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), and waste management (4.13).

4.1 Land Use Impacts

The proposed CISF would be built on land controlled by Waste Control Specialists LLC (WCS). 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. Because the site is currently undeveloped, potential land use impacts would primarily be from site preparation and construction activities. Approximately 5 ha (12 acres) would be used for contractor parking and lay-down areas during facility construction. The total disturbed area would therefore be approximately 135 ha (332 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. The removal of very dense soil or caliche may require the use of heavy equipment with ripping tools. 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.

WCS 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 WCS 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. WCS 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 WCS 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. WCS 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.

Air quality impacts from construction site preparation for the CISF were evaluated using emission factors and air dispersion modeling. Emission rates for fugitive dust were calculated using emission factors provided in AP-42, the Agency's EPA’s Compilation of Air Pollutant Emission Factors (EPA, 1995). Peak Emission Rates for fugitive dust were estimated for a 10-hour workday; estimates assumed that peak construction activity levels were maintained throughout the year. The calculated Total Work-Day Average Emissions result for fugitive emission particulates is 2.4 g/s (19.1 lbs/hr). Fugitive dust would originate predominantly from vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing, operation of a potential concrete batch plant, and to a lesser extent from wind erosion. Fugitive dust emissions were estimated using an AP-42 emission factor for construction site preparation; this factor was adjusted to account for dust suppression measures and for the fraction of total suspended particulate that is expected to be in the range of particulates matter (PM) less than or equal to 10 micrometers (PM_{10}) in diameter. Emissions were modeled as a uniform area source with emissions occurring 10 hours per day, 5 days per week, and 50 weeks per year. PM_{110} emissions from fugitive dust were also below the National Ambient Air Quality Standards (NAAQS). The results of the fugitive dust estimates should be viewed in light of the fact that the peak anticipated fugitive dust emissions were assumed to occur throughout the year, and that only a 50% reduction in the fugitive dust emissions was assumed for dust suppressant activities. These conservative assumptions would result in predicted air concentrations that tend to overestimate the potential impacts.

There is also the potential for air quality impacts from construction and operation of a proposed concrete batch plant that could be built to support construction of the CISF. Closed-loop systems are utilized during the concrete production process to minimize air emissions. Emissions from the batch plant operations subject to this standard permit would consist primarily of PM, less than ten microns in diameter (PM_{10}), and PM less than 2.5 microns in diameter ($PM_{2.5}$). The various sources of emissions are listed below:

Table 4.2-1, Various Sources of Emissions

Source Description	Air Contaminant
Aggregate Stockpiles	PM, PM_{10},$PM_{2.5}$
Aggregate Batch Bins	PM, PM_{10},$PM_{2.5}$
Aggregate Conveyor	PM, PM_{10},$PM_{2.5}$
Central Mixers	PM, PM_{10},$PM_{2.5}$
Cement Silo	PM_{10},$PM_{2.5}$
Flyash Silo	PM_{10},$PM_{2.5}$

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 WCS 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 WCS 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 WCS 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 WCS facility six roundtrips per day.

The total anticipated roundtrips per day to WCS following the completion of CISF construction for employees and non-hazardous deliveries and waste removal is approximately 247 based on the 2015 records for WCS 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 WCS 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 WCS. 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 WCS 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 (WCS 2007b:10). For the rail line that services WCS from the west, WCS recorded 160 shipments between 1/1/15 and 7/1/2016 for an average of 0.42shipments per day or 2.1 shipments per five day work week. The rail shipments received at WCS 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 WCS 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 WCS 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 when deciding how often dust suppression sprays would be applied. See Section 4.4 for a discussion of water conservation measures. In addition, closed-loop systems are utilized during the concrete production process to minimize air emissions. 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, WCS 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 will be responsible for transporting SNF from existing nuclear power plants to WCS 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 will also be responsible for coordinating with other 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 WCS.

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. WCS has acquired considerable experience in responding 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* (DOE, 2013a).

WCS 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 (NRC, 2001). 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 WCS and transported approximately 8 km (5 mi) to the CISF. WCS would construct an additional side track approximately 1.6 km (1 mi) in length to allow the transport of SNF to the Cask Handling Building at the CISF as described in Section 3.2. An illustration depicting the sidetrack leading to the Cask Handling Building at the CISF is provided in Figure 4.2-1.

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.

WCS 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 WCS LLRW Disposal Facilities. As such, the transportation impacts at the time of decommissioning would be small.

