SECTION 11
ENVIRONMENTAL REPORT AND ALTERNATIVE MANAGEMENT TECHNIQUES

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11.0 ENVIRONMENTAL REPORT AND ALTERNATIVE MANAGEMENT TECHNIQUES

Provide an environmental report under the requirements of 10 Code of Federal Regulations, §§51.45, 51.62, and 61.10, as amended. [30 TAC §336.708(b)] The following sections that were previously addressed in the application may be referenced in the report. However, for ease of reading and timeliness of review, summary statements and any additional information should be provided for every topic heading.

11.1 Purpose and Need for Proposed Project

Provide a statement of need and a description of the proposed activities identifying the location of the proposed site, the character of the proposed activities, and any plans for use of the site for purposes other than processing and disposal of waste. [30 TAC §336.708(a)(1)]

Background – In 1980, Congress enacted the Low-level Radioactive Waste Policy Act (LLRW), which states in part:

> "…Each state is responsible for providing for the availability of capacity either within or outside the state for the disposal of low-level radioactive waste generated within its borders."

This act allows states to form compacts, with the approval of Congress, for the disposition of LLRW. LLRW is generated by nuclear power utilities and by medical industries and research activities. The states of Texas and Vermont formed a Compact (referred to as the Texas Compact) to collectively dispose of the waste generated in these states. Most of these wastes are currently being stored temporarily at the generators' facility or other licensed storage facilities.

In response to the Act, the state of Texas passed legislation making the State responsible for providing for capacity either inside or outside the state for the disposal of LLRW generated within its borders. The proposed Compact facility is designed for disposal of commercial LLRW for the Texas Compact.

Purpose and Need for Compact and Federal Facilities – There is currently no in-state disposal facility available to accept Texas LLRW and MLLW. For Compact wastes, issues including long-term availability of existing facilities, restrictions on waste types accepted, and the projected costs for disposal argued strongly for licensing and development of an in-state disposal facility. The current volume of Compact waste is estimated at 2.8 [RB1]million cubic feet. A detailed discussion of the waste types, sources, volumes, and activity for the currently projected Compact waste is included in Section 8.2 of the License Application (LA).

Currently, commercial generators in Texas and Vermont rely on the Chem-Nuclear Systems, Inc. (acquired by EnergySolutions, Inc.) LLRW facility near Barnwell, South Carolina, and the Envirocare of Utah, Inc. (acquired by EnergySolutions, Inc.), LLRW near Clive, Utah, for disposal. The Clive disposal facility is restricted to disposal of only certain types of Class A commercial LLRW, and the facility cannot dispose of Class B and C LLRW. The Clive disposal facility is also constrained by the Northwest Compact in its ability to dispose of out-of-compact commercial low-level radioactive wastes. The Barnwell facility also has restrictions and limitations on the types and quantities of waste that it will accept. The Atlantic Interstate Low-

Level Radioactive Waste Management Compact (Connecticut, New Jersey, and South Carolina) is moving to eliminate out-of-compact disposal through the imposition of significant surcharges.

The legislation that authorizes a Compact facility also allows for a Federal disposal facility to be co-located. The fees obtained from the operation of the Federal facility will help to offset costs of operating the Compact facility. The current estimated volume of federal LLRW and MLLW currently projected for disposal is 42 million cubic feet. A detailed discussion of the waste types, sources, volumes, and activity for the currently projected Federal waste is included in Section 8.2.

DOE facilities currently accepting Federal facility waste include the Hanford, WA site and the Nevada Test Site (NTS). The Hanford ER LLRW disposal facility can only accept ER LLRW generated in the environmental cleanup of the Hanford Reservation. The NTS currently accepts Class A, B, and C LLRW (not including debris) from other DOE facilities only, including wastes containing PCBs, asbestos, and beryllium. The NTS is also permitted to dispose of mixed waste generated only in the state of Nevada by NNSA/NV activities. The waste acceptance criteria for NTS, DOE/NV-325-Rev. 5, October 2003, may be found on the DOE Nevada web site at http://www.nv.doe.gov.

Description of Proposed Activities – The proposed activities associated with the Compact and Federal facilities include the receipt and disposal of LLRW and MLLW. Details concerning these activities are provided in Section 5.0, "Operation."

Location of Proposed Facilities – The proposed Compact and Federal facilities are located in western Andrews County, near the Texas–New Mexico state line and approximately one mile north of Texas Highway 176 (see Attachment F). The access road to the proposed Site extend south to north just east of the Texas–New Mexico state line. Attachment F shows the proposed Compact and Federal facilities relative to the surrounding areas. Surrounding land use and a description of the operations are described in detail in Section 2.2.1 (land use) and Sections 5.3.1 and 5.4.1, "Operation".

Plans for Other Uses of Proposed Disposal Facility – No other uses are planned for the site aside from the proposed Compact and Federal facilities.

11.2 Description of Site-Selection Process

Describe the site selection process, including considerations of the interrelationships between location of waste generators, transportation costs and means, site characteristics, and compatibility with current land uses. [30 TAC §336.708(a)(6)]

Site Selection and Siting Criteria – The site selection criteria are provided for hazardous and LLRW disposal facilities in Sections 335 and 336 of the Texas Administrative Code. The proposed Site was selected via a process that considered five key factors:

- Site suitability for long-term isolation of waste per 30 TAC 335.203, 335.204, and 336.728
- Geographic screening considering waste sources and transportation routes
- Critical habitats for endangered species, wildlife refuges, parklands, and national forests

- Compatibility with existing land use
- Current land use

<u>Site Suitability Requirements and Siting Criteria for LLRW Facilities</u> – The Site suitability requirements and siting criteria for the licensing of LLRW disposal facilities are detailed in 30 TAC 336.728. Each of the siting criteria of 30 TAC 336.728 is discussed individually in Section 3.1.2 of Appendix 11.1.1, "Environmental Report."

<u>Geographic Screening</u> – The Site is geographically acceptable considering the waste sources and transportation routes.

<u>Critical Habitats for Endangered/Threatened Species</u> – No critical habitats for threatened or endangered species would be significantly affected by the proposed operations and no federally protected or endangered species were found to reside at the site. Section 11.4.2 provides a detailed discussion of site ecology including critical habitat and nine important species of potential regulatory concern (Table 11.4.2-1).

One species, the Texas horned lizard, is listed as "threatened" by the State of Texas. The Texas horned lizard has been documented as present at the WCS Site. Andrews County lies within the published range of the Texas horned lizard. The lizard is widespread in Texas and has been reported from all but a few East Texas counties. Its numbers are diminishing in many parts of the state, but it is frequently encountered in suitable habitat in much of west Texas. Marginal habitat exists for the two Federal candidate species, the lesser prairie chicken and the Sand dune lizard. Surveys were conducted for these two species at the WCS Site, including the area of the proposed disposal site, and neither of these species was noted. In addition, a lek (breeding area) survey was conducted for the lesser prairie chicken in late April 2004 and no evidence of their presence was noted. Additional discussion is provided in Section 11.4.2 and the complete ecological assessment reports are included in Appendix 2.9.1.

<u>Wildlife Refuges</u> – The nearest national wildlife refuge (NWR) is Muleshoe NWR, located approximately 100 miles north. Muleshoe NWR is the oldest national wildlife refuge in Texas. It was established by Executive Order on October 24, 1935. Located on the high plains of west Texas, Muleshoe was established as a wintering area for migrating waterfowl and sandhill cranes.

Grulla NWR is located approximately 110 miles north-northwest in Roosevelt County, New Mexico, near the small town of Arch. Grulla NWR, which is managed by the staff at Muleshoe NWR, is 3,236 acres, more than 2,000 of which is the saline lake bed of Salt Lake. The rest of the refuge is grassland. When the lake holds sufficient water, Grulla NWR is a beneficial wintering area for sandhill cranes. Ring-necked pheasant, scaled quail, and lesser prairie chicken are also often seen on or near the refuge. Neither wildlife refuge will be impacted by the proposed site activities.

<u>National and State Parks and Landmarks</u> – None of the national or state parks or landmarks in the region are expected to be impacted by the proposed operations. The nearest national park (also a designated National Monument and a World Heritage Site) is Carlsbad Caverns National Park, located approximately 100 miles west of the Site. The closest New Mexico State park is Brantley State Park (New Mexico), located east of Carlsbad Caverns, and Monahan Sandhills State Park (Texas), in Ward and Winkler Counties. The Guadalupe Ranger district of the Lincoln

National Forest is located adjacent to Carlsbad Caverns NP, and is approximately 120 miles west of the Site. The nearest National Natural Landmark is the Odessa Meteor Crater located 10 miles southwest of Odessa in Ector County, Texas.

Location of Waste Generators – Information, including the location of waste generators and their corresponding waste types and expected volumes, is included in Section 8.2 and Appendices 8.0-1 and 8.0-2 of this LA.

Transportation/Site Access – Waste materials will be brought to the facilities via trucks. A traffic survey conducted by TDOT on Highway 176 near the entrance to the WCS property indicates a relatively low to moderate number of vehicles traveling on the highway each day. The impact of the transportation of LLRW as well as any additional vehicle traffic associated with the operation of the proposed Compact or Federal facilities is expected to have minimal effect based on the current truck and vehicle traffic on Texas Highway 176.

