ± tract of land located within a portion of Section 23, Township 24 South, Range 33 East, Lea County, NM. Site access will be provided on the south side of NM State Route 128 (GEI 2016).

The OWL Surface Waste Management Facility will comprise approximately 500 acres ± of the 560-acre ± site and will include two main components: an oil field waste Processing Area (81 acres ±) and an oil field waste Landfill (224 acres ±), as well as related infrastructure (195 acres ±). At full build-out, the Processing Area may include an oil treatment facility consisting of an estimated 8 produced water load-out points, 45 produced water tanks, 12 evaporation ponds, 3 crude oil recovery tanks, and 2 oil sales tanks; as well as 1 stabilization and solidification area; and a customer jet wash (6 bays). The Landfill disposal footprint is 224 acres ± with a waste capacity (airspace) of approximately 38.3 million cubic yards. Design and operating refinements

are likely, particularly in the number and type of processing units, in response to market conditions; evolving technologies; etc. The plans for actual installations will be the subject of future submittals to the OCD (e.g., Construction Plans and Technical Specifications) in advance of construction.

The permit was approved on March 7, 2017 and appears to be under construction. Material transported to the proposed WCS site would be delivered by rail and would not impact the road capacity and the petroleum industry in the area that the OWL facility relies on. No environmental studies were located on the project.

4.15.1.2 Nuclear Activities in the ROI

4.15.1.2.1 Eddy Lea Energy Alliance/Holtec Hi-Store Consolidated Interim Storage

The proposed Holtec Hi-Store CIS Facility is 32 miles east of Carlsbad, New Mexico and 34 miles west of Hobbs, New Mexico. The facility would provide interim spent nuclear fuel storage pending licensing of a permanent repository. Phase 1 construction would disturb 119.4 acres for various components of the plant. Holtec is requesting a license to store up to 8,860 MTUs in Phase 1 and analyzed the environmental impacts of storing up to 100,000 MTUs at the CIS Facility in their license application and environmental report. "The proposed action is the issuance of an NRC license under 10 CFR 72 authorizing the construction and operation of a CIS facility on approximately 1,040 acres of land controlled by Holtec in Lea County, New Mexico. The CIS Facility would receive, possess, and store Spent Nuclear Fuel containing up to 100,000 metric tons of uranium (MTUs) of SNF" (Holtec 2019).

Their license application process has run roughly in parallel with WCS/ISP's license application and their report references the WCS CISF facility. Their approach uses different storage technology and includes a private purchase of land from the Eddy-Lea Energy Alliance (ELEA) at a site that is bordered by Federal and state lands on all sides. Their license application is in review as of August 2019.

The Environmental Report for the proposed Holtec Hi-Store CIS Facility includes a comprehensive environmental analysis of the proposed action in compliance with the application for license through the Nuclear Regulatory Commission and other applicable local, state, and federal laws and regulations. Their report concludes: "The Proposed Action would not cause any notable impacts for the following areas: visual and scenic resources; geology and

soils; ecological resources; water resources; noise; cultural resources; socioeconomics and environmental justice; non-radiological transportation; infrastructure; and waste management." The resource areas with potential for cumulative impacts according to their analysis include: "land resources, air quality, transportation of nuclear materials, and health and safety (normal operations)." See Figure 4.15-7 from (Holtec 2019).

4.15.1.2.2 National Enrichment Facility (UUSA NEF)

UUSA National Enrichment Facility (NEF) is operated by Louisiana Energy Services LLC and it is the "only operating commercial enrichment facility on US soil and is located in Eunice, New Mexico." According to Urenco, the facility began operations in 2010. Their production capacity is 4,900 tSW/a and the facility employs more than 230 people (NEF 2019). The facility is used to enrich uranium for use in manufacturing nuclear fuel for commercial nuclear power reactors. A gas centrifuge process is used at the site for uranium enrichment. The environmental impacts of the project are documented in the EIS, NUREG-1790 (NRC 2005b). This site location is also shown on Figure 4.12-2. Due to its proximity to the proposed CISF, the NEF is referenced across several sections in Chapter 4 of this license application with regard to environmental impacts.

4.15.1.2.3 Waste Isolation Pilot Plant (WIPP)

According to the Department of Energy, the WIPP is the "nation's only repository for the disposal of nuclear waste known as transuranic, or TRU, waste. It consists of clothing, tools, rags, residues, debris, soil, and other items contaminated with small amounts of plutonium and other man-made radioactive elements. Disposal of transuranic waste is critical to the cleanup of Cold War nuclear production sites. Waste from DOE sites around the country is sent to WIPP for permanent disposal." (DOE 2019a). The facility has been in operation since 1999 and uses underground salt caverns for storage. More than 90,000 cubic meters of this TRU waste has been disposed of at this facility (DOE 2019b). Environmental impacts have been assessed and the environmental impact statement documents are entitled Waste Isolation Pilot Plan Disposal Phase Final Supplemental Environmental Impact Statement, DOE/EIS-0026-S2 (DOE 2018) and Waste Isolation Pilot Plant Annual Site Environmental Report for 2016 (DOE 2017). This site location is also shown on ER Figure 4.12-2.

4.15.1.2.4 International Isotopes Fluorine Products Inc. (IIFP) Depleted Uranium Deconversion Plant (FEP/DUP)

International Isotopes Fluorine Products Inc. (IIFP) facility was granted a license from NRC in October 2012 (NRC 2019). The license would allow construction and operation of a depleted uranium deconversion facility to be known as the Fluorine Extraction Process and Depleted Uranium Deconversion Plant (FEP/DUP). According to NRC, the site in Lea County, New Mexico would "convert depleted uranium hexafluoride (UF6) into fluoride products (i.e., deconversion) for commercial resale and uranium oxides for disposal. The proposed facility is projected to be capable of processing up to 11 million pounds of depleted UF6 per year." According the NRC website, no construction activities have occurred at the FEP/DUP. Environmental Impacts were assessed in a Final EIS that was published in 2012 (NUREG-2113), incorporated here by reference (NRC 2012b). This site location is also shown on ER Figure 4.12-2.

4.15.2 POTENTIAL CUMULATIVE IMPACTS

Chapter 4 of the Environmental Report discusses environmental impacts from the proposed CISF. The project would not result in more than small or limited direct impacts to the following resources: geology and soils; water resources; ecological resources; air quality; noise; cultural resources; visual and scenic resources; environmental justice; transportation (non-nuclear); and waste management. A brief summary of resource impacts is included in the following section.

The following resources could be impacted to a moderate degree by the CISF project and therefore could contribute to cumulative impacts: land use, transportation (of nuclear materials); socioeconomics (positive); and public and occupational health. A brief summary of resource impacts is included below.

4.15.2.1 Resource Areas with Minimal Potential for Cumulative Impacts

4.15.2.1.1 Geology and Soils

The potential impacts to the geology and soils have been characterized in Section 4.3, Geology and Soils Impacts. No substantial impacts would occur from the following activities:

- *Soil re-suspension, erosion, and disruption of natural drainage*
- *Excavations to be conducted during construction*

Impacts to geology and soils would be limited to surface runoff due to routine operation and low annual rainfall. Construction activities may cause some short-term increases in soil erosion at the CISF.

Because these direct impacts would be minimal and short-term, there is low potential to contribute to substantial cumulative impacts to these resources.

4.15.2.1.2 Water Resources

The potential impacts to water resources have been characterized in ER Section 4.4, Water Resources Impacts. No substantial impacts are anticipated to the following:

- *Surface water and groundwater quality*
- *Consumptive water uses (e.g., groundwater depletion) on other water users and adverse impacts on surface-oriented water users resulting from facility activities. Site groundwater would not be utilized for any reason, and therefore, should not be impacted by routine CISF operations. The CISF water supply would be obtained from the same local publicly owned water system sources as the existing operations.*
- *Hydrological system alterations or impacts*
- *Withdrawals and returns of ground and surface water*
- *Cumulative effects on water resources.*

The CISF would not obtain any water from onsite surface or groundwater resources. Sanitary wastewater discharges would be made through sewerage to holding tanks and subsequently transported offsite to publicly owned treatment works. Storm water is not expected to contain any radiological effluents, and with a low annual rainfall, storm water runoff would be directed to natural drainage areas.

Because these direct impacts would be minimal and short-term, there is low potential to contribute to substantial cumulative impacts to these resources.

4.15.2.1.3 Ecological Resources

The potential impacts to ecological resources have been characterized in Section 4.5, Ecological Resources Impacts. No substantial impacts are anticipated from the following factors:

- *Total area of land to be disturbed*
- *Area of disturbance for each habitat type*
- *Use of chemical herbicides, roadway maintenance, and mechanical clearing*
- *Areas to be used on a short-term basis during construction*
- *Communities or habitats that have been defined as rare or unique or that support federally listed threatened and endangered species*
- *Impacts of elevated construction equipment or structures on species (e.g., bird collisions, nesting areas)*
- *Impact on important biota*

Based on database searches and site inventories conducted by qualified ecologists, impacts to ecological resources would be minimal due to the absence of potentially suitable habitat for any federally listed threatened or endangered species on the land proposed for the CISF. No federally listed species were observed within the survey area during the October 2018 or April 2019 field investigations. The project has the potential to impact one state-listed endangered species for which potentially suitable habitat is located within the survey area: the Texas horned lizard. No state-listed threatened or endangered individuals were observed during the October 2018 or April 2019 field investigations. State law prohibits direct harm to state-listed species. If any individuals of these state-listed species are observed within the survey area during construction, care should be taken to avoid harming them, and the contractor should be educated about the potential presence of these species. No further coordination is required with the USFWS or TPWD at this time.

Best management practices would be in place during construction activities. Since no impacts are anticipated to federally listed species, and one state-listed species may occur in a large area

in and around the proposed CISF facility, minimal impacts are anticipated and the project has low potential to contribute to substantial cumulative impacts to ecological species.

4.15.2.1.4 Air Quality

The potential impacts to the air quality have been characterized in Section 4.6, Air Quality Impacts. No substantial impacts from gaseous effluents would occur and visibility would not be impacted. Impacts to air quality would be minimal. Construction and operational activities would result in interim increases in hydrocarbons and particulate matter due to vehicle emissions and dust. During construction activities, best practices would be employed to reduce and control dust emissions.

Because these direct impacts would be minimal and short-term, there is low potential to contribute to substantial cumulative impacts to air quality.

4.15.2.1.5 Noise

The potential impacts related to noise generated by the facility have been characterized in Section 4.7, Noise Impacts. No substantial impacts to sensitive receptors (e.g., hospitals, schools, residences, wildlife) from predicted typical noise levels at the facility perimeter are anticipated. Noise levels would increase during construction and during operation of the CISF, but not to a level that would cause significant impact to nearby residents. The nearest residence is 6 km (3.8 mi) from the CISF.

Because these direct impacts would be minimal and short-term, there is low potential to contribute to substantial cumulative impacts to sensitive noise receivers.

4.15.2.1.6 Cultural Resources

The potential impacts to historic and cultural resources have been characterized in Section 4.8, Historic and Cultural Resource Impacts. The archeological Area of Potential Effect (APE) consists of the 216.6-acre footprint of the proposed CISF. No archeological materials of any kind were observed within the APE during a survey conducted in May 2015, and no further work is recommended within the APE prior to construction of the proposed CISF. Since the area containing the proposed project footprint is devoid of any standing structures, the proposed project would not result in a direct impact to any non-archeological historic resources. The APE for indirect/visual impacts was defined as the area within a 1.6 km (1 mi) radius from the proposed project footprint. There do not appear to be any historic resources 45 years or older

(dating to 1974 or earlier) within the 1.6 km (1 mi) indirect effects APE. The Texas Historical Commission (THC) as well as the New Mexico Department of Cultural Affairs concurred that further cultural resource investigations are not warranted prior to construction.

Because these direct impacts would be minimal and short-term, there is low potential to contribute to substantial cumulative impacts to cultural resources.

4.15.2.1.7 Visual and Scenic Resources

The potential impacts to visual/scenic resources have been characterized in Section 4.9, Visual/Scenic Resources Impacts. The proposed CISF construction would be visible only from fairly close vantage points and would be less of an impact than the adjacent URENCO NEF, which lies between the denser population of viewers in Eunice, NM and the proposed CISF, where the largest component would be the cask handling building. The Socioeconomic Impact Assessment (SIA) characterizes the proposed CISF location as having a modest scenic quality that is pleasant to regard for its rural, undeveloped nature, but not dramatic, unique, or rare (CMEC 2015). Facilities geared towards resources extraction, the Lea County Landfill, and oil well pump jacks exist in the project area, in addition to the URENCO NEF facility, which have an equal or higher impact on the visual landscape compared to the proposed new CISF activities.

Because these direct impacts would be minimal and short-term, there is low potential to contribute to substantial cumulative impacts to visual and scenic resources.

4.15.2.1.8 Environmental Justice

The potential impacts with respect to environmental justice have been characterized in the Environmental Justice section of the ER, Section 4.11. No substantial disproportionate impacts to low-income or minority persons are anticipated to result from the proposed project. Based on the data analyzed and the NUREG-1748 guidance applicable to that analysis, ISP determined that no further evaluation of potential environmental justice concerns was necessary, as no Census Block Group within the 6.4 km (4 mi) radius, i.e., 128 km² (50 mi²), of the CISF site contained a minority or low-income population exceeding the NUREG-1748 "20%" or "50%" criteria.

Because no direct adverse impacts would occur to environmental justice communities, there is low potential to contribute to substantial cumulative impacts to environmental justice communities.

4.15.2.1.9 Transportation (Non-Nuclear)

Transportation impacts have been characterized in Section 4.2, Transportation Impacts. With respect to construction-related transportation, no substantial impacts would occur. The analysis incorporated the following considerations:

- *No new access road would be required on Texas State Highway 176 to provide access to the facility. An existing roadway on the Waste Control Specialists property would be extended north to the CISF.*
- *The transportation route and mode for conveying construction material to the facility currently exists.*
- *The increase in traffic from heavy haul vehicles and construction worker commuting would not substantially change traffic patterns.*
- *Impacts from construction transportation such as fugitive dust, scenic quality, and noise would be temporary.*

Minor impacts related to construction traffic such as fugitive dust, noise, and emissions are discussed in ER Section 4.7. Additional information on noise impacts is contained in ER Section 3.7.

Because these direct impacts would be limited due to much of the transportation infrastructure already existing at the site, and construction traffic impacts would be minor and short-term, there is low potential to contribute to substantial cumulative impacts from transportation activities.

4.15.2.1.10 Waste Management

The potential impacts of waste generation and waste management have been characterized in Section 4.13, Waste Management Impacts. No substantial impacts would occur to:

- *The public, due to the composition and disposal of solid, hazardous, radioactive and mixed wastes*
- *Facility workers, due to storage, processing, handling, and disposal of solid, hazardous, radioactive, and mixed wastes.*

Impacts related to waste management would be minimal. Additionally, there would be no substantial cumulative impacts from waste generation and waste management.

4.15.2.2 Resource Areas with Potential for Cumulative Impacts

4.15.2.2.1 Land Use

Land use impacts have been characterized in Section 4.1, Land Use Impacts. No substantial impacts would occur with regard to the following: Land-use impacts at the CISF and impacts from any related federal action that may have cumulatively significant impacts; and area and location of land that would be disturbed on either a long-term or short-term basis. As discussed in Section 4.1, the proposed action would have a footprint of 130 ha (320 acres) after Phase Eight build out. An additional 5 ha (12 acres) would be used for contractor parking and lay-down area, which would be restored after the construction phase. The total impact would be approximately 135 ha (332 acres) of the 5,666 ha (14,000 acres) of land controlled by ISP Joint Venture Waste Control Specialists. As stated in Section 4.1, "overall land use impacts to the proposed CISF and vicinity would be small considering that the majority of the site would remain undeveloped, the current industrial activity on neighboring properties, the nearby expansive oil and gas well fields, and the placement of most utility installations along highway easements. ISP is not aware of any Federal action that would have cumulatively significant land use impacts."

The non-nuclear and nuclear-related activities that were previously discussed would each have some impacts on land use. Some activities discussed are generalized activities such as livestock grazing (not permitted at the ISP site) and oil and gas activities. Renewable resource projects are planned in the ROI including a wind farm. Non-nuclear and nuclear-related waste disposal activities exist and are the subject of their own environmental and regulatory compliance studies.

Land use development for the proposed project and others with federal funding or permitting requirements must meet a legitimate public purpose. In the case of the CISF, safe consolidated interim spent fuel storage would help fulfill the objectives of the Blue Ribbon Commission recommendations (BRC 2012) and the Department of Energy's 2015 establishment of a consent-based siting process to transport, store, and dispose of SNF and HLW. Each project within the ROI must meet applicable land development regulations. The proposed CISF project would contribute to cumulative land use impacts within the ROI. However, these impacts,

combined with past, present, and reasonably foreseeable future impacts based on current research, are not anticipated to result in significant, cumulative, adverse impacts to land use.

Table 4.15-1 quantifies land use impacts from various proposed and existing nuclear actions within the 50-mile region of influence. The ROI comprises more than five million acres of land. The table summarizes the total land use of all nuclear-related facilities within the WCS/ISP ROI. These anticipated nuclear related activities total approximately 1,800 acres, which is less than 0.04 percent of land in the ROI. The cumulative impacts to land use would not be statistically significant.

Table 4.15-1, Cumulative Impacts – Land Use

Facility	Land Use (acres)	Source
Proposed WCS CISF	330	WCS CSIF ER
Proposed Holtec Hi-STORE CIS	330	Holtec 2019
WIPP	300	DOE 2015
Urenco (UUSA) NEF	200	NRC 2005b
International Isotopes Fluorine Products FEP/DUP	640	NRC 2012b
Total	**1,800**	

4.15.2.2.2 Transportation (of Nuclear Materials)

With respect to the transport of radioactive materials, no substantial impacts would occur. The analysis incorporated the following factors:

- *Mode of transportation (truck, rail, or barge) and routes from the originating site to the CISF*
- *Estimated transportation distance from the originating site to the CISF*
- *Treatment and packaging procedures for radioactive wastes*
- *Radiological dose equivalents for public and workers from incident-free scenarios*
- *Potential impacts of operating transportation vehicles on the environment (e.g., fire from equipment sparking)*

Impacts related to the transport of radioactive materials are addressed in Sections 3.2 and 4.2. The materials that would be transported to and from the CISF are well within the scope of the

environmental impacts previously evaluated by the NRC in its GEIS for continued storage of spent nuclear fuel, NUREG-2157 (NRC 2014a).

With regard to transportation of nuclear materials, listed in Table 4.15-2 are the impacts associated with radiological transportation. The table describes impacts from various proposed nuclear actions within the 50-mile region of influence.

The anticipated total annual dose to the public from transportation activities would be 6.76 person-sievert (676 person-rem). The cumulative impact from the proposed WCS CISF and other proposed and existing nuclear-related sites would not be statistically significant.

Table 4.15-2, Cumulative Impacts – Transportation (Nuclear-related)

Facility	Annual Dose to Public (person-Sv)	Source
Proposed WCS CISF	0.69	WCS CSIF ER
Holtec Hi-STORE CIS	1.72	Holtec 2019
WIPP	2.50	DOE 2016
Urenco (UUSA) NEF	1.67	NRC 2005b
IIFP FEP/DUP	1.8*	NRC 2012b
Total	**6.76**	—

**NRC 2012b estimated the maximum annual dose from radiological transportation to be 0.18 Sv (18 person-rem). For conservative purposes, this dose is assumed to be public dose.*

4.15.2.2.3 Socioeconomics (Positive)

The potential socioeconomic impacts to the community have been characterized in Section 4.10, Socioeconomic Impacts and in Appendix A, Socioeconomic Impacts of the Proposed Spent Nuclear Fuel Consolidated Interim Storage Facility Andrews, Texas. No substantial negative impacts are anticipated on the area's:

- *Population characteristics (e.g., ethnic groups and population density)*
- *Housing, health and social services, or educational and transportation resources*
- *Tax structure and distribution*

The conclusions of the SIA showed positive direct, indirect, and final demand impacts to the economy for the construction and operation of the CISF. There would be no adverse direct impacts to the nearby communities. There would be minimal demands on local social resources and infrastructure to meet housing and other social infrastructure needs, based on the

anticipated increases in employment for the CISF. Section 7.0 of the ER includes a detailed benefit-cost analysis in terms of savings to the federal government and benefits to the private sector and local workforce, including redevelopment potential at decommissioned plants and several other factors. Overall, the analysis indicates that benefits outweigh the costs.

From a socioeconomic perspective, the proposed CISF project would contribute to positive cumulative effects.

4.15.2.2.4 Public and Occupational Health – Nonradiological (Normal Operations)

The potential impacts to public and occupational health for nonradiological sources have been characterized in Section 4.12.1, Nonradiological Impacts. No substantial impacts will exist to:

- *Members of the public from nonradiological discharge of liquid or gaseous effluents to water or air*
- *Facility workers as a result of occupational exposure to nonradiological chemicals, effluents, or wastes*
- *Public and occupational health from cumulative impacts*

Impacts to the public and workers from nonradiological gaseous and liquid effluents would be minimal.

4.15.2.2.5 Public and Occupational Health – Radiological (Normal Operations)

The assessment of pathways for exposure along with potential impacts to public and occupational health for radiological sources has been characterized in Section 4.12, Public and Occupational Health Impacts. No substantial impacts exist for the public (as determined by the critical group) or the workforce (based on radiological and chemical exposures) based on the average annual concentration of radioactive and hazardous materials in gaseous and liquid effluents and on reasonably foreseeable (i.e., credible) accidents with the potential to result in environmental releases. Routine operations at the CISF would create only an incremental increase in the potential for radiological and nonradiological public and occupational exposure. Potential radiation exposure would be due to the storage of spent nuclear fuel and the presence of associated fission products onsite. There would be no chemical substances, airborne particulates, or gases or liquid effluents that could contribute to offsite exposure.

All credible accident sequences were considered during the Safety Analysis performed for the facility; this information can be found in Section 1.4.3, Accident Analysis, of the WCS CSIF SAR.

Table 4.15-3 details present doses to a maximally exposed individual (MEI) from each proposed or existing nuclear related facility in the WCS CISF Region of Interest. The data in Table 4.15-3 represents an assumption that, for conservative purposes, "a single MEI would receive a maximum dose from each of the facilities considered in the cumulative analysis." The doses in the table are low compared to an individual's maximum exposure to naturally-occurring elements.

Table 4.15-3, Cumulative Radiological Doses

Facility	Cumulative Dose to Maximally Exposed Individual		Source
	mrem/yr.	mSv/yr.	
PROPOSED WCS CISF	4.3×10^{-2}	4.3×10^{-6}	WCS CSIF ER
HOLTEC HI-STORE CIS	2.5	2.5×10^{-3}	Holtec 2019
WIPP	0.24	2.4×10^{-5}	DOE 2015
URENCO (UUSA) NEF	1.3×10^{-3}	1.3×10^{-6}	NRC 2005b
IIFP FEP/DUP	1.4×10^{-2}	1.4×10^{-5}	NRC 2005
Total	**2.8**	$\mathbf{2.8 \times 10^{-3}}$	—

Figure 4.2-1

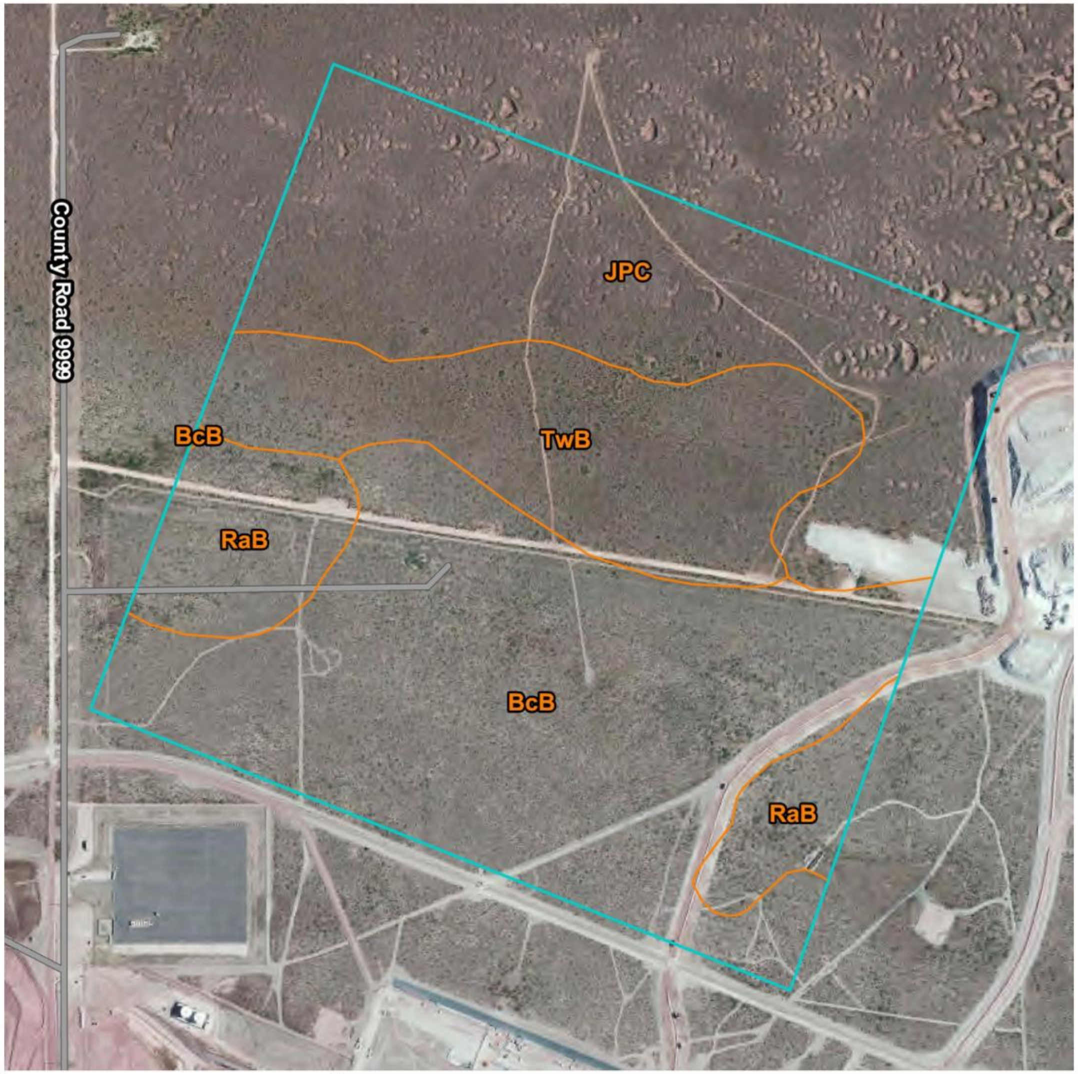
Not Used

Figure 4.2-2

Not Used

Figure 4.2-3

Not Used



LEGEND

Area of Interest (AOI)

Soils (Soil Unit Polygon)

Symbol	Unit Name	AOI	
		Acres	Percent
BcB	Blakeney and Conger Soils, gently undulating	132.8	40.8%
JPC	Jalmar-Penwell association,undulating	99.9	30.7%
RaB	Ratliff soils, gently undulating	32.8	10.1%
TwB	Triomas and Wickett soils, gently undulating	59.5	18.3%
Totals for Area of Interest		325.0	100%

Notes:

- Soil survey for the AOI was mapped at 1:31,700.
- A map unit delineation represents an area one or more major kinds of soils taxonomic classification.
- Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect the use or management of the property.

Source:

- USDA, National Cooperative Soil Survey,
- Andrews County, TX,
- Version 13, Sep 18, 2015.
- Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov

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Figure 4.3-1
Soil Map

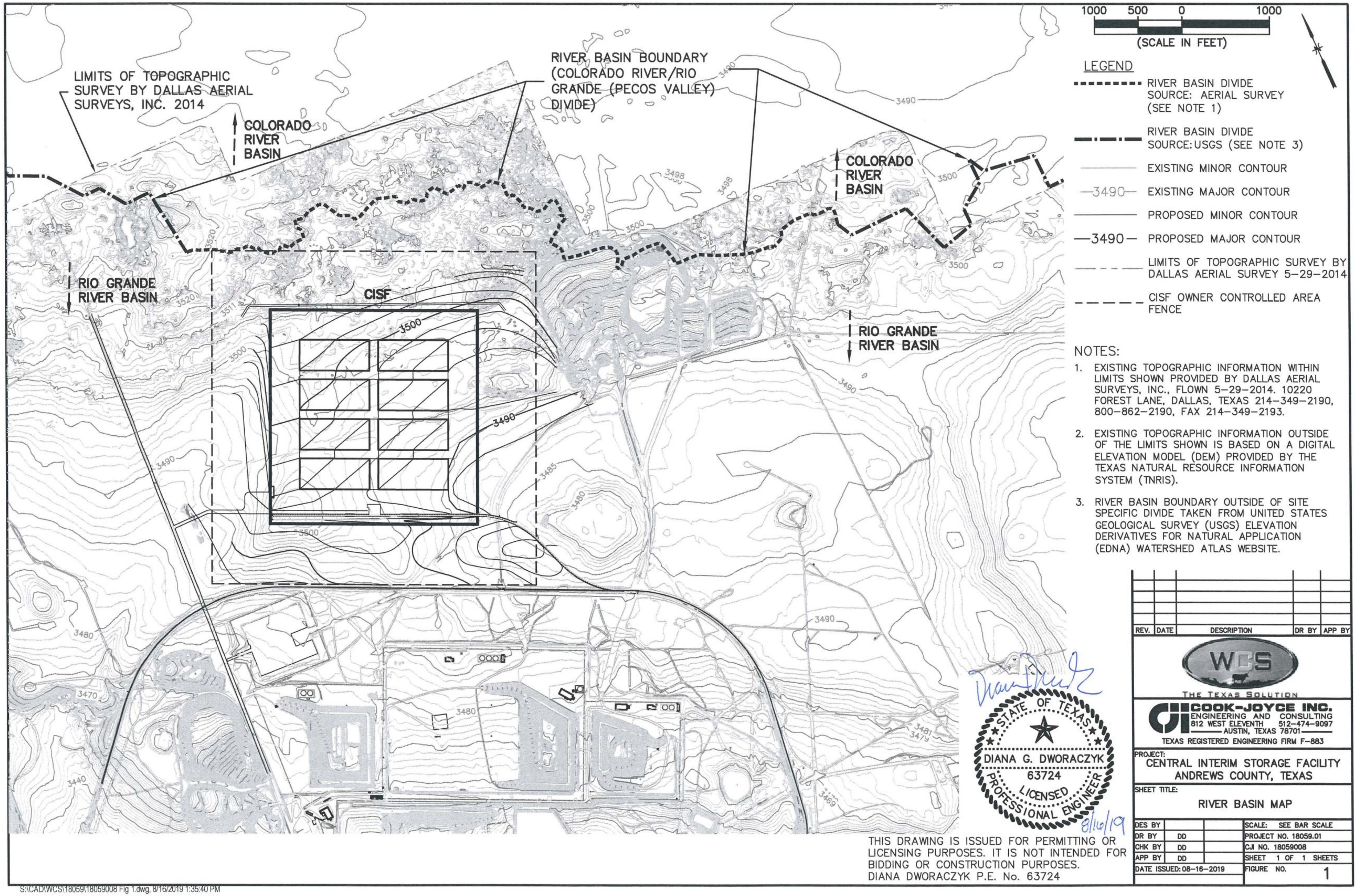
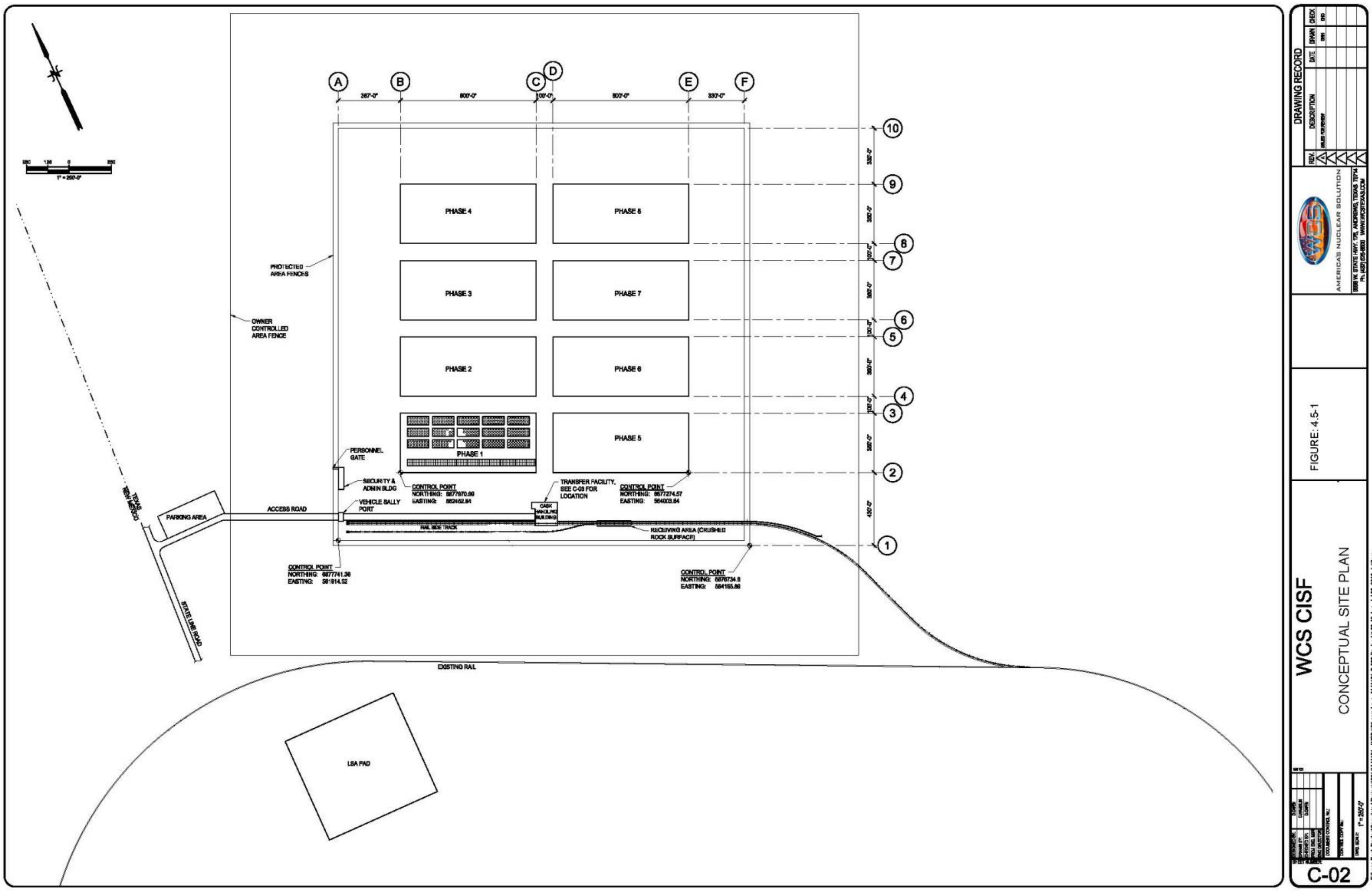


Figure 4.4-1, River Basis Map


PHASE 1
PHASE 2
PHASE 3
PHASE 4
PHASE 5
PHASE 6
PHASE 7
PHASE 8
PROTECTED AREA FENCES
OWNER CONTROLLED AREA FENCE
PERSONNEL GATE
SECURITY & ADMIN BLDG
VEHICLE SALLY PORT
ACCESS ROAD
PARKING AREA
STATE LINE ROAD
CONTROL POINT
RECEIVING AREA (CRUSHED ROCK SURFACE)
EXISTING RAIL
LSA PAD
DRAWING RECORD
WCS CISF
CONCEPTUAL SITE PLAN
FIGURE: 4.5-1
C-02

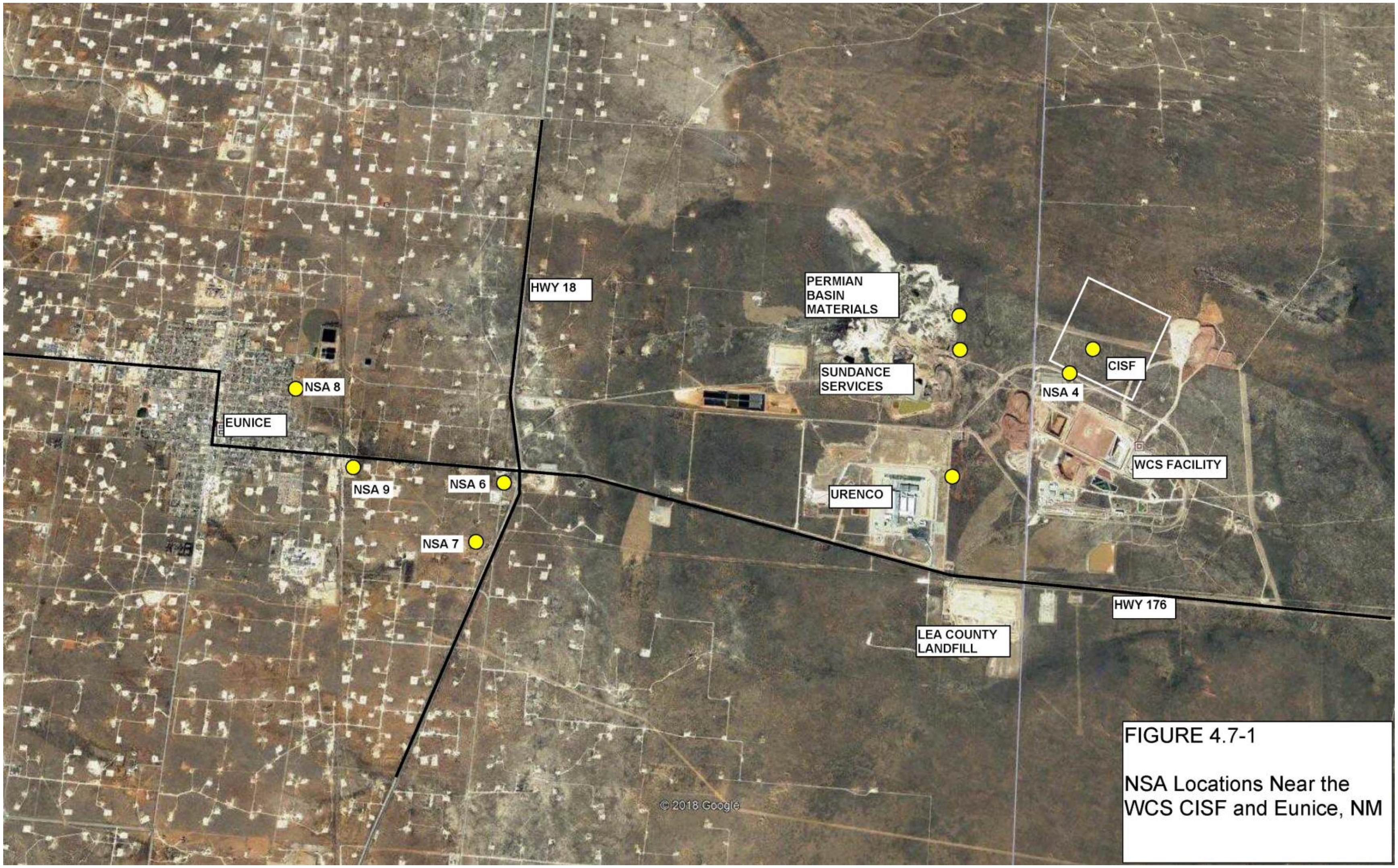


FIGURE 4.7-1

NSA Locations Near the WCS CISF and Eunice, NM

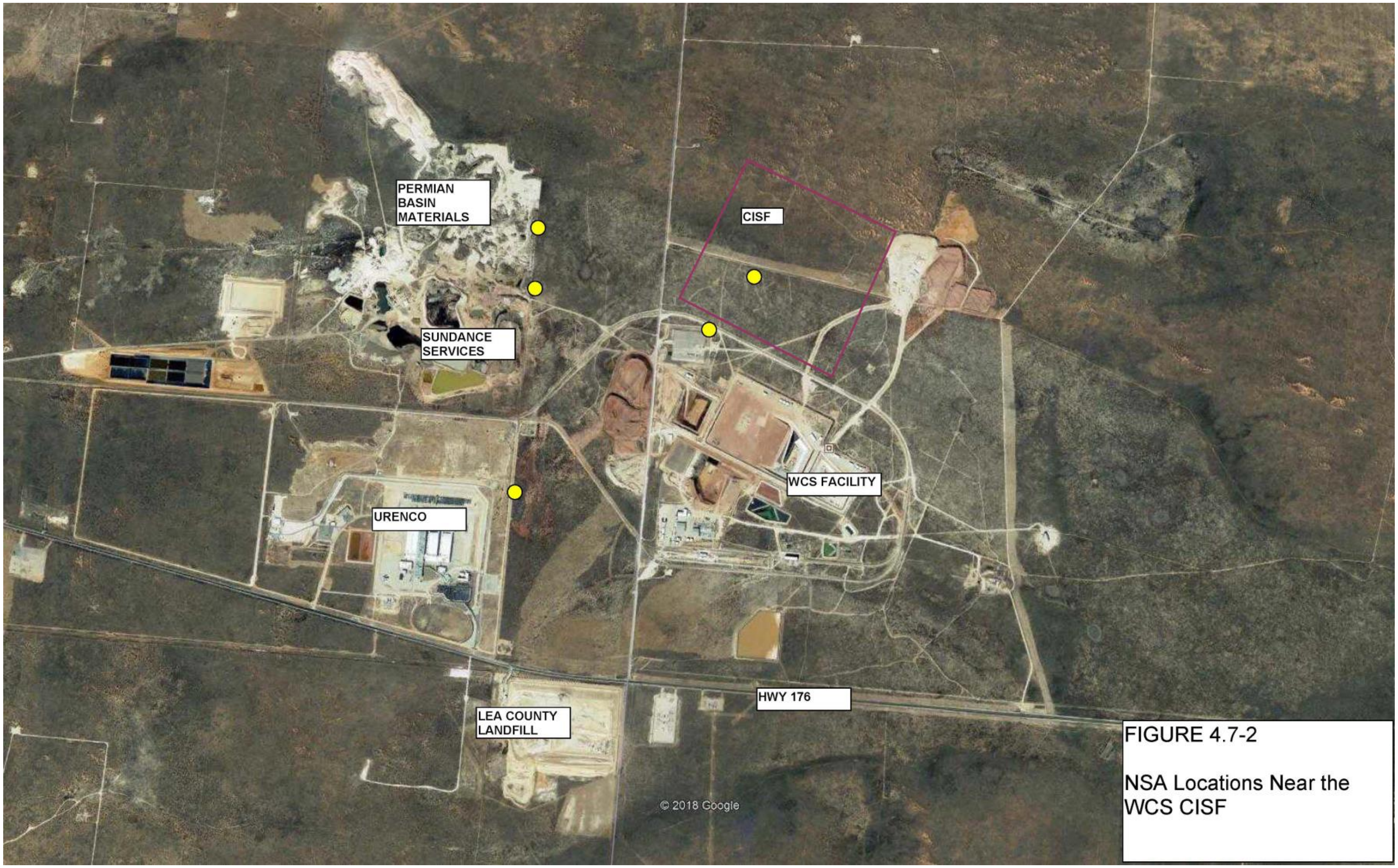


FIGURE 4.7-2

NSA Locations Near the
WCS CISF

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Figure 4.12-1

Waste Control Specialists and facilities near the proposed Consolidated Interim Spent Fuel Storage Facility (CISF)

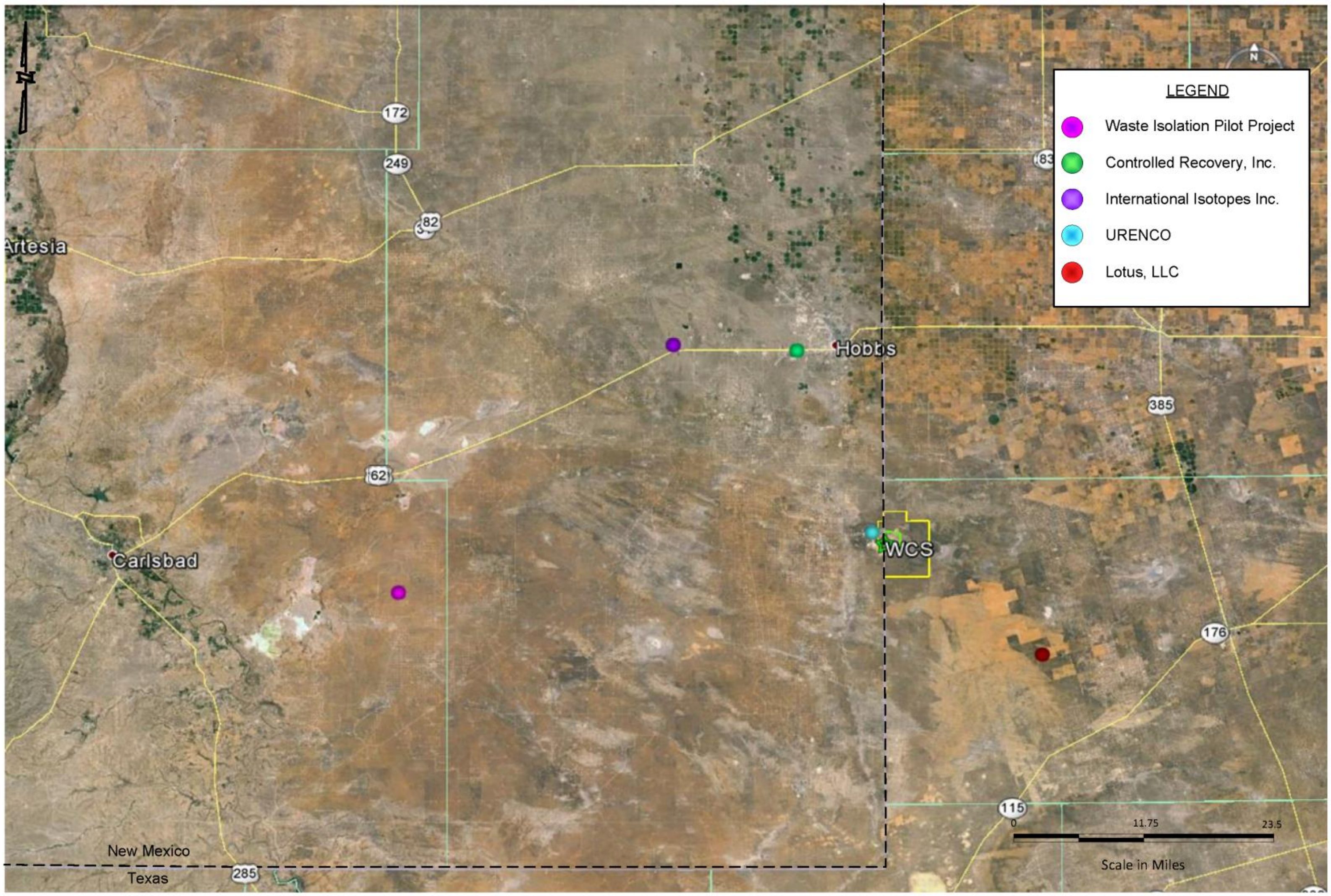

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Figure 4.12-2
Facilities adjacent to the proposed Consolidated Interim Spent Fuel Storage Facility at WCS.