4.2.6 Radiological Impacts of Transportation

WCS completed a study of the radiological impacts associated with the transport of SNF to the proposed CISF site from both operating and decommissioned sites. The study, *Transportation of Spent Nuclear Fuel to and from the Waste Control Specialist's Proposed Consolidated Interim Storage Facility,* is reproduced in Attachment 4.1. The study used three sample rail routes to estimate bounding doses for normal (incident-free) transportation and potential accidents for both proposed rail shipments to WCS, and for those from WCS to a proposed repository. Dose estimates were computed using RADTRAN, a computer code originally developed by Sandia National Laboratories under contract to the Nuclear Regulatory Commission. The doses for potential barge and heavy haul highway shipments were also analyzed for a number of decommissioned sites, as such shipments may be required to move SNF from the decommissioned site to existing rail connections.

As described in the following sections, the study determined that the radiological impacts for both incident-free transportation and accidents for shipments to and from WCS were small. The results 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* (NRC, 2001)
- *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 WCS Study

Radiological impacts of transporting SNF to and from the proposed CISF were estimated using RADTRAN (Weiner, et al, 2014). RADTRAN 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 to assess the radiological impacts is similar to those used in NUREG-2125, referenced above. 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 either side of the transportation routes using the RADTRAN software. Incident-free doses were calculated using the maximum dose rate allowed for exclusive use shipments under NRC regulations (10 CFR 71.47 (b) (3)). Use of this dose rate, (0.1 mSv per hour at 2 meters from the outer edge of the transport vehicle) assures that the doses calculated by RADTRAN bound those of the proposed SNF shipments to and from the WCS CISF.

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 WCS study. Highway routes for San Onofre and Humboldt Bay could not be run in WebTRAGIS; the reason for this could not be determined. Population densities for the appropriate population block (rural, suburban, and urban) were used to determine the doses to transfer residents near the mode rather than attempting to estimate the population densities at the mode transfer locations.

Table 4.2-2, Routing Parameter Values

Parameter	Parameter Value	Units	Comment/Reference
Rural/Suburban Unit Risk	9.11 E-08	Person-rem person-Sv	Calculated by RADTRAN for this study
Urban Unit Risk	2.05 E-09	Person-rem person-Sv	
Rail Speed	50	mph	DOE/FEIS-02850
Barge Speed	8	mph	NUREG 2125
Heavy Haul Speed	20	mph	DOE/FEIS-0250
Rural Overall Results Residential Sheilding	1.0	unit less	RADTRAN Input
Suburban Residential Shielding	0.87	unit less	RADTRAN Input
Urban Residential Shielding	0.018	unit less	RADTRAN Input

A more detailed description of the methodology used to assess the environmental impacts from transporting SNF along the three transportation routes is presented in Attachment 4-1.

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 assessments 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. This is illustrated in Figure 4.2-2, from NUREG 2125, *Spent Fuel Transportation Risk Assessment*.

The NRC recently conducted a spent fuel transportation risk assessment evaluating the impacts to public health from transporting SNF across the country in NUREG-2125 (NRC, 2014). The risk assessment superseded NUREG-0170, *Final Environmental Impact Statement* on *the Transportation* of *Radioactive Material by Air and Other Mode* (NRC, 1977).

The NRC's assessments have concluded that the risk from radiation emitted from a transportation cask of is a small fraction of the radiation dose received from the natural background; moreover, the risk from accidental release of radioactive material is several orders of magnitude less than previously assessed.

The NRC also concluded in NUREG 2125, *Spent Fuel Transportation Risk Assessment,* that (NRC, 2014):

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. The routes selected for this study adequately represent the routes for SNF transport,

and there was relatively little variation in the risks per kilometer over these routes.

3. Radioactive material would not be released in an accident if the fuel is contained in an inner welded canister inside the cask.

4. Only rail casks without inner welded canisters would release radioactive material, and only then in exceptionally severe accidents.

5. 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.

6. 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.

7. 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.

8. The risk of gamma shielding loss from a fire is negligible.

9. 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* (NRC, 2001).

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).

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* (NRC, 2014a).

WCS used the information included in these Environmental Impact Statements (EIS) to support the analysis of transporting SNF along the same routes to the CISF. Both NUREG-1714 and NUREG-2157 are included herein by reference.

4.2.7 Transportation Routes

WCS analyzed the environmental impacts associated with transporting SNF along three representative routes: from Maine Yankee Nuclear Power plant (NPP) to WCS, from the San Onofre Nuclear Generating Station (SONGS) to WCS and from WCS to the proposed repository at Yucca Mountain in Nye County, Nevada (Figure 4.2-2). The transportation routes and the transportation corridor are discussed in more detail in Section 3.2.