A maximum of approximately 342 commercial LLRW shipments and 3,631 DOE LLRW shipments are expected annually, or an average of between one and two commercial shipment and eighteen DOE shipments every working day. It is assumed that each delivery truck will arrive at the Site, unload, and depart on the same day. Therefore, each LLRW delivery truck will make two trips per day (a trip approaching the Site and a trip departing the Site). Thus, the average annual number of truck trips associated with the LLRW shipments to the Site is about 684 commercial trips and 7,262 DOE trips.

Direct access to the site and proposed facility will proceed via the existing access road from Highway 176. The additional volume of truck and vehicle traffic is not expected to require the installation or modification of the existing highway lanes or main access road. Considering the current amount of traffic (currently estimated by the TDOT at 2,550 vehicles per day), the increase in vehicle flow associated with the proposed Compact or Federal Facility operations is low.

Based on discussions with officials from the New Mexico State Highway and Transportation Department and the Texas Department of Transportation, except for standard weight, height, and length restrictions placed on trucks traveling certain routes, there are no restrictions identified that would restrict waste shipments or operations at the proposed facility.

Transportation Costs – Transportation costs were estimated based on the current projected inventories of Compact and Federal waste that may be disposed at the proposed facilities. Figures 11.2-1 and 11.2-2 show simplified present and future potential disposal routes for the Compact facilities, respectively. Waste will be transported from the point of origin to the interstate system, and transported to Texas. It is expected that wastes from Compact states will enter Texas on Interstate 30, connect to Interstate 20, and approach the Site following local roads. Other major highways that may transport waste to the Site include Interstate 10, 35, and contiguous public roadways. Refer to Appendix 11.7 (LLRW Transportation Impact Assessment) of the Application for a detailed discussion of transportation issues.

The modifications shown in the transportation routes for the future facilities were translated into estimated waste shipped per mile cost savings based on a standard transport cost per mile traveled. The total cost savings for transport of the Compact waste to the proposed facility was estimated at 64%. This resulted in an estimated savings of $27.3M for the Compact waste inventory.

Figure 11.2-1. Present Potential Disposal Routes for Texas Compact LLRW

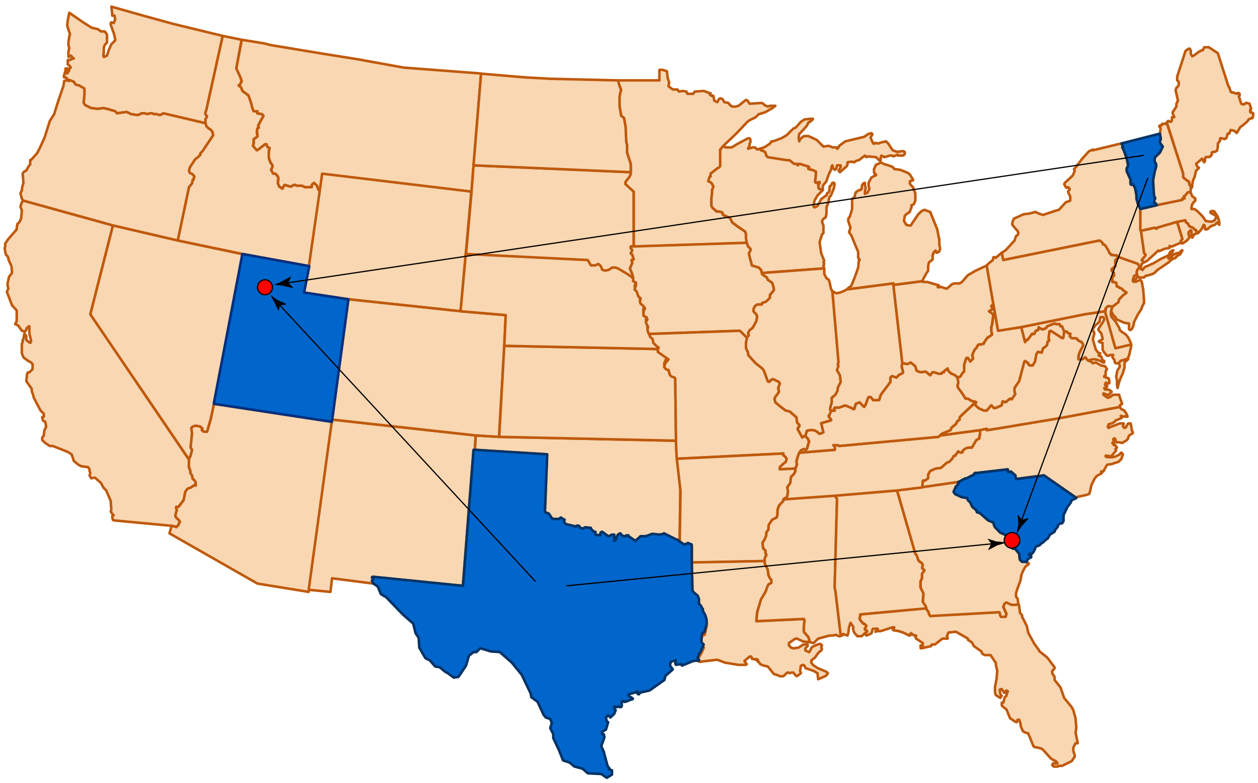
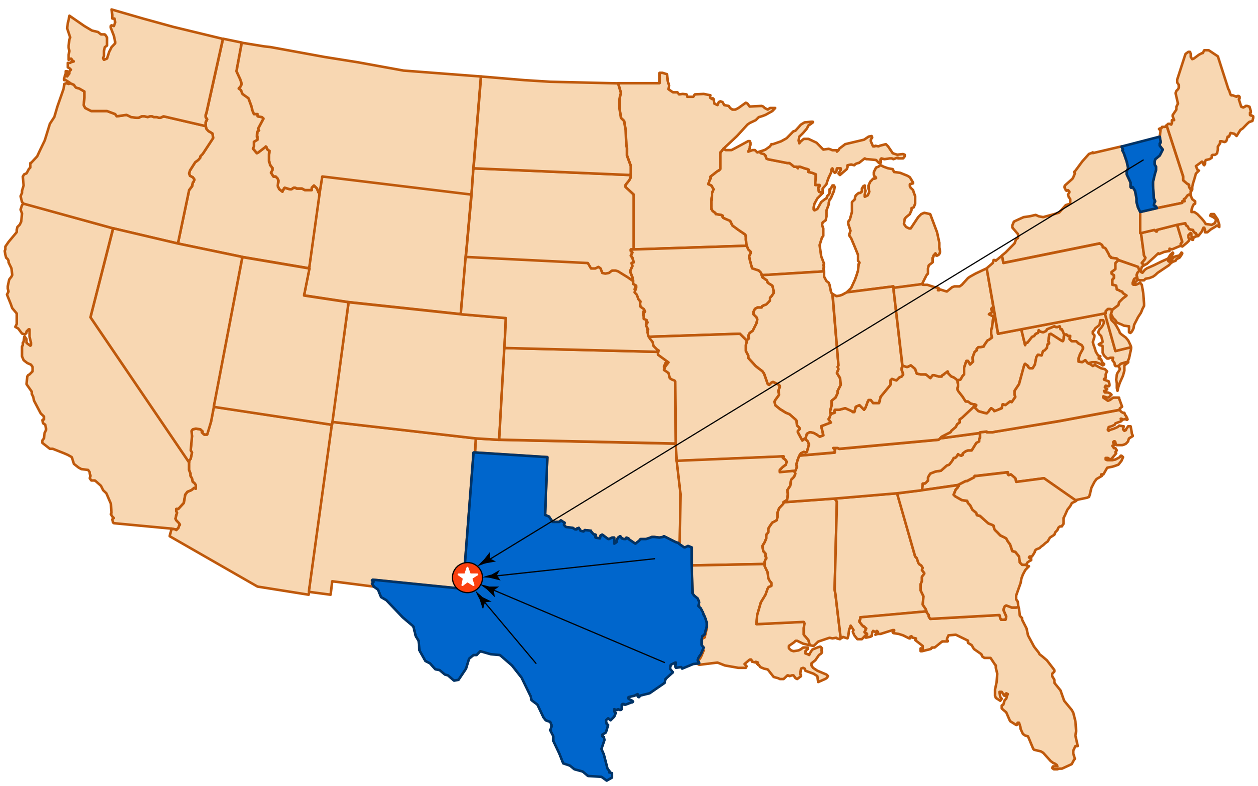


Figure 11.2-2. Future Potential Disposal Routes for Texas Compact LLRW



Site Characteristics – Appendix 11.2.1 provides a discussion of the site characteristics as they relate to the specific siting criteria per 30 TAC 336.728. Section 2.0 of this LA provides additional detailed information concerning these site characteristics including the evaluation criteria for site suitability and selection as well as other related information.