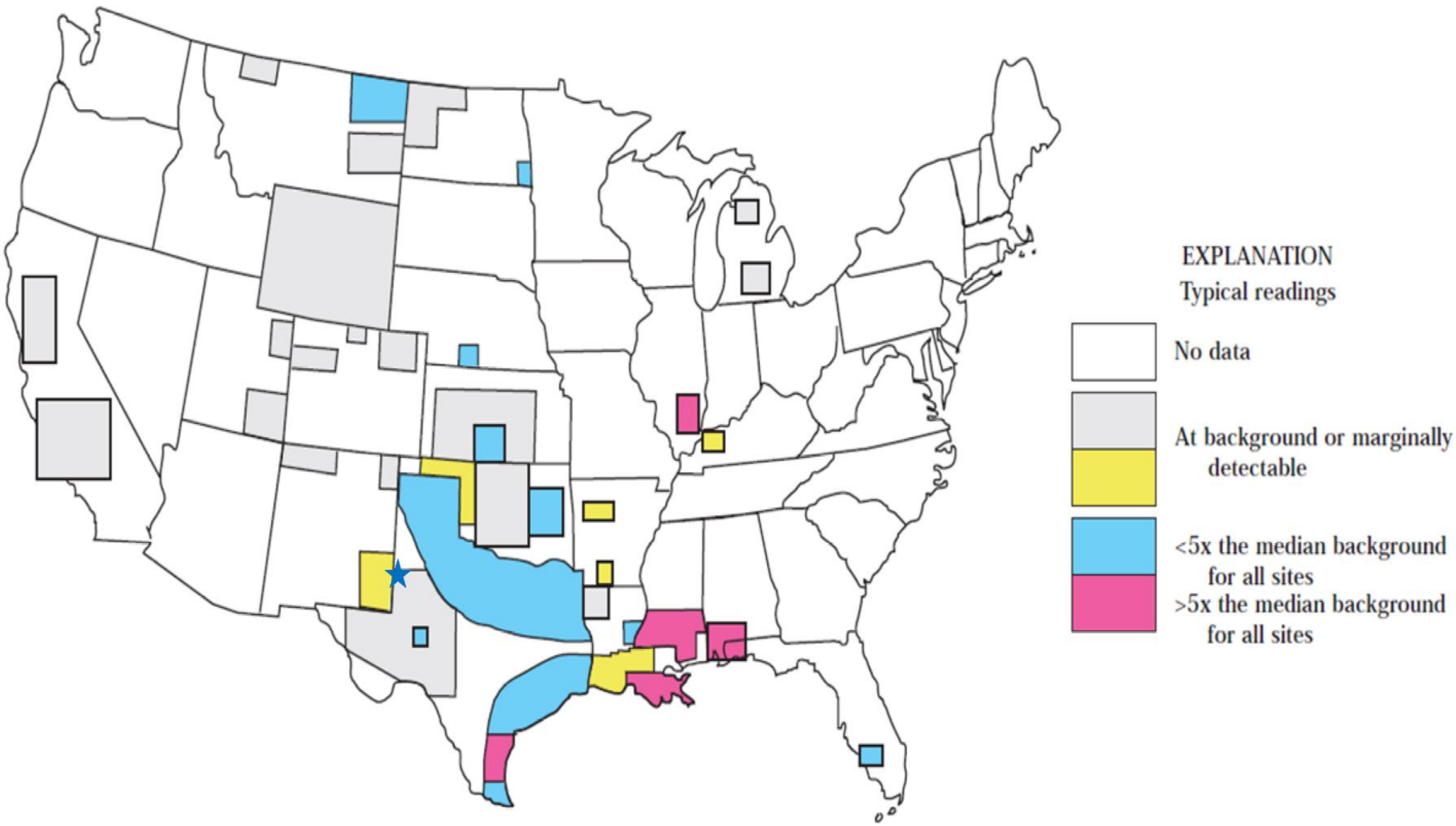

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Figure 4.12-3
U.S. map showing measurable radioactivity at the exterior surfaces of oil-field equipment (USGS 1999). The blue star indicates the approximate location of WCS where typical readings were at background.

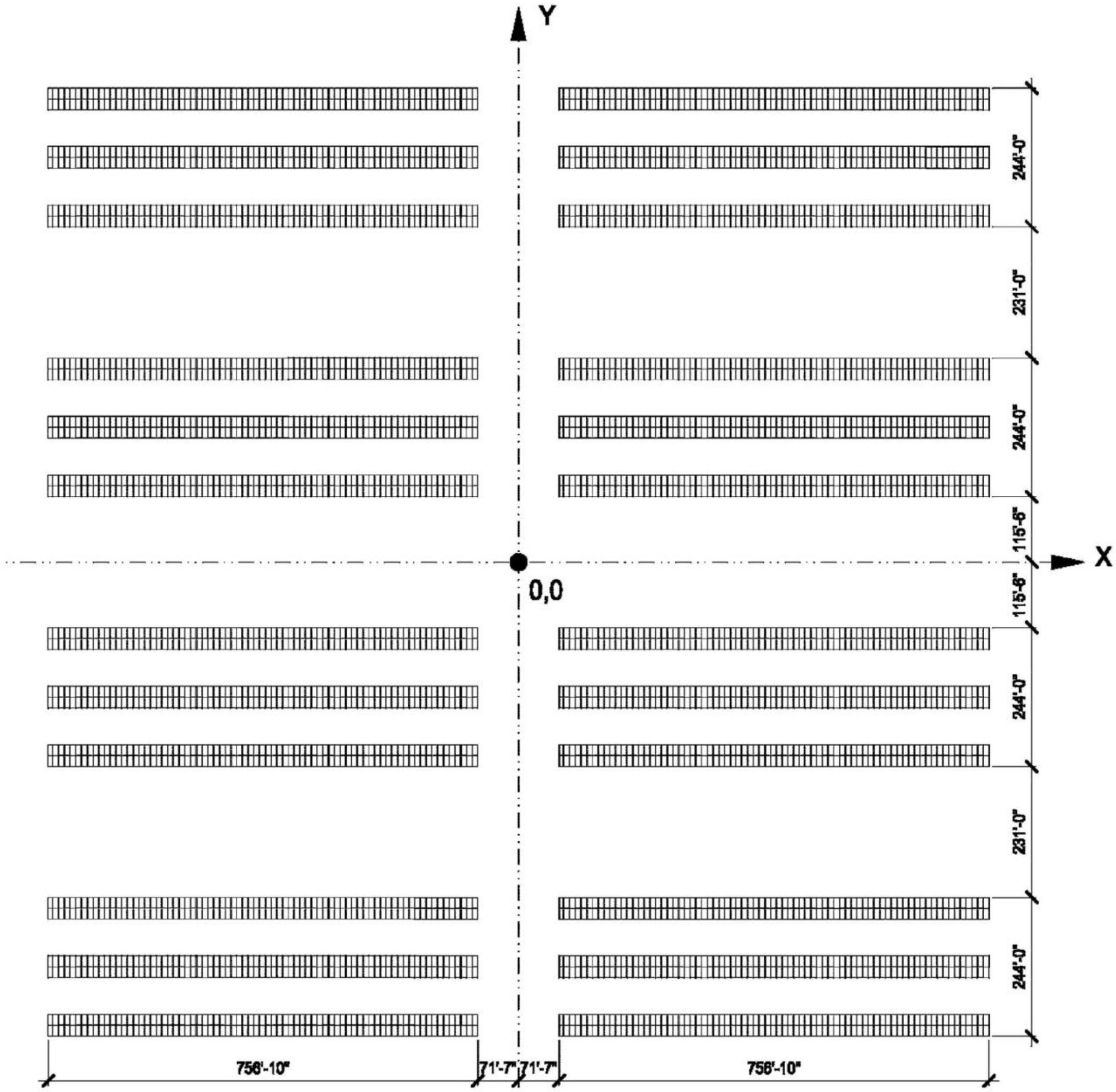

Figure 4 12-4
NUHOMS Horizontal Storage Modules (HSMs)

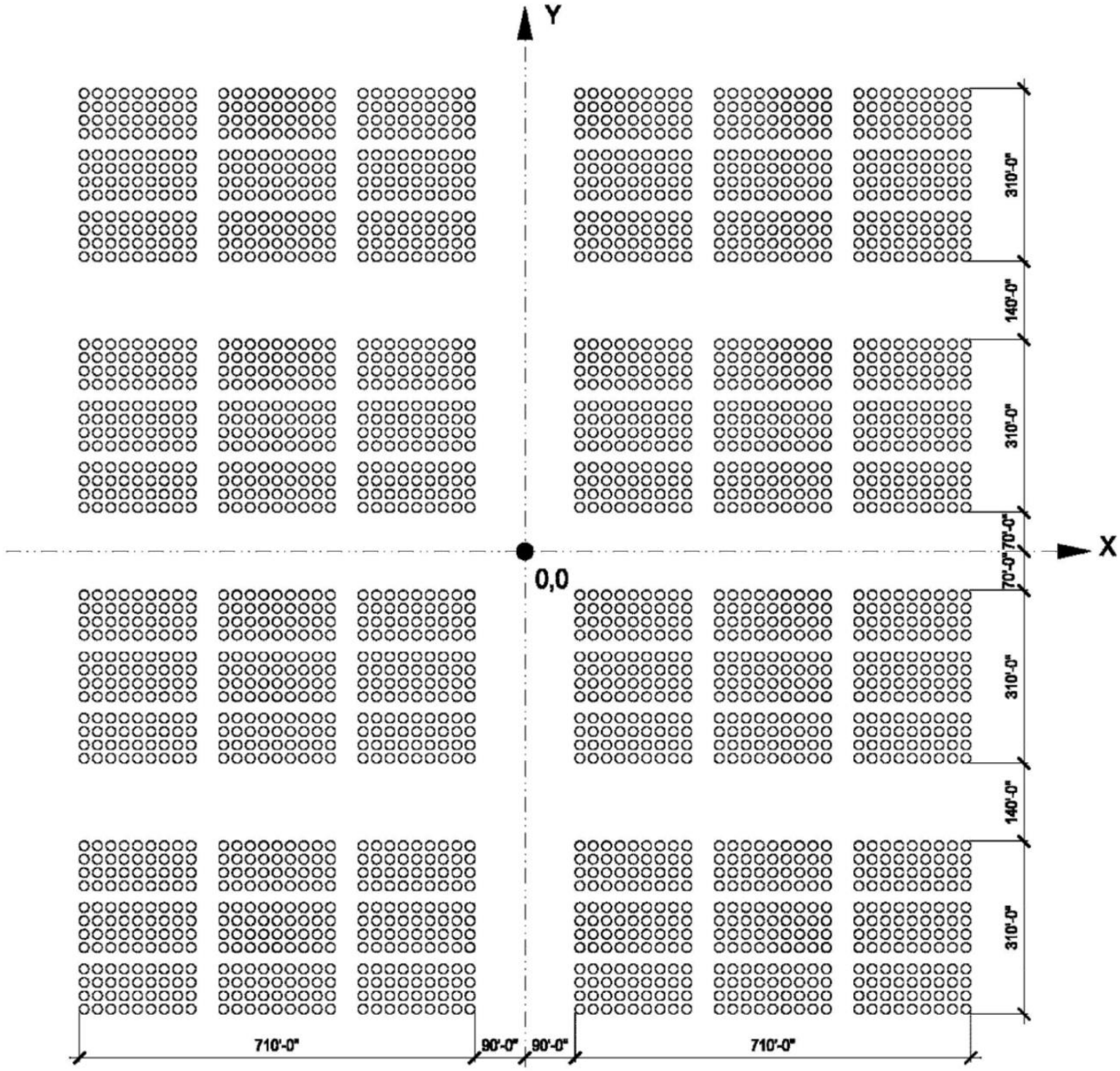

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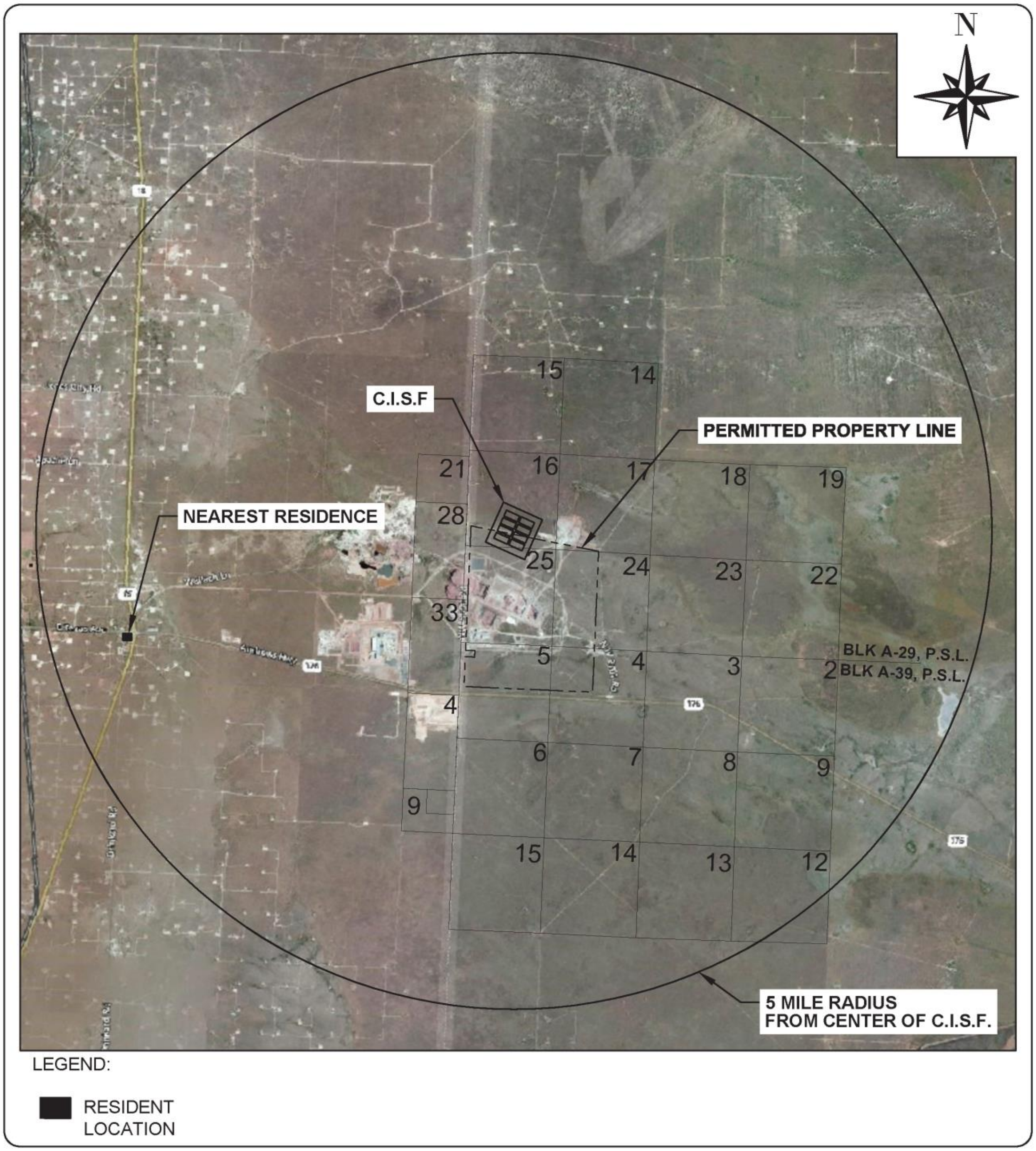
Figure 4.12-5
NAC Vertical Concrete Casks (VCC)



REV.	DESCRIPTION	DATE
A	-	-

PROJECT:

NEAREST RESIDENT

DRAWING:

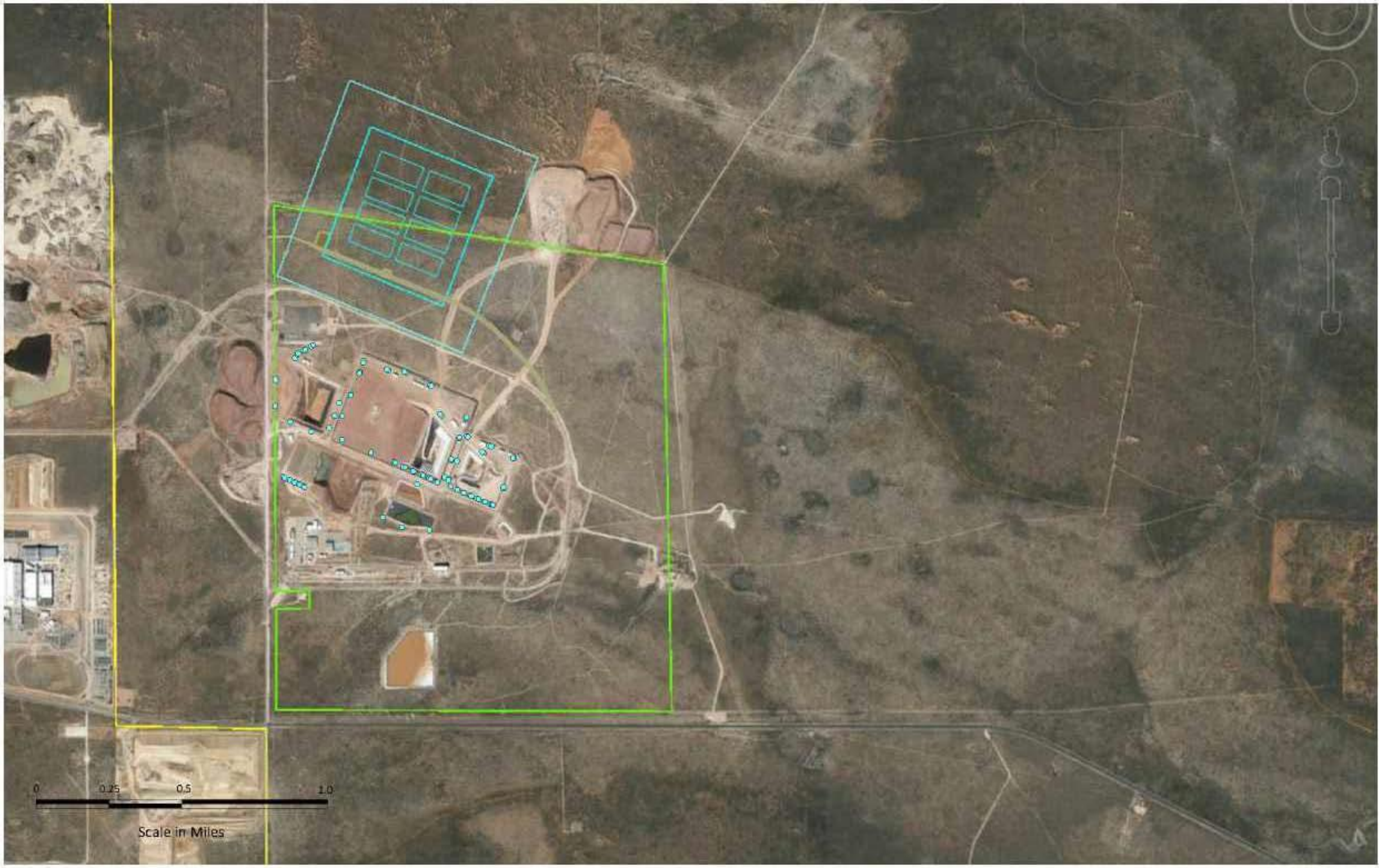
FIGURE 4.12-6

WCS THE TEXAS SOLUTION
WASTE CONTROL SPECIALISTS LLC
P.O. BOX 1129
ANDREWS, TX. 79714

DRAWN BY:	UO
CHECKED BY:	BM
DATE:	3/10/16
SCALE:	NTA
FILE:	N/A
DRAWING NO.:	N/A
PROJECT NO.:	N/A

AMERICA'S NUCLEAR SOLUTION

Figure 4.12-7
Air monitoring locations (27 stations in 2014).



AMERICA'S NUCLEAR SOLUTION

Figure 4.12-8
225-ft Zone REMP groundwater monitoring locations (88 locations in 2014).

AMERICA'S NUCLEAR SOLUTION

Figure 4.12-9
Soil monitoring locations (17 locations in 2014).

AMERICA'S NUCLEAR SOLUTION

Figure 4.12-10
On-site Thermoluminescent dosimeters (TLDs) or Optically Stimulated Luminescent dosimeters (OSLs) monitoring locations (36 locations in 2014).

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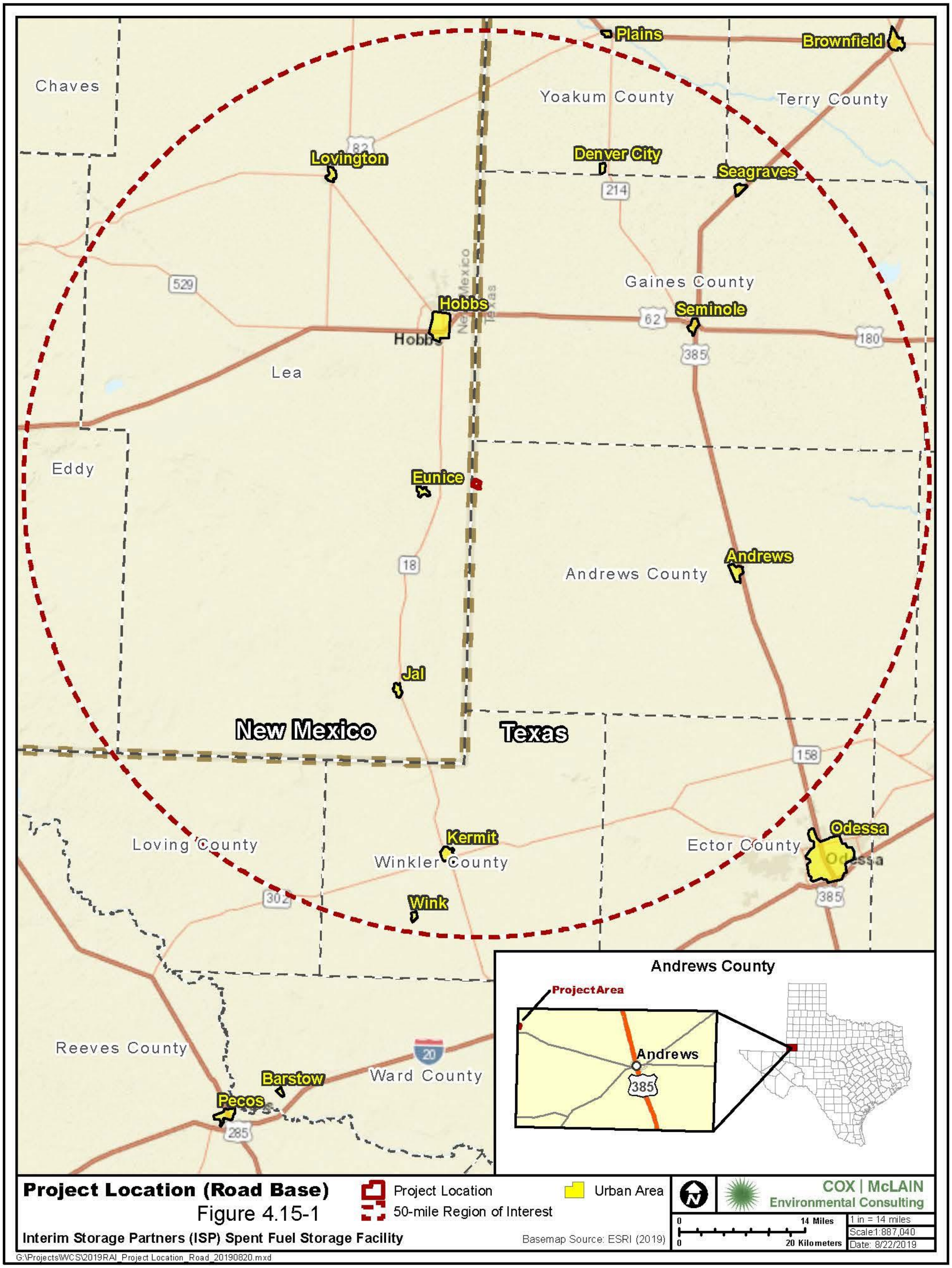
Figure 4.12-11
Surface water monitoring locations (8 locations in 2014).

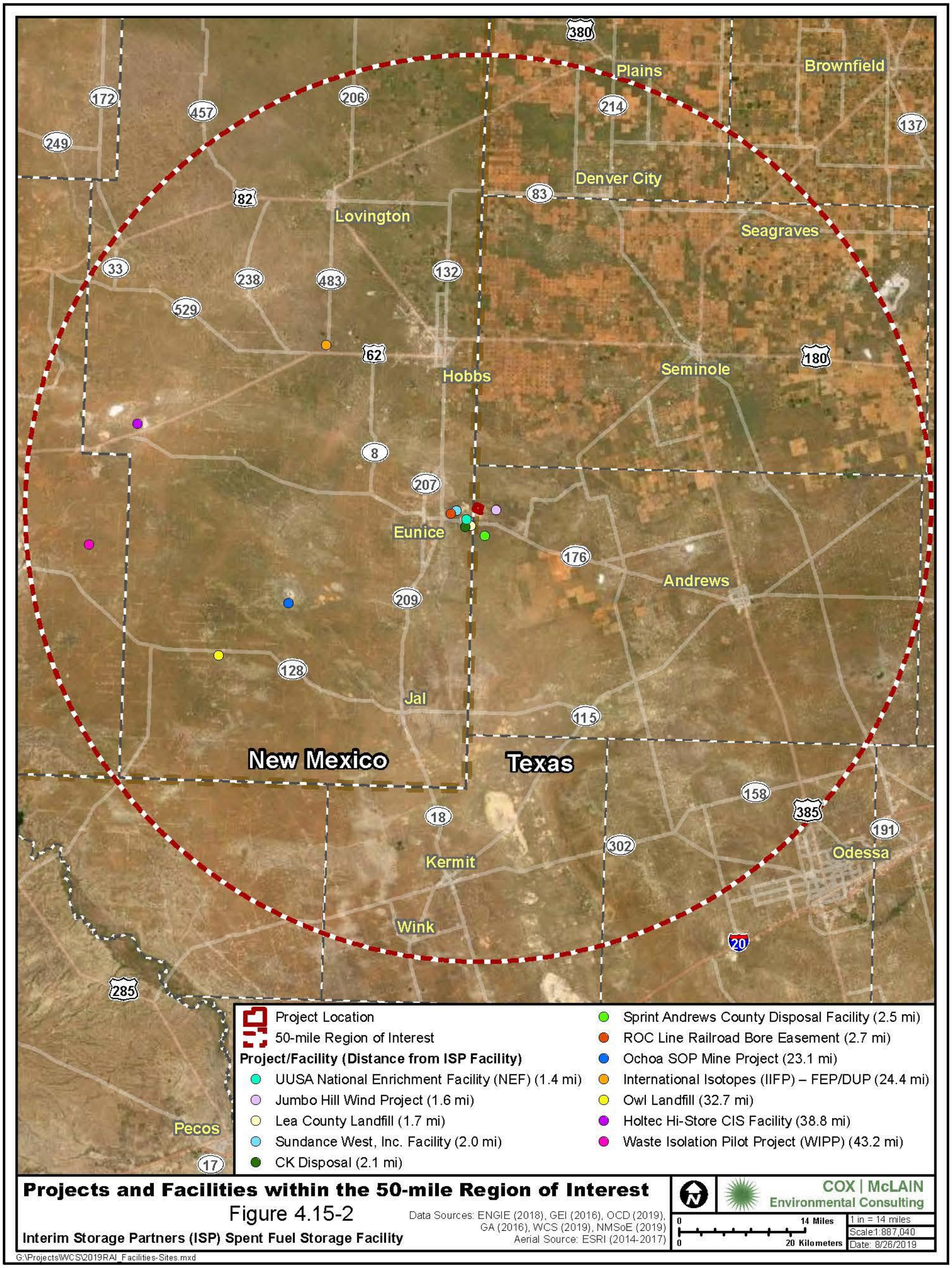
Figure 4.12-12
Vegetation monitoring locations (15 locations in 2014).



Project Location (Road Base)

Figure 4.15-1

Interim Storage Partners (ISP) Spent Fuel Storage Facility


Plains
Brownfield
Denver City
Lovington
Seagraves
Seminole
Hobbs
Eunice
Andrews
Jal
New Mexico
Texas
Kermit
Wink
Odessa
Pecos
Project Location
50-mile Region of Interest
Project/Facility (Distance from ISP Facility)
UUSA National Enrichment Facility (NEF) (1.4 mi)
Jumbo Hill Wind Project (1.6 mi)
Lea County Landfill (1.7 mi)
Sundance West, Inc. Facility (2.0 mi)
CK Disposal (2.1 mi)
Sprint Andrews County Disposal Facility (2.5 mi)
ROC Line Railroad Bore Easement (2.7 mi)
Ochoa SOP Mine Project (23.1 mi)
International Isotopes (IIFP) – FEP/DUP (24.4 mi)
Owl Landfill (32.7 mi)
Holtec Hi-Store CIS Facility (38.8 mi)
Waste Isolation Pilot Project (WIPP) (43.2 mi)
Projects and Facilities within the 50-mile Region of Interest
Figure 4.15-2
Interim Storage Partners (ISP) Spent Fuel Storage Facility
Data Sources: ENGIE (2018), GEI (2016), OCD (2019), GA (2016), WCS (2019), NMSoE (2019)
Aerial Source: ESRI (2014-2017)
COX | McLAIN Environmental Consulting
14 Miles
20 Kilometers
1 in = 14 miles
Scale 1:887,040
Date: 8/26/2019
G:\Projects\WCS\2019RAI_Facilities-Sites.mxd

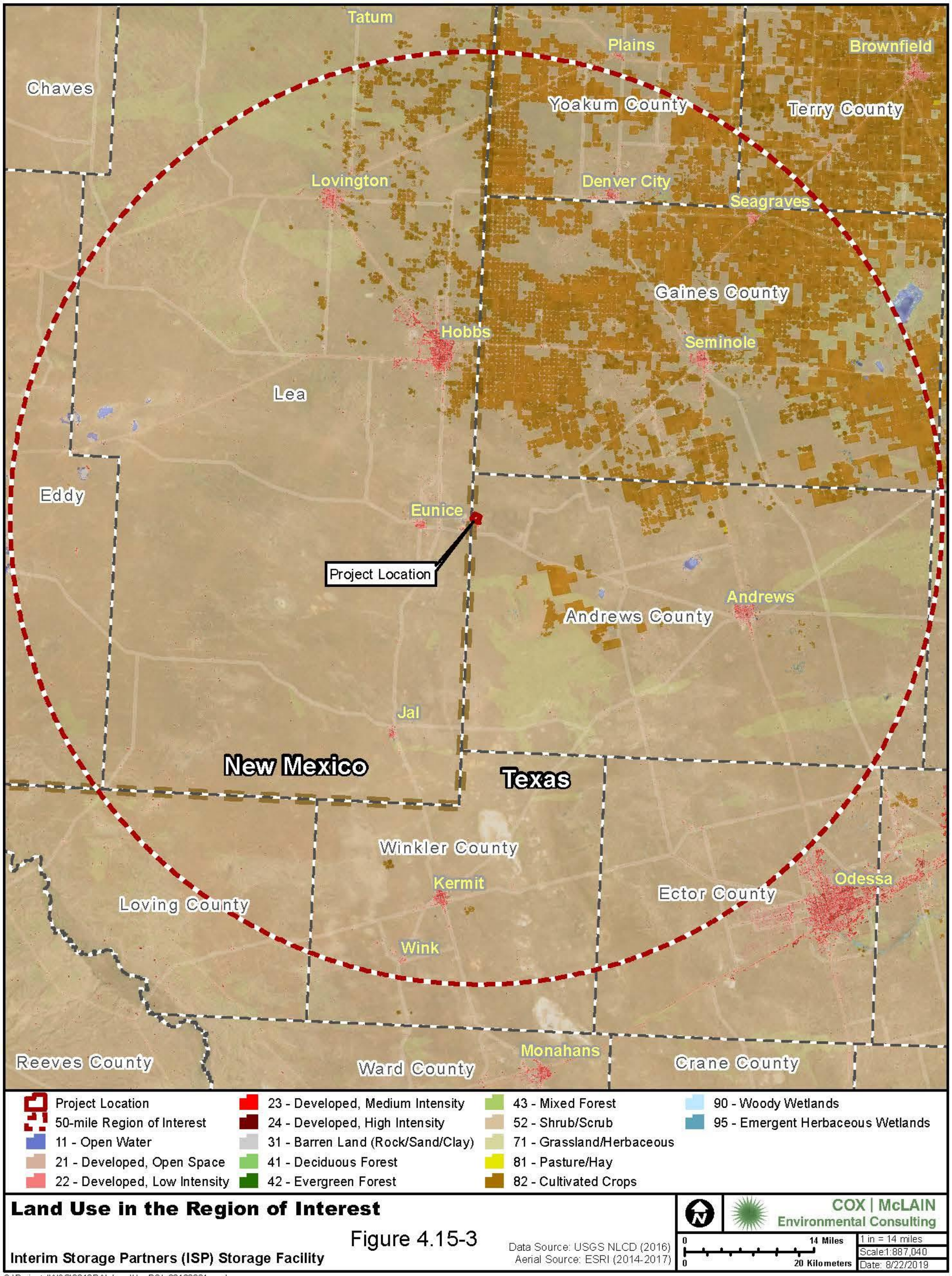
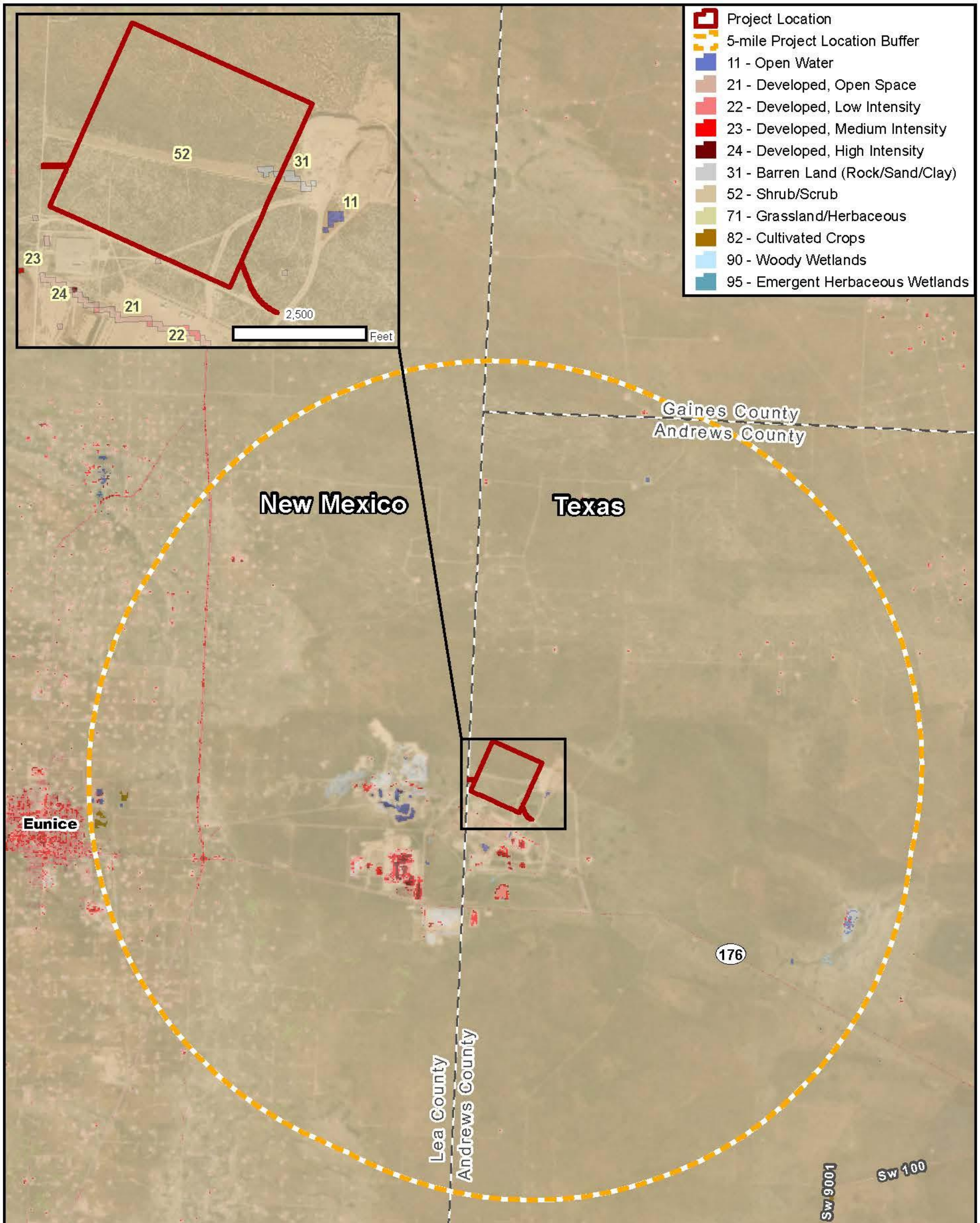