WCS also analyzed the transportation routes needed to remove and transport SNF from the 12 decommissioned reactor sites to the CISF. At these sites, SNF would require to be transported short distances by heavy haul trucks to either a rail transfer facility or a barge slip where the SNF could be subsequently be transported the CISF. The mode of transport of SNF from the 12 decommissioned reactor sites were obtained from DOE report titled, *Preliminary Evaluation of Removing Used Nuclear Fuel from Shutdown Sites* (DOE, 2014). The transportation modes that were analyzed for the shutdown reactor sites are presented in Table 4.2-3.

Table 4.2-3, Transportation Modes from Shutdown Reactor Sites.

Site	Transportation Mode Options	
Maine Yankee	Direct rail	Barge to rail
Yankee Rowe	Heavy haul truck to rail	
Connecticut Yankee	Barge to rail	Heavy haul truck to rail
Humboldt Bay	Heavy haul truck to rail	Heavy haul truck to barge to rail
Big Rock Point	Heavy haul truck to rail	Barge 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	Barge to rail
Kewaunee	Heavy haul truck to rail	Heavy haul truck to barge to rail
San Onofre	Direct rail	Heavy haul truck to barge to rail

4.2.7.1 Incident Free Transportation Doses

Radiation dose calculations were performed for each state along each of the three transportation routes for a single shipment of SNF by rail. Radiation doses were calculated for rural, suburban, and urban areas. The maximum radiation for one shipment of SNF along the transportation routes was estimated at 0.0179 μSv (1.79E-3 mrem). For perspective, the average radiation dose from background radiation is estimated at 3.11 mSv per year (311 mrem per year) as reported by the National Council of Radiation Protection and Measurements (NRCP, 2009).

The total collective dose representing the environmental impact attributable to transporting a single canister of SNF from commercial nuclear power plants across the country to the proposed CISF and then to the proposed geologic repository was estimated at 3.5 E-3 person-Sv (0.35 person- rem). WCS estimated that approximately 3,000 canisters of SNF would be transported to the CISF over the next 20 years. To ensure that the radiological impacts were bounded, WCS assumed that 200 canisters of SNF would be received for storage at the CISF annually.

The radiological impacts are 0.37 person-Sv 37person-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 0.089 person-Sv (8.9 person-rem). Similarly, the impacts of transporting 200 canisters from the CISF to the proposed geologic repository at Yucca Mountain were estimated at 0.23 person-Sv (23 person-rem). Conclusions from these transportation analyses demonstrated that the estimated collective doses along each of the three transportation routes were comparable to those estimated in NUREG-0170 for the same number of shipments (200). The dose from, e.g., 200 shipments is calculated in RADTRAN to be 200 times the dose from a single shipment. Results of the transportation analysis are presented in Tables 4.2-4 through 4.2-7.

Table 4.2-4, Comparison of Annual Incident-free Transportation Impacts

Comparison of Annual Incident-free Transportation Impacts		
	Number of Rail Shipments per Year	Collective Dose Person-Sv (Person- rem)
Maine Yankee to CISF	200	0.37 (37)
SONGS to CISF	200	0.089 (8.9)
CISF to Yucca Mountain	200	0.23 (23)
NUREG-0170	655	2.90 (290)
NUREG-0170	200	0.31 (31)

Table 4.2-5, Incident-free Transportation Radiation Dose from Maine Yankee NPP to the CISF

Incident-Free Radiation Dose From Maine Yankee NPP to the CISF								
	Rural		Suburban		Urban		Total	
	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem
ME	3.39E-06	3.39E-04	7.54E-05	7.54E-03	1.73E-06	1.73E-04	8.05E-05	8.05E-03
NH	1.44E-06	1.44E-04	3.76E-05	3.76E-03	8.12E-07	8.12E-05	3.99E-05	3.99E-03
MA	1.05E-06	1.05E-04	1.13E-04	1.13E-02	5.56E-06	5.56E-04	1.20E-04	1.20E-02
CT	1.53E-06	1.53E-04	2.00E-04	2.00E-02	9.86E-06	9.86E-04	2.11E-04	2.11E-02
NY	2.15E-06	2.18E-04	3.23E-05	3.23E-03	1.12E-05	1.12E-03	3.45E-05	3.45E-03
NJ	3.81E-07	3.81E-05	1.07E-04	1.07E-02	8.83E-06	8.83E-04	1.16E-04	1.16E-02
PA	2.73E-06	2.73E-04	6.09E-05	6.09E-03	1.43E-06	1.43E-04	6.51E-05	6.51E-03
WV	3.15E-07	3.15E-05	1.74E-06	1.74E-04	0	0	2.06E-06	2.06E-04
OH	1.58E-05	1.58E-03	2.24E-04	2.24E-02	2.73E-06	2.73E-04	2.43E-04	2.43E-02
IN	5.35E-06	5.35E-04	1.46E-04	1.46E-02	1.50E-06	1.50E-04	1.53E-04	1.53E-02
IL	4.35E-06	4.35E-04	1.02E-04	1.02E-02	2.34E-06	2.34E-04	1.09E-04	1.09E-02