Compatibility with Current Land Uses – The proposed Site is located both adjacent to and in proximity to existing facilities currently used for the processing, storage, or disposal of hazardous, LLRW, MLLW, and municipal solid waste. Therefore, the proposed Site is compatible with current land uses. Implementation of Site plans will not adversely affect current businesses in the vicinity of the WCS property. Industries operating in the vicinity of the proposed Site include gravel mining, oil and gas production, gas processing plants, oil and gas service companies, landfill operations, cattle grazing, and ranching.

A commercial uranium enrichment facility [National Enrichment Facility (NEF)] is currently being constructed in New Mexico adjacent to the western boundary of the WCS property and north of New Mexico Highway 234. Louisiana Energy Services (LES) received a license for construction and operation of the NEF from the NRC. No other significant business development within a 10-mile radius is currently proposed or identified at this time.

11.3 Alternatives to Proposed Project

Discuss project alternatives, including a discussion of the alternatives considered by the applicant for processing and disposal of waste. 30 TAC §336.708(a)(7)

Provide evidence relating to the reasonableness of any technique for managing low-level radioactive waste to be practiced at the proposed land disposal facility or facilities including: studies of alternate techniques of waste processing and reduction at the site of waste generation; and studies of the use of above-ground isolation facilities. [THSC §401.219] & [30 TAC §336.805(3)]

11.3.1 Studies of Alternate Techniques of Waste Processing and Reduction at the Site of Waste Generation

Methods to reduce waste at the point of generation to minimize or eliminate LLRW and MLLW involve the proper handling and classification of both radiological and non-radiological waste. Generators who produce wastes containing low concentrations of short-lived radionuclides (less than 300 days) are able to dispose of those wastes based on their non-radiological characteristics. This allows the wastes to be disposed of in Class I municipal landfills or in hazardous waste disposal facilities permitted by the state and has resulted in a significant decrease in the amount of LLRW and MLLW requiring disposal.

The feasibility of incineration and super-compaction to minimize the amount of waste requiring disposal was evaluated. The potential dose impact of incineration and the cost of disposal was evaluated and presented in the report *Assessment of Incineration of Low-Level Radioactive Waste in Texas: Preliminary Dose, Risk, and Cost Analysis* (Rogers 1986). The incineration of wastes will reduce the volume of waste to be disposed and result in higher concentrations of nonvolatile nuclides in the residue. Significant fractions of volatile nuclides, notably H-3 and C-14, may be released as off-gases and will require added filtration to limit particulate and radioactive emissions from the incinerator. Both dry waste stream and wet waste stream alternatives were evaluated. Volume reduction factors were applied to both waste streams. Waste volumes would be reduced by nearly 35 percent for the incineration of dry waste only and 80 percent for the incineration of wet plus dry waste.

The capital costs for installing incineration equipment is estimated to range from 15 million dollars to 25 million dollars, depending on whether or not wet wastes would be incinerated. This increased cost results in an increase in overall disposal costs because the unit cost for disposal is independent of the volume disposed of over a wide range. The dose predicted for incineration scenarios is also greater than for simple disposal options. Based upon this analysis, the installation of an incinerator was not considered cost effective as a component of the proposed Compact or Federal facilities.

The potential for compacting waste, either through the use of a fixed or mobile compactor, was also evaluated for volume reduction at the points of generation. In the evaluation of both options, it was assumed that only Class A waste received in conventional 55-gallon drums would be compacted. This was assumed, because Class B and Class C wastes must meet the stability requirements set out in the regulations and would not be readily compactable. Thus, the waste to be compacted would come only from a few waste streams. In general, the benefits of using a compaction system for volume reduction combined with the cost savings was deemed insufficient to require further consideration given the overall utility and cost of the concrete canisters and the design and construction of the waste array and facilities.

11.3.2 Studies of the Use of Above-ground Isolation Facilities

Waste Disposal Alternatives – Several alternatives, including shallow land burial and above-ground isolation, for the disposal of LLRW and MLLW have been evaluated in recent years. Several reports have been prepared since 1987 that evaluated the various alternatives in terms of performance, environmental protection, and cost of the disposal alternatives. The alternatives analyzed were:

- Shallow (near-surface) land disposal
- “Enhanced” shallow land disposal
- Above-ground vaults
- Below-ground vaults
- Above-ground modular concrete canisters
- Above-/below-ground modular concrete canisters
- Below-ground modular concrete canisters
- Earth-mounded concrete bunkers
- Mined cavities
- Unlined augured holes
- Liner augured holes

A description of these alternative technologies is contained in Chapter 2, "Low-Level Radioactive Waste Disposal Facilities: Conceptual Designs and Assessments," Vol. 1, Summary Report (Rogers and Associates, 1987a). This report was one of a series of five reports prepared for the Texas Low Level Waste Disposal Authority.

Following the survey of LLRW and MLLW disposal technologies, a decision analysis process was used to assist in the selection of the technologies that appeared best to suit the needs of the state. The selection process considered the technical performance characteristics, as well as critical social and economic factors of importance. A relative score was generated for each of the eleven technologies listed above.

The scoring or decision-making process used multi-attribute utility estimation. This method recognizes that the importance of issues and factors used to judge the performance of a disposal technology are independent of the expected performance. The analysis requires the involvement of those who are intimately familiar with the performance characteristics of the various disposal technologies, and who are able to rate the technologies on a relative technical basis. The decision-making process and the results of the selection methodology are presented in Chapter 3 of Rogers (1987). Using this method, the Authority decided on the following three technologies for the preparation of conceptual facility designs:

- Below-ground vaults with modular concrete canisters
- Above-/below-ground modular concrete canisters
- Above-ground vaults

The conceptual below-ground and above-ground modular concrete canister disposal facilities relied on disposal of waste in concrete overpacks. For the below-ground concrete canister facility, all canisters would have been placed below natural grade. Large and odd-shaped waste items not compatible with canisters would have been placed in a supplementary below-ground vault. In the case of the combination above-/below-ground modular concrete canister facility, low surface gamma activity Class A waste would be placed above natural grade. Canisters containing Class A waste with high surface gamma activity and canisters with Class B and C waste would be placed in below-ground vaults. Large and odd-shaped waste items would be placed in the below-ground vault. All waste will be covered with earth cover systems for both modular concrete facilities.

The below-ground concrete vaults were evaluated in two alternatives: (1) either below-ground with canisters placed above them with a mounded cover (similar to that used by certain facilities in Europe) or, (2) as an adjunct to the below-ground disposal of waste in canisters. The below-ground vaults were designed and constructed in the same manner as the above-ground vaults, with the only difference being the smaller size of the below-ground vaults.

The above-ground vault facility relies on disposal of the waste in concrete vaults constructed above natural grade. Waste received at the facility would be placed in the disposal cells without being removed from the shipping containers, although shipping containers would be removed from the shielding casks, as appropriate. High surface gamma activity Class A waste and Class B and C waste would be limited to the bottom layers of the internal disposal cells only. Void spaces between canisters in the vaults would be filled with granular material.

No Action Alternative – The No-Action Alternative was essentially precluded during the recent Texas state legislative session when a LLRW disposal facility in the state of Texas was accepted. Other viable alternatives for the disposition of the waste before this mandate included joining an existing compact for disposal of Texas-generated LLRW in another state, or disposal of waste in Utah or South Carolina. As discussed above in Section 11.1, the Utah facility is restricted to disposal of only certain types of waste and is also constrained by the Northwest Compact in its ability to dispose of out-of-compact commercial LLRW. The South Carolina facility also has restrictions and limitations on the types and quantities of waste that it will accept, and the Atlantic Interstate LLRW Management Compact (Connecticut, New Jersey, and South Carolina) is moving to eliminate out-of-compact disposal through the imposition of significant surcharges.

Efforts over the past several years indicated that these were not viable alternatives and the State issued the determination that a LLRW disposal facility be constructed and operated within the State.

Selection of Preferred Waste Disposal Alternative – All of the potential alternatives presented above were evaluated. The results of the analysis presented in Rogers (1987) were reviewed in depth during the selection of the preferred design presented in Section 3.0 of the LA. The final design selected was the modified “below-ground vault with modular concrete canister” design. In general, this design was considered to be one of the most simplistic, effective, and structurally sound. The design was also selected to meet the current regulatory requirements of the State.

The basic elements of this design were enhanced to include two additional important features: 1) a thicker and more robust cover design, and 2) an enhanced monolithic internal structure using reinforced concrete canisters with minimal void space in the disposal cell. The selected multi-layer cover system includes more than 20 feet of native red bed clay and a graded angular rock bio-barrier among other features. The cover design is described in detail in Section 3.5 of the LA. The enhanced internal structure of the disposal cell includes canisters that are highly reinforced and designed with additional structural stability using 2,000 psi concrete as internal fill. The vault will be filled with pea gravel and sand to specification to complete the “monolithic” cell design by eliminating void spaces between waste arrays. The design is described in detail in Section 3.0 of the LA.

Alternative Site Designs – The alternative site designs including options for waste receipt, processing, the location and configuration of the disposal units, disposal cell construction, on-site waste transport and waste placement, and cover construction are discussed below.