Tatum
Plains
Brownfield
Chaves
Yoakum County
Terry County
Lovington
Denver City
Seagraves
Gaines County
Hobbs
Seminole
Lea
Eddy
Eunice
Project Location
Andrews
Andrews County
Jal
New Mexico
Texas
Winkler County
Kermit
Loving County
Ector County
Odessa
Wink
Reeves County
Ward County
Monahans
Crane County
Project Location
50-mile Region of Interest
11 - Open Water
21 - Developed, Open Space
22 - Developed, Low Intensity
23 - Developed, Medium Intensity
24 - Developed, High Intensity
31 - Barren Land (Rock/Sand/Clay)
41 - Deciduous Forest
42 - Evergreen Forest
43 - Mixed Forest
52 - Shrub/Scrub
71 - Grassland/Herbaceous
81 - Pasture/Hay
82 - Cultivated Crops
90 - Woody Wetlands
95 - Emergent Herbaceous Wetlands
Land Use in the Region of Interest
Interim Storage Partners (ISP) Storage Facility
Data Source: USGS NLCD (2016)
Aerial Source: ESRI (2014-2017)
COX | McLAIN
Environmental Consulting
0
14 Miles
0
20 Kilometers
1 in = 14 miles
Scale 1:887,040
Date: 8/22/2019
G:\Projects\WCS\2019RAI_LandUseROI_20190821.mxd

Figure 4.15-3



Land Use (USGS National Land Cover Dataset)

Figure 4.15-4

Interim Storage Partners (ISP) Storage Facility

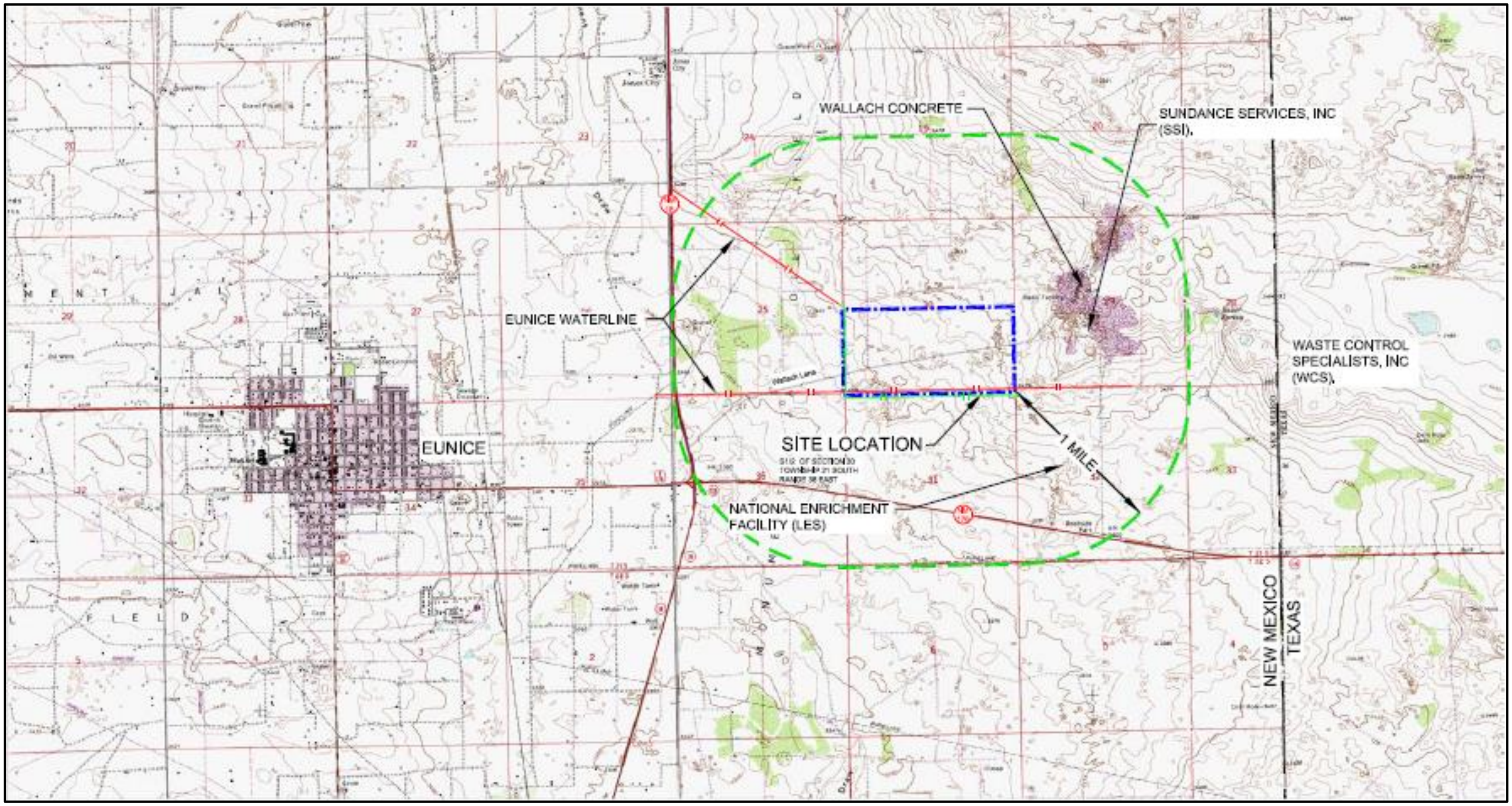


Figure 4.15-5 Location of Proposed Sundance West Surface Waste Management Facility (GEI 2016)

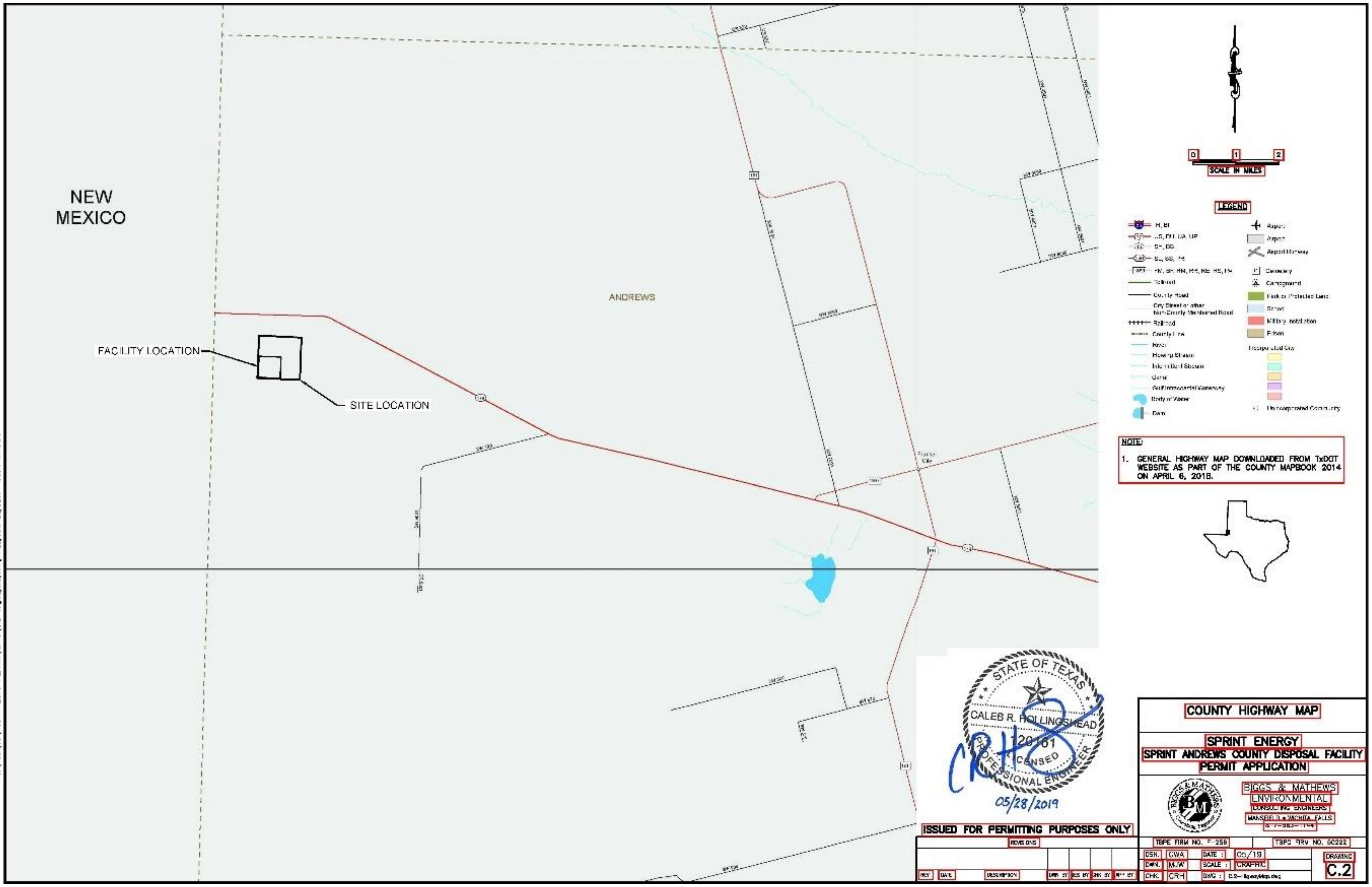


Figure 4.15-6 Location of Proposed Sprint Andrews County Disposal Facility (BME 2019)

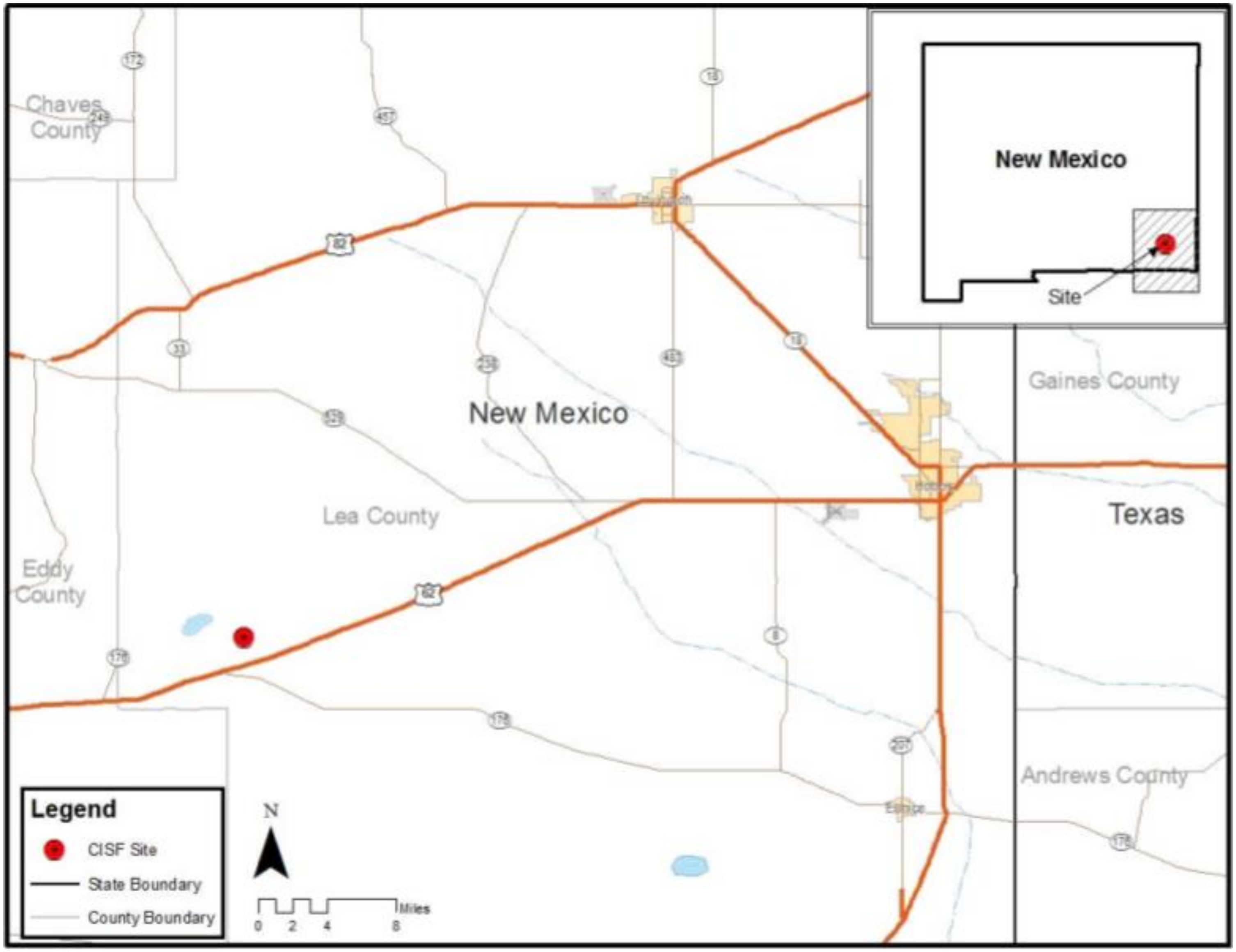


Figure 4.15-7 Location of Proposed Holtec Hi-Store CIS Facility (Holtec 2019)

CHAPTER 5

MITIGATION MEASURES

5.0 MITIGATION MEASURES

This chapter summarizes the anticipated impacts followed by proposed mitigation measures that would be in place to reduce adverse impacts that could occur during construction, routine, and non-routine operation of the CISF.

5.1 IMPACT SUMMARY

This section summarizes the environmental impacts that may result from the construction and operation of the CISF. Complete details of these potential impacts are provided in Chapter 4 of this ER.

5.1.1 Land Use

Land use impacts have been characterized in ER Section 4.1, Land Use Impacts. No substantial impacts would occur with regard to the following:

- Land-use impacts at the CISF, and impacts from any related federal action that may have cumulatively significant impacts
- Area and location of land that would be disturbed on either a long-term or short-term basis

Minor impacts related to erosion control on the CISF may occur, but would be short-term and limited. These potential impacts are discussed in ER Section 4.4, Water Resources Impacts.

5.1.2 Transportation

Transportation impacts have been characterized in ER Section 4.2, Transportation Impacts. With respect to construction-related transportation, no substantial impacts would occur. The analysis incorporated the following considerations:

- No new access road would be required on Texas State Highway 176 to provide access to the facility. An existing roadway on the Waste Control Specialists property would be extended north to the CISF.
- The transportation route and mode for conveying construction material to the facility currently exists.

- The increase in traffic from heavy haul vehicles and construction worker commuting would not substantially change traffic patterns.
- Impacts from construction transportation such as fugitive dust, scenic quality, and noise would be temporary.

Minor impacts related to construction traffic such as fugitive dust, noise, and emissions are discussed in ER Section 4.7. Additional information on noise impacts is contained in ER Section 3.7.

With respect to the transport of radioactive materials, no substantial impacts would occur. The analysis incorporated the following factors:

- Mode of transportation (truck, rail, or barge) and routes from the originating site to the CISF
- Estimated transportation distance from the originating site to the CISF
- Treatment and packaging procedures for radioactive wastes
- Radiological dose equivalents for public and workers from incident-free scenarios
- Potential impacts of operating transportation vehicles on the environment (e.g., fire from equipment sparking)

Impacts related to the transport of radioactive materials are addressed in ER Section 3.2. The materials that would be transported to and from the CISF are well within the scope of the environmental impacts previously evaluated by the NRC in its GEIS for continued storage of spent nuclear fuel, NUREG-2157 . Because these impacts have been addressed in a previous NRC EIS, no additional mitigation measures are proposed.

5.1.3 Geology and Soils

The potential impacts to the geology and soils have been characterized in ER Section 4.3, Geology and Soils Impacts. No substantial impacts would occur from the following activities:

- Soil re-suspension, erosion, and disruption of natural drainage
- Excavations to be conducted during construction

Impacts to geology and soils would be limited to surface runoff due to routine operation and low annual rainfall. Construction activities may cause some short-term increases in soil erosion at the CISF.

5.1.4 Water Resources

The potential impacts to water resources have been characterized in ER Section 4.4, Water Resources Impacts. No substantial impacts are anticipated to the following:

- Surface water and groundwater quality
- Consumptive water uses (e.g., groundwater depletion) on other water users and adverse impacts on surface-oriented water users resulting from facility activities. Site groundwater would not be utilized for any reason, and therefore, should not be impacted by routine CISF operations. The CISF water supply would be obtained from the same local publicly owned water system sources as the existing operations.
- Hydrological system alterations or impacts
- Withdrawals and returns of ground and surface water
- Cumulative effects on water resources.

The CISF would not obtain any water from onsite surface or groundwater resources. Sanitary wastewater discharges would be made through sewerage to holding tanks and subsequently transported offsite to publicly owned treatment works. Storm water is not expected to contain any radiological effluents, and with a low annual rainfall, storm water runoff would be directed to natural drainage areas.

5.1.5 Ecological Resources

The potential impacts to ecological resources have been characterized in ER Section 4.5, Ecological Resources Impacts. No substantial impacts are anticipated from the following factors:

- Total area of land to be disturbed
- Area of disturbance for each habitat type
- Use of chemical herbicides, roadway maintenance, and mechanical clearing
- Areas to be used on a short-term basis during construction

- Communities or habitats that have been defined as rare or unique or that support threatened and endangered species
- Impacts of elevated construction equipment or structures on species (e.g., bird collisions, nesting areas)
- Impact on important biota

Based on database searches and site inventories conducted by qualified ecologists, impacts to ecological resources would be minimal due to the absence of habitat for threatened and endangered species on the land proposed for the CISF.

5.1.6 Air Quality

The potential impacts to the air quality have been characterized in ER Section 4.6, Air Quality Impacts. No substantial impacts from gaseous effluents would occur and visibility would not be impacted.

Impacts to air quality would be minimal. Construction and operational activities would result in interim increases in hydrocarbons and particulate matter due to vehicle emissions and dust. During construction activities, best practices would be employed to reduce and control dust emissions.

5.1.7 Noise

The potential impacts related to noise generated by the facility have been characterized in ER Section 4.7, Noise Impacts. No substantial impacts to sensitive receptors (e.g., hospitals, schools, residences, wildlife) from predicted typical noise levels at the facility perimeter are anticipated.

Noise levels would increase during construction and during operation of the CISF, but not to a level that would cause significant impact to nearby residents. The nearest residence is 6 km (3.8 mi) from the CISF.

5.1.8 Historic and Cultural Resources

The potential impacts to historic and cultural resources have been characterized in ER Section 4.8, Historic and Cultural Resource Impacts. The archeological APE consists of the 216.6-acre footprint of the proposed CISF. No archeological materials of any kind were observed within the APE during a survey conducted in May 2015, and no further work is recommended within the

APE prior to construction of the proposed CISF. Since the area containing the proposed project footprint is devoid of any standing structures, the proposed project would not result in a direct impact to any non-archeological historic resources. The APE for indirect/visual impacts was defined as the area within a 1.6 km (1 mi) radius from the proposed project footprint. There do not appear to be any historic resources 45 years or older (dating to 1974 or earlier) within the 1.6 km (1 mi) indirect effects APE. The THC as well as the New Mexico Department of Cultural Affairs concurred that further cultural resource investigations are not warranted prior to construction.

5.1.9 Visual/Scenic Resources

The potential impacts to visual/scenic resources have been characterized in ER Section 4.9, Visual/Scenic Resources Impacts. The proposed CISF construction would be visible only from fairly close vantage points and would be less of an impact than the adjacent URENCO NEF, which lies between the denser population of viewers in Eunice, NM and the proposed CISF, where the largest component would be the cask handling building.

The SIA characterizes the proposed CISF location as having a modest scenic quality that is pleasant to regard for its rural, undeveloped nature, but not dramatic, unique, or rare . Facilities geared towards resources extraction, the Lea County Landfill, and oil well pump jacks exist in the project area, in addition to the URENCO facility, which have an equal or higher impact on the visual landscape compared to the proposed new CISF activities.

5.1.10 Socioeconomics

The potential socioeconomic impacts to the community have been characterized in ER Section 4.10, Socioeconomic Impacts and in Appendix A, *Socioeconomic Impacts of the Proposed Spent Nuclear Fuel Consolidated Interim Storage Facility Andrews, Texas*. No substantial negative impacts are anticipated on the area's:

- Population characteristics (e.g., ethnic groups and population density)
- Housing, health and social services, or educational and transportation resources
- Tax structure and distribution

The conclusions of the SIA showed positive direct, indirect, and final demand impacts to the economy for the construction and operation of the CISF. There would be no adverse direct impacts to the nearby communities. There would be minimal demands on local social resources

and infrastructure to meet housing and other social infrastructure needs, based on the anticipated increases in employment for the CISF.

5.1.11 Environmental Justice

The potential impacts with respect to environmental justice have been characterized in the Environmental Justice section of the ER, Section 4.11. No substantial disproportionate impacts to low-income or minority persons are anticipated to result from the proposed project.

Based on the data analyzed and the NUREG-1748 guidance applicable to that analysis, ISP determined that no further evaluation of potential environmental justice concerns was necessary, as no Census Block Group within the 6.4 km (4 mi) radius, i.e., 128 km² (50 mi²), of the CISF site contained a minority or low-income population exceeding the NUREG-1748 "20%" or "50%" criteria.

5.1.12 Public and Occupational Health

This section describes public and occupational health impacts from both nonradiological and radiological sources.

5.1.12.1 Nonradiological-Normal Operations

The potential impacts to public and occupational health for nonradiological sources have been characterized in ER Section 4.12.1, Nonradiological Impacts. No substantial impacts will exist to:

- Members of the public from nonradiological discharge of liquid or gaseous effluents to water or air
- Facility workers as a result of occupational exposure to nonradiological chemicals, effluents, or wastes
- Public and occupational health from cumulative impacts

Impacts to the public and workers from nonradiological gaseous and liquid effluents would be minimal.

5.1.12.2 Radiological-Normal Operations

This subsection describes public and occupational health impacts from radiological sources. It provides a brief description of the methods used to assess the pathways for exposure and a summary of the potential impacts described in section 4.12.2 of the ER.

5.1.12.2.1 Pathway Assessment

The potential for exposure to radiological sources included an assessment of pathways that could convey radioactive material to members of the public. Important ingestion pathways such as stored and fresh vegetables, milk, and meat, which were assumed to be grown or raised at the nearest resident location, were analyzed.

In addition, potential points or areas were characterized to identify the:

- Nearest CISF boundary
- Nearest full time resident
- Location of the average member of the critical group

There are no anticipated offsite releases to any surface waters or POTW.

5.1.12.2.2 Public and Occupational Exposure

The potential impacts to public and occupational health for radiological sources have been characterized in ER Section 4.12, Public and Occupational Health Impacts. No substantial impacts exist for the public (as determined by the critical group) or the workforce (based on radiological and chemical exposures) based on the average annual concentration of radioactive and hazardous materials in gaseous and liquid effluents and on reasonably foreseeable (i.e., credible) accidents with the potential to result in environmental releases.

Routine operations at the CISF would create only an incremental increase in the potential for radiological and nonradiological public and occupational exposure. Potential radiation exposure would be due to the storage of spent nuclear fuel and the presence of associated fission products onsite. There would be no chemical substances, airborne particulates, or gases or liquid effluents that could contribute to offsite exposure.

5.1.12.3 Accidental Releases

All credible accident sequences were considered during the Safety Analysis performed for the facility, this information can be found in Section 1.4.3, *Accident Analysis*, of the SAR.

5.1.13 Waste Management

The potential impacts of waste generation and waste management have been characterized in ER Section 4.13, Waste Management Impacts. No substantial impacts would occur to:

- The public, due to the composition and disposal of solid, hazardous, radioactive and mixed wastes
- Facility workers, due to storage, processing, handling, and disposal of solid, hazardous, radioactive, and mixed wastes

Additionally, there would be no substantial cumulative impacts from waste generation and waste management.

Impacts related to waste management would be minimal.

5.2 MITIGATION

This section summarizes the mitigation measures to minimize any anticipated impacts that may result from the construction and operation of the CISF.

5.2.1 Land Use

The anticipated effects on the soil during construction activities would be limited to a potential short-term increase in soil erosion. However, the following proper construction BMPs would mitigate any impacts:

- Minimizing the construction footprint to the extent possible
- Limiting site slopes to a horizontal-vertical ratio of three to one or less
- Protecting undisturbed areas with silt fencing and straw bales as appropriate
- Using site stabilization practices, such as placing crushed stone on top of disturbed soil in areas of concentrated runoff, to reduce the potential for erosion and sedimentation

After construction is complete, the CISF would be stabilized with natural and low-water maintenance landscaping.

5.2.2 Transportation

Mitigation measures would be in place to minimize potential impacts of construction-related transportation activities. To control fugitive dust production, all reasonable precautions would be taken to prevent particulate matter from becoming airborne, including the following actions:

- Using water (controlled to minimize use) in clearing and grading operations and construction activities to control dust on dirt roads.
- Using adequate containment methods during excavation and/or other similar operations.

- Covering open-bodied trucks transporting materials that are likely to give rise to airborne dust when in motion.
- Promptly removing earthen or other materials from paved roads when such material has been deposited on the paved roads by trucking or earth moving equipment, water or wind erosion, or other means.
- Promptly stabilizing or covering bare areas once earth-moving activities are complete.
- Operating construction equipment and related vehicles with standard pollution control devices in good working order.
- Washing construction trucks with water (controlled to minimize use) only when required.
- Designating personnel to monitor dust emissions and to direct increased surface watering where necessary.
- Scheduling short-duration activities that may impact traffic (e.g., concrete trucks, multiple deliveries) to minimize traffic impacts, if such activities are required during the course of construction.
- Scheduling work shifts throughout the construction period to minimize impacts to traffic in the CISF vicinity.
- Encouraging car-pooling throughout the construction period to minimize impacts to traffic in the CISF vicinity.

5.2.3 Geology and Soils

Mitigation measures would be in place to minimize any potential impact on geology and soils. These include:

- Mitigating erosional impacts due to site clearing and grading with construction and erosion control BMPs (some of which are further described below).
- Using acceptable methods to stabilize disturbed soils during construction.
- Using earthen berms, dikes, and sediment fences as necessary during all phases of construction to limit suspended solids in runoff.
- Stabilizing cleared areas not covered by structures or pavement by acceptable means as soon as practical.

- Watering (controlled to minimize use) to control fugitive construction dust.
- Using standard drilling and blasting techniques, if required, to minimize impacts to bedrock, thereby reducing the potential for over-excavation, minimizing damage to the surrounding rock, and protecting adjacent surfaces that are intended to remain intact.
- Stabilizing drainage culverts and ditches by lining them with rock aggregate/rip-rap or creating berms with silt fencing/straw bales to reduce flow velocity and prohibit scouring.
- Stockpiling soil generated during construction in a manner that reduces erosion.
- Reusing excavated materials whenever possible.

5.2.4 Water Resources

Mitigation measures would be in place to minimize potential impact on water resources. As discussed in ER Section 4.4, Water Resources Impacts, there is little potential to impact any groundwater or surface water resources. Nonetheless, the following controls would be implemented:

- Maintenance of construction equipment in good repair without visible leaks of oil, greases, or hydraulic fluids.
- Use of BMPs to ensure that storm water runoff related to these activities would not be released into nearby areas.
- Use of BMPs for dust control associated with excavation and fill operations during construction.
- Use of silt fencing and/or sediment traps.
- Control of impacts to water quality during construction through compliance with the TPDES - Construction General Permit requirements and by applying BMPs as detailed in the CISF SWPPP.
- Berming all above ground diesel storage tanks.
- Handling sanitary wastes generated during CISF construction with portable systems until such time that plant sanitary facilities are available for site use. An adequate number of these portables systems would be provided.
- Requiring control of surface water runoff for activities covered by the TPDES Construction General Permit.

As a result of implementing these controls, no impacts are expected to surface or groundwater bodies.

The CISF is designed to minimize the usage of natural resources as shown by the following measures:

- Use of low-water consumption landscaping versus conventional landscaping to reduce water usage.
- Installation of low flow toilets, sinks, and showers to reduce water usage when compared to standard flow fixtures.
- Use of mops and self-contained cleaning machines for localized floor washing to reduce water usage, as compared to conventional washing with a hose twice per week.

5.2.5 Ecological Resources

Mitigation measures would be in place to minimize any potential impacts on ecological resources. CISF construction features include:

- Minimizing the construction footprint to the extent possible
- Using BMPs and site stabilization practices to reduce the potential for erosion and sedimentation.

Proposed wildlife management procedures to minimize impacts would include:

- Managing unused open areas, including areas of native grasses and shrubs, for the benefit of wildlife (i.e. leave undisturbed).
- Using native plant and grass species (i.e., low-water consuming plants and grasses) to re-vegetate disturbed areas to enhance wildlife habitat.
- Using animal-friendly fencing around the CISF so that wildlife cannot be injured or entangled in the CISF security fence.

In addition to the proposed wildlife management practices above, ISP would consider all recommendations of appropriate state and federal agencies, including the United States Fish and Wildlife Service and the Texas Parks and Wildlife Department.

5.2.6 Air Quality

Mitigation measures would be in place to minimize any potential impact on air quality. Specifically, construction phase BMPs would be used to minimize fugitive dusts.

Air concentrations of the Criteria Pollutants for vehicle emissions and fugitive dust would be below the NAAQS (CFR, 2003w) and thus would not require further mitigation measures.

5.2.7 Noise

Minimization of operational noise sources would be needed primarily during CISF construction and operations. Natural land contours, vegetation (such as scrub brush), and CISF buildings and structures would reduce the impact of equipment located outside of structures that could contribute to CISF noise levels. The buildings themselves would absorb the majority of the noise located within.

Noise from construction activities would have the highest sound levels, but the nearest home is located 6 km (3.8 mi) from the CISF. Due to the distance between the residence and the CISF, it is not expected that residents would perceive an increase in noise levels. All noise suppression systems on construction vehicles would be kept in proper operation.

5.2.8 Historical and Cultural Resources

To minimize any potential impact on historical and cultural resources, accidental discovery procedures would be in place. In the event that any inadvertent discovery of human remains or other item of archeological significance is made during construction, the facility would immediately cease construction activities in the area around the discovery and notify the THC (the SHPO), to make the determination of appropriate measures to identify, evaluate, and treat these discoveries.

5.2.9 Visual/Scenic Resources

Measures would be in place to minimize any potential impacts to visual and scenic resources. These include the following items:

- Use of accepted natural, low-water consumption landscaping techniques to limit any potential visual impacts. These techniques would incorporate, but not be limited to, the use of landscape plantings. As for aesthetically pleasing screening measures, planned landscape plantings would include indigenous vegetation.

- Prompt natural re-vegetation or covering of bare areas would be used to mitigate visual impacts due to construction activities.
- Minimization of any removal of natural barriers, screens or buffers.

5.2.10 Socioeconomics

Socioeconomic impacts from the project would largely be positive, and no displacements would be required by the proposed project. Therefore, no socioeconomic mitigation measures are required.

5.2.11 Environmental Justice

Given the lack of environmental justice impacts, no environmental justice mitigation measures are required. However, public involvement activities conducted for the CISF licensing would include wide outreach efforts to ensure full and fair participation by low-income and/or minority communities in the study area.

5.2.12 Public and Occupational Health

This section describes the avoidance, minimization, and mitigation measures to minimize public and occupational health impacts, from both nonradiological and radiological sources.

5.2.12.1 Non-Radiological – Normal Operations

Impacts to the public and workers from nonradiological gaseous and liquid effluents would be minimal. No specific mitigation measures for nonradiological impacts during normal operations are anticipated.

5.2.12.2 Radiological – Normal Operations

Mitigation measures to minimize radiological exposure and release are listed below. Radiological practices and procedures are in place to ensure compliance with ISP's Radiation Protection Program. This program is designed to achieve and maintain radiological exposure to levels that are ALARA. These measures include:

- Conducting routine facility radiation surveys to characterize potential radiological exposure.
- Monitoring of all radiation workers via the use of dosimeters to ensure that radiological doses remain within regulatory limits and are ALARA.
- Providing radiation dosimeters at the fence line boundary to measure potential exposure to any member of the general public.

5.2.12.3 Accident Releases

Mitigation measures would be in place to minimize any impact from a potential accidental release of radiological and/or nonradiological effluents. These measures include:

- An onsite and offsite emergency plan spelling out the immediate actions to take to mitigate the impact of any accidental release.
- Actions to contain sources of radiological or nonradiological effluents in such a manner as to mitigate the impact from an accidental release.

5.2.13 Waste Management

Mitigation measures would be in place to minimize the generation and potential impact of facility wastes. Solid and liquid wastes would be controlled in accordance with regulatory limits. Mitigation measures include:

- Prohibition against onsite disposal of waste at the CISF.
- Storage of waste in designated areas of the facility until an administrative limit is reached. When the administrative limit is reached, the waste would then be shipped offsite to the appropriate, adjacent, licensed LLRW treatment, storage and/or disposal facility.
- Disposal of all industrial and municipal wastes at offsite waste disposal facilities.
- Collection of different waste types in separate containers to minimize contamination of one waste type with another.
- Storage of hazardous wastes in designated areas in carefully labeled containers.
- Decontamination and/or re-use of radioactively contaminated wastes to reduce waste volume.
- Implementation of administrative procedures and practices that provide for the collection, temporary storage, processing, and disposal of categorized solid waste in accordance with regulatory requirements.
- Implementation of handling and treatment processes designed to limit wastes and effluents. Conduct sampling and monitoring to assure facility administrative and regulatory limits are not exceeded.
- Sampling and/or monitoring of solid wastes prior to offsite treatment and disposal.
- Recycling of construction debris to the extent possible.

CHAPTER 6

ENVIRONMENTAL MEASUREMENTS AND MONITORING PROGRAMS

6.0 RADIOLOGICAL MONITORING

6.1 REGULATORY BASIS FOR RADIOLOGICAL MONITORING

The NRC requires, pursuant to 10 CFR 20, that licensees conduct surveys necessary to demonstrate compliance with these regulations and to demonstrate that the amount of radioactive material present in effluent from the facility has been kept as low as reasonably achievable (ALARA). In addition, pursuant to 10 CFR 72, the NRC requires that licensees submit annual reports specifying the quantities of the principal radionuclides released to unrestricted areas and other information needed to estimate the annual radiation dose to the public from facility operations. The NRC has also issued Regulatory Guide 4.15, *Quality Assurance for Radiological Monitoring Programs (Inception through Normal Operations to License Termination)—Effluent Streams and the Environment* that reiterates that concentrations of hazardous materials in effluent must be controlled and that licensees must adhere to the ALARA principal such that there is no undue risk to the public health and safety at or beyond the proposed CISF boundary .

Moreover, the NRC, in 10 CFR §20.1301, requires each licensee to conduct operations so that the total effective dose equivalent to individual members of the public from the licensed operation does not exceed 0.1 rem (1 mSv) in a year, exclusive of the dose contributions from background radiation. The dose in any unrestricted area from external sources may not exceed 0.002 rem (0.02 mSv) in any one hour.

6.2 ENVIRONMENTAL PATHWAYS

The only pathway for public exposure to radiation from routine operations at the CISF is external exposure at the uncontrolled boundary from the spent fuel casks stored on the pad. There is no air pathway because the casks are sealed by being welded shut. There is no potential for a liquid pathway because the spent fuel contains no liquid component and the casks are sealed to prevent any liquids from contacting the spent fuel assemblies. Any surface contamination on the stored casks is well below regulatory limits.

Though no pathways exist for exposures due to liquid effluents, administrative investigation and action levels are established for monitoring surface water runoff as an additional step in the radiation control process. Because the surface water drainage paths are normally dry, it is not possible to monitor runoff in a continuous or batch mode basis. Even if surface water were sampled, the radionuclide levels would likely be so low as to be statistically insignificant. Instead, quarterly soil sampling coupled with weekly/monthly radiological surveys on the casks and storage pad would be conducted.

There are no connections to municipal sewer systems. Onsite sewage would be routed to holding tanks, which are periodically pumped; the sewage would then be sent offsite for disposal in a POTW. Each holding tank would be periodically sampled (prior to pumping) and analyzed for relevant radionuclides.

6.3 RADIOLOGICAL MONITORING PROGRAM

The Radiological Monitoring Program includes the collection of data during pre-operational years in order to establish baseline radiological information that would be used in determining and evaluating potential impacts from CISF operations on the local environment. *Due to the fact that half of the CISF will be within the permitted boundary of the current WCS facility, the pre-operational monitoring is basically complete. Combined with the pre-operational data of the three WCS facilities and the current operational data, there is an extensive amount of data to determine any impact from the addition of the CISF.* The Radiological Monitoring Program would be initiated at least one year prior to CISF operations. The early initiation of the Radiological Monitoring Program provides assurance that a sufficient environmental baseline has been established for the CISF before the arrival of the first cask shipment. Radionuclides in environmental media would be identified using *methods of analysis in accordance with EPA SW846 methodology and the requirements of the Department of Energy (DOE) "Environmental Measurement Laboratory Manual" (HASL 300, DOE 1997). Analysis will be performed at an approved NELAC/NELAP laboratory.* Data collected during the operational years would be statistically compared to the baseline generated by the pre-operational data. Such comparisons provide a means of assessing the magnitude of potential radiological impacts on members of the public and in demonstrating compliance with applicable radiation protection standards.

As discussed in Chapter 4, Section 4.12.2.2, a bounding evaluation of off-site doses for a 40,000 MTU facility loaded in eight phases was conducted. The evaluation looked at two scenarios: 1) eight phases consisting of NUHOMS® HSMs arranged in three rows of 144 back-to-back HSMs containing 5,000 MTU in each phase (See Figure 4.12-4); and 2) eight phases consisting of NAC Vertical Concrete Casks (VCC) arranged in nine 4 x 9 arrays of casks containing 5,000 MTU in each phase (See Figure 4.12-5). The purpose of the dose calculations was to determine the impact to human health from radiation emitted from the HSMs and VCC containing up to 40,000 MTU of SNF and related GTCC waste. The design-basis of the HSMs and VCC, where canisters containing SNF are welded and sealed, prevents the release of radioactive materials into the environment. Accordingly, the only significant radiological exposure pathway impacting human health or the environment at the CISF during normal operations is from external sources of gamma-rays and neutrons resulting from radioactive decay of irradiated fuel. All other radiological pathways such as air, drinking water, soil ingestion, milk, and other foodstuff are not applicable. Additionally, no credible accidents were identified that result in a release of radioactive materials to the environment and thereby expose members of the public as discussed in Chapter 12 of the SAR. Based on the discussion above, the choice of locations, analyses, and frequencies were determined and stated in Chapter 9, Section 9.6.2.4 of the revised SAR.

Direct radiation in offsite areas emanating from fuel stored on the dry cask storage pad or resulting from cask handling operations is expected to be minimal, see Section 4.12.2 of this ER. However, TLDs or OSLs would be placed strategically around the CISF perimeter to measure these potential exposures and demonstrate regulatory compliance. *Waste Control Specialists uses the Luxel+ Ta (beta/photon/neutron) dosimeter for area monitoring under the radiation safety area monitoring program (minimum of eight locations on the inner fence of the PA) and the Landauer Inlight® Environmental X9 (beta/photon) dosimeter for the perimeter environmental monitoring program at the OCA boundary (for reference, see ER Figure 6.1-1). All dosimeters will be analyzed on a quarterly basis. Environmental boundary air and soil monitoring (i.e., Low Volume air sampling or High Volume air sampling) will be performed at a minimum of two locations on the north OCA boundary (for reference see Figures 4.12-7 and 4.12-9 in ER Chapter 4) in addition to the locations currently performed under the REMP. Analyses will be for gross alpha/beta and gamma spectrometry and performed by a*

certified offsite laboratory. Air samples will be collected monthly for each location and composited for a quarterly analysis. Soil samples will be collected and analyzed annually unless air samples indicate the need to take additional samples.

Detection of radionuclide impacts to surface water runoff would be conducted in a two-step process. First, all casks would be checked for surface contamination during *acceptance procedures and surveys, then* all storage pads would be checked for surface contamination during monthly surveys. Second, soil samples would be collected on a*n annual* basis at the culverts leading to the CISF outfalls. *Although not expected due to welded and sealed dry stored canisters, monitored* radioactive contaminants exceeding the action levels, as established in written procedures, would cause an immediate investigation and would require corrective action to protect human health and prevent future recurrences.

During the course of facility operations, revisions to the Radiological Monitoring Program may be necessary and appropriate to assure reliable sampling and collection of environmental data. The rationale and actions behind such revisions to the program would be documented and reported to the NRC and other appropriate regulatory agency, as required. Sampling focuses on locations proximate to the facility, but may also include distant locations as control sites. Potential sample locations have been identified, but are subject to change based on NRC guidance, meteorological information, ISP joint venture member Waste Control Specialists' extensive experience in environmental sampling in the area, and current land use, see figure 6.1-1.

6.4 COMPLIANCE WITH REGULATORY REQUIREMENTS

Compliance with 10 CFR §20.1301 is demonstrated using a calculation of the TEDE to the individual who is likely to receive the highest dose in accordance with 10 CFR 20.1302(b)(1). Appropriate models, codes, and assumptions that accurately represent the facility, the site and the surrounding area support the determination of the TEDE by pathway analysis.

Compliance is demonstrated through boundary monitoring and environmental sampling data. If a potential release should occur, then routine operational environmental data would be used to assess the extent of the release.

The offsite impact from the CISF storage has been evaluated and is discussed in Section 4.12 of this ER. The conservative evaluation shows that an annual dose equivalent of < 0.011 mSv (11 mrem) is expected at the highest impacted area at the facility perimeter fence. Because the offsite dose equivalent rate from stored casks is expected to be very low and difficult to distinguish from the variance in normal background radiation beyond the CISF boundary, demonstration of compliance would rely on a system that combines direct dose equivalent measurements and computer modeling to extrapolate the measurements. The direct dose equivalent at offsite locations would be measured using TLD/OSL data from the highest impacted offsite areas.

Appropriate investigation and action levels are specified for CISF surface water runoff. Data analysis methods and criteria used in evaluating and reporting environmental sample results are appropriate and would indicate when an action level is being approached in time to take corrective actions.