Incident-Free Radiation Dose From Maine Yankee NPP to the CISF Cont'd								
	Rural		Suburban		Urban		Total	
	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem
MO	8.66E-06	8.66E-04	2.44E-04	2.44E-02	1.12E-06	1.12E-04	2.54E-04	2.54E-02
KS	7.18E-06	7.15E-04	2.31E-04	2.31E-02	1.04E-06	1.04E-04	2.39E-04	2.39E-02
OK	8.39E-06	8.39E-04	1.84E-04	1.84E-02	1.69E-06	1.69E-04	1.94E-04	1.94E-02
TX	1.08E-05	1.05E-03	1.55E-04	1.55E-02	2.51E-06	2.51E-04	1.08E-05	1.08E-03
						Total	1.87E-03	1.87E-01

Table 4.2-6, Incident-free Transportation Radiation Dose from SONGS to the CISF

Incident-free Transportation Radiation Dose from SONGS to the CISF								
	Rural		Suburban		Urban		Total	
	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem
CA	6.15E-06	6.15E-04	1.44E-04	1.44E-02	2.92E-05	2.92E-03	1.79E-04	1.79E-02
AZ	6.03E-06	6.03E-04	9.15E-05	9.15E-03	2.15E-05	2.15E-03	1.19E-04	1.19E-02
NM	2.42E-06	2.42E-04	4.52E-05	4.52E-03	4.16E-07	4.16E-05	4.50E-05	4.50E-03
TX	1.86E-06	1.86E-04	9.64E-05	9.64E-03	3.50E-06	3.50E-04	1.02E-04	1.02E-02
						Total	4.45E-04	4.45E-02

Table 4.2-7, Incident-free Transportation Radiation Dose from the CISF to Yucca Mountain

Incident-free Transportation Radiation Dose from the CISF to Yucca Mountain								
	Rural		Suburban		Urban		Total	
	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem	Person-Sv	Person-rem
TX	6.20E-07	6.20E-05	3.22E-05	3.22E-03	1.17E-06	1.17E-04	3.43E-05	3.43E-03
NM	2.42E-06	2.42E-04	4.21E-05	4.21E-03	4.16E-07	4.16E-05	4.54E-05	4.54E-03
AZ	5.71E-06	S.71E-04	2.01E-04	2.01E-02	0.00E+00	0.008-00	2.09E-04	2.09E-02
CA	1.10E-06	1.10E-04	3.31E-06	3.31E-04	0.008	0.00E+00	4.44E-06	4.44E-04
NV	3.68E-07	3.68E-05	3.68E-07	3.68E-05	0.00E+00	0.00E+00	2.93E-04	2.93E-02
						Total	5.86E-04	5.86E-02

An additional radiological dose could result from the need to transport SNF from the 12 shutdown reactor sites short distances by heavy haul truck to a rail transfer facility or a barge slip. The effects of these additional doses were determined to be small when added to the doses estimated for shipment on the three analyzed rail routes. The results are summarized in Table 4.2-8 for the various shipment modes for the 12 shutdown reactor sites.

In summary, collective dose depends of on the size of the exposed population, which in turn depends on the length of the route and the bandwidth. The collective doses in Table 4.2-8 which bound expected shipments to WCS are small; the largest calculated collective dose is 0.0513 person-rem, and this dose is spread over approximately 550,000 people and 2200 miles of railroad. All of the collective doses appear to be of the same order of magnitude. Nor does the introduction of a slower vehicle like a barge appear to have a significant impact: Half of the Crystal River dose is from barge travel and half from rail travel, and the total collective dose is similar in magnitude to the others.