Alternative designs were conceived for disposal of LLRW at the WCS property to meet the requirements of the Texas Radiation Control Act and implementing regulations. Previous studies commissioned by the Texas Natural Resource Conservation Commission (Texas Compact Low-Level Radioactive Waste Generation Trends and Management Alternatives Study 2000) were reviewed during the development of alternative design. The WCS Andrews County property could feasibly support two alternative designs for the proposed LLRW and MLLW disposal facility. One design is the preferred configuration that maximizes the isolation capabilities of the approximately 700-foot-thick sequence of red bed clay deposits and utilizes the aridity of the site, minimal infiltration, and depth to groundwater beneath the landfills. The preferred design, described in detail in Section 3.0 consists of lined disposal units excavated into the red bed clays and covered with state-of-the-art multi-layered, infiltration-limiting cover. Permeable sands overlying the red bed clays will be removed by excavation adjacent to the disposal units and replaced to final grade with compacted clay.

The landfill design includes multiple synthetic and soil component liner systems in order to minimize the potential for any leakage to breach the liner systems and enter the environment. This liner system is used both below and above the disposed materials. The principal cover design features and review of TCEQ performance objectives are in Section 3.0, "Design." The potential for bathtubbing is avoided since the hydraulic characteristics of the liner above the disposed materials (the performance cover) match those of the liner below the disposed material, and the surface area of the lower liner along the bottom and sides of the landfill exceeds the surface area available for infiltration through the performance cover. The proposed landfills meet or exceed all of the design parameters contained in the EPA Technical Guidelines.

The alternative configuration would use the wedge of permeable sands rather than the red bed ridge. This alternative design would consist of shallower lined disposal units excavated into the sand, caliche, and underlying sand and gravel and covered with multilayered, infiltration-limiting covers. To provide equivalent volume, the shallow configuration would require a larger footprint, a greater number of disposal cells, or an increased mass above existing grade elevation. These changes result in a larger surface area for the cover systems, which may translate into increased infiltration into the disposal units, and increased costs for the disposal units. This alternative design does not take advantage of the isolation capabilities of the red bed deposits and does not utilize the extreme depth to groundwater.

Options for Receiving, Classifying, and Processing Waste – The need for sampling and surveying waste was evaluated for several configurations, including the current RCRA sampling facility. Operational simplicity will result from one central receipt/inspection area at the main gate, followed by package-level surveys and analysis at the correct disposal facility.

Segregation of containerized high A/B/C waste packages was evaluated and the approach allowing "random" placement of canisters containing high A/B/C waste was judged to be preferable to multiple disposal areas for each containerized waste class and to allow for operational simplicity. Since the entire waste array will be at least 35 feet below final grade with the final cover system in place, this "random" placement approach was deemed acceptable and appropriate. Waste placement and disposal is discussed in more detail in Section 5.4 and OP-4.0 and OP-4.5 in Appendix 5.5. Because canisters containing high A/B/C packages will not be intentionally grouped together by class in a specific cell, the probability that inadvertent driller cuttings will be removed from multiple packages stacked together is reduced as well.

Additional safeguards against intrusion into the waste include ownership of mineral rights by the State of Texas and control of mineral development through the use of surface use agreements, recording of restrictive covenants, physical barriers and fences, and clearly posted warnings around the disposal sites.

Planned Location and Configuration of Disposal Units – The overall land area required for the CWF and FWF was considered and evaluated as part of the design. The depth of excavation was also evaluated, and is directly related to the facility footprint. The proposed facility layout optimizes the crest elevation of the red bed clay horizon so that excavation depths are similar across both disposal cells and the topography can be restored, yet are adjacent to each other so support facilities can support both units effectively. The general shape of the disposal cells was also evaluated and several layout options were considered.

A range of waste placement and backfill options were considered, with particular emphasis on how to ensure all void spaces are removed. Dry granular fill was considered and would be effective, but flowable fill grout was judged to be preferable for placement within the canisters for a variety of operational reasons. Flowable fill material (e.g., sand or other clean fill material) will be used around the exterior of the canisters.

Construction of Disposal Units – Several excavation approaches were developed and screened, and the approach discussed in detail in Section 4.0 of the Application was determined to be most effective for the materials to be removed during construction. Construction of the waste array was evaluated to ensure several operational modes could be used; the current placement with grouting was judged to be preferable for operations. The ability to use the excavated area above the red bed clay (i.e., excavated area of OAG) was considered for placement of LLRW, but was not selected for the proposed design. While this placement approach would reduce the depth of excavation required, the proposed configuration takes maximum advantage of the Site geology and offers technical advantages by ensuring the cover system is isolated from surficial erosion mechanisms.

On-Site Transport of Waste and Placement in Cell – The proposed approach for transport of waste to the disposal array relies on dedicated WCS vehicles, but the use of over-the-road transports to deliver waste directly to the waste cell was also considered. WCS currently has over-the-road vehicles that use a steel skid platform that can be moved to wherever the truck needs to unload. The dedicated WCS vehicles would never touch contaminated material and would allow for one-time handling of the waste, which would reduce the chances for accidents, spills, and exposure. Therefore, the dedicated WCS vehicle option was selected due to the reduced potential for contamination and the benefits of transfer of packaged waste at a surface facility. Waste package and modular concrete canister (MCC) placement options using both crane and forklift were evaluated. Placement of all waste using a mobile crane was considered but judged to be less effective than using a combination of lift trucks and crane placement. Several stacking geometries for MCCs were evaluated, with the final approach selected to simplify operations planning. Similarly, the need to interlayer fill material between waste levels and the best method for dispersing the fill was evaluated, and flowable fill was selected over granular select material. Flowable fill material (e.g., sand or other clean fill material) will be used within the interlayers and around the exterior of the canisters.

Construction of Disposal Unit Covers – The final cover system considers the use of various local materials to reduce transport costs, and red bed clay was selected as generally preferable to other source materials (e.g., OAG) because it has low relative permeability and is more plastic under the conditions of placement at WCS. The geometry of the cover system considered a range of options, and the convex shape of the final cover was selected as preferable to other options. Additionally, the integration of the operational cover with the final cover design included several methods for minimizing infiltration before final closure, with the current approach selected because of its effectiveness, ability to monitor settlement from surface grade, and complementary function with the final cover system.

WCS considered a number of options for the cover system, ranging from a single, thick compacted clay cover to a composite, multi-layer, infiltration-limiting cover. WCS elected a state-of-the-art cover (see Figure 9 in Appendix 2.5.1) that relies primarily on natural materials and native vegetation to prevent infiltration of precipitation; provide internal drainage; minimize potential adverse effects of weather, plants, and burrowing animals; provide long-term stability against erosion; and protect potential inadvertent intruders.

11.4 Characteristics of Proposed Site

Describe area and site characteristics including ecology, geology (including geotechnical features), seismology, geochemistry, soils, topography, hydrology, air quality, natural radiation background, meteorology, climatology, historical and cultural landmarks, archaeology, demography, and current land uses. The applicant's report shall address the following topics: [30 TAC §336.708(a)(3)]

11.4.1 Geography and Demography

(1) Site Location

The proposed WCS disposal site is in Andrews County, Texas near the border of Lea County, New Mexico, as shown on Attachment E. The city of Andrews, Texas is the closest town to the Site in Texas and Eunice, New Mexico is the closest population center to the Site in New Mexico, at distances of about 31 miles and 6 miles, respectively. Other population centers and the respective distances from the site are as follows:

- Hobbs, Lea County, New Mexico: 20 miles north
- Jal, Lea County, New Mexico: 23 miles south
- Lovington, Lea County, New Mexico: 39 miles north-northwest
- Seminole, Gaines County, Texas: 32 miles east-northeast
- Denver City, Gaines County, Texas: 40 miles north-northeast

(2) Site Description

The proposed Compact and Federal facilities are located in western Andrews County, near the Texas-New Mexico state line and approximately one mile north of Texas Highway 176 (see Attachment F). The access road to the proposed Site extends south to north just east of the Texas–New Mexico state line. Attachment F shows the proposed Compact and Federal facilities relative to the surrounding areas. Surrounding land use and a description of the operations is described in detail in Section 2.2.1 (land use) and Sections 5.3.1 and 5.4.1 (Operation), respectively.

(3) Population Distribution

Aside from the communities identified in (1), the population density around the site region is extremely low. The combined population of the four counties (Andrews County, Gaines County, and Winkler County, Texas and Lea County, New Mexico or the Region of Interest [ROI]) that borders the proposed facility is 90,155 based on the 2000 U.S. Census (USCB 2002). This represents a 2.9% decrease over the 1990 population of 92,852 persons. Details concerning populations in the ROI are provided in the Socioeconomic Report included as Attachment A to Appendix 11.1.1, "Environmental Report."

(4) Uses of Adjacent Land and Waters

The WCS property consists of approximately 15,000 acres of land. Figure 2.2.1-1 in the LA shows the proposed Site location and land use within a five-mile radius surrounding the property. The nearest Texas town to the proposed disposal site is Andrews, 31 miles east. The nearest town in New Mexico is the City of Eunice, which is approximately six miles west of the proposed facility. The nearest residence is situated approximately 3.5 miles west of the proposed Site. The nearest perennial surface waters are a depression about 2.5 miles east of the facility boundary and manmade ponds in the Wallach Quarry about one mile west of the facility boundary. Baker Spring, about 3,000 feet west of the FWF, ponds water following precipitation events that lead to surface runoff, and the currently ponded water in Baker Spring is in response to the heavy precipitation in 2004 (some of the ponded water may also be from ephemeral ground water discharge from the OAG following the wet 2004 year). Prior to 2004 the Baker Spring area was dry for at least several years, based on direct observation. It is not known how long the spring area was dry prior to 2004.