6.5 QUALITY ASSURANCE

The Radiological Monitoring Program is included in the facility's QA program. Key parts of the program are the written procedures that ensure representative sampling; proper use of appropriate sampling methods and equipment; proper locations for sampling points; and proper handling, storage, transport, and analyses of environmental samples. In addition, written procedures ensure that sampling and measuring equipment are properly maintained and calibrated at regular intervals. Moreover, the Radiological Monitoring Program implementing procedures include functional testing and routine checks to demonstrate that monitoring and measuring instruments are in working condition. The instrument maintenance and calibration program is tailored to the given instrumentation, in accordance with manufacturers' recommendations.

A qualified independent laboratory would analyze environmental samples. Monitoring and sampling activities, laboratory analyses, and reporting of facility-related radioactivity in the environment would be conducted in accordance with industry-accepted and the NRC approved methodologies. Monitoring procedures would employ well-known analytical methods and instrumentation.

The QC procedures used by the laboratories performing the facility's Radiological Monitoring Program would be adequate to validate the analytical results and would conform to the guidance in Regulatory Guide 4.15 . These QC procedures include the use of established standards such as those provided by the National Institute of Standards and Technology, as well as standard analytical procedures such as those established by the National Environmental Laboratory Accreditation Conference.

ISP would ensure that any contractor laboratory used to analyze CISF samples participates in third-party laboratory intercomparison programs appropriate to the media and analytes being measured. Examples of these third-party programs include but are not limited to: (1) Mixed Analyte Performance Evaluation Program; and (2) Analytics Inc., Environmental Radiochemistry Cross-Check Program. ISP would require that all radiological and non-radiological laboratory vendors be certified by the National Environmental Laboratory Accreditation Program or an equivalent state laboratory accreditation agency for the analytes being tested.

ISP would ensure that only individuals trained in accordance with written procedures will be permitted to calibrate analytical sampling equipment. Sampling equipment would be inspected for defects, obstructions, and cleanliness. Calibration intervals and methods would be developed based on applicable industry standards and in accordance with procedures.

The radiation monitoring program falls under the oversight of the ISP Radiation Safety Program. Therefore, it is subject to periodic audits conducted by facility QA personnel. Written procedures would be in place to ensure the collection of representative samples; use of appropriate sampling methods and equipment; proper locations for sampling points; and proper handling, storage, transport, and analyses of environmental samples. In addition, the facility's written procedures also ensure that sampling and measuring equipment, including ancillary equipment, are properly maintained and calibrated at regular intervals, if required. Employees involved in implementation of this program will be trained in the program procedures.

6.6 REPORTING PROCEDURES

Reporting procedures would comply with the requirements of 10 CFR 72.44(d)(3) and the guidance specified in Regulatory Guide 4.16. Reports of the concentrations of any

radionuclides released to unrestricted areas would be provided and would include the Minimum Detectable Concentration (MDC) for the analysis and the error for each data point.

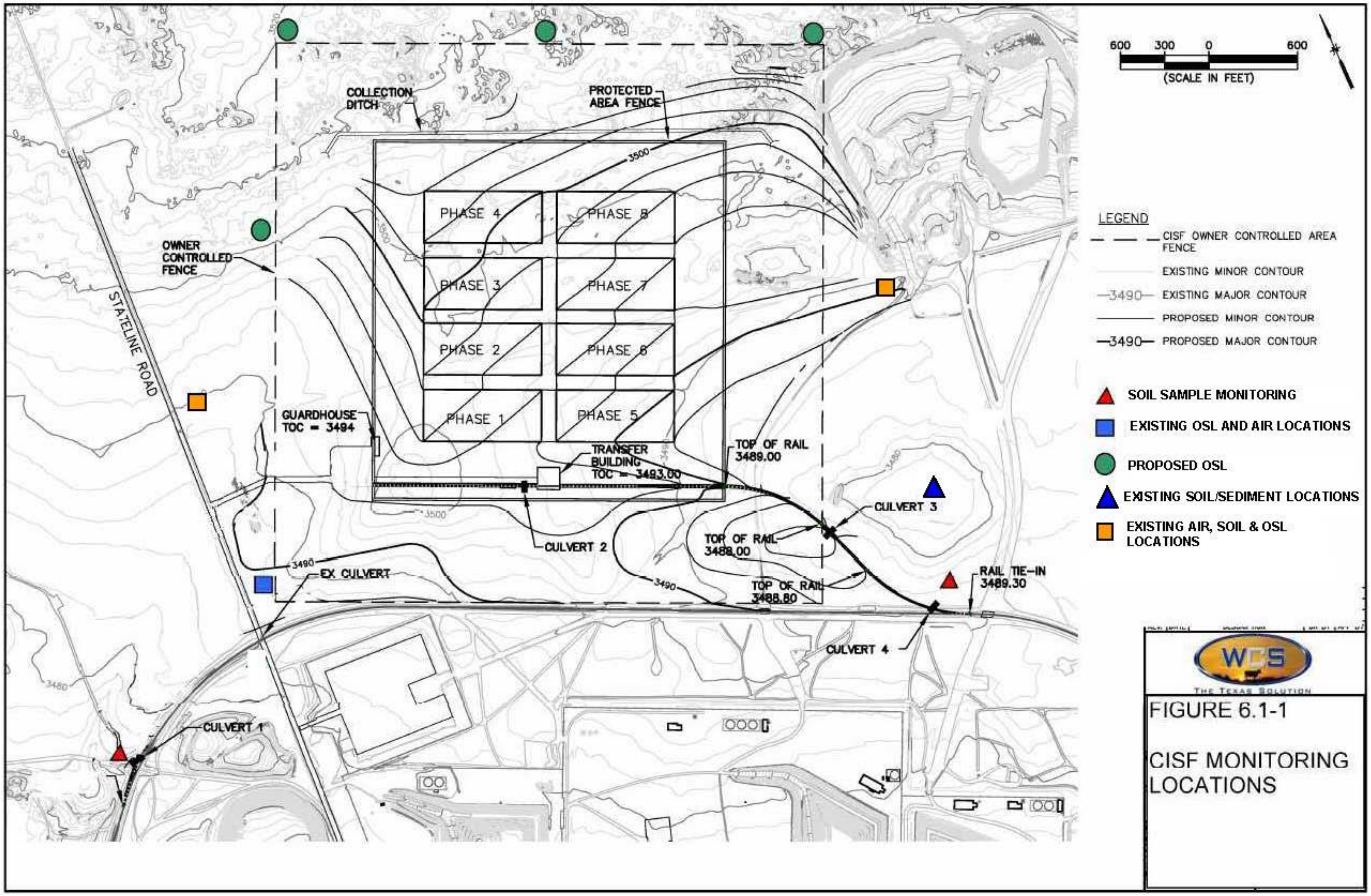
Each year, ISP would submit a summary report of the environmental sampling program to the NRC, including all associated data as required by 10 CFR 72.44(d)(3). The report would include the types, numbers, and frequencies of environmental measurements and the identities and activity concentrations of facility-related nuclides found in environmental samples. The report would also include the MDC for the analyses and the error associated with each data point. Significant positive trends in activities, if any, would also be noted in the report, along with any adjustment to the program, unavailable samples, and deviation to the sampling program.

6.7 PHYSIOCHEMICAL MONITORING

Chemicals are not anticipated to be stored at the CISF and therefore, no physicochemical monitoring would be required.

6.8 ECOLOGICAL MONITORING

Ecological monitoring would not be required given that threatened or endangered species would not be impacted during construction, operation, and decommissioning of the CISF as discussed in Section 4.5.8.


600 300 0 600
(SCALE IN FEET)
LEGEND
CISF OWNER CONTROLLED AREA FENCE
EXISTING MINOR CONTOUR
3490 EXISTING MAJOR CONTOUR
PROPOSED MINOR CONTOUR
3490 PROPOSED MAJOR CONTOUR
SOIL SAMPLE MONITORING
EXISTING OSL AND AIR LOCATIONS
PROPOSED OSL
EXISTING SOIL/SEDIMENT LOCATIONS
EXISTING AIR, SOIL & OSL LOCATIONS
COLLECTION DITCH
PROTECTED AREA FENCE
OWNER CONTROLLED FENCE
STATELINE ROAD
PHASE 4
PHASE 8
PHASE 3
PHASE 7
PHASE 2
PHASE 6
PHASE 1
PHASE 5
GUARDHOUSE TOC = 3494
TRANSFER BUILDING TOC = 3493.00
TOP OF RAIL 3489.00
CULVERT 3
CULVERT 2
TOP OF RAIL 3488.00
TOP OF RAIL 3488.80
RAIL TIE-IN 3489.30
EX CULVERT
CULVERT 4
CULVERT 1
WCS
FIGURE 6.1-1
CISF MONITORING LOCATIONS

CHAPTER 7

BENEFIT-COST ANALYSIS

7.0 BENEFIT-COST ANALYSIS

The proposed action is expected to generate substantial cost savings for the federal government, as well as substantial benefits to the private sector. The analysis in this chapter will focus on estimating the value of benefits and costs from relocating and storing spent nuclear fuel at the proposed CISF. The analysis is performed by using cost data from eight, selected shutdown nuclear power plants in the United States and then extrapolating these data for the CISF's full 40,000 MTU capacity. Section 7.1 provides background information, primarily to explain the economic benefits of the proposed action. Section 7.2 outlines the anticipated benefits of the proposed action and the assumptions used to quantify their economic value. Likewise, Section 7.3 identifies and quantifies the costs of the proposed action. Section 7.4 provides a discussion of the results and summarizes the major findings of the analysis *assuming all eight phases are permitted, as well as two scenarios that assume only permitting Phase 1 of the proposed action*. Section 7.5 discusses the environmental benefits and costs of the proposed action and 7.6 discusses the benefits and costs at evaluated alternative sites. As with NUREG-1714, the individual benefits and costs estimated in this analysis are identified as public or private, as appropriate, but the overall impacts are considered "societal" in nature. The study horizon is a 40-year period that starts with the granting of the site license in *2020*. The values reported are in *Nominal* dollars and have been discounted. *The values reported throughout this chapter, except Section 7.7, are based upon 2018 dollars that were adjusted for future inflation and then calculated at net present value. Section 7.7 provides unadjusted cost estimates in 2018 dollars for comparison purposes.*

7.1 BACKGROUND

The successful construction and operation of the proposed action has the potential to greatly reduce U.S. government expenditures for the storage and management of spent nuclear fuel, prior to the development of a permanent disposal site. The Nuclear Waste Policy Act of 1982 (NWPA) obligated the federal government to dispose of spent fuel from the nation's nuclear power plants. Additionally, the Act provided a mechanism to fund disposition of commercial spent nuclear fuel in the form of payments by utilities into the Nuclear Waste Fund. The NWF also receives taxpayer payments from the Department of Defense for defense-related waste that will go into a repository, including spent nuclear fuel from the U.S. Navy. Under the NWPA, utilities signed contracts with the Department of Energy (DOE) and paid annual fees into the Nuclear Waste Fund in exchange for a federal commitment to begin accepting spent fuel for disposal by January 31, 1998. This funding structure was intended to ensure that commercial nuclear generators (and their ratepayers) - not taxpayers – would pay the necessary monies (upfront) to construct and operate storage and disposal facilities. Beginning in 1983, monies were collected from electricity consumers, as part of their monthly bill, and deposited into the Nuclear Waste Fund. According to the Nuclear Waste Fund's 2015 Financial Audit Statement, the net value of the fund was $37.4 billion.

The NWPA also created a process for establishing a permanent, underground repository by the mid-1990s. Congress assigned responsibility to the DOE to site, construct, operate, and close a repository for the disposal of spent nuclear fuel. In December 1987, Congress amended the NWPA to designate Yucca Mountain, Nevada as the permanent repository site for the nation's nuclear waste. In 2010, the Obama Administration stopped the Yucca Mountain license review and empaneled a study commission to recommend a new policy for the long-term management of spent nuclear fuel and high-level radioactive waste. In January 2012, the Blue Ribbon Commission on America's Nuclear Future published its final recommendations to the Secretary of Energy. In January 2013, the DOE issued its used fuel management strategy to implement the Blue Ribbon Commission's recommendations.

As a consequence of federal actions (and inaction), there is presently no disposal site for tens of thousands of metric tons of spent nuclear fuel and high-level radioactive waste, no alternate site to Yucca Mountain, and a continued obligation for the disposal of spent nuclear fuel by the federal government. The unfulfilled federal obligation to dispose of spent nuclear fuel has become an increasingly expensive liability for the Federal government. Since 1998, when the

NWPA committed the federal government to dispose of spent nuclear fuel, operators of nuclear plants have had to retain, store, and manage spent nuclear fuel on-site. A recent DOE estimate of the federal government's liability for these costs was $21.4 billion through 2071. This figure was an increase from a 2006 estimate of $6.9 billion, which assumed that the permanent storage of spent nuclear fuel would be complete in 2055 (Government Accountability Office [GAO], 2014).

As the expense of ongoing storage of spent nuclear fuel has compounded for nuclear power plant operators, it has become common practice for them to either file lawsuits against the federal government or to negotiate for reimbursement of their storage costs. The reimbursements come from the U.S. Department of Treasury's Judgment Fund, which is used to pay for judgments against the United States. The Judgment Fund is permanent, has an indefinite appropriation, and is exempt from annual congressional approval. The payments are made to the plant operators because of the DOE's partial breach of contract, stemming from its failure to take possession of spent fuel (starting Jan. 31, 1998), as required by the NWPA and the Standard Contract it signed with utilities. According to an article in The National Law Journal, in 2015 alone, the federal government paid approximately $650 million to utility companies for expenses related to storing spent fuel. The same article estimates that the total expenditure over the past five years has been $4 billion (Greene, 2015). Similarly, the Congressional Budget Office reported in their December 2015 testimony before the U.S. House Subcommittee on Environment and the Economy (part of the Committee on Energy and Commerce), that $4.3 billion in damages have been paid out of the taxpayer-funded U.S. Judgment Fund to date, and that remaining liabilities will total $23.7 billion, even if legislation and sufficient appropriations are enacted that will enable the DOE to begin accepting waste within the next 10 years (Congressional Budget Office, 2015). Further delays in implementing an interim storage site beyond 2025 will increase this liability, which will ultimately be borne by the nation's taxpayers.

In late 2013, a federal court ruled that the DOE must stop collecting fees for nuclear spent fuel disposal, until it again complies with the NWPA (as it is currently written) or until Congress enacts an alternate waste management plan (National Association of Regulatory Utility Commissioners v. United States Department of Energy, 2013). Substantial concerns also exist regarding the future of the Nuclear Waste Fund, given the entanglement of budget rules and reimbursement issues facing the fund.

7.2 BENEFITS ANALYSIS

The primary economic benefit associated with the proposed action would be the net reduction of federal reimbursements to the operators of nuclear power plants for their costs associated with prolonged storage of spent fuel. If there is no action to build a CISF, the DOE's ongoing violation of the NWPA means it will continue to incur substantial and ongoing costs related to litigation, settlements, and unfavorable judgments with each individual power plant*'s* ISFSI. However, even if the proposed action is implemented, the expenditures for storage will continue to accrue until the spent fuel is removed from the plants. The total CISF capacity will be 40,000 MTU and the eight sites listed in Table 7.2-1 collectively contain approximately 3,464 MTU of spent nuclear fuel in 279 dry storage canisters and an additional 17 canisters of Greater-than-Class C (GTCC) waste. These sites were selected because they all use either TN Americas or NAC International dry fuel storage systems and, therefore, would all be candidate sites that could be de-inventoried in the earliest stages of the proposed action. It is also assumed that spent fuel being stored in the dry casks at other decommissioning nuclear power plants across the nation will be removed and sent to the proposed CISF, but those subsequent transfers were not explicitly calculated in this analysis. Rather, the benefits and costs determined from analyzing the initial eight sites were extrapolated through the entire period of the initial site license. Going forward, it was assumed that additional reactor sites would shut down as they reached their End-of-Life or encountered unfavorable economic conditions, and that the CISF would take spent fuel preferentially from these shut down sites. Given the available rolling stock and the 40-year duration of the NRC License, the total number of additional plants that could have their spent fuel removed (assuming *110* canisters per site) was *28,* which equates to an additional ~*36,036* MTU of spent fuel shipped to the site. The value of *110* canisters per shutdown site was conservatively chosen to reflect the fact that future shutdown sites would have had longer operating lives than the initial set of 8 decommissioning plant sites, and would therefore have larger inventories of spent fuel. Therefore, in its 40th year of licensure, the CISF would hold *39,500* MTU of spent fuel from approximately *36* shutdown sites. Other anticipated economic benefits from the proposed action are related to the repurposing of land at most of the plant sites, as well as other benefits that were identified but cannot be readily quantified.

Table 7.2-1: Selected Decommissioning Plant Sites Used

Site	Location	Operating Period	MTU	Spent Fuel Canisters	GTCC Canisters	Total Canisters
Connecticut Yankee	Middlesex County, CT	1968-1996	412.3	40	3	43
Crystal River	Citrus County, FL	1977-2009	583.6	39	2	41
Kewaunee	Kewaunee County, WI	1974-2013	513.3	38	*2*	40
La Crosse	Vernon County, WI	1969-1987	38.0	5	0	5
Maine Yankee	Lincoln County, ME	1972-1996	542.3	60	4	64
Rancho Seco	Sacramento County, CA	1975-1989	228.4	21	1	22
Yankee Rowe	Franklin County, MA	1961-1991	127.1	15	1	16
Zion	Lake County, IL	(1)1973-1997 (2)1974-1996	1,019.4	61	4	65
TOTAL			**3,464**	**279**	**17**	**296**

Source: STOREFuel, Vol. 18, No. 211; TN Americas and NAC estimates.

7.2.1 Eliminated Storage Costs

The implementation of the proposed action would allow the federal government to eliminate a sizeable portion of its projected payments to the eight referenced shutdown plant operators storing spent nuclear fuel, along with *28* additional plants. These savings would be the primary economic benefit of the proposed action. Table 7.2-2 provides the assumed annual cost of operating an independent spent fuel storage installation (ISFSI) at each shutdown plant. The 2012 Blue Ribbon Commission report estimated the annual cost of an ISFSI to be between $4.5 and $8 million. Another source of information was a 2012 Government Accountability Office (GAO) report, which estimated the annual cost to operate an ISFSI to be between $3 and $7 million (GAO, 2012).

The assumed costs of storing spent nuclear fuel in this analysis reflect cost estimates found in the U.S. Department of Energy's (DOE) 2016 report, Cost Implications of an Interim Storage Facility in the Waste Management System. This report was prepared for the DOE and led by researchers at the Oak Ridge National Laboratory. In the report, the estimated cost of storing spent nuclear fuel when a plant is operating or immediately after shutdown and in decommissioning mode (i.e., five years after shutdown) is $1 million annually (2014 dollars). In the revised benefits analysis, the value was adjusted to 2018 dollars using the consumer price index (CPI) to $1,060,703. The DOE study's cost estimate for dry cask storage after the initial five-year cooling period was estimated to be $10 million annually, adjusted to $10,607,030 in 2018 dollars. [

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Two additional scenarios were considered in the analysis: only building Phase 1 of the CISF; and only building Phase 1 of the CISF and assuming that no additional nuclear power plants would be shut down during the licensing period. Under the Phase 1 only scenario, the estimated benefits would be derived from transporting the spent fuel from the original eight shutdown nuclear power plants, as well as one of the generic plants. At present (2019), there are ten shutdown nuclear power plants in the United States. Phase 1 of the CISF has sufficient capacity to store the spent fuel from nine plants, based upon the assumptions of this analysis.

To absorb Phase 1's full capacity, it is estimated that 410 canisters of spent nuclear fuel would need to be transported to the CISF. However, there is no financial benefit to the federal government for the CISF to accept a partial inventory of spent fuel from a shutdown plant. Therefore, the practical capacity of the Phase 1 only scenario was assumed to be 406 canisters (which includes 17 GTCC canisters from the eight currently closed power plants) or 4,751 MTU. Under the Proposed Action scenario, it is assumed that once Phase 1 reaches its 5,000 MTU capacity, the licensing for Phase 2 and every subsequent Phase would already be in place to allow the continuous transport and storage of spent fuel (constrained only by rail car availability and inventory of cooled spent fuel). Under the second Phase 1 only scenario, fuel is moved for the same number of shutdown nuclear power plants. Spent fuel from the tenth shutdown power plant is assumed to remain on site and move to dry storage (five years after shutdown) and remain in on site dry storage through the end of the license period. For the remaining, operating plants, the accumulated spent fuel is assumed to be stored on site for the remainder of the licensing period. Both of these scenarios estimate the same potential benefit (assuming another CISF is not opened), because there is no potential for additional cost savings by the federal government beyond the practical capacity of Phase 1 (i.e. 4,751 MTU).

Table 7.2-2 also shows the estimated federal government expenditures to shutdown plant operators under two scenarios over the CISF's 40-year license: implementing the proposed action and the no action alternative. The first scenario assumes that the proposed action is implemented and begins receiving spent fuel canisters two years after being licensed by the NRC. This two-year period accounts for the time required to build the CISF, as well as completing the required operational readiness reviews. Planning studies for transporting the casks; the procurement of transportation casks, rail rolling stock, and cask moving equipment; the construction of or improvements to transportation infrastructure at the decommissioned plant sites could and should all proceed in parallel with the CISF design and licensing process.

Under the Phase 1 only scenario, it was assumed that 26 canisters would be transported during the first year (to avoid later stranding a single canister that would extend closure of an ISF) and 90 canisters would be transported during subsequent years, assuming a smaller inventory of rolling stock. The benefit and cost estimates for the proposed action were discounted at a rate of 3.4 percent, which is based upon the December 2018 update to the treasury rates. An inflation rate of 2.4 percent was also applied, based upon the latest Congressional Budget Office (CBO) forecast. These assumptions align with method used in the DOE's 2016 report, Cost Implications study. The analysis did not assume there would be cost escalations that would exceed the rate of inflation.

The assumed transportation schedule for spent fuel canisters by year is shown in Table 7.2-3. Under Phase 1, the CISF operator would accept fuel from the original eight plant shutdown sites. The transport of containers to the CISF is assumed to begin in Year 3 with 25 canisters moved during that year and each train with five cask cars. As the inventory of rolling stock is expanded, the number of canisters transported will grow to 100 canisters in Year 4. During Year 5 and for every subsequent year, it is assumed that up to 200 canisters will be moved, based upon the availability of cooled spent nuclear fuel. Throughout the canister transfer period, each train is assumed to have five cask cars, but during the early period, this might leave a single canister stranded at the plant. To avoid these situations, one additional cask car would be added to a train (total six cask cars), if it could eliminate an additional train trip with a single cask car.

[

] *It is assumed in the analysis that spent nuclear fuel will only be transferred to the CISF from plant locations that will send their entire inventory, since the purpose of the CISF is to close the interim storage facilities (ISFs) at the reactor sites to achieve cost savings for the federal government.* [

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The assumed transportation schedule differed for the Phase 1 only scenario and the scenario for Phase 1 only and no additional plant shutdowns. Under both scenarios, it was assumed that only three sets of rail cars would be purchased by ISP, due to the lower volume. As with the Proposed Action scenario, each train was assumed to have five rail cars, with two buffer cars and a crew car. During the first year of moving spent fuel (Year 3 of the license), it was assumed that 26 canisters would be transported during the first year (instead of 25, which would avoid later stranding a single canister that would extend closure of an ISF). During the next year (Year 4 of the license), a total of 90 canisters would be moved, which would be the maximum number of canisters transported each year. As with Proposed Action scenario, the actual number of canisters might vary, due to spent fuel cooling. A total of 406 canisters would be moved over a seven-year period, which would be equal to 4,751 MTU.

The travel assumptions are based upon Maheras et al.'s (2014) estimations that repositioning the empty cask cars from the CISF to the decommissioned plant could require approximately a month of travel without expedited service and the return trip would take about two weeks, depending upon the distance from the CISF. In this analysis, additional time was assumed for loading and unloading the casks, locomotive and rail car maintenance, and unforeseen delays. The assumed order of canister pick-up (in a generic sense) is shown below in Table *7.2-4.*

The assumptions related to the number of canisters per shipment, number of canisters shipped per year, total number of canisters and shipments over the time used to determine the benefits and costs of transporting spent nuclear fuel in this evaluation are different that those used in the calculations documented in Chapter 4. The assumptions used herein are appropriate and conservative for benefit-cost analysis.

Typically in a benefit-cost analysis, the valuation of benefits and costs are adjusted to their net present value (NPV) using a discount rate. This practice permits all amounts to be adjusted to a valuation in a common year. However, because there are substantial labor, technological, and regulatory compliance expenditures related to the operation of the CISF and the ISFSIs, it was assumed that these expenses would likely appreciate over time, at least at the rate of inflation. In addition to the ISFSI's annual operating costs, once the canisters exceed 20 years of service life, a site will be required by the NRC to implement an Aging Management Program (AMP). The AMP will involve periodic inspections of a sample population of canisters at each site at regular intervals. Full requirements of the AMP are not yet fully detailed and, due to the general assumptions of this analysis, the benefits estimates did not account for the potential $750,000 of additional annual savings related to the AMP for each ISFSI site.

Table 7.2-2: ***Estimated Net Benefits of the Proposed Action, Discounted***

Year	No Action SNF Storage Costs	Proposed Action SNF Storage Costs	Net Benefits of Proposed Action
1	$114,555,924	$114,555,924	$0
2	$113,448,033	$113,448,033	$0
3	$121,713,428	$121,713,428	$0
4	$120,536,316	$120,536,316	$0
5	$128,552,940	$97,945,097	$30,607,843
6	$145,496,779	$64,665,235	$80,831,544
7	$153,095,257	$73,045,449	$80,049,808
8	$160,533,153	$81,257,522	$79,275,631
9	$167,812,864	$79,490,304	$88,322,560
10	$166,189,916	$78,721,539	$87,468,377
11	$164,582,663	$68,335,492	$96,247,171
12	$171,569,426	$66,721,444	$104,847,982
13	$186,901,162	$64,188,278	$122,712,884
14	$185,093,607	$54,219,340	$130,874,267
15	$191,635,513	$52,769,199	$138,866,314
16	$206,284,969	$68,761,656	$137,523,313
17	$220,633,146	$84,439,846	$136,193,300
18	$226,591,932	$82,724,039	$143,867,893
19	$240,429,129	$89,047,826	$151,381,303
20	$269,851,082	$111,115,151	$158,735,931
21	$306,541,495	$140,607,352	$165,934,143
22	$303,576,877	$130,598,600	$172,978,277
23	$308,349,672	$119,913,761	$188,435,911
24	$305,367,567	$101,789,189	$203,578,378
25	$302,414,303	$92,404,370	$210,009,933
26	$299,489,599	$74,872,400	$224,617,199
27	$296,593,182	$57,670,896	$238,922,286
28	$293,724,776	$40,795,108	$252,929,668
29	$290,884,111	$24,240,343	$266,643,768
30	$288,070,918	$16,003,940	$272,066,978
31	$285,284,932	$0	$285,284,932
32	$282,525,890	$0	$282,525,890
33	$279,793,532	$0	$279,793,532
34	$277,087,598	$0	$277,087,598
35	$274,407,834	$0	$274,407,834
36	$271,753,987	$0	$271,753,987
37	$269,125,805	$0	$269,125,805
38	$266,523,041	$0	$266,523,041
39	$263,945,449	$0	$263,945,449
40	$261,392,785	$0	$261,392,785
TOTAL	**$9,182,360,591**	**$2,486,597,077**	**$6,695,763,515**

The assumed schedule of plant shutdowns is based upon the expiration date of each plant's existing permit. Although it is recognized that some plants may seek to extend their operating license, it is also likely that other plants will choose to shut down prior to reaching the end of their licensed operating period. Many plants have more than one reactor, so the assumed shutdown date for a plant is when the final operating reactor's permit expires. By Year 3 of the CISF's licensure, which is when it is assumed to be permitted to accept spent nuclear fuel, there will be ten shutdown nuclear power plants, eight of which could immediately send spent nuclear fuel canisters to the CISF.

Table 7.2-3: Assumed Plant Shutdown Schedule and Dates of Spent Fuel Removal

Plant	Assumed Shutdown Date	Assumed Date of Completed Spent Fuel Removal
Connecticut Yankee	Shutdown	2023
Crystal River	Shutdown	2023
Kewaunee	Shutdown	2023
La Crosse	Shutdown	2024
Maine Yankee	Shutdown	2024
Rancho Seco	Shutdown	2024
Yankee Rowe	Shutdown	2024
Zion	Shutdown	2024
Generic Plant 1	Shutdown	2027
Generic Plant 2	Shutdown	2029
Generic Plant 3	2019	2030
Generic Plant 4	2019	2031
Generic Plant 5	2020	2031
Generic Plant 6	2021	2032
Generic Plant 7	2022	2033
Generic Plant 8	2025	2036
Generic Plant 9	2026	2037
Generic Plant 10	2026	2038
Generic Plant 11	2028	2039
Generic Plant 12	2029	2040
Generic Plant 13	2029	2041
Generic Plant 14	2030	2041
Generic Plant 15	2030	2042
Generic Plant 16	2031	2042
Generic Plant 17	2032	2043
Generic Plant 18	2032	2044
Generic Plant 19	2033	2044
Generic Plant 20	2033	2045
Generic Plant 21	2033	2045
Generic Plant 22	2033	2046
Generic Plant 23	2034	2046
Generic Plant 24	2034	2047
Generic Plant 25	2034	2047
Generic Plant 26	2034	2048
Generic Plant 27	2034	2049
Generic Plant 28	2036	2049

Table 7.2-4: Assumed Schedule of SNF Canister Transfers from Plant Site to CISF

CISF PHASE	Year	Year	MTUs Stored	Total Canisters Moved	Trains	ISFs Closed	Cumulative Canisters Moved
1	1	2020	0	0	0	0	0
	2	2021	0	0	0	0	0
	3	2022	293	25	5	0	25
	4	2023	1,463	100	20	3	125
	5	2024	3,464	171	34	5	296
	6	2025	3,464	0	0	0	296
	7	2026	3,464	0	0	0	296
	8	2027	4,751	110	22	1	406
	9	2028	4,751	0	0	0	406
2	10	2029	6,038	110	22	1	516
	11	2030	8,378	200	40	1	716
	12	2031	9,899	130	26	2	846
3	13	2032	11,186	110	22	1	956
	14	2033	12,473	110	22	1	1,066
	15	2034	12,473	0	0	0	1,066
	16	2035	12,473	0	0	0	1,066
	17	2036	13,760	110	22	1	1,176
4	18	2037	16,100	200	40	1	1,376
	19	2038	16,334	20	4	1	1,396
	20	2039	17,621	110	22	1	1,506
	21	2040	19,961	200	40	1	1,706
5	22	2041	22,301	200	40	2	1,906
	23	2042	24,056	150	30	2	2,056
6	24	2043	26,396	200	40	1	2,256
	25	2044	28,736	200	40	2	2,456
7	26	2045	31,076	200	40	2	2,656
	27	2046	33,416	200	40	2	2,856
8	28	2047	35,756	200	40	2	3,056
	29	2048	38,096	200	40	1	3,256
	30	2049	39,500	120	24	2	3,376
CISF AT CAPACITY	31	2050	39,500	0	0	0	3,376
	32	2051	39,500	0	0	0	3,376
	33	2052	39,500	0	0	0	3,376
	34	2053	39,500	0	0	0	3,376
	35	2054	39,500	0	0	0	3,376
	36	2055	39,500	0	0	0	3,376
	37	2056	39,500	0	0	0	3,376
	38	2057	39,500	0	0	0	3,376
	39	2058	39,500	0	0	0	3,376
	40	2059	39,500	0	0	0	3,376

Note: The cost analysis accounts for transporting and storing 17 GTCC canisters at facility, but their contents do not count against the licensed MTU capacity.

The net estimated difference for federal government payments to shutdown sites between the no action alternative and implementing the proposed action (i.e. subtracting the total expenditures shown over the 40-year period in Table 7.2-2 for the proposed action from the total expenditures from the no action scenario) was *$6,695,763,515*. Figure 7.2-1 is a graphical representation of these figures on an annualized basis.

Additional details behind the estimated costs of spent fuel storage are shown below. Table 7.2-5 serves as a key for reading and identifying the estimated costs of spent fuel storage at the power plants by each period of activity, as enumerated earlier in this section. Table 7.2-6 provides the assumed costs of storing spent fuel at each facility under the "no action" scenario during each year of the proposed 40-year license. Table 7.2-7 shows the assumed spent fuel storage costs under the "proposed action" scenario. Once all spent fuel is removed from a power plant, it is assumed that no additional storage costs are incurred by the federal government. Table 7.2-8 provides the assumed costs of storing spent fuel at each facility under the "no action" scenario, assuming only Phase 1 is permitted. Table 7.2-9 shows the assumed costs under the "proposed action," but only for Phase 1. Table 7.2-10 provides the cost of storing spent fuel under the "no action" scenario, but assuming that all plants that are not currently shutdown will remain operating through the license period. Finally, Table 7.2-11 shows the storage costs under the "proposed action," assuming that no additional power plants are shutdown (from present) and the remaining plants continue to operate through the license period.

Table 7.2-5: Storage Cost Assumptions in the Benefit Cost Analysis (2018 $)

Storage Costs	***Activity***
$1,060,703	*Plant in operation*
$1,060,703	*Last year of power plant operation*
$1,060,703	*Spent fuel continues to cool in pool,* **[ ]**
$10,607,030	*Spent fuel transferred to dry storage to continue cooling* **[ ]**
$10,607,030	*Spent fuel continues to cool in dry storage at ISF, available for removal*
$10,607,030	*Years with red outline denote period of transporting SNF from ISF to CISF*
$10,607,030	*Plant shutdown, fuel in ISF dry storage at the power plant, available for transfer*

Table 7.2-6: Assumed Storage Costs by Facility of No Action, Discounted

(6 pages)

Year	Licensure	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2021	Year 2	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249
2024	Year 5	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614
2025	Year 6	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943
2026	Year 7	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226
2027	Year 8	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454
2028	Year 9	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618
2029	Year 10	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709
2030	Year 11	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717
2031	Year 12	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635
2032	Year 13	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453
2033	Year 14	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162
2034	Year 15	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754
2035	Year 16	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221
2036	Year 17	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553
2037	Year 18	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743
2038	Year 19	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699
2047	Year 28	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022
2048	Year 29	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114
2049	Year 30	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970
2050	Year 31	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581
2051	Year 32	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941
2052	Year 33	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043
2053	Year 34	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878
2054	Year 35	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440
2055	Year 36	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722
2056	Year 37	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717
2057	Year 38	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418
2058	Year 39	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818
2059	Year 40	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911
	TOTAL	**$353,249,648**	**$353,249,648**	**$353,249,648**	**$353,249,648**	**$353,249,648**	**$353,249,648**

Table 7.2-6: Assumed Storage Costs by Facility of No Action, Discounted

(6 pages)

Year	Licensure	Yankee Rowe	Zion	Generic Plant 1	Generic Plant 2	Generic Plant 3	Generic Plant 4
2020	Year 1	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$10,504,448	$10,504,448	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$1,020,261	$1,020,261
2025	Year 6	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943
2026	Year 7	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226
2027	Year 8	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454
2028	Year 9	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618
2029	Year 10	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709
2030	Year 11	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717
2031	Year 12	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635
2032	Year 13	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453
2033	Year 14	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162
2034	Year 15	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754
2035	Year 16	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221
2036	Year 17	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553
2037	Year 18	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743
2038	Year 19	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699
2047	Year 28	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022
2048	Year 29	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114
2049	Year 30	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970
2050	Year 31	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581
2051	Year 32	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941
2052	Year 33	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043
2053	Year 34	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878
2054	Year 35	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440
2055	Year 36	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722
2056	Year 37	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717
2057	Year 38	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418
2058	Year 39	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818
2059	Year 40	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911
	TOTAL	**$353,249,648**	**$353,249,648**	**$334,249,318**	**$315,614,723**	**$306,432,370**	**$306,432,370**

Table 7.2-6: Assumed Storage Costs by Facility of No Action, Discounted

(6 pages)

Year	Licensure	Generic Plant 5	Generic Plant 6	Generic Plant 7	Generic Plant 8	Generic Plant 9	Generic Plant 10
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$10,006,226	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$9,909,454	$9,909,454	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$9,813,618	$9,813,618	$9,813,618	$981,362	$981,362	$981,362
2029	Year 10	$9,718,709	$9,718,709	$9,718,709	$971,871	$971,871	$971,871
2030	Year 11	$9,624,717	$9,624,717	$9,624,717	$962,472	$962,472	$962,472
2031	Year 12	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$953,163	$953,163
2032	Year 13	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453
2033	Year 14	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162
2034	Year 15	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754
2035	Year 16	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221
2036	Year 17	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553
2037	Year 18	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743
2038	Year 19	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699
2047	Year 28	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022
2048	Year 29	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114
2049	Year 30	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970
2050	Year 31	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581
2051	Year 32	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941
2052	Year 33	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043
2053	Year 34	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878
2054	Year 35	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440
2055	Year 36	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722
2056	Year 37	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717
2057	Year 38	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418
2058	Year 39	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818
2059	Year 40	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911
	TOTAL	**$297,338,821**	**$288,333,218**	**$279,414,709**	**$253,173,370**	**$244,594,899**	**$244,594,899**

Table 7.2-6: Assumed Storage Costs by Facility of No Action, Discounted

(6 pages)

Year	Licensure	Generic Plant 11	Generic Plant 12	Generic Plant 13	Generic Plant 14	Generic Plant 15	Generic Plant 16
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$9,257,754	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$9,168,221	$9,168,221	$9,168,221	$916,822	$916,822	$916,822
2036	Year 17	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$907,955
2037	Year 18	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743
2038	Year 19	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699
2047	Year 28	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022
2048	Year 29	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114
2049	Year 30	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970
2050	Year 31	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581
2051	Year 32	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941
2052	Year 33	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043
2053	Year 34	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878
2054	Year 35	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440
2055	Year 36	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722
2056	Year 37	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717
2057	Year 38	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418
2058	Year 39	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818
2059	Year 40	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911
	TOTAL	**$227,686,045**	**$219,354,067**	**$219,354,067**	**$211,102,668**	**$211,102,668**	**$202,931,070**

Table 7.2-6: Assumed Storage Costs by Facility of No Action, Discounted

(6 pages)

Year	Licensure	Generic Plant 17	Generic Plant 18	Generic Plant 19	Generic Plant 20	Generic Plant 21	Generic Plant 22
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$8,904,783	$8,904,783	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699
2047	Year 28	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022
2048	Year 29	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114
2049	Year 30	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970
2050	Year 31	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581
2051	Year 32	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941
2052	Year 33	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043
2053	Year 34	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878
2054	Year 35	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440
2055	Year 36	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722
2056	Year 37	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717
2057	Year 38	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418
2058	Year 39	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818
2059	Year 40	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911
	TOTAL	**$194,838,501**	**$194,838,501**	**$186,824,197**	**$186,824,197**	**$186,824,197**	**$186,824,197**

Table 7.2-6: Assumed Storage Costs by Facility of No Action, Discounted

(6 pages)

Year	Licensure	Generic Plant 23	Generic Plant 24	Generic Plant 25	Generic Plant 26	Generic Plant 27	Generic Plant 28
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$873,338
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$864,891
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699
2047	Year 28	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022
2048	Year 29	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114
2049	Year 30	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970
2050	Year 31	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581
2051	Year 32	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941
2052	Year 33	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043
2053	Year 34	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878
2054	Year 35	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440
2055	Year 36	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722
2056	Year 37	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717
2057	Year 38	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418
2058	Year 39	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818
2059	Year 40	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911
	TOTAL	**$178,887,400**	**$178,887,400**	**$178,887,400**	**$178,887,400**	**$178,887,400**	**$163,243,339**

Table 7.2-7: Assumed Storage Costs by Facility of Proposed Action, Discounted

(6 pages)

Year	Licensure	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2021	Year 2	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249
2024	Year 5				$10,202,614	$10,202,614	$10,202,614
2025	Year 6						
2026	Year 7						
2027	Year 8						
2028	Year 9						
2029	Year 10						
2030	Year 11						
2031	Year 12						
2032	Year 13						
2033	Year 14						
2034	Year 15						
2035	Year 16						
2036	Year 17						
2037	Year 18						
2038	Year 19						
2039	Year 20						
2040	Year 21						
2041	Year 22						
2042	Year 23						
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$41,816,584**	**$41,816,584**	**$41,816,584**	**$52,019,198**	**$52,019,198**	**$52,019,198**

Table 7.2-7: Assumed Storage Costs by Facility of Proposed Action, Discounted

(6 pages)

Year	Licensure	Yankee Rowe	Zion	Generic Plant 1	Generic Plant 2	Generic Plant 3	Generic Plant 4
2020	Year 1	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$10,504,448	$10,504,448	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$1,020,261	$1,020,261
2025	Year 6			$10,103,943	$10,103,943	$10,103,943	$10,103,943
2026	Year 7			$10,006,226	$10,006,226	$10,006,226	$10,006,226
2027	Year 8			$9,909,454	$9,909,454	$9,909,454	$9,909,454
2028	Year 9				$9,813,618	$9,813,618	$9,813,618
2029	Year 10				$9,718,709	$9,718,709	$9,718,709
2030	Year 11					$9,624,717	$9,624,717
2031	Year 12						$9,531,635
2032	Year 13						
2033	Year 14						
2034	Year 15						
2035	Year 16						
2036	Year 17						
2037	Year 18						
2038	Year 19						
2039	Year 20						
2040	Year 21						
2041	Year 22						
2042	Year 23						
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$52,019,198**	**$52,019,198**	**$63,038,491**	**$63,936,222**	**$64,378,586**	**$73,910,221**

Table 7.2-7: Assumed Storage Costs by Facility of Proposed Action, Discounted

(6 pages)

Year	Licensure	Generic Plant 5	Generic Plant 6	Generic Plant 7	Generic Plant 8	Generic Plant 9	Generic Plant 10
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$10,006,226	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$9,909,454	$9,909,454	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$9,813,618	$9,813,618	$9,813,618	$981,362	$981,362	$981,362
2029	Year 10	$9,718,709	$9,718,709	$9,718,709	$971,871	$971,871	$971,871
2030	Year 11	$9,624,717	$9,624,717	$9,624,717	$962,472	$962,472	$962,472
2031	Year 12	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$953,163	$953,163
2032	Year 13		$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453
2033	Year 14			$9,348,162	$9,348,162	$9,348,162	$9,348,162
2034	Year 15				$9,257,754	$9,257,754	$9,257,754
2035	Year 16				$9,168,221	$9,168,221	$9,168,221
2036	Year 17				$9,079,553	$9,079,553	$9,079,553
2037	Year 18					$8,991,743	$8,991,743
2038	Year 19						$8,904,783
2039	Year 20						
2040	Year 21						
2041	Year 22						
2042	Year 23						
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$64,816,672**	**$65,250,522**	**$65,680,175**	**$66,944,364**	**$67,357,636**	**$76,262,419**