Table 4.2-8, Radiological Impacts from Transportation

Transportation Impacts from 12 Shutdown Reactor Sites (Transport Short Distances to Rail Transfer Facility and Barge Slip)						
	Population Dose (Person-Sv)			Population Dose (Person-rem)		
Origins	Direct Rail	Rail + barge	Rail + Heavy Haul	Direct Rail	Rail + barge	Rail + Heavy Haul
Maine Yankee	5.13E-04	5.13E-04	N/A	5.13E-02	5.13E-02	N/A
Yankee Rowe	N/A	N/A	2.26E-04	N/A	N/A	N/A
Connecticut Yankee	N/A	7.21E-05	2.94E-04	N/A	7.21E-03	N/A
Humbolt Bay	N/A	1.93E+00	N/A	N/A	1.93E+02	N/A
Big Rock Point	N/A	2.72E-04	2.79E-04	N/A	2.72E-02	N/A
Rancho Seco	1.80E-04	N/A	N/A	1.80E-02	N/A	N/A
Trojan	2.79E-04	2.76E-04	N/A	2.79E-02	2.76E-02	N/A
La Crosse	1.51E-04	2.94E-05	N/A	1.51E-02	2.94E-03	N/A
Zion	1.55E-04	2.05E-04	N/A	1.55E-02	2.05E-02	N/A
Crystal River	1.59E-04	1.08E-04	N/A	1.59E-02	1.08E-02	N/A

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 WCS study 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 finding 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

Severe accidents that involved damage to the transportation cask causing the release of radioactive materials were analyzed using RADTRAN. The dose risks were calculated estimating the radiation doses from both external and internally deposited radionuclides. The concentrations of radionuclides released during the accidents were assessed using a Gaussian dispersion model. The inventory of radionuclides used to support this analysis is provided in Attachment 4-1.

Under this scenario, the probability of an accident is combined with the conditional probability of a severe accident leading to a release of radioactive materials; this combined probability is then multiplied by the estimated dose of radiation a population or an individual may receive. Population dose risks are calculated as follows:

1. The total effective dose equivalent, inhalation plus external dose, is calculated by RADTRAN.

2. That dose equivalent is multiplied by the total population on the link. Since residential shielding plays no role, the largest population dose would be in an urban area.

3. This dose is then multiplied by the accident rate for the state – the probability that there would be an accident at all, and by the cumulative conditional probabilities of the various different types of accidents (Sprung, et al, 2000; NRC, 2014), The probability of an accident is of the order of 10^{-6} per kilometer and the conditional probability, of the order of 10^{-10}. The worst case release accident dose risk is estimated to be 2×10^{-19} rem (2×10^{-17} Sv) on a Connecticut urban link on the Maine Yankee NP to WCS route.

4.2.8.3 Loss-of-Shielding (LOS) Accidents

A third accident type was analyzed that involved degradation or loss of the transportation cask's lead shielding. A loss of shielding type of accident involves a severe impact coupled with a fire. The conditions that must exist for a fire to damage the cask as assumed make this type of accident improbable. Information provided in Chapter 3 and Appendix D of NUREG-2125 was used to evaluate the effects of a fire on a cask used to transport SNF (NRC, 2014b). Lead melts at 330°C (626°F). The shield would have to melt before the initial temperature of the cask would exceed the melting point of lead. The effects of such an accident would result in thinning of the lead shield in the section of the cask damaged by and the impact. The thinning is modeled as a gap. For this type of accident to occur, the fire must be no more than 3 m from the cask.

In this analysis the neutron shield is assumed to be destroyed and the largest gap is assumed to be 7.25% of the neutron shield. Residential shielding affects this estimated dose risk so that the dose risks are larger in suburban areas than urban areas.

The highest dose and dose risk are estimated at 1.23E-3 Sv (0.12 rem) and 1.2E-12 person-Sv (1.2E-10 person-rem), respectively, for a transportation accident involving loss of shielding along any of the three transportation routes in California. The reported radiation doses are expressed as the summation of both gamma rays and neutrons. The estimated dose and dose risk for a severe loss of shielding accident for each of the three transportation routes are provided in Table 4.2-9.

4.2.9 Nonradiological Risks

The NRC staff assessed the impacts of nonradiological truck accidents that may occur during the transport of SNF to the repository. A nonradiological accident is a truck 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 truck accident. Data on national accident statistics have been compiled from a number of sources by the U.S. Department of Transportation (DOT), Bureau of Transportation Statistics, between 1975 and 2013. Since 1990, data have been collected on the number of accidents, injuries, and fatalities peryear (DOT, 2014; DOT,2015). Based on the accident rate data for 2013, , the average rate of injury is 0.0038 per heavy truck-km [0.0023 per heavy truck-mile], and the average fatality is 0.00005 per heavy truck-km [0.00008 per heavy truck-mile]; the average injury rate for rail is 0.006 per km (0.01 per mile) and the average fatality rate for rail is 0.0005 per km (0.0007 per mile). On the basis of these statistics—along with the WebTRAGIS computer code route data—the projected number of nonradiological injuries, and fatalities for rail transport – the dominant transportation mode to be used – would be 31 injuries and two deaths on the route from Maine Yankee, seven injuries and less than one death on the route from San Onofre, and five injuries and less than one death on the route to Yucca Mountain.