Industries in the vicinity of the proposed Site include gravel and caliche mining, oil and gas production and processing, oil and gas service companies, landfill operations, cattle grazing, and ranching. Louisiana Energy Services (LES) has received a license from the NRC to operate a uranium enrichment facility about one mile west of the proposed Site. No other significant business development within a 10-mile radius is identified at this time. Livestock grazing is a seasonal activity that depends on current range conditions. The majority of the land within five miles of the site is used for grazing and ranching activities. Other businesses in proximity to the WCS property include Wallach Quarry, Sundance, Inc, and DD Landfarm, located about one mile northwest and west of the proposed Site. The Lea County Landfill occupies approximately 40 acres and is located southwest of the proposed Site about one mile and adjacent to WCS property. Oil and gas wells are located to the west in New Mexico and to the north, south and east in Texas.

11.4.2 Ecology

This text below includes a summary of the ecological assessment reported in the Section 2.2 of the Environmental Report (Appendix 11.1.1). The complete ecological assessment, including the 2004 and 2006 updates prepared by URS, is included in Appendix 2.9.1.

The Site is located in the High Plains region, which is part of the central Great Plains. Site vegetation consists mostly of grasses, forbs, and shrubs with a few scattered trees. Site fauna includes kangaroo rats, cottontails, deer, coyote, raccoon, turkey vulture, Swainsons hawk, American kestrel, American robin, a variety of sparrows, and many other common species typical of habitats found on and in the vicinity of the Site. Amphibians and reptiles observed on and near the Site included the New Mexico spadefoot toad, ornate box turtle, Texas horned lizard, whiptail lizards, and western coachwhip snake. In addition, the Site is populated with western diamondback rattlesnakes, and it is likely that prairie rattlesnakes also inhabit WCS property. Invertebrates observed on and near the Site included scorpions, spiders, and a variety of common families of beetles and bugs. Species of flora and fauna found during surveys and those expected to occur in habitats of the Site and vicinity are common and widespread in the region. Negative impacts of project development would be insignificant to these common and widespread species and regional ecosystems.

Natural habitats on and near the Site, though disturbed and fragmented, support many native species and a relatively complete terrestrial ecosystem. All four classes of terrestrial vertebrates and many invertebrate phyla are present in the area. Abundant insects graze on vegetation, as do many small mammals (e.g., pocket mice, kangaroo rats). Small predators include grasshopper mice, spiders, snakes, and lizards. Mule deer and peccary are the largest herbivore species and are also consumed by humans. The largest predators on and around the Site include the coyote and hawks. The food web of this community is complete, though impacted by human development and livestock. All functional groups are represented, and pathways of energy, nutrients, and potential contamination are standard for desert grassland and scrubland communities. Potential adverse effects on aquatic ecosystems of the region are unlikely, due to the absence of aquatic habitat on or near the Site. Periodic flooding may occur, but effects would likely be limited to minor physical disturbance.

Nine species of regulatory concern may potentially occur at the Site (Table 11.4.2-1). No negative impacts are expected to occur to these species, as they are not expected to be more than occasional visitors to the Site. Two species of potential regulatory concern, the lesser prairie chicken and the Texas horned lizard, were reportedly observed on the WCS property. Neither species was observed during a survey conducted in 2004. WCS' property does not provide the preferred habitat for the lesser prairie chicken and the habitat loss during construction and operation is not expected to adversely impact any potential local populations. Lesser prairie chicken survey data are included in Appendix 2.9.1. The Texas horned lizard is widely distributed throughout the region, and the construction and operation of the proposed disposal facilities will not significantly affect habitat availability or local populations. The habitat of the sand dune lizard is in a limited area of Texas and New Mexico. The preferred habitat is active sand dunes with mesquite, which are marginally present at the Site. Site construction and operation will not affect habitat for the sand dune lizard.

Mule deer, northern bobwhite, scaled quail, collared peccary (javelina), and mourning dove are important game species in the region. Site development is likely to have insignificant negative impacts on the habitat of these common and widespread species. Additional species present at the Site could possibly pose a threat to the integrity of the cover/barrier systems of the proposed disposal units. Burrowing animals, such as ground squirrels and ants, and deep-rooted plants, particularly shrubs and grasses, could penetrate cap materials necessitating bio-intrusion barriers and other controls. Appropriate controls will be implemented as part of the design and construction of the cover/barrier systems.

Table 11.4.2-1. Species of Regulatory Concern

Species	Suitable Habitat at WCS	Federal Endangered	Texas Endangered	Federal Threatened	Texas Threatened	Federal Candidate Species, Category 1
Birds						
American Peregrine Falcon (*Falco peregrinus*)	No. WCS may be on migration route		X			
American Swallow-tailed Kite (*Elanoides forficatus*)	No. WCS may be on migration route				X	
Bald Eagle (*Haliaeetus leucocephalus*)	No. WCS may be on migration route			X	X	
Lesser Prairie Chicken (*Tympanuchus pallidicinctus*)	Marginal habitat present, not observed during 2004 survey					X
Southwestern Willow Flycatcher (*Empidonax traillii extimus*)	No. WCS may be on migration route	X	X			
Whooping Crane (*Grus americana*)	No. Not observed on or near Site.	X	X			
Mammals						
Black-tailed Prairie Dog (*Cynomys ludovicianus*)	No. Not observed on or near Site.					X
Reptiles						
Texas horned lizard (*Phrynosoma cornutum*)	Yes. Observed on WCS property.				X	
Sand Dune Lizard (*Sceloperus arenicolus*)	Marginal habitat present, not observed.					X

11.4.3 Meteorology and Air Quality

This section provides a summary of meteorology and air quality data collected. See Section 2.3, Appendix 2.3.1, and the ER Section 2.3 for a more detailed discussion and data presentation.

Meteorology – Data were collected from the on-site meteorological station operated by WCS as well as four additional stations in the area for use as a comparative analysis. The data collected by the on-site station operated by WCS is summarized in conjunction with data collected by the four regional weather stations as discussed in detail in Section 2.3. Data summaries for precipitation, temperature, humidity, wind speed, direction, stability, and other parameters are provided in Appendix 2.3.1.

Air Quality – Currently, Lea County, New Mexico, and Andrews County, Texas, are in attainment for all of the criteria pollutants (nitrogen oxides, sulfur oxides, lead, carbon monoxide, particulate matter, and ozone). The primary air pollutants that will be generated during construction and operation will include particulate matter from transport vehicles and excavation activities and carbon monoxide from fuel combustion. Other criteria pollutants, volatile organics, and inorganic emissions are not expected in amounts significant to require analysis. The amount of particulate and other pollutants from the construction and operation are considered to have minimal effect in the vicinity of the proposed Site as well as in the region.

11.4.4 Hydrology

The WCS Site is located in a semi-arid region. There are no perennial streams flowing through or adjacent to the Site. There are two perennial water bodies within five miles of the Site: a depression about 2.5 miles to the east and a manmade pond in the Wallach Quarry about one mile to the west. The depression likely holds water in all but extended periods of drought. The pond in the Wallach Quarry is sustained by transfer of surface water captured in excavated areas of the quarry and by pumping of groundwater, if encountered, from quarry excavations. Ephemeral water bodies include each of the playas, which hold surface water for short periods of time following heavy or sustained rainfall events. In general, the playas retain surface water for less than two weeks. Man-made features, such as stock ponds, retain water for periods of months to years.

The remaining surface water features include Baker Spring, three stock ponds located near the eastern boundary of the WCS property, and a stock pond located southeast of the facility boundary. The stock ponds are man-made features that retain surface water for several months following significant rainfall events. Baker Spring, a historic spring that discharged from the OAG, is normally dry. It may discharge ephemerally following heavy precipitation. Ponded water in the Baker Spring area is primarily the result of surface water that collects in a past gravel and caliche mining area in a shallow excavation into the Dockum red beds. The excavation in the Baker Spring area retains surface water for sustained periods following significant precipitation.

The principal surface water drainage feature on the Site consists of a draw, referred to as the ranch house drainage, which crosses the southern portion of the Site. The draw crosses the WCS property about ½-mile south of the proposed disposal site and flows from east to west. Most of the surface water caught by ranch house drainage is lost to infiltration in the eolian sands deposited in the drainage. Sand dunes encroach on the drainage in the southwest part of the facilities area. Ranch house drainage crosses under the access road to the southwest of the proposed site through six 29-inch by 18-inch culverts and crosses under State Highway 176 through two 43-inch by 27-inch culverts. After crossing the highway, the drainage intersects an earthen feature that appears to be an old dirt road that allows the drainage to continue southwest and ultimately drains into Monument Draw in New Mexico.