Table 7.2-7: Assumed Storage Costs by Facility of Proposed Action, Discounted

(6 pages)

Year	Licensure	Generic Plant 11	Generic Plant 12	Generic Plant 13	Generic Plant 14	Generic Plant 15	Generic Plant 16
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$9,257,754	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$9,168,221	$9,168,221	$9,168,221	$916,822	$916,822	$916,822
2036	Year 17	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$907,955
2037	Year 18	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743
2038	Year 19	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663
2040	Year 21		$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376
2041	Year 22			$8,648,914	$8,648,914	$8,648,914	$8,648,914
2042	Year 23					$8,565,269	$8,565,269
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$68,172,228**	**$68,573,626**	**$77,222,539**	**$68,971,141**	**$77,536,409**	**$69,364,811**

Table 7.2-7: Assumed Storage Costs by Facility of Proposed Action, Discounted

(6 pages)

Year	Licensure	Generic Plant 17	Generic Plant 18	Generic Plant 19	Generic Plant 20	Generic Plant 21	Generic Plant 22
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$8,904,783	$8,904,783	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25		$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26				$8,319,156	$8,319,156	$8,319,156
2046	Year 27						$8,238,699
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$69,754,675**	**$78,155,072**	**$70,140,768**	**$78,459,923**	**$78,459,923**	**$86,698,623**

Table 7.2-7: Assumed Storage Costs by Facility of Proposed Action, Discounted

(6 pages)

Year	Licensure	Generic Plant 23	Generic Plant 24	Generic Plant 25	Generic Plant 26	Generic Plant 27	Generic Plant 28
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$873,338
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$864,891
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699
2047	Year 28		$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022
2048	Year 29				$8,080,114	$8,080,114	$8,080,114
2049	Year 30					$8,001,970	$8,001,970
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$78,782,183**	**$86,944,114**	**$86,944,114**	**$95,027,216**	**$103,032,250**	**$87,383,955**

Table 7.2-8: Assumed Storage Costs by Facility of No Action – Phase 1 Only, Discounted

(2 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco	Yankee Rowe	Zion	Generic Plant 1
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2021	Year 2	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$1,050,445
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249
2024	Year 5	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614
2025	Year 6	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943
2026	Year 7	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226
2027	Year 8	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454
2028	Year 9	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618
2029	Year 10	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709
2030	Year 11	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717
2031	Year 12	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635
2032	Year 13	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453
2033	Year 14	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162
2034	Year 15	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754
2035	Year 16	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221
2036	Year 17	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553
2037	Year 18	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743
2038	Year 19	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699
2047	Year 28	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022
2048	Year 29	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114

Table 7.2-8: Assumed Storage Costs by Facility of No Action – Phase 1 Only, Discounted

(2 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco	Yankee Rowe	Zion	Generic Plant 1
2049	Year 30	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970
2050	Year 31	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581
2051	Year 32	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941
2052	Year 33	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043
2053	Year 34	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878
2054	Year 35	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440
2055	Year 36	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722
2056	Year 37	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717
2057	Year 38	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418
2058	Year 39	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818
2059	Year 40	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911
SUBTOTAL		**$353,249,650**	**$353,249,650**	**$353,249,650**	**$353,249,650**	**$353,249,650**	**$353,249,650**	**$353,249,650**	**$353,249,650**	**$353,249,650**
							COST OF NO ACTION FOR PHASE 1			**$3,160,246,520**

Table 7.2-9: Assumed Storage Costs by Facility of No Action – Phase 1 Only, Discounted

(2 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco	Yankee Rowe	Zion	Generic Plant 1
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2021	Year 2	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$1,050,445
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249
2024	Year 5				$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614
2025	Year 6						$10,202,614	$10,202,614	$10,202,614	$10,103,943
2026	Year 7									$10,006,226
2027	Year 8									$9,909,454
2028	Year 9									$9,909,454
2029	Year 10									
2030	Year 11									
2031	Year 12									
2032	Year 13									
2033	Year 14									
2034	Year 15									
2035	Year 16									
2036	Year 17									
2037	Year 18									
2038	Year 19									
2039	Year 20									
2040	Year 21									
2041	Year 22									
2042	Year 23									
2043	Year 24									
2044	Year 25									
2045	Year 26									
2046	Year 27									
2047	Year 28									

Table 7.2-9: Assumed Storage Costs by Facility of No Action – Phase 1 Only, Discounted

(2 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco	Yankee Rowe	Zion	Generic Plant 1
2048	Year 29									
2049	Year 30									
2050	Year 31									
2051	Year 32									
2052	Year 33									
2053	Year 34									
2054	Year 35									
2055	Year 36									
2056	Year 37									
2057	Year 38									
2058	Year 39									
2059	Year 40									
SUBTOTAL		**$41,816,584**	**$41,816,584**	**$41,816,584**	**$52,019,198**	**$52,019,198**	**$62,221,812**	**$62,221,812**	**$62,221,812**	**$72,947,945**
							COST OF PROPOSED ACTION FOR PHASE 1			**$489,101,529**

Table 7.2-10: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Discounted

(6 pages)

Year	Licensure	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2021	Year 2	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249
2024	Year 5	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$10,202,614
2025	Year 6	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$10,103,943
2026	Year 7	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$10,006,226
2027	Year 8	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$9,909,454
2028	Year 9	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$9,813,618
2029	Year 10	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$9,718,709
2030	Year 11	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$9,624,717
2031	Year 12	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$9,531,635
2032	Year 13	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$9,439,453
2033	Year 14	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$9,348,162
2034	Year 15	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$9,257,754
2035	Year 16	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$9,168,221
2036	Year 17	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$9,079,553
2037	Year 18	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$8,991,743
2038	Year 19	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$8,904,783
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$8,818,663
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$8,733,376
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$8,648,914
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$8,565,269
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$8,482,432
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$8,400,397
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$8,319,156
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$8,238,699
2047	Year 28	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$8,159,022
2048	Year 29	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$8,080,114
2049	Year 30	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$8,001,970
2050	Year 31	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$7,924,581
2051	Year 32	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$7,847,941
2052	Year 33	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$7,772,043
2053	Year 34	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$7,696,878
2054	Year 35	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$7,622,440
2055	Year 36	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$7,548,722
2056	Year 37	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$7,475,717
2057	Year 38	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$7,403,418
2058	Year 39	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$7,331,818
2059	Year 40	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$7,260,911
	TOTAL	**$353,249,650**	**$353,249,650**	**$353,249,650**	**$353,249,650**	**$353,249,650**	**$353,249,650**

Table 7.2-10: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Discounted

(6 pages)

Year	Licensure	Yankee Rowe	Yankee Rowe	Generic Plant 1	Generic Plant 2	Generic Plant 3	Generic Plant 4
2020	Year 1	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$10,504,448	$10,504,448	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$1,020,261	$1,020,261
2025	Year 6	$10,103,943	$10,103,943	$10,103,943	$10,103,943	$1,010,394	$1,010,394
2026	Year 7	$10,006,226	$10,006,226	$10,006,226	$10,006,226	$1,000,623	$1,000,623
2027	Year 8	$9,909,454	$9,909,454	$9,909,454	$9,909,454	$990,945	$990,945
2028	Year 9	$9,813,618	$9,813,618	$9,813,618	$9,813,618	$981,362	$981,362
2029	Year 10	$9,718,709	$9,718,709	$9,718,709	$9,718,709	$971,871	$971,871
2030	Year 11	$9,624,717	$9,624,717	$9,624,717	$9,624,717	$962,472	$962,472
2031	Year 12	$9,531,635	$9,531,635	$9,531,635	$9,531,635	$953,163	$953,163
2032	Year 13	$9,439,453	$9,439,453	$9,439,453	$9,439,453	$943,945	$943,945
2033	Year 14	$9,348,162	$9,348,162	$9,348,162	$9,348,162	$934,816	$934,816
2034	Year 15	$9,257,754	$9,257,754	$9,257,754	$9,257,754	$925,775	$925,775
2035	Year 16	$9,168,221	$9,168,221	$9,168,221	$9,168,221	$916,822	$916,822
2036	Year 17	$9,079,553	$9,079,553	$9,079,553	$9,079,553	$907,955	$907,955
2037	Year 18	$8,991,743	$8,991,743	$8,991,743	$8,991,743	$899,174	$899,174
2038	Year 19	$8,904,783	$8,904,783	$8,904,783	$8,904,783	$890,478	$890,478
2039	Year 20	$8,818,663	$8,818,663	$8,818,663	$8,818,663	$881,866	$881,866
2040	Year 21	$8,733,376	$8,733,376	$8,733,376	$8,733,376	$873,338	$873,338
2041	Year 22	$8,648,914	$8,648,914	$8,648,914	$8,648,914	$864,891	$864,891
2042	Year 23	$8,565,269	$8,565,269	$8,565,269	$8,565,269	$856,527	$856,527
2043	Year 24	$8,482,432	$8,482,432	$8,482,432	$8,482,432	$848,243	$848,243
2044	Year 25	$8,400,397	$8,400,397	$8,400,397	$8,400,397	$840,040	$840,040
2045	Year 26	$8,319,156	$8,319,156	$8,319,156	$8,319,156	$831,916	$831,916
2046	Year 27	$8,238,699	$8,238,699	$8,238,699	$8,238,699	$823,870	$823,870
2047	Year 28	$8,159,022	$8,159,022	$8,159,022	$8,159,022	$815,902	$815,902
2048	Year 29	$8,080,114	$8,080,114	$8,080,114	$8,080,114	$808,011	$808,011
2049	Year 30	$8,001,970	$8,001,970	$8,001,970	$8,001,970	$800,197	$800,197
2050	Year 31	$7,924,581	$7,924,581	$7,924,581	$7,924,581	$792,458	$792,458
2051	Year 32	$7,847,941	$7,847,941	$7,847,941	$7,847,941	$784,794	$784,794
2052	Year 33	$7,772,043	$7,772,043	$7,772,043	$7,772,043	$777,204	$777,204
2053	Year 34	$7,696,878	$7,696,878	$7,696,878	$7,696,878	$769,688	$769,688
2054	Year 35	$7,622,440	$7,622,440	$7,622,440	$7,622,440	$762,244	$762,244
2055	Year 36	$7,548,722	$7,548,722	$7,548,722	$7,548,722	$754,872	$754,872
2056	Year 37	$7,475,717	$7,475,717	$7,475,717	$7,475,717	$747,572	$747,572
2057	Year 38	$7,403,418	$7,403,418	$7,403,418	$7,403,418	$740,342	$740,342
2058	Year 39	$7,331,818	$7,331,818	$7,331,818	$7,331,818	$733,182	$733,182
2059	Year 40	$7,260,911	$7,260,911	$7,260,911	$7,260,911	$726,091	$726,091
	TOTAL	**$353,249,650**	**$353,249,650**	**$334,249,320**	**$315,614,725**	**$35,324,963**	**$35,324,963**

Table 7.2-10: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Discounted

(6 pages)

Year	Licensure	Generic Plant 5	Generic Plant 6	Generic Plant 7	Generic Plant 8	Generic Plant 9	Generic Plant 10
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$873,338	$873,338	$873,338	$873,338	$873,338	$873,338
2041	Year 22	$864,891	$864,891	$864,891	$864,891	$864,891	$864,891
2042	Year 23	$856,527	$856,527	$856,527	$856,527	$856,527	$856,527
2043	Year 24	$848,243	$848,243	$848,243	$848,243	$848,243	$848,243
2044	Year 25	$840,040	$840,040	$840,040	$840,040	$840,040	$840,040
2045	Year 26	$831,916	$831,916	$831,916	$831,916	$831,916	$831,916
2046	Year 27	$823,870	$823,870	$823,870	$823,870	$823,870	$823,870
2047	Year 28	$815,902	$815,902	$815,902	$815,902	$815,902	$815,902
2048	Year 29	$808,011	$808,011	$808,011	$808,011	$808,011	$808,011
2049	Year 30	$800,197	$800,197	$800,197	$800,197	$800,197	$800,197
2050	Year 31	$792,458	$792,458	$792,458	$792,458	$792,458	$792,458
2051	Year 32	$784,794	$784,794	$784,794	$784,794	$784,794	$784,794
2052	Year 33	$777,204	$777,204	$777,204	$777,204	$777,204	$777,204
2053	Year 34	$769,688	$769,688	$769,688	$769,688	$769,688	$769,688
2054	Year 35	$762,244	$762,244	$762,244	$762,244	$762,244	$762,244
2055	Year 36	$754,872	$754,872	$754,872	$754,872	$754,872	$754,872
2056	Year 37	$747,572	$747,572	$747,572	$747,572	$747,572	$747,572
2057	Year 38	$740,342	$740,342	$740,342	$740,342	$740,342	$740,342
2058	Year 39	$733,182	$733,182	$733,182	$733,182	$733,182	$733,182
2059	Year 40	$726,091	$726,091	$726,091	$726,091	$726,091	$726,091
	TOTAL	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**

Table 7.2-10: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Discounted

(6 pages)

Year	Licensure	Generic Plant 11	Generic Plant 12	Generic Plant 13	Generic Plant 14	Generic Plant 15	Generic Plant 16
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$873,338	$873,338	$873,338	$873,338	$873,338	$873,338
2041	Year 22	$864,891	$864,891	$864,891	$864,891	$864,891	$864,891
2042	Year 23	$856,527	$856,527	$856,527	$856,527	$856,527	$856,527
2043	Year 24	$848,243	$848,243	$848,243	$848,243	$848,243	$848,243
2044	Year 25	$840,040	$840,040	$840,040	$840,040	$840,040	$840,040
2045	Year 26	$831,916	$831,916	$831,916	$831,916	$831,916	$831,916
2046	Year 27	$823,870	$823,870	$823,870	$823,870	$823,870	$823,870
2047	Year 28	$815,902	$815,902	$815,902	$815,902	$815,902	$815,902
2048	Year 29	$808,011	$808,011	$808,011	$808,011	$808,011	$808,011
2049	Year 30	$800,197	$800,197	$800,197	$800,197	$800,197	$800,197
2050	Year 31	$792,458	$792,458	$792,458	$792,458	$792,458	$792,458
2051	Year 32	$784,794	$784,794	$784,794	$784,794	$784,794	$784,794
2052	Year 33	$777,204	$777,204	$777,204	$777,204	$777,204	$777,204
2053	Year 34	$769,688	$769,688	$769,688	$769,688	$769,688	$769,688
2054	Year 35	$762,244	$762,244	$762,244	$762,244	$762,244	$762,244
2055	Year 36	$754,872	$754,872	$754,872	$754,872	$754,872	$754,872
2056	Year 37	$747,572	$747,572	$747,572	$747,572	$747,572	$747,572
2057	Year 38	$740,342	$740,342	$740,342	$740,342	$740,342	$740,342
2058	Year 39	$733,182	$733,182	$733,182	$733,182	$733,182	$733,182
2059	Year 40	$726,091	$726,091	$726,091	$726,091	$726,091	$726,091
	TOTAL	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**

Table 7.2-10: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Discounted

(6 pages)

Year	Licensure	Generic Plant 17	Generic Plant 18	Generic Plant 19	Generic Plant 20	Generic Plant 21	Generic Plant 22
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$873,338	$873,338	$873,338	$873,338	$873,338	$873,338
2041	Year 22	$864,891	$864,891	$864,891	$864,891	$864,891	$864,891
2042	Year 23	$856,527	$856,527	$856,527	$856,527	$856,527	$856,527
2043	Year 24	$848,243	$848,243	$848,243	$848,243	$848,243	$848,243
2044	Year 25	$840,040	$840,040	$840,040	$840,040	$840,040	$840,040
2045	Year 26	$831,916	$831,916	$831,916	$831,916	$831,916	$831,916
2046	Year 27	$823,870	$823,870	$823,870	$823,870	$823,870	$823,870
2047	Year 28	$815,902	$815,902	$815,902	$815,902	$815,902	$815,902
2048	Year 29	$808,011	$808,011	$808,011	$808,011	$808,011	$808,011
2049	Year 30	$800,197	$800,197	$800,197	$800,197	$800,197	$800,197
2050	Year 31	$792,458	$792,458	$792,458	$792,458	$792,458	$792,458
2051	Year 32	$784,794	$784,794	$784,794	$784,794	$784,794	$784,794
2052	Year 33	$777,204	$777,204	$777,204	$777,204	$777,204	$777,204
2053	Year 34	$769,688	$769,688	$769,688	$769,688	$769,688	$769,688
2054	Year 35	$762,244	$762,244	$762,244	$762,244	$762,244	$762,244
2055	Year 36	$754,872	$754,872	$754,872	$754,872	$754,872	$754,872
2056	Year 37	$747,572	$747,572	$747,572	$747,572	$747,572	$747,572
2057	Year 38	$740,342	$740,342	$740,342	$740,342	$740,342	$740,342
2058	Year 39	$733,182	$733,182	$733,182	$733,182	$733,182	$733,182
2059	Year 40	$726,091	$726,091	$726,091	$726,091	$726,091	$726,091
	TOTAL	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**

Table 7.2-10: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Discounted

(6 pages)

Year	Licensure	Generic Plant 23	Generic Plant 24	Generic Plant 25	Generic Plant 26	Generic Plant 27	Generic Plant 28
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$873,338	$873,338	$873,338	$873,338	$873,338	$873,338
2041	Year 22	$864,891	$864,891	$864,891	$864,891	$864,891	$864,891
2042	Year 23	$856,527	$856,527	$856,527	$856,527	$856,527	$856,527
2043	Year 24	$848,243	$848,243	$848,243	$848,243	$848,243	$848,243
2044	Year 25	$840,040	$840,040	$840,040	$840,040	$840,040	$840,040
2045	Year 26	$831,916	$831,916	$831,916	$831,916	$831,916	$831,916
2046	Year 27	$823,870	$823,870	$823,870	$823,870	$823,870	$823,870
2047	Year 28	$815,902	$815,902	$815,902	$815,902	$815,902	$815,902
2048	Year 29	$808,011	$808,011	$808,011	$808,011	$808,011	$808,011
2049	Year 30	$800,197	$800,197	$800,197	$800,197	$800,197	$800,197
2050	Year 31	$792,458	$792,458	$792,458	$792,458	$792,458	$792,458
2051	Year 32	$784,794	$784,794	$784,794	$784,794	$784,794	$784,794
2052	Year 33	$777,204	$777,204	$777,204	$777,204	$777,204	$777,204
2053	Year 34	$769,688	$769,688	$769,688	$769,688	$769,688	$769,688
2054	Year 35	$762,244	$762,244	$762,244	$762,244	$762,244	$762,244
2055	Year 36	$754,872	$754,872	$754,872	$754,872	$754,872	$754,872
2056	Year 37	$747,572	$747,572	$747,572	$747,572	$747,572	$747,572
2057	Year 38	$740,342	$740,342	$740,342	$740,342	$740,342	$740,342
2058	Year 39	$733,182	$733,182	$733,182	$733,182	$733,182	$733,182
2059	Year 40	$726,091	$726,091	$726,091	$726,091	$726,091	$726,091
	TOTAL	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**

Table 7.2-11: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Discounted

(6 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2021	Year 2	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448	$10,504,448
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857	$10,402,857
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249	$10,302,249
2024	Year 5				$10,202,614	$10,202,614	$10,202,614
2025	Year 6						$10,202,614
2026	Year 7						
2027	Year 8						
2028	Year 9						
2029	Year 10						
2030	Year 11						
2031	Year 12						
2032	Year 13						
2033	Year 14						
2034	Year 15						
2035	Year 16						
2036	Year 17						
2037	Year 18						
2038	Year 19						
2039	Year 20						
2040	Year 21						
2041	Year 22						
2042	Year 23						
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$41,816,584**	**$41,816,584**	**$41,816,584**	**$52,019,198**	**$52,019,198**	**$62,221,812**

Table 7.2-11: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Discounted

(6 pages)

Year	License	Yankee Rowe	Zion	Generic Plant 1	Generic Plant 2	Generic Plant 3	Generic Plant 4
2020	Year 1	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$10,504,448	$10,504,448	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$10,402,857	$10,402,857	$10,402,857	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$10,302,249	$10,302,249	$10,302,249	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$10,202,614	$10,202,614	$10,202,614	$10,202,614	$1,020,261	$1,020,261
2025	Year 6	$10,202,614	$10,202,614	$10,103,943	$10,103,943	$1,010,394	$1,010,394
2026	Year 7			$10,006,226	$10,006,226	$1,000,623	$1,000,623
2027	Year 8			$9,909,454	$9,909,454	$990,945	$990,945
2028	Year 9			$9,909,454	$9,813,618	$981,362	$981,362
2029	Year 10				$9,718,709	$971,871	$971,871
2030	Year 11				$9,624,717	$962,472	$962,472
2031	Year 12				$9,531,635	$953,163	$953,163
2032	Year 13				$9,439,453	$943,945	$943,945
2033	Year 14				$9,348,162	$934,816	$934,816
2034	Year 15				$9,257,754	$925,775	$925,775
2035	Year 16				$9,168,221	$916,822	$916,822
2036	Year 17				$9,079,553	$907,955	$907,955
2037	Year 18				$8,991,743	$899,174	$899,174
2038	Year 19				$8,904,783	$890,478	$890,478
2039	Year 20				$8,818,663	$881,866	$881,866
2040	Year 21				$8,733,376	$873,338	$873,338
2041	Year 22				$8,648,914	$864,891	$864,891
2042	Year 23				$8,565,269	$856,527	$856,527
2043	Year 24				$8,482,432	$848,243	$848,243
2044	Year 25				$8,400,397	$840,040	$840,040
2045	Year 26				$8,319,156	$831,916	$831,916
2046	Year 27				$8,238,699	$823,870	$823,870
2047	Year 28				$8,159,022	$815,902	$815,902
2048	Year 29				$8,080,114	$808,011	$808,011
2049	Year 30				$8,001,970	$800,197	$800,197
2050	Year 31				$7,924,581	$792,458	$792,458
2051	Year 32				$7,847,941	$784,794	$784,794
2052	Year 33				$7,772,043	$777,204	$777,204
2053	Year 34				$7,696,878	$769,688	$769,688
2054	Year 35				$7,622,440	$762,244	$762,244
2055	Year 36				$7,548,722	$754,872	$754,872
2056	Year 37				$7,475,717	$747,572	$747,572
2057	Year 38				$7,403,418	$740,342	$740,342
2058	Year 39				$7,331,818	$733,182	$733,182
2059	Year 40				$7,260,911	$726,091	$726,091
	TOTAL	**$62,221,812**	**$62,221,812**	**$72,947,945**	**$315,614,725**	**$35,324,963**	**$35,324,963**

Table 7.2-11: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Discounted

(6 pages)

Year	License	Generic Plant 5	Generic Plant 6	Generic Plant 7	Generic Plant 8	Generic Plant 9	Generic Plant 10
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$873,338	$873,338	$873,338	$873,338	$873,338	$873,338
2041	Year 22	$864,891	$864,891	$864,891	$864,891	$864,891	$864,891
2042	Year 23	$856,527	$856,527	$856,527	$856,527	$856,527	$856,527
2043	Year 24	$848,243	$848,243	$848,243	$848,243	$848,243	$848,243
2044	Year 25	$840,040	$840,040	$840,040	$840,040	$840,040	$840,040
2045	Year 26	$831,916	$831,916	$831,916	$831,916	$831,916	$831,916
2046	Year 27	$823,870	$823,870	$823,870	$823,870	$823,870	$823,870
2047	Year 28	$815,902	$815,902	$815,902	$815,902	$815,902	$815,902
2048	Year 29	$808,011	$808,011	$808,011	$808,011	$808,011	$808,011
2049	Year 30	$800,197	$800,197	$800,197	$800,197	$800,197	$800,197
2050	Year 31	$792,458	$792,458	$792,458	$792,458	$792,458	$792,458
2051	Year 32	$784,794	$784,794	$784,794	$784,794	$784,794	$784,794
2052	Year 33	$777,204	$777,204	$777,204	$777,204	$777,204	$777,204
2053	Year 34	$769,688	$769,688	$769,688	$769,688	$769,688	$769,688
2054	Year 35	$762,244	$762,244	$762,244	$762,244	$762,244	$762,244
2055	Year 36	$754,872	$754,872	$754,872	$754,872	$754,872	$754,872
2056	Year 37	$747,572	$747,572	$747,572	$747,572	$747,572	$747,572
2057	Year 38	$740,342	$740,342	$740,342	$740,342	$740,342	$740,342
2058	Year 39	$733,182	$733,182	$733,182	$733,182	$733,182	$733,182
2059	Year 40	$726,091	$726,091	$726,091	$726,091	$726,091	$726,091
	TOTAL	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**

Table 7.2-11: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Discounted

(6 pages)

Year	License	Generic Plant 11	Generic Plant 12	Generic Plant 13	Generic Plant 14	Generic Plant 15	Generic Plant 16
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$873,338	$873,338	$873,338	$873,338	$873,338	$873,338
2041	Year 22	$864,891	$864,891	$864,891	$864,891	$864,891	$864,891
2042	Year 23	$856,527	$856,527	$856,527	$856,527	$856,527	$856,527
2043	Year 24	$848,243	$848,243	$848,243	$848,243	$848,243	$848,243
2044	Year 25	$840,040	$840,040	$840,040	$840,040	$840,040	$840,040
2045	Year 26	$831,916	$831,916	$831,916	$831,916	$831,916	$831,916
2046	Year 27	$823,870	$823,870	$823,870	$823,870	$823,870	$823,870
2047	Year 28	$815,902	$815,902	$815,902	$815,902	$815,902	$815,902
2048	Year 29	$808,011	$808,011	$808,011	$808,011	$808,011	$808,011
2049	Year 30	$800,197	$800,197	$800,197	$800,197	$800,197	$800,197
2050	Year 31	$792,458	$792,458	$792,458	$792,458	$792,458	$792,458
2051	Year 32	$784,794	$784,794	$784,794	$784,794	$784,794	$784,794
2052	Year 33	$777,204	$777,204	$777,204	$777,204	$777,204	$777,204
2053	Year 34	$769,688	$769,688	$769,688	$769,688	$769,688	$769,688
2054	Year 35	$762,244	$762,244	$762,244	$762,244	$762,244	$762,244
2055	Year 36	$754,872	$754,872	$754,872	$754,872	$754,872	$754,872
2056	Year 37	$747,572	$747,572	$747,572	$747,572	$747,572	$747,572
2057	Year 38	$740,342	$740,342	$740,342	$740,342	$740,342	$740,342
2058	Year 39	$733,182	$733,182	$733,182	$733,182	$733,182	$733,182
2059	Year 40	$726,091	$726,091	$726,091	$726,091	$726,091	$726,091
	TOTAL	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**

Table 7.2-11: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Discounted

(6 pages)

Year	License	Generic Plant 17	Generic Plant 18	Generic Plant 19	Generic Plant 20	Generic Plant 21	Generic Plant 22
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$873,338	$873,338	$873,338	$873,338	$873,338	$873,338
2041	Year 22	$864,891	$864,891	$864,891	$864,891	$864,891	$864,891
2042	Year 23	$856,527	$856,527	$856,527	$856,527	$856,527	$856,527
2043	Year 24	$848,243	$848,243	$848,243	$848,243	$848,243	$848,243
2044	Year 25	$840,040	$840,040	$840,040	$840,040	$840,040	$840,040
2045	Year 26	$831,916	$831,916	$831,916	$831,916	$831,916	$831,916
2046	Year 27	$823,870	$823,870	$823,870	$823,870	$823,870	$823,870
2047	Year 28	$815,902	$815,902	$815,902	$815,902	$815,902	$815,902
2048	Year 29	$808,011	$808,011	$808,011	$808,011	$808,011	$808,011
2049	Year 30	$800,197	$800,197	$800,197	$800,197	$800,197	$800,197
2050	Year 31	$792,458	$792,458	$792,458	$792,458	$792,458	$792,458
2051	Year 32	$784,794	$784,794	$784,794	$784,794	$784,794	$784,794
2052	Year 33	$777,204	$777,204	$777,204	$777,204	$777,204	$777,204
2053	Year 34	$769,688	$769,688	$769,688	$769,688	$769,688	$769,688
2054	Year 35	$762,244	$762,244	$762,244	$762,244	$762,244	$762,244
2055	Year 36	$754,872	$754,872	$754,872	$754,872	$754,872	$754,872
2056	Year 37	$747,572	$747,572	$747,572	$747,572	$747,572	$747,572
2057	Year 38	$740,342	$740,342	$740,342	$740,342	$740,342	$740,342
2058	Year 39	$733,182	$733,182	$733,182	$733,182	$733,182	$733,182
2059	Year 40	$726,091	$726,091	$726,091	$726,091	$726,091	$726,091
	TOTAL	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**

Table 7.2-11: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Discounted

(6 pages)

Year	License	Generic Plant 23	Generic Plant 24	Generic Plant 25	Generic Plant 26	Generic Plant 27	Generic Plant 28
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445	$1,050,445
2022	Year 3	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286	$1,040,286
2023	Year 4	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225	$1,030,225
2024	Year 5	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261	$1,020,261
2025	Year 6	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394	$1,010,394
2026	Year 7	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623	$1,000,623
2027	Year 8	$990,945	$990,945	$990,945	$990,945	$990,945	$990,945
2028	Year 9	$981,362	$981,362	$981,362	$981,362	$981,362	$981,362
2029	Year 10	$971,871	$971,871	$971,871	$971,871	$971,871	$971,871
2030	Year 11	$962,472	$962,472	$962,472	$962,472	$962,472	$962,472
2031	Year 12	$953,163	$953,163	$953,163	$953,163	$953,163	$953,163
2032	Year 13	$943,945	$943,945	$943,945	$943,945	$943,945	$943,945
2033	Year 14	$934,816	$934,816	$934,816	$934,816	$934,816	$934,816
2034	Year 15	$925,775	$925,775	$925,775	$925,775	$925,775	$925,775
2035	Year 16	$916,822	$916,822	$916,822	$916,822	$916,822	$916,822
2036	Year 17	$907,955	$907,955	$907,955	$907,955	$907,955	$907,955
2037	Year 18	$899,174	$899,174	$899,174	$899,174	$899,174	$899,174
2038	Year 19	$890,478	$890,478	$890,478	$890,478	$890,478	$890,478
2039	Year 20	$881,866	$881,866	$881,866	$881,866	$881,866	$881,866
2040	Year 21	$873,338	$873,338	$873,338	$873,338	$873,338	$873,338
2041	Year 22	$864,891	$864,891	$864,891	$864,891	$864,891	$864,891
2042	Year 23	$856,527	$856,527	$856,527	$856,527	$856,527	$856,527
2043	Year 24	$848,243	$848,243	$848,243	$848,243	$848,243	$848,243
2044	Year 25	$840,040	$840,040	$840,040	$840,040	$840,040	$840,040
2045	Year 26	$831,916	$831,916	$831,916	$831,916	$831,916	$831,916
2046	Year 27	$823,870	$823,870	$823,870	$823,870	$823,870	$823,870
2047	Year 28	$815,902	$815,902	$815,902	$815,902	$815,902	$815,902
2048	Year 29	$808,011	$808,011	$808,011	$808,011	$808,011	$808,011
2049	Year 30	$800,197	$800,197	$800,197	$800,197	$800,197	$800,197
2050	Year 31	$792,458	$792,458	$792,458	$792,458	$792,458	$792,458
2051	Year 32	$784,794	$784,794	$784,794	$784,794	$784,794	$784,794
2052	Year 33	$777,204	$777,204	$777,204	$777,204	$777,204	$777,204
2053	Year 34	$769,688	$769,688	$769,688	$769,688	$769,688	$769,688
2054	Year 35	$762,244	$762,244	$762,244	$762,244	$762,244	$762,244
2055	Year 36	$754,872	$754,872	$754,872	$754,872	$754,872	$754,872
2056	Year 37	$747,572	$747,572	$747,572	$747,572	$747,572	$747,572
2057	Year 38	$740,342	$740,342	$740,342	$740,342	$740,342	$740,342
2058	Year 39	$733,182	$733,182	$733,182	$733,182	$733,182	$733,182
2059	Year 40	$726,091	$726,091	$726,091	$726,091	$726,091	$726,091
	TOTAL	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**	**$35,324,963**

7.2.2 Repurposed Land

Once the decommissioning of a nuclear power plant is complete and its license terminated, the NRC places no restrictions on the future use of the land. A nuclear power plant's future uses can include industrial activities, but it can also be used for other commercial or societally-beneficial purposes, such as farming or housing (NRC, 2016). The pace at which a decommissioned site can be reused is, in part, determined by the operator's decommissioning strategy. When a utility decides to shut down a nuclear power plant, it must choose between one of three decommissioning strategies: DECON, SAFSTOR, or ENTOMB. The DECON strategy requires that all parts of the plant (equipment, structures, and other portions of the facility with radioactive contaminants) be removed or decontaminated. When the facility is considered adequately decontaminated, the NRC releases the property and terminates its license. Under the SAFSTOR option, the facility is maintained while the radioactivity decays to lower levels for subsequent decontamination and dismantlement, as with the DECON strategy. The third option is ENTOMB, where all radioactive contaminants are encased in concrete. The facility is monitored and maintained until the radioactivity decays to a level that allows the facility to undergo a restricted release. No NRC-licensed facility has used the ENTOMB strategy to date (NRC, 2015).

The precise value of land at a particular decommissioned nuclear power plant is difficult to estimate. Readapting the land to nature preserves or parks is a frequent consideration for former plant sites. Table *7.2-12* identifies two instances where a former site has been repurposed. The first is the Maine Yankee site, which has 400 acres committed as an industrial park for local economic development. A review of recent aerial photography shows the pace of redevelopment has been limited to date. The second example is 62 acres of the 2,400-acre Rancho Seco site, which will be used for a solar energy facility. Several of the shutdown nuclear power plants are co-located with fossil fuel plants, which are not being decommissioned concurrently with the nuclear reactor. These locations include the former Crystal River and the La Crosse plant sites. Other facilities continue to undergo the process of decommissioning and will not be available on the real estate market for a number of years.

Table *7.2-12* provides a listing of each of the eight facilities covered in this analysis, the number of acres on the site, the plant's decommissioning strategy, its expected date to be released from its license or when it received a release, and the site's current and future land use.

Table *7.2-12*: Site Size, Regulatory Status, and Land Use Potential at Decommissioned Nuclear Power Plants

Site	Location	Approximate Site Acreage	License Status	Estimated Closure Date	Site's Current/Future Use
Connecticut Yankee	Middlesex County, CT	544	DECON Completed	2007	Vacant, available
Crystal River	Citrus County, FL	4,700	SAFSTOR In progress	2074	Continued use for fossil fuel power plants during decommissioning
Kewaunee	Kewaunee County, WI	900	SAFSTOR In progress	TBD	Continues to undergo decommissioning
La Crosse	Vernon County, WI	163	SAFSTOR	TBD	Continued use for fossil fuel power plants
Maine Yankee	Lincoln County, ME	820	DECON Completed	2005	200 acres donated for conservation and education; 400 acres for economic development
Rancho Seco	Sacramento County, CA	2,400	DECON In progress	N/A	62 acres planned for solar facility
Yankee Rowe	Franklin County, MA	2,200	DECON Completed	2007	Vacant, available
Zion	Lake County, IL	257	DECON In Progress	2020	Continues to undergo decommissioning

Sources: NRC, 2016; Maine Yankee, 2016; Connecticut Yankee, 2016; Content, 2015; Joyce, 2015; Wernau, 2015; Maheras et al., 2014; Abel, 2013; Broncaccio, 2013; Penn, 2013; Friedman and Diskin, 2006; Libow, 2001; and Peyton, 1999.

One of the challenges to reusing the site of a fully decommissioned nuclear power plant is that the facility may retain a public perception of risk, even after the NRC has determined that the site is safe for reuse, Pasqualetti and Pijawka (1996)[1] surveyed residents within eight kilometers of the Humboldt nuclear power plant in 1992 and found that public perceptions of risk remain throughout a plant's decommissioning stage. However, the perceived risks from a decommissioned plant do diminish once its spent fuel is removed from the site. Nonetheless, even if the spent fuel is moved offsite and all parts of the decommissioned plant removed, almost 17 percent of the survey respondents believed the facility still presented a high level of risk. While such fears are not scientifically sound, they can still create some negative impacts on the value of land at a decommissioned site.

Another factor that can affect the value of land at a shutdown nuclear power plant has been the response of some local governments to decommissioning. Nuclear power plants are often located in rural areas that are away from population centers and not always economically robust. In many communities, local governments have been dependent upon the power plants, with their large workforce of well-paid employees and contributions to local governments, to support their local economies. When a facility is shut down and later fully decommissioned, it can lead to substantial loss of jobs and public revenue in the community, especially if the site is not redeveloped soon after its decommissioning.

The closing of the Kewaunee nuclear power plant in Carlton, Wisconsin led to the loss of 550 jobs and $350,000 of revenue for the municipal government (Bosman, 2015). Initially, the town of Carlton appraised the value of the plant's 900-acre tract at $10 million for the 2013 tax roll. However, in 2014, the same 900-acre tract was appraised at $457 million (Yancey, 2015), as local officials try to generate new revenue. The owner of the plant has since sued the town of Carlton to reduce the appraised value. The valuation of the land at the Kewaunee plant is further complicated because the owner has up to 60 years to restore the site (Content, 2015). Situations like these further complicate the valuation of land at a decommissioned site.

The estimated value of the land at shutdown nuclear plants in this analysis was based upon the typical price of brownfield industrial property in the area surrounding the site (see Table *7.2-13*). Unfortunately, none of the listings for industrial properties near the shutdown facilities were

[1] Pasqualetti, Martin J. and K. David Pijawka. 1996. Unsiting Nuclear Power Plants: Decommissioning Risks and Their Land Use Context. Professional Geographer, 48(1), 57-69.

described as brownfield properties, so comparable parcels of industrial property were identified from recent local property listings and the assumed price per acre for this land was discounted by 50 percent. The 50 percent valuation discount is consistent with the findings of several studies of brownfield properties. Page and Rabinowitz (1993) found that the value of brownfield properties had prices that were 10 to 50 percent lower than similar properties. Patchin (1994) found the discounted price of commercial and industrial brownfield land between 21 and 94 percent lower than more pristine property. Finally, Howland (2010) found that parcels with historic uses that gave reasons to suspect contamination sold at an average discount of 65 percent.

Table *7.2-13*: Estimated Value of Land at Decommissioned Nuclear Power Plants *2018 $*

Site	*Approximate Site Acreage*	*Estimated Value per Acre (2018 $)*	*Acres Available for Redevelopment*	*Estimated Value of Land (2018 $)*
Connecticut Yankee	*544*	*$42,766*	*544*	*$23,264,704*
Crystal River	*4,700*	—	—	—
Kewaunee	*900*	*$11,072*	*900*	*$9,964,800*
La Crosse	*163*	—	—	—
Maine Yankee	*820*	*$10,032*	*620*	*$6,219,840*
Rancho Seco	*2,400*	*$25,871*	*2,338*	*$60,486,398*
Yankee Rowe	*2,200*	*$26,610*	*2,200*	*$58,542,000*
Zion	*257*	*$23,759*	*257*	*$6,106,063*
Subtotal	***11,984***	**—**	***6,859***	***$164,583,805***
Average	***1,498***	***$23,352***	***1,143***	***$27,430,634***

Note: Crystal River, Kewaunee, La Crosse sites are assumed to continue as fossil fuel power plants.

Source: Loopnet.com, 2016 and Maine Commercial Association of Realtors, 2016.

The total estimated value of land returned to the market at 6 of the 8 currently decommissioned plants and the *28* generic plants with their fuel removed was estimated to be $*766.8 million* dollars. The site acreage and the value of land at each generic decommissioned plant was assumed to be equal to the average values of the six decommissioned nuclear power plants that will return land to the market.

The estimates of land values at closed power plants were revised to identify the assumed year that the land would return to the market. For each facility, it was assumed the land would return to market ten years after the complete removal of spent fuel from the plant site, which would be 20 or more years after the assumed plant shutdown date. Table 7.2-14 provides the discounted value of land at each plant.

Table *7.2-14*: Total Estimated Value of Land at Decommissioned Nuclear Power Plants Served by the Proposed Action*, Discounted*

Plant	*Assumed Shutdown Date*	*Assumed Date of Completed Spent Fuel Removal*	*Assumed Date Returned to Market*	*Discounted Market Value*
Connecticut Yankee	*Shutdown*	*2023*	*2033*	*$24,175,100*
Crystal River	*Shutdown*	*2023*	*2033*	*$24,175,100*
Kewaunee	*Shutdown*	*2023*	*2033*	*$24,175,100*
La Crosse	*Shutdown*	*2024*	*2034*	*$23,941,298*
Maine Yankee	*Shutdown*	*2024*	*2034*	*$23,941,298*
Rancho Seco	*Shutdown*	*2024*	*2034*	*$23,941,298*
Yankee Rowe	*Shutdown*	*2024*	*2034*	*$23,941,298*
Zion	*Shutdown*	*2024*	*2034*	*$23,941,298*
Generic Plant 1	*Shutdown*	*2027*	*2037*	*$23,253,373*
Generic Plant	*Shutdown*	*2029*	*2039*	*$22,805,773*
Generic Plant	*2019*	*2030*	*2040*	*$22,585,214*
Generic Plant	*2019*	*2031*	*2041*	*$22,366,788*
Generic Plant	*2020*	*2031*	*2041*	*$22,366,788*
Generic Plant	*2021*	*2032*	*2042*	*$22,150,475*
Generic Plant	*2022*	*2033*	*2043*	*$21,936,254*
Generic Plant	*2025*	*2036*	*2046*	*$21,305,941*
Generic Plant	*2026*	*2037*	*2047*	*$21,099,887*
Generic Plant	*2026*	*2038*	*2048*	*$20,895,826*
Generic Plant	*2028*	*2039*	*2049*	*$20,693,739*
Generic Plant	*2029*	*2040*	*2050*	*$20,493,606*
Generic Plant	*2029*	*2041*	*2051*	*$20,295,409*
Generic Plant	*2030*	*2041*	*2051*	*$20,295,409*
Generic Plant	*2030*	*2042*	*2052*	*$20,099,128*
Generic Plant	*2031*	*2042*	*2052*	*$20,099,128*
Generic Plant	*2032*	*2043*	*2053*	*$19,904,746*
Generic Plant	*2032*	*2044*	*2054*	*$19,712,244*
Generic Plant	*2033*	*2044*	*2054*	*$19,712,244*
Generic Plant	*2033*	*2045*	*2055*	*$19,521,603*
Generic Plant	*2033*	*2045*	*2055*	*$19,521,603*
Generic Plant	*2033*	*2046*	*2056*	*$19,332,806*
Generic Plant	*2034*	*2046*	*2056*	*$19,332,806*
Generic Plant	*2034*	*2047*	*2057*	*$19,145,835*
Generic Plant	*2034*	*2047*	*2057*	*$19,145,835*
Generic Plant	*2034*	*2048*	*2058*	*$18,960,672*
Generic Plant	*2034*	*2049*	*2059*	*$18,777,300*
Generic Plant	*2036*	*2049*	*2059*	*$18,777,300*
			TOTAL	***$766,819,521***

7.2.3 Other Economic Benefits Not Quantified

In addition to the economic benefits identified above, there are other tangible economic benefits that were not quantified in this analysis, due to the lack of specific information, the data necessary to make an estimate, or uncertainty about future conditions.