These risks are derived from accident data, and reflect observed accident rates.

The NRC staff also attempted to estimate the potential human health effects of vehicle emissions of from locomotives during rail transport of radioactive materials. NUREG 1437 (NRC, 1996) and DOE/EIS-0200-F (page E-32) presented risk factors for latent mortality from pollution inhalation for truck travel in an urban area; 10 per 100 million truck-km (16 per 100 million truck-miles). DOE reports that no similar estimates are available for rural and suburban areas). A 2003 study in Germany cites essentially the same result (Wichmann, 2000). The cited risk estimates are for diesel emissions from trucks, but the transportation of SNF to and from the CSIP will be almost entirely by rail. However, comparable estimates would be much lower in suburban and rural areas because they are much less densely populated than urban areas. Moreover, locomotive emissions are dispersed into the air and are diluted by a factor of approximately 70 (RADTRAN, National Average Weather). To develop a conservative estimate, the NRC staff applied the risk factor to rail and to both the urban and suburban areas. The total mileage to and from the CSIP is 4744 miles (7634 km). NUREG 1437 estimated 1.8 latent mortalities due to pollutant emissions in 17.8 million km (11.1 million miles) Using the same risk factor yields an expected 0.00043 latent mortalities for one transit of the entire 4744-mile route.

The NRC staff assessed the impacts of nonradiological rail accidents that may occur during the transport of SNF to the repository. A nonradiological accident is a truck 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 truck accident. Data on national accident statistics have been compiled from a number of sources by the U.S. Department of Transportation (DOT), Bureau of Transportation Statistics, between 1975 and 1995. Since 1990, data have been collected on the number of accidents, injuries, and fatalities per 100 million truck-miles (DOT 1999). Based upon the accident rate data from 1990 to 1995, the average rate of large truck accidents is 145 per 100 million truck-km [233 per 100 million truck-miles], the average rate of injury is 13 per 100 million truck-km [21 per 100 million truck-miles], and the average fatality is 0.26 per 100 million truck-km [0.42 per 100 million truck-miles]. On the basis of these statistics—along with the HIGHWAY computer code route data—the expected number of nonradiological accidents, injuries, and fatalities is calculated as shown in Table 5 for shipments during the 40-year (without license renewal) and 60-year (with license renewal) repository operations period. Over a 40- or 60-yearperiod, these risks amount to very small annual risks; less than 0.0015 fatalities per year (with or without license renewal).

The NRC staff also estimated the potential human health effects of rail emissions of transport trucks and escort vehicles using conservative assumptions. DOE/EIS-0200-F (page E-32) presents a risk factor for latent mortality from pollution inhalation for truck travel in an urban area; 10 per 100 million truck-km (16 per 100 million truck-miles). DOE reports that no similar estimates are available for rural and suburban areas. However, comparable estimates would be much lower in suburban and rural areas because they are much less densely populated than urban areas. To develop a conservative estimate, the NRC staff assumed that escort vehicles had emissions as large as the large trucks that haul SNF. Further, the NRC staff applied the risk factor to both the urban and suburban areas. The route with the largest distance of combined urban and suburban travel was the south by the beltway route, 59.1 km (36.9 miles) (Table 1). For the license-renewal scenario, an estimate on the order of 75,000 shipments yields total vehicle travel distance of 17.8 million km (11.1 million miles) including both repository-bound and return trips for both the transport truck and the escort vehicle. Using the risk factor reported by DOE yields an expected 1.8 latent mortalities due to pollutant emissions by the transport trucks and escort vehicles for the entire campaign. Assuming a 40-year campaign, this estimate yields an expected 0.045 latent mortalities per year.

Table 4.2-9, Estimated Dose and Dose-Risk for Loss of Shielding Accidents

Estimated Dose and Dose Risk for Each Transportation Route for a Loss of Sheilding Accident			
Route	State	Dose Sv(rem)	Dose Risk Person-Sv (person-rem)
Main Yankee NPP to WCS	CT	2.6E-3 (0.26)	2.6E-12 (2.16E-10)
SONGS to WCS	CA	1.23E-3 (0.12)	1.2E-12 (2.6E-10)
WCS to YUCCA Mountain	TX	3.84E-4 (0.038)	3.8E-13 (3.8E-11)

Additional information regarding the methods used to calculate the transportation impacts attributable to a loss of shielding accident is provided in Attachment 4-1.