Drainage of the Site was evaluated as part of the floodplain analysis conducted in February 2004. Figure II.F.4 in Appendix 2.4.1 shows the floodplain for the drainage area. The combination of the low annual precipitation, permeable surficial soils, high evapotranspiration, and site topography results in a well-drained site. The disposal site is free from areas of flooding or frequent ponding.

No downstream surface water uses in Monument Draw, New Mexico have been identified within 10 miles of the Site through the review of aerial photographs. The location of water wells within a 10 km radius of the existing RCRA/TSCA landfill is provided in Appendix 2.6.1.

11.4.5 Geology and Hydrogeology

Geology – The regional and local geology of the WCS site is discussed in detail in Section 2.5. Section 2.5 includes discussions of regional and site-specific stratigraphy, structural setting and tectonic features, seismicity, salt dissolution, geomorphic features and erosion. The Site is underlain by the Late Tertiary/Quaternary-aged pedogenic caprock caliche that developed on all pre-Quaternary strata on the High Plains. Quaternary Blackwater Draw eolian sands and younger windblown sands overlie the caprock caliche in the northern and southern parts of the WCS property. Below the caprock caliche are sands, gravels, and sandstones that have been variously ascribed to the Tertiary Ogallala Formation, the Tertiary-aged sections of the Gatuna Formation, and the Cretaceous Antlers Formation.

The sands, gravels, and sandstones on which the caprock caliche developed represent a single hydrostratigraphic unit overlying the distinctive red and purple claystones, siltstones and sandstones (referred to as the red beds) of the Triassic Dockum Group. The undifferentiated sands, gravels, and sandstones of the Ogallala/Antlers/Gatuna Formations are referred to as the OAG hydrostratigraphic unit, or simply the OAG unit. The OAG unit is present beneath the entire WCS property at depths ranging from about 20 feet in the vicinity of the proposed LLRW disposal sites to about 60 to 70 feet on the northern and southern boundaries of the WCS property.

The OAG unit overlies the Triassic red beds throughout the WCS property. The Cooper Canyon Formation, composed mainly of claystone red beds with interbedded siltstones and sandstones, comprises the upper 600 feet of the Triassic Dockum Group. The Dockum Group extends to a depth of about 1,400 feet. There are several sandstone/siltstone layers identified below the top of the Cooper Canyon Formation, labeled as the 80-foot zone, the 125-foot zone, the 180-foot zone and the 225-foot zone. The 80-foot zone occurs sporadically and in places appears to be a mixture of sandstone/siltstone/claystone which as a package may be identifiable but the individual sandstone/siltstone beds do not correlate well between boreholes. The 125- and 180-foot zones appear relatively continuous in the facilities area, with the 180-foot zone apparently thinning to zero south of the proposed landfills. The 225-foot zone appears to be present throughout the facilities area.

The WCS property is located over a geologic feature referred to as the red bed ridge (Appendix2.6.1, Figure 4.19b). The buried ridge occurs on the upper surface of the Triassic Dockum Group and extends for at least 160 km from northern Lea County, New Mexico through western Andrews County and into Winkler and Ector Counties, Texas. Appendix 2.6.1, Section 4.1.1.4 provides additional discussion of the structural setting and development of the buried red bed ridge.

Seismic Conditions and Hazards – The Central Basin Platform, the predominant regional geologic structural feature, is an area of moderate, low-intensity seismic activity. The Rattlesnake Canyon earthquake in 1992, with an epicenter located about 20 km southwest of the Site and a magnitude M=5, was the largest recorded in the vicinity.

A site-specific probabilistic seismic hazard analysis of the Site was performed and is provided in Appendix 2.5.2. The largest contributor to the hazard at the proposed Site is the background seismicity of the Southern Great Plains seismic source zone. The results indicated a peak acceleration of approximately 0.05 g, resulting in a modest increase in ground motions.. The small calculated peak accelerations and minimal ground motion resulting from the probabilistic seismic analysis indicates that the FWF and CWF are in a stable seismic zone. Based on experience with modeling the geomechanical properties of the Dockum formation and the OAG, and the level of shaking with peak ground accelerations of only 0.05g, shaking-induced displacements, strains, and stresses of the liners and performance cover are expected to be extremely small.

Faulting, Folding and Tectonic Processes – Discussion of faulting, folding and tectonic processes is provided in Sections 2.5.3 and 2.5.4 and in Appendix 2.6.1. Faulting of any significance in the vicinity of the WCS site or the Central Basin Platform is generally considered to be Permian or earlier. An apparent deep-seated anticline and syncline pair occur in the Upper Permian formations about 1,500 feet below ground surface. The anticline appears to be coincident with the red bed ridge, perhaps suggesting the ridge may in part have structural origins. Small reverse faults, with displacement up to about 20 feet, and gentle folding were observed in the Triassic red beds below the OAG unit in the existing RCRA/TSCA landfill cell. A geologic investigation of the faults showed no indication that the Cretaceous Antlers Formation or any younger geologic units were affected by the faulting in the Triassic red beds. The faults in the Triassic red beds predate the Antlers Formation, which is about 135 million years old.

Post Laramide tectonic activity in west Texas and New Mexico includes volcanism and Basin and Range extension in Trans-Pecos Texas and New Mexico, development of the Rio Grande rift and epeirogenic uplift of the Colorado Plateau and High Plains areas. The closest areas of faulting that affect Quaternary strata are faults associated with the Basin and Range physiographic province. The closest Quaternary faults are associated with the range-front of the Guadalupe Mountains and are located along the southwestern base of the mountain range. The closest Quaternary fault is the Guadalupe fault approximately 104 miles southwest of the WCS facility in Guadalupe Mountains National Park in Culberson County, Texas. A discussion of the Quaternary faults is provided in Appendix 2.6.1, Section 4.1.

Subsidence and Salt Dissolution – Subsidence and salt dissolution are discussed in Section 2.5.6 and in Appendix 2.6.1. A detailed evaluation of potential salt dissolution in the vicinity of the WCS site is provided in Attachment 4-2 of Appendix 2.6.1. No subsidence features related to geologic processes or human activities have been identified in the vicinity of the Site . The nearest active subsidence features to the proposed Site are the San Simon Swale, the San Simon Sink, the Wink Sink, an unnamed sink within about one mile of the Wink Sink, and a sink northwest of Jal, New Mexico. These subsidence features, 20 miles or more to the west and southwest, are all located above the Permian Capitan reef aquifer. They are believed to be caused by the collapse of solution cavities formed above the Capitan Reef aquifer. The WCS facility is located near or within the interior dissolution zone defined by Gustavson and Finley (1985). Reeves (1991), based on apparent Permian salt removal in oilfield geophysical logs, indicates that Whalen and Shafter Lakes may be subsidence features. These lakes are located approximately 15 miles and 25 miles southeast and east of the WCS facility, respectively.

Erosion – Erosion is discussed in Section 2.5.7 and in two separate Attachments (4-1 and 4-3) to Appendix 2.6.1. Photo-geologic evaluation of the landforms in the vicinity of the facilities area using stereoscopically-paired aerial photographs from 1938 through 2004 as well as NHAP color infrared aerial photographs and satellite images indicate the landforms have remained stable for at least the last 70 years. A small area of erosion visible in the aerial photos in 1938 has been covered with windblown sand and is completely buried in later photos, indicating local aggradation. The photo-geologic interpretation is that active erosional processes have a relatively low impact in the facilities area.

From a regional perspective using extremely conservative erosion rates from areas on the High Plains with higher precipitation it is estimated it would take 50,000 years for retreat of the High Plains escarpment to reach the WCS facilities area (Attachment 4-1 to Appendix 2.6.1). The time it would take Monument Draw to retreat to the WCS facilities area, assuming the area returned to pluvial climatic conditions, was estimated at between 66,000 and 160,000 years (Attachment 4-1 to Appendix 2.6.1).

At the local site scale, the site is presently stable and/or aggrading. The relict drainage system on the site, termed the ranch house drainage, is not currently integrated (Attachment 4-3 to Appendix 2.6.1). Patterns of active channels are disrupted, short, and discontinuous, due to blockages by accumulation of eolian sediment. Eolian deposits cover more than two-thirds of the facility area and have accumulated during various periods since at least 60,000 years ago, based on luminescence dating of eolian sands that have accumulated in the main ranch house drainage that runs from east to west across the site. The ubiquitous presence of cryptogamic soils, fragile biological soil crusts, across most of the site indicates that surfaces are presently stable. The ranch house drainage was not apparently re-integrated during the pluvial period at the end of the last glaciation, based on the net aggradation eolian profiles and age dating of the eolian deposits. The climate analysis (Appendix 2.3.3-1 to the LLRW LA) concludes that the wettest period in the next 50,000 years will be less wet than the last pluvial period, indicating that, without any variable other than climate, net aggradation would continue to be expected in the future.

Lineaments – Lineaments are discussed in Section 2.5.7.2. The dominant orientation of surface lineations in the Southern High Plains is northwest to southeast, with a secondary orientation of northeast to southwest (Finley and Gustavson, 1981). Lineaments at the WCS site trend about 300° to 310°. Lineaments, aligned playas and drainages are prevalent on the Hobbs Sheet (Geologic Atlas of Texas, 1976: provided in Appendix 2.B as Plate 2-1) in areas with similar surficial geology. Bachman (1973) discusses these types of lineaments, concluding that the aligned depressions (playas) formed by etching of caliche between former longitudinal dunes that have since disappeared. Bachman suggests a late Pliocene or early Pleistocene age for the aligned swales and longitudinal dunes, "because winds were from the west-northwest, as indicated by alignment of swales, rather than from the west or southwest as shown by younger dunes."