- The GAO estimates the federal government has spent an additional $219.5 million through December 2013 defending the DOE against lawsuits brought by plant operators over the cost of storing spent fuel. These ongoing legal defense costs would be reduced and eventually be eliminated once the federal government meets its obligations under the NWPA.
- Another avoided cost will be eliminating the need for studies and programs designed to find an immediate solution for the storage of spent fuel.
- There will be various indirect and induced economic benefits from developing the CISF, its operation, and professional and transportation services. While the direct expenditures could not be counted as benefits, the indirect and induced impacts could.[2]
- A licensed CISF would also eliminate the need for the DOE to undergo a separate consent-based siting program for a CISF. Likewise, the generic TSAR (Technical Safety Analysis Report), that DOE has solicited proposals for, would not be needed, as a CISF would already be licensed.[3] While each of these avoided costs is likely to save the DOE from substantial expenditures, those savings were not quantified in this analysis.
- Improvements to transportation corridors between the shutdown nuclear plants could create positive economic impacts for other users of the transportation infrastructure.

7.3 COSTS ANALYSIS

Development of the CISF and the relocation of the spent nuclear fuel to this facility will incur substantial upfront costs, as well as ongoing annual operating expenditures. Most of the upfront costs for planning and permitting will be borne initially by the private sector. However, prior to commencing construction, operation, and receipt of licensed material at the WCS CISF, ISP expects to enter into a contract(s) with DOE or the SNF Title Holder(s) that will provide the funding for facility construction, operation, and decommissioning. Due to the limited amount of

[2] See the Socioeconomic Impact Assessment appendix in this document for a discussion of the indirect and induced impacts resulting from the construction and operation of the proposed action.
[3] The DOE's RFP was issued on April 15, 2016.

information on this topic, this analysis incorporates assumptions and cost estimates from the Electric Power Research Institute's (EPRI) 2009 report, Cost Estimate for an Away-From-Reactor Generic Interim Storage Facility (GISF) for Spent Nuclear Fuel adjusting them to *2018* dollars using the CPI and adjusting values where appropriate for the circumstances of the proposed action. In addition to using the information for this discussion, ISP has also relied substantially upon the EPRI figures to develop internal planning information for the project.

7.3.1 Planning, Permitting, and Constructing the Proposed Project

The initial planning stage of the project requires various studies to assess the technical feasibility of the project, the consideration of various alternatives, and the impacts of the alternatives on the human and natural environment for the project's environmental report. Additionally, ISP must inform the public about the proposed facility and engage local stakeholders. Prior to the submission of an application for an NRC license, ISP will also develop a preliminary design for the facility and a safety analysis. The estimated cost for these activities is $*21.0* million (See Table 7.3-1, as derived from the 2009 EPRI report).

After the initial submittal of the license application, ISP will pay fees to the NRC to review its application, as well as for the preparation of an environmental impact statement (EIS) and the public hearing process, as necessary. There will also be costs associated with state and local government review of the project. Additionally, it will be necessary for ISP to continue providing public information and engaging stakeholders as the project progresses. During the review of the license application, technical and legal support will be retained and a detailed engineering design will be prepared for the CISF and the site's transportation infrastructure. The total estimated cost for the license application review stage is $*46.7* million, as derived from the 2009 EPRI report.

The initial source of this funding for planning and permitting is ISP and other project team members, including in-kind contributions of time and expertise. However, ISP would seek to recover these costs through a future contract with DOE or the SNF Title Holder(s).

After receiving the license, the CISF's construction will begin to move forward, which will require the services of engineers and construction personnel. As the site is constructed, it will be necessary to ensure and confirm the quality of construction. The total cost for this phase is estimated to be approximately $*10.4* million, as derived from the 2009 EPRI report. As

explained in the license application, funding of construction is expected to be primarily through a future contract with DOE or the SNF Title Holder(s).

Overall, the initial phase of developing the CISF is expected to cost approximately $*78.1* million, as derived from the 2009 EPRI report. This expense also includes project management costs and a contingency assumption of 30 percent.

Table 7.3-1: CISF Design, Engineering, Licensing, and Startup Professional Services, *Discounted*

Cost Category	*Estimated Cost (Millions $)*
Pre-Licensing Phase	
Project Management	*$3.48*
Public Information and Stakeholder Involvement	*$1.74*
Geotechnical Investigations and Environmental Report Development	*$2.32*
Preliminary Design, Safety Analysis, and Preparation of License Application	*$8.58*
Subtotal Pre-Licensing Phase	*$16.12*
Contingency: 30%	*$4.84*
Total CISF Pre-License Submittal Phase:	***$20.96***
License Application Review Stage	
Project Management	*$2.90*
Public Information and Stakeholder Involvement	*$1.74*
NRC Fees for LA Review, EIS, and Hearing Process	*$18.56*
Technical and Legal Support during LA Review and Hearing Process	*$6.96*
Detailed Design for CISF Facilities and Transportation Infrastructure	*$5.22*
State and Local Authority Review	*$0.58*
Subtotal: CISF License Application Review Phase	*$35.95*
Contingency: 30%	*$10.79*
Total CISF License Application Review Phase	***$46.74***
Initial Construction/Pre-Operations Phase	
Project Management	*$1.62*
Public Information and Stakeholder Involvement	*$1.74*
Engineering and Legal Support during Construction	*$2.67*
System Start-up, Dry-Run Testing	*$1.97*
Subtotal CISF Initial Construction/Pre-Operations Phase	*$8.00*
Contingency: 30%	*$2.40*
Total CISF Initial Construction/Pre-Operations Phase	***$10.40***
Total CISF Design, Engineering, Licensing, and Startup Professional Services	***$78.10***

Source: Derived from EPRI, 2009.

7.3.2 CISF Capital Costs

Under ISP's approach, DOE or the SNF Title Holder(s) would be responsible for transportation, including associated costs. As explained in the license application, funding of construction is expected to be primarily through a future contract with DOE or the SNF Title Holder(s).

7.3.2.1 Transportation Capital Costs

The development of the CISF facility will require transportation improvements and the purchase of rolling stock that will be used to bring the spent fuel from the shutdown nuclear power plants to the CISF. The CISF site is already well served by roads and a rail spur, so fewer transportation improvements will likely be needed than would be assumed at EPRI's generic facility or any of the alternative CISF sites that have been considered. The estimates in Table 7.3-2 reflect adjustments for these conditions. The cost analysis also assumes the purchase of rolling stock for *seven* trains. *This rolling stock includes seven rail escort cars (at $6.4 million each) that will hold personnel (including security), and 35 rail cask cars that will carry the transportation casks (at $1.6 million apiece, plus $6.4 million apiece for 35 transportation casks), as well as 14 rail buffer cars (at $2.1 million apiece). One rail buffer car rides on either side of the group of rail cask cars to protect the crew from radiation.* Locomotives and their crews were assumed to be provided by the railroad providing the service.

Table 7.3-2: Estimated Costs of Transportation Infrastructure*, Discounted*

Description	***Cost Estimate (Millions $)***
Access Road Improvements	*$1.58*
Land Improvements	*$5.27*
Rail Escort Cars @ $6.4 million: 7	*$44.01*
Rail Buffer Cars @ $1.6 million: 14	*$22.00*
Cask Rolling Stock *Rail Cask Car @ $2.1 million:35* *Transportation Casks @ $6.4 million: 35* *Associated transport equipment (impact limiters, etc.)*	*$292.97*
Subtotal Transportation Infrastructure	***$365.83***
Contingency: 30%	***$109.75***
Total Transportation Infrastructure	***$475.58***

Source; Derived from EPRI, 2009.

7.3.2.2 CISF Infrastructure

Development of the CISF will require the construction of various buildings to support activities at the site. The assumed facilities include a combined administrative and security and health physics building and a canister handling building. Maintenance and operations activities will be carried out at existing buildings on the site. It is also assumed, over the 40-year license, that all the equipment and building furnishings will need a one-time replacement. *It is assumed that this replacement will occur during Year 21 of the license period.* The assumed cost for building construction is $*37.2* million, and with a 30 percent contingency, totals costs are estimated to be $*48.4* million (See Table 7.3-3).

Table 7.3-3: Estimated Costs of CISF Infrastructure*, Discounted*

CISF Capital Cost Elements	*Estimated Costs (Millions $)*
Administrative, Security, and Health Physics Building	
Building construction	*$2.74*
Furnishings, equipment, emergency diesel generator, vehicles (with one-time replacement)	*$6.76*
Total Administrative, Security, and Health Physics Building	*$9.50*
Canister Handling Building	
Building construction	*$6.22*
Canister transfer cells and equipment: 3	*$8.75*
Heavy lifting equipment and heavy haul equipment (with one-time replacement)	*$12.75*
Total Canister Handling Building	*$27.72*
Subtotal CISF Infrastructure	***$37.22***
Contingency: 30%	***$11.17***
Total CISF Infrastructure	***$48.39***

7.3.2.3 Spent Fuel Storage Facility

Storage of the spent fuel canisters will require the construction of new storage pads and security features. Multiple canisters will sit on large concrete pads that will have an average cost of $*105,945* per canister, along with $*3.5* million expended for site preparation (See Table 7.3-4). *Under the Phase 1 only scenarios, concrete pads would only be constructed for 406 canisters.* For security, the facility is assumed to have a fenced inner and outer perimeter that will cost $1 million. Other security features will include lighting, intrusion detection, close-circuit television, and other types of monitoring equipment. It was estimated that the electronics portion of this expense is approximately $*2.7* million and that it would be replaced four times over the 40-year period to remain in good working order and to take advantage of new technological advances.

The decennial replacement of electronics results in additional costs during Year 11, Year 21 and Year 31. All these items will have a collective cost of almost $*324.7* million and, with a $*97.4* million contingency, will total $*422.0* million.

Table 7.3-4: Spent Fuel Storage Facility Costs*, Discounted*

CISF Fuel Storage Facility Costs	*Estimated Costs (Millions $)*
Excavation and Grading	*$3.48*
Concrete Storage Pads	
Large concrete pads estimated to cost $105,945 per canister @ 3,376 canisters stored	*$299.92*
Security Fence	***$1.08***
Inner and outer security fences – 12,400 linear feet	
Fencing: $87.40/linear foot	
Security System	
Lighting, intrusion detection, CCTV, monitoring equipment (with four updates to the electronic equipment)	*$20.17*
Subtotal Fuel Storage Facility	***$324.65***
Contingency 30%	***$97.39***
Total Fuel Storage Facility	***$422.64***

7.3.3 CISF Operating Costs

As explained in the license application, ISP will obtain funds to operate the CISF pursuant to a future contract with DOE or the SNF Title Holder(s). ISP also intends to collect funds for the decommissioning of equipment, facilities, and land at the CISF pursuant to a future contract with DOE.

7.3.3.1 Recurring Administrative Costs

Table 7.3-5 shows estimates of various recurring administrative operating expenses for the proposed action. Travel and living expenses for the security crews who will pick-up the spent fuel canisters is estimated to be approximately $*2.31* million. This expense assumes *675* rail shipments that will remove *3,376* casks of spent fuel. *The Phase 1 only scenarios would*

require 82 rail shipments carrying 406 canisters of spent fuel and GTCC waste. There will be an annual office expense of $*970,286* (over 40 years that totals $*38.8* million) that includes communications and reproduction, office supplies, office equipment and leases, office equipment maintenance and repair, postage, dues and subscriptions, and insurance. The total expenditure including contingency is $*53.5* million.

Table 7.3-5: Administrative Operating Costs*, Discounted*

CISF Administrative Operating Costs	*Estimated Costs (Millions $)*
Travel and Living Expenses	
Security Crew *675 rail shipments for 3,376 casks* *$4,079 per rail shipment*	*$2.31*
Annual Office Expenses	
Communications and reproduction, office supplies, office equipment and leases, office equipment maintenance and repair, postage, dues and subscriptions, insurance	*$38.81*
Subtotal: Annual Administrative Operating Costs	***$41.12***
Contingency: 30%	***$12.34***
Total Administrative Operating Costs	***$53.46***

Total over the 40-year licensure period

Source: Derived from EPRI, 2009.

7.3.3.2 Concrete Overpacks

Upon relocation to the CISF, each shipment will arrive in a dual purpose canister and will need to be placed into a concrete overpack and set on a pad. Each concrete overpack is expected to cost $*233,078* (See Table 7.3-6). The total expenditure for placing all the spent fuel canisters relocated from the eight shutdown plants and the *28* generic plants, including contingency costs, is estimated to be $*857.8* million. *Under the Phase 1 only scenarios, concrete overpacks would only be constructed for 406 canisters for a total cost of $117.5 million.*

Table 7.3-6: Costs for Concrete Overpack, *Discounted*

Concrete Overpack Costs	*Estimated Costs (Millions $)*
Concrete Overpack Costs	
$233,078 per overpack: 3,376 canisters	*$659.8*
Contingency: 30%	*$197.9*
Total Costs	***$857.8***

Source: Derived from EPRI, 2009.

7.3.3.3 Transportation Planning and Transport at Shutdown Plant Sites

The EPRI study did not discuss the potential costs related to moving the casks from the shutdown nuclear power plants to a railroad transloading location, which in some cases might be within the boundaries of the plant property or for others, many miles away. Reaching these transloading locations could require moving the cask from the plant by barge or heavy-haul truck, depending upon the circumstances. The EPRI study also did not identify costs for the extensive transportation and safety planning that would be necessary along each route between the shutdown plant and the CISF. A detailed discussion of the activities that must occur before and during the transfer of the casks is provided in Maheras et. al. (2014). However, that report does not provide cost estimations for any of these activities. A 2014 GAO report, entitled *Spent Nuclear Fuel Management: Outreach Needed to Help Gain Public Acceptance for Federal Activities that Address Liability*, did give estimates for some of the local transportation costs. Table 7.3-7 shows general approximations of the identified expenditures for all *36* spent fuel sites. *Under the Phase 1 only scenarios, the on-site transportation planning and transport costs reflect the modified and reduced schedule of spent fuel removal.*

Table 7.3-7: Assumed On-site Transportation Planning and Transport Costs, *Discounted*

On-Site Transportation Planning and Transport Costs	*Estimated Costs (Millions $)*
Assemble Project Organization	
Assemble management teams	*$68.96*
Identify shutdown site existing infrastructure, constraints, & transportation resource needs and develop interface procedures.	*$91.95*
Conduct Preliminary Logistics Analysis and Planning	
Develop specs, solicit bids, issue contracts, & initiate preparations for shipping campaigns	*$11.54*
Revisions to certificates of compliance as may be needed	*$22.99*
Conduct Preliminary Logistics Analysis and Planning	
Determine fleet size, transport requirements, and modes of transport for shutdown site	*$9.19*
Coordinate with Stakeholders	
Assess and select routes & modes of transport	*$13.79*
Support training of emergency response personnel	*$90.14*
Develop Campaign Plans	
Develop plans, policies, & procedures for at-site operational interfaces, support operations, and in-transit security operations	*$41.47*
Conduct Readiness Activities	
Assemble & train at-site operations interface team & shutdown site workers	*$45.97*
Includes readiness reviews, tabletop exercises, and dry run operations	*$68.96*
Local Transportation	
Portable transportation equipment – 7 sets @ $2.1 million	*$14.75*
Local transportation improvements – 36 sites @ $1.1 million.	*$33.06*
Transfer cask to site to railroad - $264,862 per cask: 3,376 casks	*$749.80*
Subtotal: On-Site Transportation Planning and Transport Costs	***$1,262.57***
Contingency: 30%	***$378.77***
Total Transportation Planning and Transport Costs	***$1,641.34***

Note: Values are for all 36 sites.

Source: Derived from GAO (2014)

7.3.3.4 Rail Costs from Shutdown Plants to CISF

For cost and safety reasons, the preferred mode for transporting the casks of spent fuel is rail (DOE, 2013)[4]. In some cases, the locations with spent fuel have an existing rail spur in the facility, which connects to a short line or a regional or Class I railroad. However, in a number of cases, it will be necessary for the cask to be transported by truck or barge to a rail head capable of handling the cargo.

Regardless of which part of the country the casks will be transported from, they will eventually need to travel on the Union Pacific (UP) rail line that is parallel to Interstate Highway (IH) 20, known as the TP Line. In the Texas town of Monahans, the train will interchange with the Texas & New Mexico Railway (TNMR), which is a short line railroad. The TNMR is a modern facility that can handle 286,000 lbs. rail cars and is the same capacity as the UP's TP Line. The TNMR connects to ISP joint venture member Waste Control Specialists's internal rail spur.

Table 7.3-8 shows the estimated distances of rail trips needed to remove the casks from existing, decommissioned facility. In a 2011 MIT Study, it was estimated that the transportation cost of moving a train with three casks was $75 per mile. That amount was adjusted to $*87.40*, based upon the change in the CPI. The distance by rail from each facility to the WCS CISF was based upon the shortest route of the train, which considered track weight capacity, but none of the other factors that might influence the routing of the train.

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[4] Department of Energy. 2013. Office of Fuel Cycle and Research Development, A Project Concept for Nuclear Fuels Storage and Transportation. FCRD-NFST-2013-000132 Rev. 1 (June 15, 2013).

Table 7.3-8: Estimated Distances of Rail Transportation to CISF

Site	Estimated Distance
Connecticut Yankee	2,337
Crystal River	1,672
Kewaunee	1,509
La Crosse	1,443
Maine Yankee	2,435
Rancho Seco	1,498
Yankee Rowe	2,293
Zion	1,404
AVERAGE	**1,824**

Source: Derived from EPRI, 2009.

7.3.3.5 Other Operating Costs

There will be additional recurring expenses to operate the CISF that are shown in Table 7.3-9. The largest expense shown will be the transport of the spent fuel by rail to the CISF, estimated to be approximately $*180.5* million. Other assumed annual expenses include: state inspection fees (estimated at $*38.8* million); equipment, spare parts, and maintenance (estimated at $*74.1* million over the 40-year license); regulatory fees and license fees (estimated at $*28.2* million over the 40-year license); utilities (estimated at $*28.2* million over the 40-year license); and the disposal of low-level nuclear waste (LLW) (estimated at $*2.6* million over the 40-year license). Total expenditures for other operating costs, with contingencies, is approximately $*458.2* million.

Table 7.3-9: Assumptions for Other Operating Costs*, Discounted*

Assumptions for Other Operating Costs	*Estimated Costs (Millions $)*
Railroad Freight Fees	
Estimated cost for 675 shipments of 5 SNF transport casks by dedicated train @ $87.40 per mile round-trip; average trip length 1,824 miles	*$180.47*
State Inspection Fees	*$38.81*
Equipment, spare parts, and maintenance	*$74.09*
Regulatory fees and license fees	*$28.23*
Utilities	*$28.23*
LLW Disposal (50 cubic feet per year; $1,500 per cubic foot)	*$2.65*
Subtotal: Other Operating Costs	*$352.47*
Contingency: 30%	*$105.74*
Total: Other Operating Costs	***$458.21†***

† Total over the 40-year licensure period

Source: Derived from EPRI, 2009.

7.3.4 Labor Costs

Labor costs at the proposed facility are likely to be lower than estimated in the EPRI study, since many of the job functions identified for the CISF are currently performed by existing staff at the LLW facility located on the same site. Therefore, it was assumed that the labor requirements for the CISF would be similar to the "caretaker" status, with a reduction made to the number of administrative personnel. However, teams of two workers were included for each reactor site where fuel was being removed. *Thirty-six new employees would be hired to work at the CISF, 20 of whom would work as site security, along with new administrative staff, engineering and technical staff, and maintenance and equipment operating staff. The number of at-reactor crews employed will vary from year-to-year. During some years, there will be no canisters transported because the spent fuel is cooling. Additionally, during the first two years of the license and after Year 30, when the CISF is assumed to be at capacity, at-reactor crews will not be needed.* The estimated payroll, including the 40 percent for fringe benefits and contingency, was $*131.1* million over the 40-year period (See Table 7.3-10).

Table 7.3-10: Assumed CISF Annual Labor Costs *over 40-Year Licensure, Discounted*

Labor Categories during Caretaker Period	*Estimated Annual FTE*	*Average Cost per FTE ($000s)*	*Estimated Costs (Millions $)*
Administrative Staff: General manager, administrative assistants, public relations, financing and purchasing, accounting and payroll, governmental affairs	*3*	*$104.0*	*$10.4*
Security staff: assumes 5 staff per shift, 4 shifts, 7 days per week	*20*	*$64.1*	*$42.7*
Engineering and technical staff: Nuclear and licensing engineers, health physics managers and technicians, quality assurance managers and technicians, transportation specialist, training	*7*	*$93.2*	*$21.7*
Maintenance and equipment operating staff: Mechanical and electrical maintenance, crane and equipment operators, general plant workers, fire and EMT	*6*	*$60.4*	*$12.1*
At-reactor loading crews: 2 per site	*varies*	*$81.6*	*$6.8*
Subtotal: Labor during Caretaker	***36***		*$93.6*
Fringe benefits and contingency: 40%			*$37.5*
Total Annual Labor Costs			*$131.1*

Source: Derived from EPRI, 2009.

7.4 DISCUSSION AND SUMMARY

7.4.1 Proposed Action Alternative

Implementation of the proposed action is assumed to create a number of economic benefits, two of which were quantifiable with existing information. The first quantifiable benefit would be the avoided reimbursements to power plant operators for storing spent fuel the government is obligated to dispose of under the NWPA. Because the federal government does not have a storage or disposal facility for spent nuclear fuel, the DOE has been successfully sued by plant operators to reimburse them for their storage costs. The estimated benefit of the proposed action was measured as the cost of continuing to reimburse operators of shutdown plants for storing spent nuclear fuel over the next 40 years under a "no action" scenario and subtracting the reduced reimbursement schedule, if the CISF is built. Based upon the very conservative assumptions in this benefit-cost analysis, the proposed action would create a benefit to the federal government of $*6,695,763,515*, as shown in Table 7.4-1. The second quantifiable benefit was the value of land at shutdown nuclear power plants that is currently undevelopable. The overall value of land that could be returned to an economic use, if the site's spent fuel was removed, was estimated to be worth $*766,819,521*. The total economic benefits from implementing the proposed action are $*7,462,583,036*.

Table 7.4-1: Summary of Quantified Benefits from CISF over 40-Year Licensure, *Discounted*

Benefit Category	***Cost Estimate (Millions $)***
Avoided Reimbursements to Utilities for Storing Spent Fuel	*$6,696*
Value of Land Potentially Returned to Economic Use	*$767*
Total Benefit	***$7,463***

A summary of the estimated economic costs of the proposed action, which were discussed in Section 7.3 and detailed in Tables 7.3-1 through 7.3-10, is provided in Table 7.4-2. The figures demonstrate various costs to build and operate the CISF facility, as well as to transfer the spent nuclear fuel from the shutdown nuclear power plants. Table 7.4-2 also includes an estimate of

the decommissioning costs, which is $*270.9* million. EPRI's cost estimate of site decommissioning is based upon 20 percent of the cost for the fuel storage facility ($*84.4* million) and 20 percent of the cost for the concrete overpacks ($*171.6* million), plus a 30 percent contingency *and discounted from Year 40 of the license*. Cumulatively, over the 40-year license period, the assumed cost of the proposed action was approximately *$4,436,887,589*. *Table 7.4-3 provides the detailed costs estimates for a Phase 1 only facility. The total estimated cost for a Phase 1 facility would be $1,245,559,274 in discounted dollars. It would store 406 canisters or 4,751 MTUs transported over a seven-year period, assuming three operating trains. This number of canisters would remove all SNF from nine shutdown power plants and 17 canisters of existing GTCC waste.*

Table 7.4-2: Summary of Costs for CISF over 40-Year Licensure, Discounted

(2 pages)

Year	Design, Engineering, Licensing and Startup Professional Services	Transport-ation Infra-structure	CISF Infra-structure	Fuel Storage Facility	Admin-istrative Operating Costs	Concrete Overpacks	On-site Transportation Planning and Transportation Costs	Other: Transport-ation, License Fees	Annual Operating Labor Costs	Total Costs for CISF over 40-Year Licensure
1	$39,238,739	$71,962,937	$25,479,700	$10,018,343	$1,515,009	$0	$10,894,024	$6,714,245	$3,652,592	$169,475,590
2	$38,859,254	$217,210,816	$11,457,274	$13,408,079	$1,500,357	$0	$25,300,146	$6,649,311	$3,617,267	$318,002,504
3	$0	$186,406,267	$0	$3,376,925	$1,511,849	$7,429,235	$40,458,644	$8,617,643	$3,806,304	$251,606,868
4	$0	$0	$0	$13,377,065	$1,574,481	$29,429,543	$56,268,033	$14,573,242	$3,769,492	$118,991,857
5	$0	$0	$0	$22,653,555	$1,630,659	$49,837,822	$56,633,888	$20,014,138	$4,392,161	$155,162,222
6	$0	$0	$0	$0	$1,443,153	$0	$11,024,560	$6,395,791	$4,567,266	$23,430,771
7	$0	$0	$0	$0	$1,429,196	$0	$12,217,209	$6,333,937	$3,445,702	$23,426,043
8	$0	$0	$0	$14,153,740	$1,524,358	$31,138,227	$46,196,699	$14,792,099	$3,412,378	$111,217,499
9	$0	$0	$0	$0	$1,401,686	$0	$31,450,736	$6,212,016	$3,590,707	$42,655,144
10	$0	$0	$0	$13,881,297	$1,495,016	$30,538,853	$69,039,789	$14,507,368	$3,346,693	$132,809,015
11	$0	$0	$0	$28,189,259	$1,567,163	$54,988,192	$86,649,048	$21,137,211	$3,521,590	$196,052,464
12	$0	$0	$0	$16,089,388	$1,485,298	$35,396,655	$62,261,329	$15,718,045	$3,692,791	$134,643,506
13	$0	$0	$0	$13,482,434	$1,452,058	$29,661,354	$45,231,284	$14,090,516	$3,657,077	$107,574,723
14	$0	$0	$0	$13,352,042	$1,438,015	$29,374,493	$33,380,106	$13,954,244	$3,420,401	$94,919,302
15	$0	$0	$0	$0	$1,322,291	$0	$10,101,271	$5,860,154	$3,387,322	$20,671,039
16	$0	$0	$0	$0	$1,309,503	$0	$29,382,364	$5,803,480	$3,157,130	$39,652,477
17	$0	$0	$0	$12,968,387	$1,396,695	$28,530,451	$54,592,523	$13,553,285	$3,126,596	$114,167,937
18	$0	$0	$0	$23,350,850	$1,464,098	$51,371,869	$69,971,969	$19,747,113	$3,289,991	$169,195,890
19	$0	$0	$0	$2,312,502	$1,289,682	$5,087,504	$34,319,351	$7,028,665	$3,449,933	$53,487,637
20	$0	$0	$0	$12,595,755	$1,356,563	$27,710,662	$68,769,242	$13,163,847	$3,226,663	$126,822,731
21	$0	$0	$11,453,344	$25,578,663	$1,422,029	$49,895,758	$89,287,623	$19,179,702	$3,195,457	$200,012,576
22	$0	$0	$0	$22,460,549	$1,408,276	$49,413,207	$87,301,079	$18,994,212	$3,350,803	$182,928,125
23	$0	$0	$0	$16,682,496	$1,351,838	$36,701,492	$77,914,901	$15,463,340	$3,502,845	$151,616,913
24	$0	$0	$0	$22,028,209	$1,381,169	$48,462,061	$90,929,003	$18,628,596	$3,286,304	$184,715,341
25	$0	$0	$0	$21,815,171	$1,367,811	$47,993,375	$90,049,612	$18,448,435	$3,254,521	$182,928,926
26	$0	$0	$0	$21,604,192	$1,354,583	$47,529,223	$89,178,726	$18,270,017	$3,402,195	$181,338,936
27	$0	$0	$0	$21,395,254	$1,341,482	$47,069,559	$88,316,263	$18,093,325	$3,369,292	$179,585,174

Table 7.4-2: Summary of Costs for CISF over 40-Year Licensure, Discounted

(2 pages)

Year	Design, Engineering, Licensing and Startup Professional Services	Transport-ation Infra-structure	CISF Infra-structure	Fuel Storage Facility	Admin-istrative Operating Costs	Concrete Overpacks	On-site Transportation Planning and Transportation Costs	Other: Transport-ation, License Fees	Annual Operating Labor Costs	Total Costs for CISF over 40-Year Licensure
28	$0	$0	$0	$21,188,337	$1,328,509	$46,614,341	$79,928,230	$17,918,341	$3,336,707	$170,314,464
29	$0	$0	$0	$20,983,421	$1,315,660	$46,163,525	$63,125,538	$17,745,049	$3,304,437	$152,637,630
30	$0	$0	$0	$12,468,292	$1,238,933	$27,430,242	$31,170,729	$12,570,158	$3,100,161	$87,978,513
31	$0	$0	$0	$2,630,319	$1,131,873	$0	$0	$5,016,257	$3,070,179	$11,848,628
32	$0	$0	$0	$0	$1,120,927	$0	$0	$4,967,743	$2,702,484	$8,791,154
33	$0	$0	$0	$0	$1,110,086	$0	$0	$4,919,700	$2,676,348	$8,706,133
34	$0	$0	$0	$0	$1,099,350	$0	$0	$4,872,120	$2,650,464	$8,621,935
35	$0	$0	$0	$0	$1,088,718	$0	$0	$4,825,001	$2,624,831	$8,538,550
36	$0	$0	$0	$0	$1,078,189	$0	$0	$4,778,338	$2,599,446	$8,455,972
37	$0	$0	$0	$0	$1,067,762	$0	$0	$4,732,125	$2,574,306	$8,374,193
38	$0	$0	$0	$0	$1,057,435	$0	$0	$4,686,360	$2,549,410	$8,293,205
39	$0	$0	$0	$0	$1,047,208	$0	$0	$4,641,038	$2,524,754	$8,213,000
40	$0	$0	$0	$0	$1,037,081	$0	$0	$4,596,153	$2,500,336	$8,133,570
Subtotal	**$78,097,992**	**$475,580,021**	**$48,390,319**	**$422,044,524**	**$53,456,051**	**$857,767,641**	**$1,641,343,919**	**$458,212,359**	**$131,105,332**	**$4,165,998,158**
								Decommissioning		**$270,889,431**
								COSTS - GRAND TOTAL		**$4,436,887,589**

Table 7.4-3: Estimated Costs to Operate Phase 1 of the Proposed Action over 40-Year Licensure, Discounted

(2 pages)

Year	Design, Engineering, Licensing and Startup Professional Services	Transport-ation Infra-structure	CISF Infra-structure	Fuel Storage Facility	Admin-istrative Operating Costs	Concrete Overpacks	On-site Transportation Planning and Transportation Costs	Other: Transport-ation, License Fees	Annual Operating Labor Costs	Total Costs for CISF over 40-Year Licensure
1	$39,238,739	$71,962,937	$25,479,700	$10,018,343	$1,515,009	$0	$5,483,646	$6,714,245	$3,652,592	$164,065,212
2	$38,859,254	$138,101,068	$11,457,274	$13,408,079	$1,500,357	$0	$18,890,804	$6,649,311	$3,617,267	$232,483,413
3	$0	$0	$0	$3,512,002	$1,517,050	$7,726,405	$31,406,308	$9,024,171	$3,806,304	$56,992,239
4	$0	$0	$0	$12,039,359	$1,564,180	$26,486,589	$51,168,170	$13,768,050	$4,435,053	$109,461,400
5	$0	$0	$0	$11,922,924	$1,549,053	$26,230,432	$41,586,664	$13,634,897	$4,172,453	$99,096,423
6	$0	$0	$0	$11,807,615	$1,534,072	$25,976,753	$38,517,808	$13,503,031	$4,132,100	$95,471,379
7	$0	$0	$0	$0	$1,429,196	$0	$12,233,734	$6,333,937	$3,445,702	$23,442,568
8	$0	$0	$0	$11,580,332	$1,504,543	$25,476,731	$30,921,382	$13,243,114	$3,625,772	$86,351,874
9	$0	$0	$0	$2,548,519	$1,421,309	$5,606,742	$6,371,298	$7,746,021	$3,590,707	$27,284,597
10	$0	$0	$0	$0	$1,388,130	$0	$0	$6,151,938	$3,346,693	$10,886,761
11	$0	$0	$0	$3,194,627	$1,374,705	$0	$0	$6,092,442	$3,314,327	$13,976,100
12	$0	$0	$0	$0	$1,361,410	$0	$0	$6,033,521	$3,282,273	$10,677,204
13	$0	$0	$0	$0	$1,348,243	$0	$0	$5,975,169	$3,250,530	$10,573,943
14	$0	$0	$0	$0	$1,335,204	$0	$0	$5,917,382	$3,219,093	$10,471,680
15	$0	$0	$0	$0	$1,322,291	$0	$0	$5,860,154	$3,187,961	$10,370,407
16	$0	$0	$0	$0	$1,309,503	$0	$0	$5,803,480	$3,157,130	$10,270,113
17	$0	$0	$0	$0	$1,296,839	$0	$0	$5,747,353	$3,126,596	$10,170,788
18	$0	$0	$0	$0	$1,284,297	$0	$0	$5,691,770	$3,096,359	$10,072,425
19	$0	$0	$0	$0	$1,271,876	$0	$0	$5,636,723	$3,066,413	$9,975,013
20	$0	$0	$0	$0	$1,259,576	$0	$0	$5,582,210	$3,036,757	$9,878,543
21	$0	$0	$11,453,344	$2,898,773	$1,247,394	$0	$0	$5,528,223	$3,007,388	$24,135,123
22	$0	$0	$0	$0	$1,235,330	$0	$0	$5,474,759	$2,978,303	$9,688,392
23	$0	$0	$0	$0	$1,223,383	$0	$0	$5,421,811	$2,949,500	$9,594,694
24	$0	$0	$0	$0	$1,211,552	$0	$0	$5,369,376	$2,920,974	$9,501,902
25	$0	$0	$0	$0	$1,199,834	$0	$0	$5,317,448	$2,892,725	$9,410,007
26	$0	$0	$0	$0	$1,188,231	$0	$0	$5,266,022	$2,864,749	$9,319,002
27	$0	$0	$0	$0	$1,176,739	$0	$0	$5,215,093	$2,837,044	$9,228,876

Table 7.4-3: Estimated Costs to Operate Phase 1 of the Proposed Action over 40-Year Licensure, Discounted

(2 pages)

Year	Design, Engineering, Licensing and Startup Professional Services	Transport-ation Infra-structure	CISF Infra-structure	Fuel Storage Facility	Admin-istrative Operating Costs	Concrete Overpacks	On-site Transportation Planning and Transportation Costs	Other: Transport-ation, License Fees	Annual Operating Labor Costs	Total Costs for CISF over 40-Year Licensure
28	$0	$0	$0	$0	$1,165,359	$0	$0	$5,164,657	$2,809,606	$9,139,622
29	$0	$0	$0	$0	$1,154,088	$0	$0	$5,114,709	$2,782,434	$9,051,231
30	$0	$0	$0	$0	$1,142,927	$0	$0	$5,065,243	$2,755,524	$8,963,695
31	$0	$0	$0	$2,630,319	$1,131,873	$0	$0	$5,016,257	$2,728,875	$11,507,324
32	$0	$0	$0	$0	$1,120,927	$0	$0	$4,967,743	$2,702,484	$8,791,154
33	$0	$0	$0	$0	$1,110,086	$0	$0	$4,919,700	$2,676,348	$8,706,133
34	$0	$0	$0	$0	$1,099,350	$0	$0	$4,872,120	$2,650,464	$8,621,935
35	$0	$0	$0	$0	$1,088,718	$0	$0	$4,825,001	$2,624,831	$8,538,550
36	$0	$0	$0	$0	$1,078,189	$0	$0	$4,778,338	$2,599,446	$8,455,972
37	$0	$0	$0	$0	$1,067,762	$0	$0	$4,732,125	$2,574,306	$8,374,193
38	$0	$0	$0	$0	$1,057,435	$0	$0	$4,686,360	$2,549,410	$8,293,205
39	$0	$0	$0	$0	$1,047,208	$0	$0	$4,641,038	$2,524,754	$8,213,000
40	$0	$0	$0	$0	$1,037,081	$0	$0	$4,596,153	$2,500,336	$8,133,570
Subtotal	**$78,097,992**	**$210,064,006**	**$48,390,319**	**$85,560,892**	**$50,870,307**	**$117,503,653**	**$236,579,815**	**$256,081,095**	**$124,491,583**	**$1,207,639,661**
								Decommissioning		**$37,919,613**
								COSTS - GRAND TOTAL		**$1,245,559,274**

Considering both the benefits to the federal government in avoiding liability costs and the land value, the net benefit of the proposed action would be $3.0 billion or a benefit-cost (B/C) ratio of 1.68 (see Table 7.4-4). Only implementing Phase 1 of the CISF would produce a net benefit of $1.6 billion and a C/B ratio of 2.32. If only Phase 1 were implemented and it was assumed that no other reactors were shut down, the net benefit of Phase 1 would also be $1.6 billion and the C/B ratio would be 2.32. Table 7.4-5 shows the total benefits, costs, and C/B ratios, if the market value of the land is not assumed in the analysis. Without the benefits from the re-purposed land, the project would still create positive economic benefits and only modestly lower B/C ratios that are well above 1.0.

Table 7.4-4: Summary of Benefit Cost Analysis Assuming Market Value of Land, Discounted

SCENARIO	BENEFITS			Cost of Facility Construction, Operations, and Decommissioning	Benefit/ Cost Ratio
	Spent Fuel Storage Costs Avoided	Market Value of Land	Total Benefits		
Phase 1 Only	*$2,671,144,991*	*$215,485,165*	*$2,886,630,156*	*$1,245,559,274*	*2.32*
Phase 1 Only, No Other Reactors Shut Down	*$2,671,144,991*	*$215,485,165*	*$2,886,630,156*	*$1,245,559,274*	*2.32*
Proposed Action	*$6,695,763,515*	*$766,819,521*	*$7,462,583,036*	*$4,436,887,589*	*1.68*

Table 7.4-5: Summary of Benefit Cost Analysis without Including Market Value of Land, Discounted

SCENARIO	*BENEFITS Spent Fuel Storage Costs Avoided*	*Cost of Facility Construction, Operations, and Decommissioning*	*Benefit/ Cost Ratio*
Phase 1 Only	*$2,671,144,991*	*$1,245,559,274*	*2.14*
Phase 1 Only, No Other Reactors Shut Down	*$2,671,144,991*	*$1,245,559,274*	*2.14*
Proposed Action	*$6,695,763,515*	*$4,436,887,589*	*1.51*

7.4.2 Eliminated Alternatives

In addition to the location in Andrews County, three other locations were considered for the proposed CISF, but eliminated as viable alternatives. These locations were in: Loving County, TX; Lea County, NM, and Eddy County, NM. It is assumed that implementing a CISF at one of the three eliminated alternative locations would create the same overall benefits as the proposed alternative and all the same expenses. The eliminated alternatives would also require additional expenditures that would not be required for the proposed alternative. Specifically, these additional costs would be: construction of an operations and maintenance building that was not assumed for the proposed action alternative, because an existing building at the site would be used; a larger number of staff, since there would be no existing staff to handle some tasks; and additional road and rail infrastructure that would be needed for a greenfield facility. The cost of the operations and maintenance building was estimated to be $*12.54* million based upon EPRI estimates, adjusted by the CPI, contingency costs, and assuming that the building's furnishings and equipment would require a one-time replacement over the 40-year license period (See Table *7.4-6*).

Table 7.4-6: Estimated Costs of an Operations and Maintenance Building at an Eliminated Alternative Site, Discounted

CISF Capital Cost Elements	***Cost Estimate Millions $***
Operations and Maintenance Building	
Building construction	*$1.97*
Furnishings, equipment (with one-time replacement)	*$2.32*
Heavy lifting equipment (with one-time replacement)	*$5.35*
Subtotal: Operations and Maintenance Building	***$9.64***
Contingency: 30%	***$2.89***
Total: Operations and Maintenance Building	***$12.54***

Source: Derived from EPRI, 2009.