4.3 GEOLOGY AND SOILS IMPACTS

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 Gatuña and/or Antlers 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. Because the CISF requires an area of flat terrain, cut and fill might be required for some portions of the site. It is planned that the volume of material excavated from the higher portions of the site would be fully utilized for fill at the lower areas of the site. There are no plans to excavate or dispose of excavated materials offsite. The resulting terrain change for the site from gently sloping to flat topography is not expected to cause significant environmental impact. Numerous areas of flat terrain exist in the region due to natural erosion processes.

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. 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.

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. WCS 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 August 29, 2007, the USACE notified WCS of its determination that there are no USACE jurisdictional waters at the WCS site 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 natural outfalls. As currently occurs at the site, infiltration into the ground and evaporation would account for the mitigation of a significant amount of the storm water runoff. For an average annual rainfall at the site of 41 cm/yr (16 in/yr), the potential runoff volumes (before evapotranspiration and infiltration) are about 530,000 m^3/yr (140,000,000 gal/yr).

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 is will be supplied by existing potable water system at WCS. There are not any surface waters in the vicinity of the proposed CISF. The closest surface water conveyance is Monumnet Draw, New Mexico located approximately 3 miles from the proposed WCS CISF. No adverse impacts to 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 WCS 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 WCS 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, WCS 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 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

Figure 4.2-1 depicts a view of the proposed WCS CISF development from the northwest showing, from left to right, the parking area, the Security and Administration Building, the Phase One Spent Nuclear Fuel Storage Pad partially loaded with spent nuclear fuel storage systems and the large Cask Handling Building. The Rail Sidetrack is also shown passing through the Cask Handling Building. 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 135 ha (332 acres). This area includes 5 ha (12 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 135 ha (332 acres) of the 5,668 ha (14,000 acres) WCS 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 135 ha (332 acres) in the owner controlled area of the 5,668 ha (14,000 acres) WCS 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 5 ha (12 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 135 ha (332 acre) site.

Dune formations in combination with the Plains Sand Scrub vegetation community at the WCS 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 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 135 ha (332 acres) CISF. Therefore, no special maintenance practices are proposed.

4.5.13 Wildlife Management Practices

WCS is proposing to incorporate several best management practices to limit or minimize impacts to existing wildlife habitat.in association with the CISF. 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 involve airborne particulate matter arising from the earthwork involved in site preparation and construction. Air quality impacts from construction site preparation for the CISF were evaluated using emission factors and air dispersion modeling. Emission rates for fugitive dust were calculated using emission factors provided in AP-42, the EPA's Compilation of Air Pollutant Emission Factors (EPA, 1995). Emission rates for fugitive dust Peak Emission Rates were estimated for a 10-hour workday assuming peak construction activity levels were maintained throughout the year. The calculated Total Work-Day Average Emissions result for fugitive emission particulates is 2.4 g/s (19.1 lbs/hr). Fugitive dust would originate predominantly from vehicle traffic on unpaved surfaces, earth moving, excavating and bulldozing, and to a lesser extent from wind erosion.

Fugitive dust emissions were estimated using an AP-42 emission factor for construction site preparation that was adjusted to account for dust suppression measures and the fraction of total suspended particulate that is expected to be in the range of particulates less than or equal to 10 micrometers (PM10) in diameter. Emissions were modeled as a uniform area source with emissions occurring 10 hours per day, 5 days per week, and 50 weeks per year. PM10 emissions from fugitive dust were also below the National Ambient Air Quality Standards (NAAQS) (CFR, 2003w).

The results of the fugitive dust estimates should be viewed in light of the fact that the peak anticipated fugitive emissions were assumed to occur throughout the year, and that only 50% reduction in the fugitive dust emissions was assumed for dust suppressant activities. These conservative assumptions would result in predicted air concentrations that tend to overestimate the potential impacts. Air dispersion estimates can be found in Section 3.6.8.

There is also the potential for air quality impacts from operation of a proposed concrete batch plant for construction of the CISF. Closed-loop systems are utilized during the concrete production process to minimize air emissions. Emissions from the batch plant operations subject to this standard permit would consist primarily of PM, PM less than ten microns in diameter (PM_{10}) and PM less than 2.5 microns ($PM_{2.5}$). The various sources of emissions are listed in Table 4.6-1.