Geotechnical Features – The geotechnical features of the Site include the natural slope of about 1% to the southwest, sufficient to promote effective drainage, but at velocities that will not carry a significant sediment load or cause significant erosion. The caprock caliche provides a natural armoring that assists in preventing erosion and human or animal intrusion. There is a natural drainage layer at the OAG unit/Dockum interface to which the drainage layer in the cover system can be connected, thereby diverting any moisture that enters the cover system to subsurface drainage away from the disposal areas. The depth to the disposal horizon in the red beds meets minimum depth requirements for canister waste, provides reasonable assurance against intrusion, results in a thick cover minimizing any potential radiation doses after closure, mitigates any need for post-closure maintenance, and allows the performance cover elements to be placed significantly below grade, again assisting in minimizing erosion and isolating the waste from intruders. The red beds have a very low hydraulic conductivity that minimizes both ground water flow and infiltration through the cover which will be constructed of red bed clays.

Hydrogeology – The regional and local hydrogeology is discussed in detail in Section 2.5 8 and in Appendix 2.6.1. The water table is located in the OAG north of the proposed landfills. As the proposed landfills are approached from the north the water table enters the red beds and drops below the 125-foot zone, evidenced by dry wells in the 125-foot zone. Continuing to the southwest the water table crosses the claystones between the 125- and 180-foot sandstones. The water table beneath the northern parts of the proposed FWF and CWF disposal units is confined to the claystones between the dry 125-foot zone and the 180-foot zone. The claystone between the 125- and 180-foot zones is too impermeable to yield water to wells. The location of the water table in the zone between the dry 125-foot zone and the 180-foot zone is discussed in detail in the context of the WCS site hydrogeological conceptual model in Appendix 2.6.1, Section 6.2.6.

The 180-foot zone goes from confined to unconfined to dry conditions from the north to the south side of the FWF. There are four wells in the 180-foot zone that exhibit unconfined or water table conditions. Where the 180-foot zone contains confined ground water, the water table (and capillary fringe) above the 180-foot zone are interpreted from core sample moisture contents that approach 100%. The water table is in all instances of the order of 40 feet or more below the bottom of the FWF and CWF. Where the 180-foot zone is dry to the south of the FWF and CWF, the water table is confined to the claystone between the dry 180-foot zone and the 225-foot zone, which is saturated and under confined conditions.

11.4.6 Archaeological, Cultural Resources, and Historical Landmarks

The proposed project was analyzed for potentially negative impact on historic resources located within the construction and staging areas of the proposed project. If proposed project activities required the physical relocation, demolition, or alteration of those character-defining elements that convey the significance of an historic property, potential archaeological, cultural, or historic resources could be negatively impacted. Historic resources include buildings, structures, objects and non-archeological sites and districts that are important in the history of a community, a region, the state of Texas, or the nation. Investigations were conducted within 10 kilometers of the proposed project site to determine whether historic resources that are listed in or eligible for listing in the National Register of Historic Places (NRHP) or that are designated as New Mexico Registered Cultural Properties (NMRCP) or Registered Texas Historical Landmarks (RTHL) are present in the vicinity, and if so, whether the proposed project would impact listed or eligible historic resources. A map showing National Register Properties, National Natural Landmarks, National Parks, New Mexico Registered Cultural Properties, Recorded Texas Historical Landmarks, and Texas State Archaeological Landmarks located within a 10 km radius is discussed as part of Appendix E to the Socioeconomic Impact Analysis (SIA) included as Attachment A in Appendix 11.1.1**.**

A search of the Texas Historical Commission's (THC) files indicates that there are no previously identified NRHP or RTHL historic resources in the construction or staging areas of the project. Thus, the project would not directly impact any historic resources. The THC search also indicates that there are no previously identified NRHP or RTHL historic resources within 10 km of the proposed project site. Based on a search of the on-line database for the New Mexico Registered Cultural Properties and communication with the NMRCP coordinator at the New Mexico Historic Preservation Division (Personal Communication. John Murphey, March 1, 2006), there are no previously identified NMRCPs within 10 km of the proposed project site.

Project architectural historians reviewed current and historical maps of the area within a radius of 10 kilometers of the project site, to identify buildings or structures 50 years old or older. Buildings that appear on both current USGS quad maps and on historical maps were flagged as potential historic resources to be investigated further during fieldwork. Buildings that appear on current USGS maps but did not appear on the pre-1955 maps were flagged as likely non-historic properties, but were confirmed as such during the survey. An architectural historian conducted the field investigations on March 8, 2006. The investigation consisted of driving all public roads within the 10 km study area to visually identify buildings, structures and objects that meet criteria for historic significance and integrity. Photographic and written documentation was gathered on four properties that appeared to be 50 years old or older. Additional photos were taken of properties that did not appear to be historic in order to provide an overview of the character of the building stock in the vicinity of the historic-age properties.

Following the field investigations, project architectural historians compiled an evaluation context for the study area and conducted analysis to determine whether any of the historic-age properties meet the criteria for listing in the NRHP or for being registered as RTHLs or NMRCPs. The findings of this analysis were summarized in letter reports submitted to the THC and the NMHPD for their comments. The letter reports concluded that none of the historic-age properties represent significant themes in local, state or national history, are not associated with significant persons and do not represent significant trends in architecture or design. They further conclude that since no significant historic resources are present in the 10 km study area, the project has no potential to adversely impact historic resources. Copies of the letter reports and coordination are provided in Appendix E to the Socioeconomic Impact Analysis (included as Attachment A in Appendix 11.1.1), and THC and NMHPD concurred with the reports on July 20 and July 21, 2006 respectivel.

Resources along travel routes beyond the 10 km study area would not be affected except in the case of a widespread emergency contamination. In such cases, the health and safety of the public would be the first priority, and standard remediation efforts would be employed. If it appears that historic resources would be affected by the non-emergency stages of remediation, professional architectural historians will be consulted to determine whether remediation efforts would impact significant historical resources and to identify ways of avoiding impacts.

In March 2006, archeological research for this study consisted of a review of the site records and previous projects conducted within a 314.16 km^2 area (10 km radius of the project center) encompassing parts of Texas and New Mexico. Research was conducted at the Archaeological

Records Management Section of the New Mexico Historic Preservation Division (NMHPD), the Texas Historical Commission (THC), and the Texas Archeological Research Laboratory. A total of 18 archeological sites were identified within the study area, 14 in New Mexico and four in Texas. Of these 18 sites, seven sites (LA140701 through LA140707) have been determined eligible for the National Register of Historic Places (NRHP) and two sites (LA133469 and LA126555) have been determined not eligible for the NRHP. The NRHP eligibility of the remaining nine sites (LA43486, LA107322, LA51718, LA54940, LA55984, 41GA52, 41AD49, 41AD50, and 41AD51) is undetermined. Site LA140701, in New Mexico, is the closest archeological site to the project area and is approximately 3.4 kilometers from the center of the study area. Site 41AD51, in Texas, is located approximately 4.1 kilometers from the center of the study area.

A survey was conducted in 1994 that covered the proposed expansion site. This survey documented cultural resources, and in fact determined that the area is not well suited for the presence and preservation of archeological sites. In the unlikely event that archeological resources are uncovered during construction, all work will cease and an Archeological Reviewer at the State Historic Preservation Office (512/463-6100) will be notified to assess the site before work can proceed. Based on coordination with the NMHPD and the THC, the proposed expansion site will have no adverse effect upon historic properties within 10 kilometers of the facility. Coordination with NMHPD and THC was conducted in March and July of 2006 and the agencies concurred with the findings on July 20 and July 21, 2006. See Appendix E to the Socioeconomic Impact Analysis (SIA) included as Attachment A in Appendix 11.1.1.

11.4.7 Socioeconomics

The socioeconomic effects on the surrounding communities will be largely beneficial for regions in both Texas and New Mexico that have endured recent economic hardship following the "oil boom" years. Based on the size and makeup of the labor force, current unemployment, and economic conditions, the construction and operation of this proposed facility would be a benefit to Lea County, NM, Andrews County, Texas and their communities. The detailed presentations of socioeconomic data and impact analysis are presented in Attachment A to Appendix 11.1.1, "Environmental Report".

11.5 Design of Proposed Facility

Provide a flow diagram of waste processing and disposal operations, a description and accurate drawings of processing equipment, and any special handling techniques to be employed. [30 TAC §336.708(a)(5)]

The waste disposal operations for the proposed Compact and Federal facilities are discussed in detail in Section 5.3.2. Section 5.3.2 also includes special handling techniques for unloading and placing heavy or bulky materials and other special handling equipment.