The assumed labor force required to handle activities at the eliminated alternative sites was *67* full-time employees (FTEs) (See Table *7.4-7*). The eliminated alternative sites would require more administrative staff, engineering and technical staff, and maintenance and operating staff than the proposed alternative. *The total discounted labor cost over the 40-year licensure is estimated to be $249.5 million.*

Table 7.4-7: Assumed CISF Annual Labor Costs for Alternative Locations over 40-Year Licensure, Discounted

Labor Categories during Caretaker Period	*Estimated Annual FTE*	*Average Cost per FTE (Thousands $)*	*Estimated Costs (Millions $)*
Administrative Staff: General manager, administrative assistants, public relations, financing and purchasing, accounting and payroll, governmental affairs	*10*	*$104.0*	*$34.6*
Security staff: assumes 5 staff per shift, 4 shifts, 7 days per week	*20*	*$64.1*	*$42.7*
Engineering and technical staff: Nuclear and licensing engineers, health physics managers and technicians, quality assurance managers and technicians, transportation specialist, training	*18*	*$93.2*	*$55.9*
Maintenance and equipment operating staff: Mechanical and electrical maintenance, crane and equipment operators, general plant workers, fire and EMT	*19*	*$60.4*	*$38.2*
At-reactor loading crews: 2 per site	*Varies*	*$81.6*	*$6.8*
Subtotal: Labor during Caretaker	***67***		***$178.2***
Fringe benefits and contingency: 40%			***$71.3***
Total Labor Costs			***$249.5***

Specific sites for the rejected alternative CISFs were not identified, so generic locations were chosen to estimate the costs of transportation infrastructure. Table *7.4-8* shows the assumed distance and the estimated cost of connecting the eliminated alternative sites to the existing rail and road network, as well as constructing the transportation infrastructure within the facility. It assumed that the Loving County and Eddy County facilities would be connected directly to the Union Pacific TP line, while the Lea County facility would likely be connected and located in close proximity to the TNMR.

Table 7.4-8: Estimated Distances and Costs of Transportation Infrastructure Required for the Eliminated Alternatives, Discounted

	Loving County, TX	***Lea County, NM***	***Eddy County, NM***
Rail Distance	*35 miles*	*4 miles*	*56 miles*
Rail Cost @ $1.59 million per mile and 30% contingency	*$72.0 million*	*$8.2 million*	*$115.7 million*
Road Distance	*4 miles* *2 lanes*	*4 miles* *2 lanes*	*4 miles* *2 lanes*
Road cost @ $6.36 million per lane and 30% contingency	*$66.1 million*	*$66.1 million*	*$66.1 million*

The final costs of the eliminated alternatives shown in Table *7.4-9* are moderately higher than the proposed alternative, ranging from $*4.64* billion to $*4.75* billion.

Table 7.4-9: Summary of Costs for Eliminated Alternative CISFs over 40-Year Licensure, Discounted

Cost Category	***Cost Estimate (Millions $)***		
	Loving County, TX	***Lea County, NM***	***Eddy County, NM***
Design, Engineering, Licensing and Startup Professional Services	*$78.10*	*$78.10*	*$78.10*
Transportation Infrastructure	*$613.38*	*$549.58*	*$656.48*
CISF Infrastructure	*$60.93*	*$60.93*	*$60.93*
Fuel Storage Facility	*$422.04*	*$422.04*	*$422.04*
Administrative Operating Costs	*$53.46*	*$53.46*	*$53.46*
Concrete Overpacks	*$857.77*	*$857.77*	*$857.77*
On-site Transportation Planning and Transportation Costs	*$1,641.34*	*$1,641.34*	*$1,641.34*
Other: Transportation, License Fees	*$458.21*	*$458.21*	*$458.21*
Annual Operating Labor Costs	*$249.48*	*$249.48*	*$249.48*
Decommissioning	*$270.89*	*$270.89*	*$270.89*
Total Costs for CISF over 40-Year Licensure	***$4,705.60***	***$4,641.80***	***$4,748.70***

7.5 ENVIRONMENTAL BENEFITS AND COSTS

If the No Action alternative is selected, spent nuclear fuel would remain in storage at decommissioned reactors, which would result in ongoing and escalating costs of storing and managing the spent fuel at existing reactor sites. Benefits to reactor site communities would not occur, if consolidated interim spent fuel storage continues to be unavailable.

7.5.1 Environmental Benefits of the Proposed Action

Because there are economies of scale with the proposed action, a CISF could incorporate and maintain more sophisticated security, lighting, and intrusion detection equipment and maintain a larger and more highly trained security force to safeguard the spent nuclear fuel. Finally, because there is a relatively low population density surrounding the proposed CISF and the geological characteristics of the preferred site minimize the likelihood of harm to the natural environment, if a highly unlikely incident were to occur, a smaller population and fewer natural resources would be affected than at many of the decommissioned plant sites.

Under the proposed action, the CISF would also benefit the local economy through employment opportunities associated with the construction and operation of the proposed CISF. As detailed in Chapter 4 (and in the Socioeconomic Impact Assessment appendix), the socioeconomic model estimates that the CISF would create 912 person-years of employment over a ten-year period through the direct, indirect, and induced effects of the facility's operations. Additional financial resources for ISP would offer expanded opportunities for local social, educational, and economic development. Various tax benefits would accrue to state and local governments, based on the economic activity associated with constructing the CISF facility. Overall, anticipated state and local tax revenues that would result from the WCS CISF facility would have a moderate, positive impact on the overall county tax revenues, based on recent data.

7.5.2 Environmental Costs of the Proposed Action

The environmental costs of the proposed action that are directly related to the potential environmental impacts of the proposed action are discussed extensively in Chapter 4. A few key environmental costs are discussed below.

Industrial construction at the CISF site would create a short-term risk with regard to a variety of operations and constituents used in construction activities. Best Management Practices (BMPs) would assure storm water runoff related to construction activities would be detained prior to release to the surrounding land surface. BMPs would also be used for dust control associated with excavation and fill operations during construction. Impact from storm water runoff generated during plant operations is not expected to differ substantially from impacts currently experienced at the site. The water quality of the discharge from the site storm water detention basin would be typical of runoff from building roofs and paved areas from any industrial facility. Except for small amounts of oil and grease typically found in runoff from paved roadways and parking areas, the discharge is not expected to contain contaminants.

The CISF would be designed and constructed in manner that would minimize the quantity of radioactive wastes and contaminated equipment, and facilitate the removal of radioactive wastes and contaminated materials at the time the CISF is permanently decommissioned pursuant to 10 CFR 72.130, “Criteria for decommissioning.”

The environmental impacts to the affected areas would be attributable to radiation doses received by members of the public along the transportation routes. Over the next several years, the DOE is expected to commission new transportation systems desirable for transportation of SNF from existing commercial reactor sites, including the shutdown reactor sites, to a CISF or a permanent geologic repository. Other environmental impacts would be attributable to upgrades that would be required to the railroads, roads, or barge docks and channels leading from the former reactor sites to a CISF or a geologic repository. The connected environmental impacts potentially associated with the transportation of SNF and upgrades required to support the removal of SNF from the shutdown and decommissioned reactor sites are discussed in Section 4.2.

Several practices and procedures have been designed to minimize adverse impacts to the ecological resources of the proposed CISF. These practices and procedures include the use of BMPs, minimizing the construction footprint to the extent possible, avoiding all direct discharge

(including storm water) to any waters of the United States, the protection of all undisturbed naturalized areas, and site stabilization practices to reduce the potential for erosion and sedimentation. The use of native plant species to re-vegetate disturbed areas will enhance and maximize the opportunity for native wildlife habitat to be reestablished at the site.

The other location sites for a proposed CISF discussed in Chapter 2 would experience similar environmental costs and benefits as those described here. However, with regard to costs, the proposed green field sites themselves would experience greater environmental impacts when compared to the WCS CISF, where substantial infrastructure currently exists. This site infrastructure would support the additional proposed permitted use on part of the site controlled by Waste Control Specialists. Environmental costs from establishing a new CISF site on previously undeveloped land would potentially result in higher impacts to ecological and cultural resources when compared to the WCS CISF. Additionally, a greenfield site would potentially take longer to develop due to an extended environmental review, uncertainties in permitting and more extensive construction work. These potential delays in facility commissioning and operation could result in delays or reductions in the avoided federal government liability costs (at least in the near term) from removing spent nuclear fuel from shutdown sites.

7.6 ENVIRONMENTAL BENEFITS AND COSTS AT EVALUATED ALTERNATIVE SITES

Environmental impacts of developing the WCS CISF site versus the alternative sites in Loving County, Lea County, or Eddy County were analyzed in Chapter 2 and summarized in Table 2.3-3. With respect to environmental benefits and costs, there are both similarities and differences among the sites considered.

The full process of relocating SNF includes current storage sites and alternative CISF sites. For any CISF location selected, once the site is opened, key beneficiaries would include the decommissioned and other power plants that could begin to move their SNF to the CISF, which could potentially open up some land area to redevelopment.

The socioeconomic benefits that would occur at any of the alternative site locations would be similar in terms of direct, indirect, and induced economic benefits. Both the construction and operations phases of the CISF would bring economic benefits to the host community to the extent that some labor and materials could be sourced locally. The Andrews County CISF site already has some infrastructure and personnel on site, so the potential economic benefits to the other sites in Lea County, Loving County, and Eddy County could be slightly higher because

more infrastructure and more construction and specialty labor would be utilized for site mobilization. Construction and operational labor force considerations, along with community amenities, for all four sites were summarized in Table 2.3-2. Substantially fewer labor resources and community amenities would be available for the Loving County site, making the site more challenging to develop.

Another key component of the operational comparison was transportation routes. Andrews County was followed by Eddy County then Lea County when assessed for site railhead, access to highways, traffic capacity, and efficient access. Loving County had the least transportation infrastructure to support development of the CISF. Any new transportation infrastructure required to transport SNF from the source sites to a CISF would have additional environmental impacts or costs.

For areas where criteria differed from site to site, a brief summary is shown below. Each of the alternative sites received equal ratings with regard to no RAD contamination, not CERCLA or RCRA, no remediation needed, floodplains, ponding, environmental permits, facility discharges, and airports. All sites were considered equal in terms of air quality and ease of decommissioning. For a more in-depth discussion of these environmental considerations see Chapter 2.0. The discussion for each alternative site in Table 7.5-1 provides a brief, relative, and qualitative description of the potential for costs to be incurred for the site with respect to addressing the particular criterion. The score that each site received in Table 2.3-3 is included here and where a site received lower than a 10, the potential costs associated with addressing that issue are briefly described.

Table 7.6-1 Screening Matrix Results: Environmental Selection Summary and Potential Environmental Costs

Criterion	Sub-Criteria	Andrews County	Loving County	Lea County	Eddy County
Criterion 11 - Environmental Protection	Existing Site Characterization Data - It is highly preferable that site characterization surveys are available for hydrology, meteorology (rain, wind, tornadoes, temperatures, etc.), topography, archeology and protected species.	10	1 – substantial costs would be required to characterize site data	6 - some costs would be required to characterize site data	6 - some costs would be required to characterize site data
	Documentation - It is highly preferable that the site have existing, well-documented site surveys and monitoring studies for radiological, chemical, and hazardous material contamination, and that the site not be contaminated.	10	3 - substantial costs would be required to document absence of contamination at site	9 – limited costs would be required to document absence of contamination at site	5 - some costs would be required to document absence of contamination at site
	Neighboring Plume- Within the area that includes the site, it is highly preferable that no facility has existing release plumes (air or water) of hazardous material or radiation.	10	10	8 – some indication of existing release plumes; costs would be incurred to evaluate	10

Criterion	Sub-Criteria	Andrews County	Loving County	Lea County	Eddy County
Criterion 11 - Environmental Protection	Future Migration The potential for future migration of contamination from adjoining or nearby sites should be negligible.	10	10	8 – some potential for migration of contamination; costs would be incurred to evaluate	10
	Protected Species - The site should not be habitat for protected species (USFWS federally listed threatened or endangered species). Also, adjacent properties should have no areas designated as wildlife refuges, critical habitat, or vegetation such as rare plant species that would be adversely affected by the facility.	10	10	8 – some potential cost to assess wildlife and vegetation conditions	10
	Archeological and Cultural Resources - The site should have a low probability of containing archeological/cultural resources.	10	5 – some costs would be incurred to determine the potential for site to contain archeological/ cultural resources	5 - some costs would be incurred to determine the potential for site to contain archeological/ cultural resources	5 - some costs would be incurred to determine the potential for site to contain archeological/ cultural resources
	Environmental Justice - The site should have a low probability of disproportionate, adverse impacts to low-income or minority communities.	10	7 Limited costs would need to be invested to initiate EJ investigations.	7 Limited costs would need to be invested to initiate EJ investigations.	7 Limited costs would need to be invested to initiate EJ investigations.

Criterion	Sub-Criteria	Andrews County	Loving County	Lea County	Eddy County
Criterion 12 - Discharge Routes	Differentiation - For sites with extant nuclear facilities, facility discharges are readily identifiable from extant facility discharges.	9 – some costs potentially associated with addressing discharges	10	10	10
Criterion 13 - Proximity of Hazardous Operations/ High-Risk Facilities	Hazardous Chemical Sites - ISP will consider the distance of the site from any facility storing, handling, or processing large quantities of hazardous chemicals.	8 – proximity to NEF uranium hexafluoride plant poses minimal risks	10	10	10
	Gas Pipelines - ISP will consider the distance of the site from one or more large propane or natural gas pipelines.	10	10	8 – potential cost/risk associated with proximity to natural gas transmission pipeline	8 -potential cost/risk associated with proximity to WIPP
	Emergency Area - The site should be outside the general emergency area for any nearby hazardous operations facility (other than an extant nuclear-related facility).	8 –Some costs could be incurred addressing adjacency to NEF	10	10	10
Criterion 14 - Ease of Decommissioning	Adjacent Site's Medium/Long-Term Plans - It is desirable that planned major construction and heavy industrial activities in adjacent sites within 1.6 km (1 mi) of the site boundary are minimal over the reasonably anticipated period of CISF decommissioning.	8 – some costs may be incurred associated with accommodating major construction projects within one mile of the site	10	10	10

Criterion	Sub-Criteria	Andrews County	Loving County	Lea County	Eddy County
Criterion 15 - Disposal of LLRW	Proximity to and Availability of Disposal Options - Site-specific issues (e.g., availability/access to nearby facilities for disposal of low-level waste, transportation modes, etc.) do not impede disposal of low-level waste.	10	8 – some costs could be incurred associated with preparing to handle LLRW	8 - some costs could be incurred associated with preparing to handle LLRW	8 - some costs could be incurred associated with preparing to handle LLRW

7.7 TABLES OF UNDISCOUNTED VALUES

The values reported throughout chapter 7.0, except Section 7.7, are based upon 2018 dollars that were adjusted for future inflation and then calculated at net present value. The Tables in this Section provide unadjusted cost estimates in 2018 dollars for comparison purposes. Table 7.7-1 gives cross-references between the Tables in Section 7.2, 7.3 and 7.4, including Figure 7.2-1, and those included in Section 7.7.

Table 7.7-1: Crosswalk for Discounted and Not Discounted Tables in Chapter 7

Not Discounted Table Number	***Discounted Table Number***
7.7-2	*Table 7.2-2: Estimated Net Benefits of the Proposed Action, Discounted*
7.7-3	*Table 7.2-6: Assumed Storage Costs by Facility of No Action, Discounted*
7.7-4	*Table7.2-7: Assumed Storage Costs by Facility of Proposed Action, Discounted*
7.7-5	*Table 7.2-8: Assumed Storage Costs by Facility of No Action – Phase 1 Only, Discounted*
7.7-6	*Table 7.2-9: Assumed Storage Costs by Facility of Proposed Action – Phase 1 Only, Discounted*
7.7-7	*Table 7-2.10: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Discounted*
7.7-8	*Table 7.2-11: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Discounted*
7.7-9	*Table 7.2-14: Total Estimated Value of Land at Decommissioned Nuclear Power Plants Served by the Proposed Action, Discounted*
7.7-10	*Table 7.3-1: CISF Design, Engineering, Licensing, and Startup Professional Services, Discounted*
7.7-11	*Table 7.3-2: Estimated Costs of Transportation Infrastructure, Discounted*
7.7-12	*Table 7.3-3: Estimated Costs of CISF Infrastructure, Discounted*
7.7-13	*Table 7.3-4: Spent Fuel Storage Facility Costs, Discounted*
7.7-14	*Table 7.3-5: Administrative Operating Costs, Discounted*
7.7-15	*Table 7.3-6: Costs for Concrete Overpack, Discounted*
7.7-16	*Table 7.3-7: Assumed On-site Transportation Planning and Transport Costs, Discounted*
7.7-17	*Table 7.3-9: Assumptions for Other Operating Costs, Discounted*
7.7-18	*Table 7.3-10: Assumed CISF Annual Labor Cost over 40-Year Licensure, Discounted*
7.7-19	*Table 7.4-1: Summary of Quantified Benefits from CISF over 40-Year Licensure, Discounted*
7.7-20	*Table 7.4-2: Summary of Costs for CISF over 40-Year Licensure, Discounted*
7.7-21	*Table 7.4-3: Estimated Costs to Operate Phase 1 of the Proposed Action over 40-Year Licensure, Discounted*
7.7-22	*Table 7.4-4: Summary of Benefit Cost Analysis Assuming Market Value of Land, Discounted*
7.7-23	*Table 7.4-5: Summary of Benefit Cost Analysis without Including Market Value of Land, Discounted*
7.7-24	*Table 7.4-6: Estimated Costs of an Operations and Maintenance Building at an Eliminated Alternative Site, Discounted*
7.7-25	*Table 7.4-7: Assumed CISF Annual Labor Costs for Alternative Locations over 40-Year Licensure, Discounted*
7.7-26	*Table 7.4-8: Estimated Distances and Costs of Transportation Infrastructure Required for the Eliminated Alternatives, Discounted*
7.7-27	*Table 7.4-9: Summary of Costs for Eliminated Alternative CISFs over 40-Year Licensure, Discounted*
Not Discounted Figure Number	***Discounted Figure Number***
7.7-1	*Figure 7.2-1: Federal Expenditures No Action Scenario vs. Proposed Action Scenario, Discounted*

Table 7.7-2: Estimated Net Benefits of the Proposed Action, Not Discounted (2018 $)

Year	No Action SNF Storage Costs	Proposed Action SNF Storage Costs	Net Benefits of Proposed Action
1	$114,555,924	$114,555,924	$0
2	$114,555,924	$114,555,924	$0
3	$124,102,251	$124,102,251	$0
4	$124,102,251	$124,102,251	$0
5	$133,648,578	$101,827,488	$31,821,090
6	$152,741,232	$67,884,992	$84,856,240
7	$162,287,559	$77,431,319	$84,856,240
8	$171,833,886	$86,977,646	$84,856,240
9	$181,380,213	$85,916,943	$95,463,270
10	$181,380,213	$85,916,943	$95,463,270
11	$181,380,213	$75,309,913	$106,070,300
12	$190,926,540	$74,249,210	$116,677,330
13	$210,019,194	$72,127,804	$137,891,390
14	$210,019,194	$61,520,774	$148,498,420
15	$219,565,521	$60,460,071	$159,105,450
16	$238,658,175	$79,552,725	$159,105,450
17	$257,750,829	$98,645,379	$159,105,450
18	$267,297,156	$97,584,676	$169,712,480
19	$286,389,810	$106,070,300	$180,319,510
20	$324,575,118	$133,648,578	$190,926,540
21	$372,306,753	$170,773,183	$201,533,570
22	$372,306,753	$160,166,153	$212,140,600
23	$381,853,080	$148,498,420	$233,354,660
24	$381,853,080	$127,284,360	$254,568,720
25	$381,853,080	$116,677,330	$265,175,750
26	$381,853,080	$95,463,270	$286,389,810
27	$381,853,080	$74,249,210	$307,603,870
28	$381,853,080	$53,035,150	$328,817,930
29	$381,853,080	$31,821,090	$350,031,990
30	$381,853,080	$21,214,060	$360,639,020
31	$381,853,080	$0	$381,853,080
32	$381,853,080	$0	$381,853,080
33	$381,853,080	$0	$381,853,080
34	$381,853,080	$0	$381,853,080
35	$381,853,080	$0	$381,853,080
36	$381,853,080	$0	$381,853,080
37	$381,853,080	$0	$381,853,080
38	$381,853,080	$0	$381,853,080
39	$381,853,080	$0	$381,853,080
40	$381,853,080	$0	$381,853,080
TOTAL	**$11,465,138,727**	**$2,841,623,337**	**$8,623,515,390**

Table 7.7-3: Assumed Storage Costs by Facility of No Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2021	Year 2	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2024	Year 5	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2025	Year 6	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2026	Year 7	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2027	Year 8	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2028	Year 9	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2029	Year 10	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2030	Year 11	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2031	Year 12	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2032	Year 13	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2033	Year 14	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2034	Year 15	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2035	Year 16	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2036	Year 17	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2037	Year 18	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2038	Year 19	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2047	Year 28	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2048	Year 29	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2049	Year 30	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2050	Year 31	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2051	Year 32	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2052	Year 33	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2053	Year 34	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2054	Year 35	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2055	Year 36	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2056	Year 37	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2057	Year 38	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2058	Year 39	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2059	Year 40	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
	TOTAL	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**

Table 7.7-3: Assumed Storage Costs by Facility of No Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Yankee Rowe	Zion	Generic Plant 1	Generic Plant 2	Generic Plant 3	Generic Plant 4
2020	Year 1	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2025	Year 6	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2026	Year 7	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2027	Year 8	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2028	Year 9	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2029	Year 10	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2030	Year 11	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2031	Year 12	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2032	Year 13	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2033	Year 14	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2034	Year 15	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2035	Year 16	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2036	Year 17	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2037	Year 18	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2038	Year 19	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2047	Year 28	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2048	Year 29	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2049	Year 30	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2050	Year 31	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2051	Year 32	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2052	Year 33	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2053	Year 34	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2054	Year 35	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2055	Year 36	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2056	Year 37	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2057	Year 38	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2058	Year 39	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2059	Year 40	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
	TOTAL	**$424,281,200**	**$424,281,200**	**$405,188,546**	**$386,095,892**	**$376,549,565**	**$376,549,565**

Table 7.7-3: Assumed Storage Costs by Facility of No Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 5	Generic Plant 6	Generic Plant 7	Generic Plant 8	Generic Plant 9	Generic Plant 10
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2032	Year 13	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2033	Year 14	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2034	Year 15	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2035	Year 16	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2036	Year 17	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2037	Year 18	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2038	Year 19	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2047	Year 28	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2048	Year 29	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2049	Year 30	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2050	Year 31	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2051	Year 32	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2052	Year 33	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2053	Year 34	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2054	Year 35	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2055	Year 36	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2056	Year 37	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2057	Year 38	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2058	Year 39	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2059	Year 40	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
	TOTAL	**$367,003,238**	**$357,456,911**	**$347,910,584**	**$319,271,603**	**$309,725,276**	**$309,725,276**

Table 7.7-3: Assumed Storage Costs by Facility of No Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 11	Generic Plant 12	Generic Plant 13	Generic Plant 14	Generic Plant 15	Generic Plant 16
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2037	Year 18	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2038	Year 19	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2047	Year 28	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2048	Year 29	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2049	Year 30	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2050	Year 31	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2051	Year 32	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2052	Year 33	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2053	Year 34	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2054	Year 35	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2055	Year 36	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2056	Year 37	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2057	Year 38	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2058	Year 39	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2059	Year 40	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
	TOTAL	**$290,632,622**	**$281,086,295**	**$281,086,295**	**$271,539,968**	**$271,539,968**	**$261,993,641**

Table 7.7-3: Assumed Storage Costs by Facility of No Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 17	Generic Plant 18	Generic Plant 19	Generic Plant 20	Generic Plant 21	Generic Plant 22
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2047	Year 28	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2048	Year 29	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2049	Year 30	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2050	Year 31	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2051	Year 32	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2052	Year 33	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2053	Year 34	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2054	Year 35	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2055	Year 36	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2056	Year 37	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2057	Year 38	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2058	Year 39	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2059	Year 40	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
	TOTAL	**$252,447,314**	**$252,447,314**	**$242,900,987**	**$242,900,987**	**$242,900,987**	**$242,900,987**

Table 7.7-3: Assumed Storage Costs by Facility of No Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 23	Generic Plant 24	Generic Plant 25	Generic Plant 26	Generic Plant 27	Generic Plant 28
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2047	Year 28	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2048	Year 29	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2049	Year 30	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2050	Year 31	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2051	Year 32	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2052	Year 33	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2053	Year 34	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2054	Year 35	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2055	Year 36	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2056	Year 37	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2057	Year 38	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2058	Year 39	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2059	Year 40	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
	TOTAL	**$233,354,660**	**$233,354,660**	**$233,354,660**	**$233,354,660**	**$233,354,660**	**$214,262,006**

Table 7.7-4: Assumed Storage Costs by Facility of Proposed Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2021	Year 2	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2024	Year 5				$10,607,030	$10,607,030	$10,607,030
2025	Year 6						
2026	Year 7						
2027	Year 8						
2028	Year 9						
2029	Year 10						
2030	Year 11						
2031	Year 12						
2032	Year 13						
2033	Year 14						
2034	Year 15						
2035	Year 16						
2036	Year 17						
2037	Year 18						
2038	Year 19						
2039	Year 20						
2040	Year 21						
2041	Year 22						
2042	Year 23						
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$53,035,150**	**$53,035,150**	**$53,035,150**

Table 7.7-4: Assumed Storage Costs by Facility of Proposed Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Yankee Rowe	Zion	Generic Plant 1	Generic Plant 2	Generic Plant 3	Generic Plant 4
2020	Year 1	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2025	Year 6			$10,607,030	$10,607,030	$10,607,030	$10,607,030
2026	Year 7			$10,607,030	$10,607,030	$10,607,030	$10,607,030
2027	Year 8			$10,607,030	$10,607,030	$10,607,030	$10,607,030
2028	Year 9				$10,607,030	$10,607,030	$10,607,030
2029	Year 10				$10,607,030	$10,607,030	$10,607,030
2030	Year 11					$10,607,030	$10,607,030
2031	Year 12						$10,607,030
2032	Year 13						
2033	Year 14						
2034	Year 15						
2035	Year 16						
2036	Year 17						
2037	Year 18						
2038	Year 19						
2039	Year 20						
2040	Year 21						
2041	Year 22						
2042	Year 23						
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$53,035,150**	**$53,035,150**	**$65,763,586**	**$67,884,992**	**$68,945,695**	**$79,552,725**

Table 7.7-4: Assumed Storage Costs by Facility of Proposed Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 5	Generic Plant 6	Generic Plant 7	Generic Plant 8	Generic Plant 9	Generic Plant 10
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2032	Year 13		$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2033	Year 14			$10,607,030	$10,607,030	$10,607,030	$10,607,030
2034	Year 15				$10,607,030	$10,607,030	$10,607,030
2035	Year 16				$10,607,030	$10,607,030	$10,607,030
2036	Year 17				$10,607,030	$10,607,030	$10,607,030
2037	Year 18					$10,607,030	$10,607,030
2038	Year 19						$10,607,030
2039	Year 20						
2040	Year 21						
2041	Year 22						
2042	Year 23						
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$70,006,398**	**$71,067,101**	**$72,127,804**	**$75,309,913**	**$76,370,616**	**$86,977,646**

Table 7.7-4: Assumed Storage Costs by Facility of Proposed Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 11	Generic Plant 12	Generic Plant 13	Generic Plant 14	Generic Plant 15	Generic Plant 16
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2037	Year 18	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2038	Year 19	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2040	Year 21		$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2041	Year 22			$10,607,030	$10,607,030	$10,607,030	$10,607,030
2042	Year 23					$10,607,030	$10,607,030
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$78,492,022**	**$79,552,725**	**$90,159,755**	**$80,613,428**	**$91,220,458**	**$81,674,131**

Table 7.7-4: Assumed Storage Costs by Facility of Proposed Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 17	Generic Plant 18	Generic Plant 19	Generic Plant 20	Generic Plant 21	Generic Plant 22
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25		$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26				$10,607,030	$10,607,030	$10,607,030
2046	Year 27						$10,607,030
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$82,734,834**	**$93,341,864**	**$83,795,537**	**$94,402,567**	**$94,402,567**	**$105,009,597**

Table 7.7-4: Assumed Storage Costs by Facility of Proposed Action, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 23	Generic Plant 24	Generic Plant 25	Generic Plant 26	Generic Plant 27	Generic Plant 28
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2047	Year 28		$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2048	Year 29				$10,607,030	$10,607,030	$10,607,030
2049	Year 30					$10,607,030	$10,607,030
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$95,463,270**	**$106,070,300**	**$106,070,300**	**$116,677,330**	**$127,284,360**	**$108,191,706**

Table 7.7-5: Assumed Storage Costs by Facility of No Action – Phase 1 Only, Not Discounted (2018 $)

(2 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco	Yankee Rowe	Zion	Generic Plant 1
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2021	Year 2	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2024	Year 5	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2025	Year 6	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2026	Year 7	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2027	Year 8	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2028	Year 9	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2029	Year 10	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2030	Year 11	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2031	Year 12	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2032	Year 13	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2033	Year 14	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2034	Year 15	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2035	Year 16	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2036	Year 17	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2037	Year 18	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2038	Year 19	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2047	Year 28	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2048	Year 29	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2049	Year 30	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030

Table 7.7-5: Assumed Storage Costs by Facility of No Action – Phase 1 Only, Not Discounted (2018 $)

(2 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco	Yankee Rowe	Zion	Generic Plant 1
2050	Year 31	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2051	Year 32	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2052	Year 33	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2053	Year 34	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2054	Year 35	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2055	Year 36	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2056	Year 37	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2057	Year 38	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2058	Year 39	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2059	Year 40	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
SUBTOTAL		**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$405,188,546**
							COST OF NO ACTION FOR PHASE 1			**$3,799,438,146**

Table 7.7-6: Assumed Storage Costs by Facility of Proposed Action – Phase 1 Only, Not Discounted (2018 $)

(2 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco	Yankee Rowe	Zion	Generic Plant 1
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2021	Year 2	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2024	Year 5				$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2025	Year 6						$10,607,030	$10,607,030	$10,607,030	$10,607,030
2026	Year 7									$10,607,030
2027	Year 8									$10,607,030
2028	Year 9									$10,607,030
2029	Year 10									
2030	Year 11									
2031	Year 12									
2032	Year 13									
2033	Year 14									
2034	Year 15									
2035	Year 16									
2036	Year 17									
2037	Year 18									
2038	Year 19									
2039	Year 20									
2040	Year 21									
2041	Year 22									
2042	Year 23									
2043	Year 24									
2044	Year 25									
2045	Year 26									
2046	Year 27									
2047	Year 28									
2048	Year 29									

Table 7.7-6: Assumed Storage Costs by Facility of Proposed Action – Phase 1 Only, Not Discounted (2018 $)

(2 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco	Yankee Rowe	Zion	Generic Plant 1
2049	Year 30									
2050	Year 31									
2051	Year 32									
2052	Year 33									
2053	Year 34									
2054	Year 35									
2055	Year 36									
2056	Year 37									
2057	Year 38									
2058	Year 39									
2059	Year 40									
SUBTOTAL		**$42,428,120**	**$42,428,120**	**$42,428,120**	**$53,035,150**	**$53,035,150**	**$63,642,180**	**$63,642,180**	**$63,642,180**	**$76,370,616**
							COST OF PROPOSED ACTION FOR PHASE 1			**$500,651,816**

Table 7.7-7: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2021	Year 2	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2024	Year 5	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2025	Year 6	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2026	Year 7	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2027	Year 8	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2028	Year 9	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2029	Year 10	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2030	Year 11	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2031	Year 12	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2032	Year 13	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2033	Year 14	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2034	Year 15	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2035	Year 16	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2036	Year 17	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2037	Year 18	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2038	Year 19	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2047	Year 28	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2048	Year 29	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2049	Year 30	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2050	Year 31	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2051	Year 32	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2052	Year 33	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2053	Year 34	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2054	Year 35	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2055	Year 36	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2056	Year 37	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2057	Year 38	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2058	Year 39	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2059	Year 40	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
	TOTAL	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**	**$424,281,200**

Table 7.7-7: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Yankee Rowe	Yankee Rowe	Generic Plant 1	Generic Plant 2	Generic Plant 3	Generic Plant 4
2020	Year 1	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2025	Year 6	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2026	Year 7	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2027	Year 8	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2028	Year 9	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2029	Year 10	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2030	Year 11	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2031	Year 12	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2032	Year 13	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2033	Year 14	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2034	Year 15	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2035	Year 16	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2036	Year 17	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2037	Year 18	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2038	Year 19	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2039	Year 20	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2040	Year 21	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2041	Year 22	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2042	Year 23	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2043	Year 24	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2044	Year 25	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2045	Year 26	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2046	Year 27	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2047	Year 28	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2048	Year 29	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2049	Year 30	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2050	Year 31	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2051	Year 32	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2052	Year 33	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2053	Year 34	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2054	Year 35	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2055	Year 36	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2056	Year 37	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2057	Year 38	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2058	Year 39	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2059	Year 40	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
	TOTAL	**$424,281,200**	**$424,281,200**	**$405,188,546**	**$386,095,892**	**$42,428,120**	**$42,428,120**

Table 7.7-7: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 5	Generic Plant 6	Generic Plant 7	Generic Plant 8	Generic Plant 9	Generic Plant 10
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2041	Year 22	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2042	Year 23	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2043	Year 24	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2044	Year 25	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2045	Year 26	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2046	Year 27	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2047	Year 28	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2048	Year 29	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2049	Year 30	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2050	Year 31	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2051	Year 32	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2052	Year 33	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2053	Year 34	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2054	Year 35	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2055	Year 36	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2056	Year 37	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2057	Year 38	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2058	Year 39	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2059	Year 40	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**

Table 7.7-7: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 11	Generic Plant 12	Generic Plant 13	Generic Plant 14	Generic Plant 15	Generic Plant 16
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2041	Year 22	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2042	Year 23	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2043	Year 24	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2044	Year 25	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2045	Year 26	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2046	Year 27	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2047	Year 28	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2048	Year 29	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2049	Year 30	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2050	Year 31	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2051	Year 32	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2052	Year 33	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2053	Year 34	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2054	Year 35	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2055	Year 36	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2056	Year 37	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2057	Year 38	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2058	Year 39	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2059	Year 40	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**

Table 7.7-7: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 17	Generic Plant 18	Generic Plant 19	Generic Plant 20	Generic Plant 21	Generic Plant 22
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2041	Year 22	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2042	Year 23	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2043	Year 24	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2044	Year 25	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2045	Year 26	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2046	Year 27	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2047	Year 28	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2048	Year 29	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2049	Year 30	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2050	Year 31	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2051	Year 32	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2052	Year 33	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2053	Year 34	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2054	Year 35	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2055	Year 36	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2056	Year 37	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2057	Year 38	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2058	Year 39	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2059	Year 40	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**

Table 7.7-7: Assumed Storage Costs by Facility of No Action and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	Licensure	Generic Plant 23	Generic Plant 24	Generic Plant 25	Generic Plant 26	Generic Plant 27	Generic Plant 28
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2041	Year 22	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2042	Year 23	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2043	Year 24	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2044	Year 25	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2045	Year 26	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2046	Year 27	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2047	Year 28	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2048	Year 29	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2049	Year 30	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2050	Year 31	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2051	Year 32	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2052	Year 33	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2053	Year 34	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2054	Year 35	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2055	Year 36	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2056	Year 37	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2057	Year 38	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2058	Year 39	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2059	Year 40	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**

Table 7.7-8: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	License	Connecticut Yankee	Crystal River	Kewaunee	La Crosse	Maine Yankee	Rancho Seco
2020	Year 1	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2021	Year 2	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$10,607,030
2024	Year 5				$10,607,030	$10,607,030	$10,607,030
2025	Year 6						$10,607,030
2026	Year 7						
2027	Year 8						
2028	Year 9						
2029	Year 10						
2030	Year 11						
2031	Year 12						
2032	Year 13						
2033	Year 14						
2034	Year 15						
2035	Year 16						
2036	Year 17						
2037	Year 18						
2038	Year 19						
2039	Year 20						
2040	Year 21						
2041	Year 22						
2042	Year 23						
2043	Year 24						
2044	Year 25						
2045	Year 26						
2046	Year 27						
2047	Year 28						
2048	Year 29						
2049	Year 30						
2050	Year 31						
2051	Year 32						
2052	Year 33						
2053	Year 34						
2054	Year 35						
2055	Year 36						
2056	Year 37						
2057	Year 38						
2058	Year 39						
2059	Year 40						
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$53,035,150**	**$53,035,150**	**$63,642,180**

Table 7.7-8: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	License	Yankee Rowe	Zion	Generic Plant 1	Generic Plant 2	Generic Plant 3	Generic Plant 4
2020	Year 1	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2025	Year 6	$10,607,030	$10,607,030	$10,607,030	$10,607,030	$1,060,703	$1,060,703
2026	Year 7			$10,607,030	$10,607,030	$1,060,703	$1,060,703
2027	Year 8			$10,607,030	$10,607,030	$1,060,703	$1,060,703
2028	Year 9			$10,607,030	$10,607,030	$1,060,703	$1,060,703
2029	Year 10				$10,607,030	$1,060,703	$1,060,703
2030	Year 11				$10,607,030	$1,060,703	$1,060,703
2031	Year 12				$10,607,030	$1,060,703	$1,060,703
2032	Year 13				$10,607,030	$1,060,703	$1,060,703
2033	Year 14				$10,607,030	$1,060,703	$1,060,703
2034	Year 15				$10,607,030	$1,060,703	$1,060,703
2035	Year 16				$10,607,030	$1,060,703	$1,060,703
2036	Year 17				$10,607,030	$1,060,703	$1,060,703
2037	Year 18				$10,607,030	$1,060,703	$1,060,703
2038	Year 19				$10,607,030	$1,060,703	$1,060,703
2039	Year 20				$10,607,030	$1,060,703	$1,060,703
2040	Year 21				$10,607,030	$1,060,703	$1,060,703
2041	Year 22				$10,607,030	$1,060,703	$1,060,703
2042	Year 23				$10,607,030	$1,060,703	$1,060,703
2043	Year 24				$10,607,030	$1,060,703	$1,060,703
2044	Year 25				$10,607,030	$1,060,703	$1,060,703
2045	Year 26				$10,607,030	$1,060,703	$1,060,703
2046	Year 27				$10,607,030	$1,060,703	$1,060,703
2047	Year 28				$10,607,030	$1,060,703	$1,060,703
2048	Year 29				$10,607,030	$1,060,703	$1,060,703
2049	Year 30				$10,607,030	$1,060,703	$1,060,703
2050	Year 31				$10,607,030	$1,060,703	$1,060,703
2051	Year 32				$10,607,030	$1,060,703	$1,060,703
2052	Year 33				$10,607,030	$1,060,703	$1,060,703
2053	Year 34				$10,607,030	$1,060,703	$1,060,703
2054	Year 35				$10,607,030	$1,060,703	$1,060,703
2055	Year 36				$10,607,030	$1,060,703	$1,060,703
2056	Year 37				$10,607,030	$1,060,703	$1,060,703
2057	Year 38				$10,607,030	$1,060,703	$1,060,703
2058	Year 39				$10,607,030	$1,060,703	$1,060,703
2059	Year 40				$10,607,030	$1,060,703	$1,060,703
	TOTAL	**$63,642,180**	**$63,642,180**	**$76,370,616**	**$386,095,892**	**$42,428,120**	**$42,428,120**

Table 7.7-8: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	License	Generic Plant 5	Generic Plant 6	Generic Plant 7	Generic Plant 8	Generic Plant 9	Generic Plant 10
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2041	Year 22	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2042	Year 23	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2043	Year 24	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2044	Year 25	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2045	Year 26	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2046	Year 27	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2047	Year 28	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2048	Year 29	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2049	Year 30	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2050	Year 31	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2051	Year 32	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2052	Year 33	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2053	Year 34	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2054	Year 35	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2055	Year 36	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2056	Year 37	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2057	Year 38	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2058	Year 39	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2059	Year 40	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**

Table 7.7-8: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	License	Generic Plant 11	Generic Plant 12	Generic Plant 13	Generic Plant 14	Generic Plant 15	Generic Plant 16
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2041	Year 22	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2042	Year 23	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2043	Year 24	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2044	Year 25	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2045	Year 26	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2046	Year 27	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2047	Year 28	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2048	Year 29	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2049	Year 30	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2050	Year 31	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2051	Year 32	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2052	Year 33	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2053	Year 34	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2054	Year 35	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2055	Year 36	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2056	Year 37	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2057	Year 38	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2058	Year 39	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2059	Year 40	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**

Table 7.7-8: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	License	Generic Plant 17	Generic Plant 18	Generic Plant 19	Generic Plant 20	Generic Plant 21	Generic Plant 22
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2041	Year 22	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2042	Year 23	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2043	Year 24	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2044	Year 25	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2045	Year 26	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2046	Year 27	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2047	Year 28	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2048	Year 29	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2049	Year 30	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2050	Year 31	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2051	Year 32	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2052	Year 33	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2053	Year 34	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2054	Year 35	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2055	Year 36	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2056	Year 37	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2057	Year 38	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2058	Year 39	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2059	Year 40	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**

Table 7.7-8: Assumed Storage Costs by Facility of Phase 1 and No Additional Plant Closures, Not Discounted (2018 $)

(6 pages)

Year	License	Generic Plant 23	Generic Plant 24	Generic Plant 25	Generic Plant 26	Generic Plant 27	Generic Plant 28
2020	Year 1	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2021	Year 2	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2022	Year 3	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2023	Year 4	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2024	Year 5	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2025	Year 6	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2026	Year 7	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2027	Year 8	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2028	Year 9	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2029	Year 10	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2030	Year 11	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2031	Year 12	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2032	Year 13	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2033	Year 14	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2034	Year 15	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2035	Year 16	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2036	Year 17	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2037	Year 18	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2038	Year 19	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2039	Year 20	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2040	Year 21	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2041	Year 22	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2042	Year 23	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2043	Year 24	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2044	Year 25	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2045	Year 26	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2046	Year 27	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2047	Year 28	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2048	Year 29	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2049	Year 30	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2050	Year 31	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2051	Year 32	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2052	Year 33	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2053	Year 34	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2054	Year 35	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2055	Year 36	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2056	Year 37	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2057	Year 38	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2058	Year 39	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
2059	Year 40	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703	$1,060,703
	TOTAL	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**	**$42,428,120**

Table 7.7-9: Total Estimated Value of Land at Decommissioned Nuclear Power Plants Served by the Proposed Action, Not Discounted (2018 $)

Plant	Assumed Shutdown Date	Assumed Date of Completed Spent Fuel Removal	Assumed Date Returned to Market	Market Value $2018
Connecticut Yankee	Shutdown	2023	2033	$27,430,634
Crystal River	Shutdown	2023	2033	$27,430,634
Kewaunee	Shutdown	2023	2033	$27,430,634
La Crosse	Shutdown	2024	2034	$27,430,634
Maine Yankee	Shutdown	2024	2034	$27,430,634
Rancho Seco	Shutdown	2024	2034	$27,430,634
Yankee Rowe	Shutdown	2024	2034	$27,430,634
Zion	Shutdown	2024	2034	$27,430,634
Generic Plant 1	Shutdown	2027	2037	$27,430,634
Generic Plant 2	Shutdown	2029	2039	$27,430,634
Generic Plant 3	2019	2030	2040	$27,430,634
Generic Plant 4	2019	2031	2041	$27,430,634
Generic Plant 5	2020	2031	2041	$27,430,634
Generic Plant 6	2021	2032	2042	$27,430,634
Generic Plant 7	2022	2033	2043	$27,430,634
Generic Plant 8	2025	2036	2046	$27,430,634
Generic Plant 9	2026	2037	2047	$27,430,634
Generic Plant 10	2026	2038	2048	$27,430,634
Generic Plant 11	2028	2039	2049	$27,430,634
Generic Plant 12	2029	2040	2050	$27,430,634
Generic Plant 13	2029	2041	2051	$27,430,634
Generic Plant 14	2030	2041	2051	$27,430,634
Generic Plant 15	2030	2042	2052	$27,430,634
Generic Plant 16	2031	2042	2052	$27,430,634
Generic Plant 17	2032	2043	2053	$27,430,634
Generic Plant 18	2032	2044	2054	$27,430,634
Generic Plant 19	2033	2044	2054	$27,430,634
Generic Plant 20	2033	2045	2055	$27,430,634
Generic Plant 21	2033	2045	2055	$27,430,634
Generic Plant 22	2033	2046	2056	$27,430,634
Generic Plant 23	2034	2046	2056	$27,430,634
Generic Plant 24	2034	2047	2057	$27,430,634
Generic Plant 25	2034	2047	2057	$27,430,634
Generic Plant 26	2034	2048	2058	$27,430,634
Generic Plant 27	2034	2049	2059	$27,430,634
Generic Plant 28	2036	2049	2059	$27,430,634
			TOTAL	**$987,502,824**

Table 7.7-10: CISF Design, Engineering, Licensing, and Startup Professional Services, Not Discounted (2018 $)

Cost Category	***Estimated Cost (Millions 2018$)***
Pre-Licensing Phase	
Project Management	*$3.50*
Public Information and Stakeholder Involvement	*$1.75*
Geotechnical Investigations and Environmental Report Development	*$2.33*
Preliminary Design, Safety Analysis, and Preparation of License Application	*$8.62*
Subtotal Pre-Licensing Phase	*$16.20*
Contingency: 30%	*$4.86*
Total CISF Pre-License Submittal Phase:	***$21.06***
License Application Review Stage	
Project Management	*$2.91*
Public Information and Stakeholder Involvement	*$1.75*
NRC Fees for LA Review, EIS, and Hearing Process	*$18.65*
Technical and Legal Support during LA Review and Hearing Process	*$6.99*
Detailed Design for CISF Facilities and Transportation Infrastructure	*$5.24*
State and Local Authority Review	*$0.58*
Subtotal: CISF License Application Review Phase	*$36.13*
Contingency: 30%	*$10.84*
Total CISF License Application Review Phase	***$46.97***
Initial Construction/Pre-Operations Phase	
Project Management	*$1.63*
Public Information and Stakeholder Involvement	*$1.75*
Engineering and Legal Support during Construction	*$2.68*
System Start-up, Dry-Run Testing	*$1.98*
Subtotal CISF Initial Construction/Pre-Operations Phase	*$8.04*
Contingency: 30%	*$2.41*
Total CISF Initial Construction/Pre-Operations Phase	***$10.45***
Total CISF Design, Engineering, Licensing, and Startup Professional Services	***$78.48***

Source: Derived from EPRI, 2009.