Table 4.6-1, Various Sources of Emissions

Source Description	Air Contaminant
Aggregate Stockpiles	PM, PM_{10},$PM_{2.5}$
Aggregate Batch Bins	PM, PM_{10},$PM_{2.5}$
Aggregate Conveyor	PM, PM_{10},$PM_{2.5}$
Central Mixers	PM, PM_{10},$PM_{2.5}$
Cement Silo	PM_{10},$PM_{2.5}$
Flyash Silo	PM_{10},$PM_{2.5}$

Projected emissions from these sources have been quantified using calculated data from an existing WCS concrete batch plant. WCS currently operates a concrete batch plant permitted for production of 250,000 cubic yards per year. The proposed batch plant would produce 100,000 cubic yards per year. Projected emissions have been scaled from the existing plant air permit calculations. A summary of the projected annual emissions is in Table 4.6-2.

Table 4.6-2, Summary of Projected Annual Emissions

PM Fraction	Stockpile	Silo-1	Silo-2	Aggregate Bin	Conveyor	Mixer	Total
PM	0.03	N/A	N/A	0.12	0.12	0.12	0.39
PM_{10}	0.02	0.04	0.04	0.06	0.06	0.06	0.28
$PM_{2.5}$	0.002	0.04	0.04	0.009	0.009	0.009	0.069

Air quality impacts are expected to be highest during construction. Operational emissions would be intermittent and would not be expected to contribute to an exceedance of any ambient air quality standard. Visibility impacts during construction would be minimal and dust suppressants would be used to help minimize visibility impacts. During operation, there are no anticipated visibility impacts. The cumulative impacts to air quality are expected to be small.

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 impact to air quality during decommissioning would be small.

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

HUD guidelines set the acceptable Day-Night Average Sound Level (L_{dn}) for areas of industrial, manufacturing, and utilities at 80 dBA. The EPA has set a goal of 55 dBA for L_{dn} in outdoor spaces, as detailed in the EPA Levels Document (EPA, 1973). Predicted noise levels, background noise levels, calculated construction noise levels, and operational noise levels should typically be well below both the HUD and EPA guidelines.

4.7.2 Potential Impacts

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

The neighboring site URENCO conducted a background noise-level survey at the four corners of the site boundary on September 16-18, 2003 (NEF, 2005). The measured background noise levels at the site boundaries, which ranged from between 40.1 and 50.4 decibels A-weighted, represent the nearest receptor locations for the general public (NEF, 2005). Based on proximity, it is assumed that background noise levels at WCS and URENCO would be similar.

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 WCS facility.

The first development at the WCS facility was constructed in the late 1990s; none of the development is historic-age. Adjacent to the WCS 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 WCS 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 WCS property, and the URENCO facility. Based on information from WCS, 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 (NMSHPO, 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, WCS 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, WCS 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. WCS 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 at the WCS facility.

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 project. Views were captured to illustrate several zones: foreground, middle ground, background, and seldom-seen. This inventory replicated photos taken for the WCS 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, WCS 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 WCS property.

4.9.1 Aesthetic and Scenic Quality Rating

The visual resource inventory process provides a means for determining visual values (BLM , 1984) (BLM, 1986). 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 by WCS 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 WCS 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 WCS 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 at the WCS facility.

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 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, WCS 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 WCS 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 WCS spent fuel 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 WCS 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 WCS. It includes WCS 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

WCS 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 WCS (WCS, 2014). Figures 4.12-1 and 4.12-2 show the locations of key facilities within and outside the WCS 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 (USGS, 1999). A 1989 American Petroleum Institute preliminary nationwide reconnaissance of measurable radioactivity at the exterior surfaces of oil-field equipment (Otto, 1989) 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

WCS conducted a bounding evaluation of off-site doses for a 40,000 MTU facility loaded in eight phases. 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 WCS. 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.

4.12.3 Summary of Environmental Monitoring Program

WCS 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 WCS facility REMP encompasses procedures and planning documents addressing the types, frequency, and methodologies employed to acquire the requisite data (WCS, 2015).

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 (WCS, 2013).

Table 4.12-2 shows the key radionuclides measured for the REMP at WCS. 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 WCS (WCS, 2015).

Table 4.12-2, Key radionuclides monitored by the REMP at WCS

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 WCS. 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 WCS' 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 3,200 SNF Storage Systems would be used at the CISF over 20 years. 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

WCS 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. WCS analyzed the cumulative impacts for storing 40,000 MTUs of SNF and associated reactor related GTCC waste. 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. WCS 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. There could be a potential for additional air quality impacts from the construction and operation of a proposed concrete batch plant.

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. WCS 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, WCS determined that 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.

WCS analyzed the incremental and radiological impacts associated with storing 5,000 MTUs of SNF during Phase 1. 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 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 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. WCS 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*