Table 7.7-11: Estimated Costs of Transportation Infrastructure, Not Discounted (2018 $)

Description	***Cost Estimate (Millions 2018$)***
Access Road Improvements	*$1.59*
Land Improvements	*$5.30*
Rail Escort Cars @ $6.4 million: 7	*$44.50*
Rail Buffer Cars @ $1.6 million: 14	*$22.25*
Cask Rolling Stock *Rail Cask Car @ $2.1 million:35* *Transportation Casks @ $6.4 million: 35* *Associated transport equipment (impact limiters, etc.)*	*$296.65*
Subtotal Transportation Infrastructure	***$370.28***
Contingency: 30%	***$111.08***
Total Transportation Infrastructure	***$481.36***

Source; Derived from EPRI, 2009.

Table 7.7-12: Estimated Costs of CISF Infrastructure, Not Discounted (2018 $)

CISF Capital Cost Elements	***Cost Estimate (Millions 2018$)***
Administrative, Security, and Health Physics Building	
Building construction	*$2.75*
Furnishings, equipment, emergency diesel generator, vehicles (with one-time replacement)	*$7.42*
Total Administrative, Security, and Health Physics Building	*$10.17*
Canister Handling Building	
Building construction	*$6.25*
Canister transfer cells and equipment: 3	*$8.79*
Heavy lifting equipment and heavy haul equipment (with one-time replacement)	*$13.98*
Total Canister Handling Building	*$29.03*
Subtotal CISF Infrastructure	***$39.20***
Contingency: 30%	***$11.76***
Total CISF Infrastructure	***$50.96***

Table 7.7-13: Spent Fuel Storage Facility Costs, Not Discounted (2018 $)

CISF Fuel Storage Facility Costs	Estimated Costs (Millions 2018$)
Excavation and Grading	*$3.50*
Concrete Storage Pads	
Large concrete pads estimated to cost $105,945 per canister @ 3,376 canisters stored	*$357.67*
Security Fence	*$1.08*
Inner and outer security fences – 12,400 linear feet	
Fencing: $87.40/linear foot	
Security System	
Lighting, intrusion detection, CCTV, monitoring equipment (with four updates to the electronic equipment)	*$21.67*
Subtotal Fuel Storage Facility	***$383.91***
Contingency 30%	***$115.17***
Total Fuel Storage Facility	***$499.09***

Table 7.7-14: Administrative Operating Costs, Not Discounted (2018 $)

CISF Administrative Operating Costs	Estimated Costs (Millions 2018$)
Travel and Living Expenses	
Security Crew	
675 rail shipments for 3,376 casks	*$2.75*
$4,079 per rail shipment	
Annual Office Expenses	
Communications and reproduction, office supplies, office equipment and leases, office equipment maintenance and repair, postage, dues and subscriptions, insurance	*$46.62*
Subtotal: Annual Administrative Operating Costs	***$49.37***
Contingency: 30%	***$14.81***
Total Administrative Operating Costs	***$64.18***

Total over the 40-year licensure period in 2015$

Source: Derived from EPRI, 2009.

Table 7.7-15: Costs for Concrete Overpack, Not Discounted (2018 $)

Concrete Overpack Costs	***Estimated Costs (Millions 2018$)***
Concrete Overpack Costs	
$233,078 per overpack: 3,376 canisters	*$786.87*
Contingency: 30%	*$236.06*
Total Costs	***$1,022.93***

Source: Derived from EPRI, 2009.

Table 7.7-16: Assumed On-site Transportation Planning and Transport Costs, Not Discounted (2018 $)

On-Site Transportation Planning and Transport Costs	Estimated Costs (Millions 2018$)
Assemble Project Organization	
Assemble management teams	$81.0
Identify shutdown site existing infrastructure, constraints, & transportation resource needs and develop interface procedures.	$108.1
Conduct Preliminary Logistics Analysis and Planning	
Develop specs, solicit bids, issue contracts, & initiate preparations for shipping campaigns	$13.6
Revisions to certificates of compliance as may be needed	$27.0
Conduct Preliminary Logistics Analysis and Planning	
Determine fleet size, transport requirements, and modes of transport for shutdown site	$10.8
Coordinate with Stakeholders	
Assess and select routes & modes of transport	$16.2
Support training of emergency response personnel	$105.9
Develop Campaign Plans	
Develop plans, policies, & procedures for at-site operational interfaces, support operations, and in-transit security operations	$48.7
Conduct Readiness Activities	
Assemble & train at-site operations interface team & shutdown site workers	$54.0
Includes readiness reviews, tabletop exercises, and dry run operations	$81.0
Local Transportation	
Portable transportation equipment – 7 sets @ $2.1 million	$14.8
Local transportation improvements – 36 sites @ $1.1 million.	$38.1
Transfer cask to site to railroad - $264,862 per cask: 3,376 casks	$894.2
Subtotal: On-Site Transportation Planning and Transport Costs	**$1,493.6**
Contingency: 30%	**$448.1**
Total Transportation Planning and Transport Costs	**$1,941.7**

Note: Values are for all 36 sites.

Source: Derived from GAO (2014)

Table 7.7-17: Assumptions for Other Operating Costs, Not Discounted (2018 $)

Assumptions for Other Operating Costs	*Estimated Costs (Millions 2018$)*
Railroad Freight Fees	
Estimated cost for 673 shipments of 5 SNF transport casks by dedicated train @ $87.40 per mile round-trip; average trip length 1,824 miles	*$215.22*
State Inspection Fees	*$46.62*
Equipment, spare parts, and maintenance	*$88.99*
Regulatory fees and license fees	*$33.90*
Utilities	*$33.90*
LLW Disposal (50 cubic feet per year; $1,500 per cubic foot)	*$3.18*
Subtotal: Other Operating Costs	*$421.82*
Contingency: 30%	*$126.55*
Total: Other Operating Costs	***$548.36***

† Total over the 40-year licensure period in 2018$

Source: Derived from EPRI, 2009.

Table 7.7-18: Assumed CISF Annual Labor Cost over 40-Year Licensure, Not Discounted (2018 $)

Labor Categories during Caretaker Period	*Estimated Annual FTE*	*Average Cost per FTE ($000s)*	*Estimated Costs (Millions 2018$)*
Administrative Staff: General manager, administrative assistants, public relations, financing and purchasing, accounting and payroll, governmental affairs	*3*	*$104.0*	*$12.5*
Security staff: assumes 5 staff per shift, 4 shifts, 7 days per week	*20*	*$64.1*	*$51.3*
Engineering and technical staff: Nuclear and licensing engineers, health physics managers and technicians, quality assurance managers and technicians, transportation specialist, training	*7*	*$93.2*	*$26.1*
Maintenance and equipment operating staff: Mechanical and electrical maintenance, crane and equipment operators, general plant workers, fire and EMT	*6*	*$60.4*	*$14.5*
At-reactor loading crews: 2 per site	*Varies*	*$81.6*	*$8.0*
Subtotal: Labor during Caretaker	***36+***		***$112.4***
Fringe benefits and contingency: 40%			***$44.9***
Total Annual Labor Costs			***$157.3***

Source: Derived from EPRI, 2009.

Table 7.7-19: Summary of Quantified Benefits from CISF over 40-Year Licensure, Discounted (2018 $)

Benefit Category	***Cost Estimate (Millions 2018$)***
Avoided Reimbursements to Utilities for Storing Spent Fuel	*$8,624*
Value of Land Potentially Returned to Economic Use	*$988*
Total Benefit	***$9,612***

Table 7.7-20: Summary of Costs for CISF over 40-Year Licensure, Not Discounted (2018 $)

(2 pages)

Year	Design, Engineering, Licensing and Startup Professional Services	Transport-ation Infra-structure	CISF Infra-structure	Fuel Storage Facility	Admin-istrative Operating Costs	Concrete Overpacks	On-site Transportation Planning and Transportation Costs	Other: Transport-ation, License Fees	Annual Operating Labor Costs	Total Costs for CISF over 40-Year Licensure
1	$39,238,739	$71,962,937	$25,479,700	$10,018,343	$1,515,009	$0	$10,894,024	$6,714,245	$3,652,592	$169,475,590
2	$39,238,739	$219,332,015	$11,569,161	$13,539,018	$1,515,009	$0	$25,547,218	$6,714,245	$3,652,592	$321,107,997
3	$0	$190,064,792	$0	$3,443,203	$1,541,522	$7,575,046	$41,252,710	$8,786,778	$3,881,009	$256,545,059
4	$0	$0	$0	$13,772,811	$1,621,060	$30,300,184	$57,932,661	$15,004,376	$3,881,009	$122,512,101
5	$0	$0	$0	$23,551,507	$1,695,295	$51,813,315	$58,878,767	$20,807,467	$4,566,259	$161,312,610
6	$0	$0	$0	$0	$1,515,009	$0	$11,573,486	$6,714,245	$4,794,676	$24,597,416
7	$0	$0	$0	$0	$1,515,009	$0	$12,950,767	$6,714,245	$3,652,592	$24,832,613
8	$0	$0	$0	$15,150,092	$1,631,665	$33,330,203	$49,448,716	$15,833,389	$3,652,592	$119,046,656
9	$0	$0	$0	$0	$1,515,009	$0	$33,993,468	$6,714,245	$3,881,009	$46,103,731
10	$0	$0	$0	$15,150,092	$1,631,665	$33,330,203	$75,350,249	$15,833,389	$3,652,592	$144,948,190
11	$0	$0	$0	$31,066,297	$1,727,110	$60,600,368	$95,492,577	$23,294,506	$3,881,009	$216,061,868
12	$0	$0	$0	$17,904,654	$1,652,875	$39,390,239	$69,285,888	$17,491,415	$4,109,425	$149,834,497
13	$0	$0	$0	$15,150,092	$1,631,665	$33,330,203	$50,825,997	$15,833,389	$4,109,425	$120,880,771
14	$0	$0	$0	$15,150,092	$1,631,665	$33,330,203	$37,875,230	$15,833,389	$3,881,009	$107,701,587
15	$0	$0	$0	$0	$1,515,009	$0	$11,573,486	$6,714,245	$3,881,009	$23,683,749
16	$0	$0	$0	$0	$1,515,009	$0	$33,993,468	$6,714,245	$3,652,592	$45,875,314
17	$0	$0	$0	$15,150,092	$1,631,665	$33,330,203	$63,776,764	$15,833,389	$3,652,592	$133,374,704
18	$0	$0	$0	$27,545,622	$1,727,110	$60,600,368	$82,541,811	$23,294,506	$3,881,009	$199,590,426
19	$0	$0	$0	$2,754,562	$1,536,219	$6,060,037	$40,879,873	$8,372,271	$4,109,425	$63,712,389
20	$0	$0	$0	$15,150,092	$1,631,665	$33,330,203	$82,715,195	$15,833,389	$3,881,009	$152,541,552
21	$0	$0	$13,910,539	$31,066,297	$1,727,110	$60,600,368	$108,443,344	$23,294,506	$3,881,009	$242,923,174
22	$0	$0	$0	$27,545,622	$1,727,110	$60,600,368	$107,066,063	$23,294,506	$4,109,425	$224,343,096
23	$0	$0	$0	$20,659,217	$1,674,085	$45,450,276	$96,488,006	$19,149,441	$4,337,842	$187,758,867
24	$0	$0	$0	$27,545,622	$1,727,110	$60,600,368	$113,704,020	$23,294,506	$4,109,425	$230,981,052
25	$0	$0	$0	$27,545,622	$1,727,110	$60,600,368	$113,704,020	$23,294,506	$4,109,425	$230,981,052
26	$0	$0	$0	$27,545,622	$1,727,110	$60,600,368	$113,704,020	$23,294,506	$4,337,842	$231,209,469
27	$0	$0	$0	$27,545,622	$1,727,110	$60,600,368	$113,704,020	$23,294,506	$4,337,842	$231,209,469
28	$0	$0	$0	$27,545,622	$1,727,110	$60,600,368	$103,909,658	$23,294,506	$4,337,842	$221,415,107

Table 7.7-20: Summary of Costs for CISF over 40-Year Licensure, Not Discounted (2018 $)

(2 pages)

Year	Design, Engineering, Licensing and Startup Professional Services	Transport-ation Infra-structure	CISF Infra-structure	Fuel Storage Facility	Admin-istrative Operating Costs	Concrete Overpacks	On-site Transportation Planning and Transportation Costs	Other: Transport-ation, License Fees	Annual Operating Labor Costs	Total Costs for CISF over 40-Year Licensure
29	$0	$0	$0	$27,545,622	$1,727,110	$60,600,368	$82,866,957	$23,294,506	$4,337,842	$200,372,406
30	$0	$0	$0	$16,527,373	$1,642,270	$36,360,221	$41,318,433	$16,662,402	$4,109,425	$116,620,124
31	$0	$0	$0	$3,520,675	$1,515,009	$0	$0	$6,714,245	$4,109,425	$15,859,355
32	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
33	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
34	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
35	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
36	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
37	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
38	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
39	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
40	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
Subtotal	**$78,477,477**	**$481,359,744**	**$50,959,401**	**$499,089,484**	**$64,179,578**	**$1,022,934,219**	**$1,941,690,895**	**$548,361,715**	**$157,296,096**	**$4,844,348,609**
								Decommissioning		**$395,726,163**
								COSTS - GRAND TOTAL		**$5,240,074,771**

Table 7.7-21: Estimated Costs to Operate Phase 1 of the Proposed Action over 40-Year Licensure, Not Discounted (2018 $)

(2 pages)

Year	Design, Engineering, Licensing and Startup Professional Services	Transport-ation Infra-structure	CISF Infra-structure	Fuel Storage Facility	Admin-istrative Operating Costs	Concrete Overpacks	On-site Transportation Planning and Transportation Costs	Other: Transport-ation, License Fees	Annual Operating Labor Costs	Total Costs for CISF over 40-Year Licensure
1	$39,238,739	$71,962,937	$25,479,700	$10,018,343	$1,515,009	$0	$5,483,646	$6,714,245	$3,652,592	$164,065,212
2	$39,238,739	$139,449,711	$11,569,161	$13,539,018	$1,515,009	$0	$19,075,284	$6,714,245	$3,652,592	$234,753,759
3	$0	$0	$0	$3,580,931	$1,546,824	$7,878,048	$32,022,708	$9,201,284	$3,881,009	$58,110,804
4	$0	$0	$0	$12,395,530	$1,610,455	$27,270,166	$52,681,924	$14,175,363	$4,566,259	$112,699,696
5	$0	$0	$0	$12,395,530	$1,610,455	$27,270,166	$43,235,095	$14,175,363	$4,337,842	$103,024,450
6	$0	$0	$0	$12,395,530	$1,610,455	$27,270,166	$40,435,654	$14,175,363	$4,337,842	$100,225,010
7	$0	$0	$0	$0	$1,515,009	$0	$12,968,284	$6,714,245	$3,652,592	$24,850,131
8	$0	$0	$0	$12,395,530	$1,610,455	$27,270,166	$33,098,093	$14,175,363	$3,881,009	$92,430,615
9	$0	$0	$0	$2,754,562	$1,536,219	$6,060,037	$6,886,406	$8,372,271	$3,881,009	$29,490,504
10	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
11	$0	$0	$0	$3,520,675	$1,515,009	$0	$0	$6,714,245	$3,652,592	$15,402,521
12	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
13	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
14	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
15	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
16	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
17	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
18	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
19	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
20	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
21	$0	$0	$13,910,539	$3,520,675	$1,515,009	$0	$0	$6,714,245	$3,652,592	$29,313,060
22	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
23	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
24	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
25	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
26	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846

Table 7.7-21: Estimated Costs to Operate Phase 1 of the Proposed Action over 40-Year Licensure, Not Discounted (2018 $)

(2 pages)

Year	Design, Engineering, Licensing and Startup Professional Services	Transport-ation Infra-structure	CISF Infra-structure	Fuel Storage Facility	Admin-istrative Operating Costs	Concrete Overpacks	On-site Transportation Planning and Transportation Costs	Other: Transport-ation, License Fees	Annual Operating Labor Costs	Total Costs for CISF over 40-Year Licensure
27	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
28	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
29	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
30	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
31	$0	$0	$0	$3,520,675	$1,515,009	$0	$0	$6,714,245	$3,652,592	$15,402,521
32	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
33	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
34	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
35	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
36	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
37	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
38	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
39	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
40	$0	$0	$0	$0	$1,515,009	$0	$0	$6,714,245	$3,652,592	$11,881,846
Subtotal	**$78,477,477**	**$211,412,649**	**$50,959,401**	**$90,036,997**	**$61,035,176**	**$123,018,748**	**$245,887,095**	**$302,559,349**	**$149,073,092**	**$1,312,459,984**
								Decommissioning		**$55,394,494**
								COSTS - GRAND TOTAL		**$1,367,854,478**

Table 7.7-22: Summary of Benefit Cost Analysis Assuming Market Value of Land, Discounted (2018 $)

SCENARIO	BENEFITS			Cost of Facility Construction, Operations, and Decommissioning	Benefit/ Cost Ratio
	Spent Fuel Storage Costs Avoided	Market Value of Land	Total Benefits		
Phase 1 Only	*$3,298,786,330*	*$246,875,706*	*$3,545,662,036*	*$1,367,854,478*	***2.59***
Phase 1 Only, No Other Reactors Shut Down	*$3,298,786,330*	*$246,875,706*	*$3,545,662,036*	*$1,367,854,478*	***2.59***
Proposed Action	*$8,623,515,390*	*$987,502,824*	*$9,611,018,214*	*$5,240,074,771*	***1.83***

Table 7.7-23: Summary of Benefit Cost Analysis without Including Market Value of Land, Discounted (2018 $)

SCENARIO	BENEFITS Spent Fuel Storage Costs Avoided	Cost of Facility Construction, Operations, and Decommissioning	Benefit/ Cost Ratio
Phase 1 Only	*$3,298,786,330*	*$1,367,854,478*	***2.41***
Phase 1 Only, No Other Reactors Shut Down	*$3,298,786,330*	*$1,367,854,478*	***2.41***
Proposed Action	*$8,623,515,390*	*$5,240,074,771*	***1.65***

Table 7.7-24: Estimated Costs of an Operations and Maintenance Building at an Eliminated Alternative Site, Not Discounted (2018 $)

CISF Capital Cost Elements	*Cost Estimate Millions (2018$)*
Operations and Maintenance Building	
Building construction	*$1.98*
Furnishings, equipment (with one-time replacement)	*$3.03*
Heavy lifting equipment (with one-time replacement)	*$6.99*
Subtotal: Operations and Maintenance Building	***$12.00***
Contingency: 30%	***$3.60***
Total: Operations and Maintenance Building	***$15.60***

Source: Derived from EPRI, 2009.

Table 7.7-25: Assumed CISF Annual Labor Costs for Alternative Locations over 40-Year Licensure, Not Discounted (2018 $)

Labor Categories during Caretaker Period	*Estimated Annual FTE*	*Average Cost per FTE (Thousands $)*	*Estimated Costs (Millions $)*
Administrative Staff: General manager, administrative assistants, public relations, financing and purchasing, accounting and payroll, governmental affairs	*10*	*$104.0*	*$41.6*
Security staff: assumes 5 staff per shift, 4 shifts, 7 days per week	*20*	*$64.1*	*$51.3*
Engineering and technical staff: Nuclear and licensing engineers, health physics managers and technicians, quality assurance managers and technicians, transportation specialist, training	*18*	*$93.2*	*$67.1*
Maintenance and equipment operating staff: Mechanical and electrical maintenance, crane and equipment operators, general plant workers, fire and EMT	*19*	*$60.4*	*$45.9*
At-reactor loading crews: 2 per site	*Varies*	*$81.6*	*$8.0*
Subtotal: Labor during Caretaker	***67+***		***$213.9***
Fringe benefits and contingency: 40%			***$85.6***
Total Annual Labor Costs			***$299.5***

Source: Derived from EPRI, 2009.

Table 7.7-26: Estimated Distances and Costs of Transportation Infrastructure Required for the Eliminated Alternatives, Not Discounted (2018 $)

	Loving County, TX	Lea County, NM	Eddy County, NM
Rail Distance	*35 miles*	*4 miles*	*56 miles*
Rail Cost @ $1.59 million per mile and 30% contingency	*$72.3 million*	*$8.3 million*	*$115.7 million*
Road Distance	*4 miles*	*4 miles*	*4 miles*
	2 lanes	*2 lanes*	*2 lanes*
Road cost @ $6.36 million per lane and 30% contingency	*$66.1 million*	*$66.1 million*	*$66.1 million*

Table 7.7-27: Summary of Costs for Eliminated Alternative CISFs over 40-Year Licensure, Not Discounted (2018 $)

Cost Category	*Cost Estimate (Millions 2018$)*		
	Loving County, TX	*Lea County, NM*	*Eddy County, NM*
Design, Engineering, Licensing and Startup Professional Services	*$78.48*	*$78.48*	*$78.48*
Transportation Infrastructure	*$618.17*	*$554.17*	*$661.57*
CISF Infrastructure	*$66.56*	*$66.56*	*$66.56*
Fuel Storage Facility	*$499.09*	*$499.09*	*$499.09*
Administrative Operating Costs	*$64.18*	*$64.18*	*$64.18*
Concrete Overpacks	*$1,022.93*	*$1,022.93*	*$1,022.93*
On-site Transportation Planning and Transportation Costs	*$1,941.69*	*$1,941.69*	*$1,941.69*
Other: Transportation, License Fees	*$548.36*	*$548.36*	*$548.36*
Annual Operating Labor Costs	*$299.47*	*$299.47*	*$299.47*
Decommissioning	*$395.73*	*$395.73*	*$395.73*
Total Costs for CISF over 40-Year Licensure	***$5,534.67***	***$5,470.67***	***$5,578.07***

Figure 7.2-1: Comparison of Cumulative Federal Expenditures for Spent Fuel Storage Liabilities at Stranded Sites between the Proposed Action and the No Action Scenarios

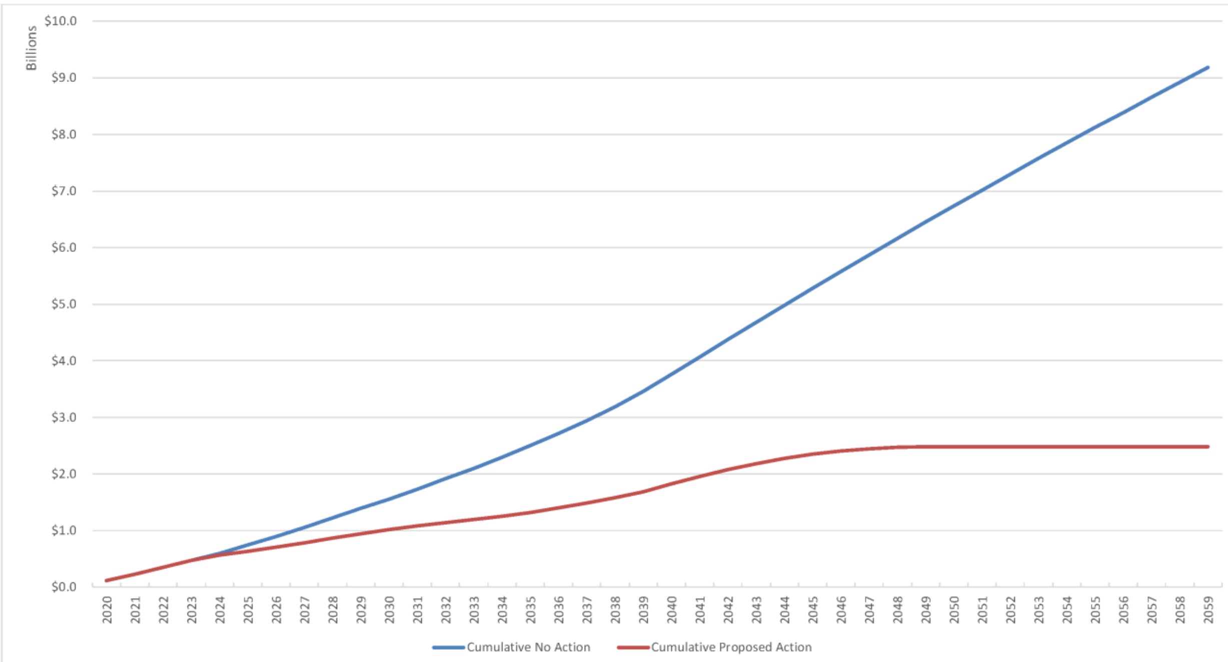
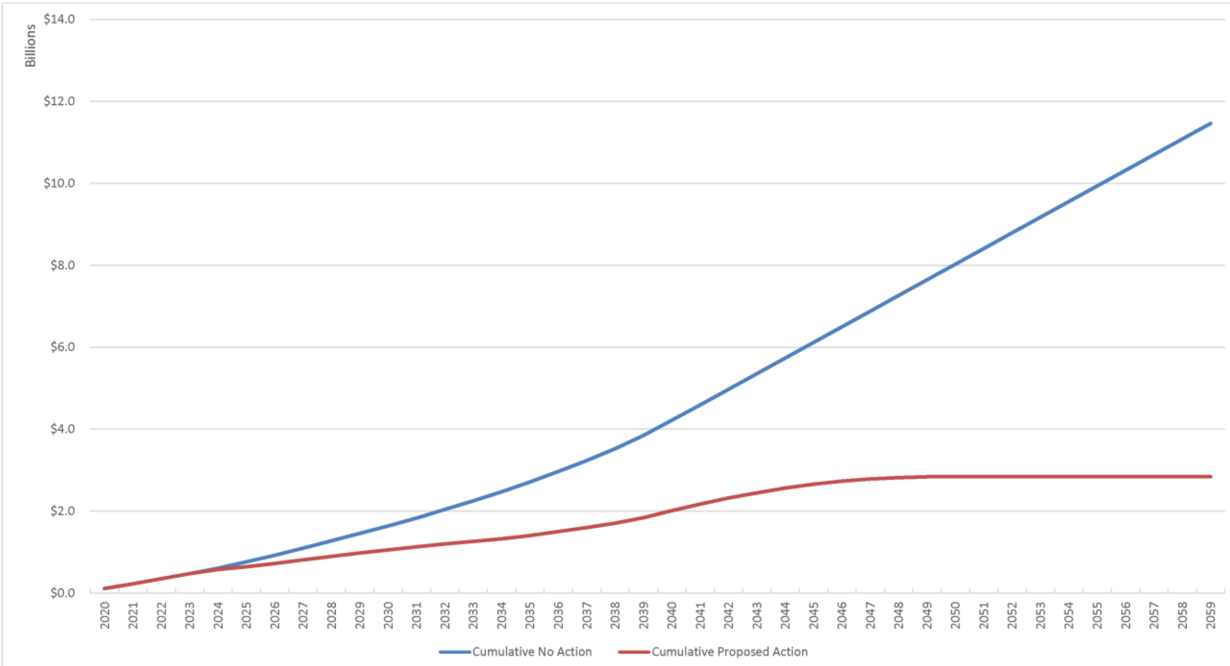


Figure 7.7-1: Federal Expenditures No Action Scenario vs. Proposed Action Scenario, Discounted (2018 $)



CHAPTER 8

SUMMARY OF ENVIRONMENTAL CONSEQUENCES

8.0 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

8.1 UNAVOIDABLE ADVERSE ENVIRONMENTAL IMPACTS

Section 102(2)(C)(ii) of NEPA requires that an EIS include information about any adverse environmental effects that cannot be avoided if the proposal is implemented.

8.1.1 Geology, Minerals, and Soils

Unavoidable soil erosion from both wind and water will occur during construction activities. Dust control and stormwater control measures, as well as revegetation of disturbed areas, will minimize soil erosion. With these mitigations, the resulting levels of soil erosion by wind and water should be similar to the levels that currently exist in Andrews County.

Disturbing the existing soil profile and using aggregate in construction are unavoidable adverse impacts of the proposed action. However, only a very small amount of soil is permanently lost in project construction, and aggregate materials could be recovered after decommissioning. Economic mineral resources located beneath the CISF would be unavailable for exploitation during the life of the project. These impacts, however, would be small.

8.1.2 Water Resources

Unavoidable impacts to surface water are not a concern since there are no surface waters near the facility; however, there may be increased stormwater runoff from the CISF due to the presence of impervious surfaces (e.g., buildings, asphalt, concrete, etc.). Such runoff would be directed to natural drainage networks and controlled under the appropriate permits.

No unavoidable adverse impacts on groundwater are expected as a result of construction or operation of the CISF because the groundwater beneath the facility is neither of the proper quality nor quantity to be used. Therefore of potable water may be brought in from the existing potable water system at ISP joint venture member Waste Control Specialists.

8.1.3 Air Quality

Unavoidable impacts to air quality from construction and decommissioning of the CISF would be associated with earth moving activities that create airborne dust. Through the use of adequate

control measures, such as treating disturbed areas with dust suppressants, the potential impacts to air quality due to suspended particulate matter would be minimal.

8.1.4 Ecological Resources

The CISF would eventually require the commitment of 130 ha (320 acres) for the life of the facility. The loss of wildlife habitat in these areas would be unavoidable. In areas lost for the life of the project, the existing vegetation, with the exception of invasive annuals, would not be restored unless revegetation is undertaken as part of decommissioning and closure of the CISF.

Currently, this land is sparsely vegetated and supports a low amount of wildlife. Small areas of animal habitat would be unavoidably lost in the disturbed areas during construction activities. It is likely that individual animals of less mobile species would be lost during construction.

The impacts to vegetation and wildlife are expected to be small, especially considering the other available land areas in west Texas and southeastern New Mexico that are comparable to the potentially affected area.

8.1.5 Socioeconomic and Community Resources

Because of the size of the regional employment force and the relatively small number of workers to be employed on the proposed project, no adverse socioeconomic impacts are expected.

8.1.6 Cultural Resources

Based on available data, construction, operation, and decommissioning of the CISF would have no adverse impacts on historic properties. In the unlikely event that buried cultural resource sites or artifacts are encountered during construction activities, the significance and potential for adverse impacts would be evaluated at that time.

8.1.7 Human Health Impacts

The impacts of radiation from the casks during transport and storage at the CISF cannot be avoided. However, the radiation doses that would occur as a result of the proposed action are well below NRC regulatory limits specified in 10 CFR 20 and represent a small fraction of the existing background levels of radiation. Thus, the radiological health risk is considered to be small.

8.2 OTHER IMPACTS

8.2.1 Noise

Increased noise will accompany construction, operation, and decommissioning of the proposed CISF; however, the anticipated noise levels will not create adverse impacts.

8.2.2 Scenic Qualities

Because the proposed CISF will be located next to the current Waste Control Specialists facility and URENCO, the impacts to scenic qualities would be minimal.

8.2.3 Recreation

There are no recreational facilities near the site other than a small picnic area along Texas State Highway 176 that is not visible from the CISF. There would be no adverse impacts to recreational activities in the vicinity of the CISF.

8.3 GENERIC ENVIRONMENTAL IMPACT STATEMENT

The NRC completed a *Generic Environmental Impact Statement for Continued Storage of Spent Nuclear Fuel* (NUREG-2157) that addressed, among other things, the unavoidable adverse environmental impacts attributable to continued storage of SNF. ISP is proposing an operational time period of 40 years. However, the environmental impacts analyzed in NUREG-2157 include those related to short-term (60 years), long-term (an additional 100 years), and indefinite storage of SNF at existing commercial nuclear power plants, as well as at an “away-from-reactor” storage facility. The NRC has concluded that the most likely outcome is that a repository will become available to accept SNF within the short-term timeframe, or about 60 years after the end of the reactor’s licensed life for operation.

For an “away-from-reactor” storage facility such as the CISF, the NRC concluded in its GEIS that the unavoidable adverse environmental impacts for each resource area were small except for air quality, terrestrial ecology, aesthetics, waste management, and transportation; the impacts to these resources could range from small to moderate. Socioeconomic impacts would range from small to beneficial and large. Historic and cultural impacts could be small, moderate, or large, depending on a variety of local conditions. The potential moderate impacts to air quality, terrestrial wildlife, and transportation were based on construction-related potential fugitive dust emissions, terrestrial wildlife direct and indirect mortalities, and temporary construction traffic impacts. The potential moderate impacts to aesthetics and waste

management were based on noticeable changes to the viewshed from constructing a new ISFSI. The volume of nonhazardous solid waste generated by assumed ISFSI and dry transfer system replacement activities would be minimal. Potential large positive impacts to socioeconomics would be due to local economic tax revenue increases from the CISF. The GEIS' potential large impacts to historic and cultural and special status species apply to assumed site-specific circumstances at an away-from-reactor ISFSI involving the presence of these resources during construction activities and the absence of effective protection measures. Specifically, these potential historic and cultural impacts vary depending on whether resources are present, the extent of proposed land disturbance, and whether the licensee has management plans and procedures in place that are protective of historic and cultural resources. For the WCS CISF, the land disturbance area is relatively small and the impact on threatened or endangered species is very small. ISP joint venture member Waste Control Specialists has implemented management plans to be protective of the ecology.

In developing NUREG-2157, NRC referred to the previous environmental analyses that supported issuance of the FEIS for the PFS facility in Toole, Utah. In that FEIS, the NRC concluded that issuance of a license to PFS authorizing construction and operation of an ISFSI in Toole County, Utah, would not result in significant impacts adverse to the environment.

Overall, the unavoidable adverse environmental impacts of the CISF are very small, except for the socioeconomic impact, which has been determined to be moderate to large and beneficial rather than adverse.

No cultural resources impacts are anticipated based on the work done for the site. Aesthetic impacts would be low because the facility would not be built in an undeveloped area, but would be screened by existing buildings at the current plant site. Although some wildlife could be impacted, there are no impacts to threatened or endangered species are anticipated. In addition, measures have been put in place in the management plan to prevent adverse impacts. One area where it seems clear that impacts would occur would be land use, geology, and soils within the physical footprint of the CISF since it is currently undeveloped. For those impacts, mitigation would not be necessary.

8.3.1 Irreversible and Irretrievable Commitments of Resources

Section 102(2)(C)(v) of NEPA requires that an EIS include information about irreversible and irretrievable commitments of resources that would occur if the proposed actions were implemented. The NRC guidance in NUREG−1748, *Environmental Review Guidance for*

Licensing Actions Associated with NMSS Programs, defines an irreversible commitment as the commitment of environmental resources that cannot be restored . In addition, an irretrievable commitment refers to the commitment of material resources that once used cannot be recycled or restored for other uses by practical means.

For an away-from-reactor ISFSI, the NRC concluded in its GEIS that there would be no irreversible and irretrievable commitments of resources during continued storage for most resources. However, impacts on land use, aesthetics, historic and cultural resources, waste management, and transportation would result in irreversible and irretrievable commitments. As finite resources, the loss of historic and cultural resources would constitute irreversible and irretrievable impacts. For the indefinite storage timeframe, land and visual resources allocated for SNF storage would be committed in perpetuity as continued operations would preempt other productive land uses and permanently affect the viewshed. Waste-management activities involving waste treatment, storage, and disposal would result in the irreversible commitment of capacity for waste disposal. Transportation activities would involve the irreversible and irretrievable commitment of resources, including vehicle fuel for commuting workers and shipping activities.

Certain activities associated with the proposed CISF, especially those involving construction of ISFSI facilities and the operation of heavy equipment would result in the irreversible commitment of certain fuels, energy, building materials, capacity for waste disposal, and process materials. Because an ISFSI would be in operation for as long as 60 years under the license renewal scenario, land commitments for the ISFSI could be protracted, but not irreversible or irretrievable assuming the facility is closed, decommissioned, and dismantled at the end of its life.

8.4 SHORT-TERM AND LONG-TERM IMPACTS

The proposed initial operating period for the CISF is 40 years with a possible license extension of 20 years for an extended operating period of 60 years. Assuming the facility is closed and decommissioned at the end of the 60-year license period, the impacts from the facility would be short-term (i.e., no more than 60 years). Impacts during the short term would be limited to small impacts on land use and air quality related to dust and fossil fuel emissions. Long-term impacts could result if the CISF lifetime were extended indefinitely or if the facility were not decommissioned at the end of its life as is planned.

8.5 SHORT-TERM USES OF THE ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

Section 102(2)(C)(iv) of NEPA requires that an EIS include information about the relationship between local short-term uses of the environment and the maintenance and enhancement of long-term productivity. The NRC guidance in NUREG−1748 further clarifies that the short-term use period represents the period of the action under review and the long-term productivity period represents the period extending beyond the end of the action under review.

The proposed CISF would occupy land that is presently undeveloped rangeland. A limited amount of grazing currently occurs on this land. This land does not have any other current agricultural or productive uses. The use of this land for the proposed project would reduce the amount of such land available, but the reduction would not be a significant amount. The proposed project would replace this land with an industrial development which has its own infrastructure. The addition of such infrastructure to the area would increase the productivity and usefulness of the land far above its current use and could potentially increase the opportunities for further economic development in the area.

In the Waste Confidence GEIS, NRC examined the relationship of short-term uses and long-term productivity and concluded that the maximum impact on long-term productivity of the land occupied by an ISFSI would result if the CISF is not dismantled after the short-term storage period ends . Under the indefinite storage scenario, therefore, the loss of productivity in the location would be indefinite and other productive uses of the site would be foregone. Long-term productivity of those lands needed for waste disposal would also be impacted.

Once storage ends and the decommissioning is complete, the NRC license may be terminated and the site would be available for other uses. Other potential long-term impacts on productivity include the commitment of land and consumption of disposal capacity necessary to meet waste disposal needs. This commitment of land for disposal would remove land from other productive use. A small contribution to greenhouse gas emissions would add to the atmospheric burden of emissions that could contribute to potential long-term impacts. Impacts to long-term productivity can be eliminated under the short-term storage scenario once the ISFSI operations cease and the associated facilities are decommissioned.

Though greenhouse gas emissions of the CISF proposal would be very small, those emissions could contribute to long-term impacts associated with climate change . *Emission estimates of the greenhouse gas (GHG) carbon dioxide (CO_2) have been quantified for construction and operations at the CISF site. Peak CO_2 emissions are estimated to occur during Phase 1 of the construction process and are not expected to exceed 7,849.33 tpy, well below the threshold of 75,000 tpy CO_{2e}. Emissions of GHGs are considered to be a minimal contribution to the overall emissions of the site, and therefore no mitigation, project design, or adaptation measures are included with this project as existing engine manufacturer design and controls provide sufficient reductions to minimize emissions. Emission estimates are based on factors found in EPA's AP-42 Chapter 3.3 and may be found in ER Section 4.6.*

CHAPTER 9

LIST OF REFERENCES

9.0 LIST OF REFERENCES

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