Figure 5.3.2-1 is a diagram showing the flow of wastes into the disposal units. Before entering the fenced area around the disposal units, trailers are switched from the shipping firms' trucks to WCS trucks. In this manner, on-site personnel transport material into the disposal cells. Once wastes are in the disposal units, they are disposed or segregated for disposal according to the operating plans detailed in Section 5.0. Facility descriptions, design criteria, and drawings of the proposed facilities are provided in Section 3.1 and Appendix 3.0-2.

11.5.1 Description of Wastes to be Accepted

Provide a description of the types, chemical and physical forms, quantities, classification, and specifications of the radioactive material proposed to be received, possessed, processed, and disposed of at the land disposal facility. This description shall include any prior disposal containing radioactive material at the site. This description shall include performance criteria for form and packaging of the waste or radioactive material that has been previously received and will be received. [30 TAC §336.707(6)]

Waste Types, Chemical and Physical Forms, Quantities, Classification, and Specifications of the Radioactive Material – Detailed information concerning the waste types, including chemical and physical form, quantities, classification, and radiological content proposed for acceptance in the proposed Compact and Federal facilities is provided in Section 8.2 and Appendices 8.0-1 and 8.0-2. Major generators of LLRW in Texas and Vermont were contacted during the preparation of this data for the proposed Compact Facility. Projections of the types and quantities of waste expected by generators in Vermont have been developed in a comparable manner to the Texas projections. The following information on waste characteristics is provided in Section 8.2:

- A discussion of the potential of waste disposal from generators outside of the Texas Compact (the states of Texas and Vermont) and the conditions for receipt of LLRW at the proposed WCS disposal facility
- A description of the individual waste streams characterized in terms of specific waste-generating facilities that constitute the majority of the waste volume and activity
- A characterization of the waste streams identified in terms of typical waste streams that constitute the remaining waste volume and activity
- The physical, chemical, and radiological characteristics of each waste stream, including annual volumes, waste classes, average concentrations of the principal radionuclides comprising the waste, and the chemical and physical properties and characteristics of typical waste canisters
- Estimates of future rates of waste generation and shipment
- Plans by major generators to alter waste-generation rates during the first five years of the operational life of the disposal facility
- Limitations that will be imposed on waste receipt, waste form, packaging, total inventory at the facility, or other characteristics that might affect assessments of the disposal facility performance
- Summaries of the total projected waste volume and activity for each year of the operational life of the disposal facility.

It is necessary that the capacity of each disposal facility be sufficiently large that, even in the face of future uncertainties, it will accommodate the projected waste volumes to be delivered to the site during its 35-year lifetime. At the same time, it is also undesirable to construct a disposal facility that greatly exceeds disposal needs. The disposal facility is expected to accept waste from 2009 through 2044, followed by five years of site closure activities. The projection accounts for the decommissioning of nuclear power plants in Texas and Vermont in addition to the other types of operational Compact waste within the 35-yr operating period. Without license extensions, all of the reactors in Texas and Vermont will be decommissioned within projected 35-yr operating life. Based on the Compact waste volume estimates in Appendix 8.0-1, the current design capacity of the CWF is more than twice the current Texas and Vermont (Compact) inventory for the 35-yr operating life.

Waste streams from Texas and Vermont Compact have been assessed. The principal source of LLRW of Compact waste is nuclear power plants, although such other sources as universities, hospitals, research laboratories, industries, and military users also contribute. The physical and radiological characteristics of LLRW depend on the source of the waste and, in particular, on the way in which the waste is generated and processed.

A description of the potential waste streams to be received from the Compact states of Texas and Vermont is provided in Appendix 8.0-1 of this LA. Waste streams are categorized according to standard definitions and descriptions used by the NRC in their oversight of LLRW handling and disposal activities. In addition, six more waste streams are defined to characterize reactor-decommissioning wastes expected to be received from within the Compact. Waste streams anticipated for receipt from Federal facilities are described in Appendix 8.0-2 of this LA.

Prior Disposal Containing Radioactive Material at the Site – Wastes containing exempt quantities of radioactive material were disposed, and continue to be disposed, at the existing RCRA facility operated by WCS. Non-exempt radioactive material has not been disposed at the RCRA facility.

Data on the exempt waste buried in the existing RCRA facility and impact on the source term and performance assessment is included in Section 8.1.2. Based on past waste disposal, a conservatively high radionuclide inventory was developed for the existing RCRA facility. This inventory was added to the source term used for the RESRAD modeling conducted to estimate the potential radiological impacts from the existing RCRA facility. An alternate modeling scenario using RESRAD was also conducted that assumed the entire RCRA and 11(e)2 inventory source terms were contained in the FWF. Both scenarios are fully detailed in Section 8.1.2.

Performance Criteria for Form and Packaging of the Waste – The performance criteria for the waste form and packaging is included in Section 8.2.1.

11.5.2 Facility Description

Provide a description of the design features of the land disposal facility and the disposal units. For near-surface disposal, the description shall include those design features related to infiltration of water; integrity of covers for disposal units; structural stability of backfill, wastes, and covers; contact of wastes with standing water; disposal site drainage; disposal site closure and stabilization; elimination of long-term disposal site maintenance; inadvertent intrusion; occupational exposures; disposal site monitoring; and adequacy of the size of the buffer zone for monitoring and potential mitigative measures. The description also should include the following features: [30 TAC §336.707(4)]

(1) Principal Features

The site has a number of natural site characteristics which will contribute to the long term isolation of the LLRW and protection of the public. The design supports and enhances these attributes to create an effective waste isolation system.

The site was selected because of its low rainfall and high relative evapotransporation. Annual rainfall for the site averages approximately 15 inches per year. The evapotransporation rate, using the "Penman-Monteith" method, is calculated to be 64 inches. The facility is designed to mitigate the effects of natural adverse affects such as tornadoes or heavy rains. The final cover design used the same criteria as is required for uranium mill tailings and is intended to provide for minimal erosion and no maintenance once the site is closed.

The design includes an intruder barrier within the unit covers. The presence of dense, spherical rock from the surrounding caliche formation will be used in the final cover to provide a natural deterrent to excavation and intrusion.

The design uses a natural drainage layer that is formed between the top of the red clay and the bottom of the caliche. There is a layer of sand and gravel between the clay and the caliche. This sand and gravel layer will allow any storm water that infiltrates through the top soil to drain away from the facility's water resistant cover.

The facility will be constructed in a layer of red bed clay. This clay has a strong natural resistance to water. There is over 900 feet of red bed clay under the site. This depth increases the effective travel time for water to migrate. Compacted red bed clay will be used in the cover system to ensure water does not penetrate the facility.

The modest slope of the site is approximately 1%. This slope promotes effective drainage but does not create significant erosion. The site is located near a topographic divide. This high location (relative to its surroundings) also helps reduce erosion by reducing the surface water that can run overland before reaching the disposal site.

The principal design features or elements of the proposed Compact and Federal disposal facilities are described in detail in Section 3.1.2 of this LA.

(2) Site Utilization Plan

The proposed design consists of two separate facilities. These are labeled as the Federal Waste Facility and the Compact Waste Facility. The administration and guard buildings are common buildings to support the site. The Compact Waste Facility and the Federal Waste Facility will each have its own waste staging building and decontamination area. The site will be surrounded by a security fence.

The site layout plan is included in Appendix 3.0-2 of this LA.

(3) Construction Plans

The site is designed to meet TCEQ and Nuclear Regulatory standards. These are stringent standards developed to protect the public and the environment. Strict construction monitoring is required by these standards and will be enforced.

The facility will be constructed in phases. This construction method exposes only a small portion of the proposed facility to the open environment at any given time. As a phase nears completion, construction will begin on the next phase. Once a phase is completed, it will be covered with its protective layer.

Additional information regarding the construction standards may be found in Section 3 on design, in the drawings, and in Section 4 on construction.

(4) Types of Structures

The site will include an administration building, a guard house, the Compact Waste Facility, the Federal Waste Facility, staging buildings, roadways, a scale facility, and security fences and gates.

The structures included in the site are shown in the facilities layout plan in Section 3.3 of this LA.

(5) Excavated Materials Area

The excavated material areas will be located to the north and northwest of the proposed disposal areas. The staging areas for the excavated materials will be based on the quality of the excavated materials and the use of these materials. The location of the proposed stockpile area may be found in Appendix 3.0-2.

11.6 Environmental Effects of Proposed Facility

Provide a description of the pathways analyzed in demonstrating protection of the general population from releases of radioactivity shall include air, soil, groundwater, surface water, plant uptake, and exhumation by animals. The analyses shall clearly identify and differentiate between the roles performed by the natural disposal site characteristics and design features in isolating and segregating the wastes. The analyses shall clearly demonstrate that there is reasonable assurance that the exposures to humans from the release of radioactivity will not exceed the limits set forth in 30 TAC §336.724 (relating to Protection of the General Population from Releases of Radioactivity). The applicant's report shall address the following topics: [30 TAC §336.709(1)]

A pathway analysis was developed and is described in detail in Section 8.3 of this LA. The modeling analysis and pathways provide a description of the release mechanisms, environmental transport pathways, and receptors of concern that demonstrate that the applicable radiological performance objectives will be satisfied. Section 8.3 summarizes the basis for focusing the performance assessment on the particular release mechanisms, pathways, and receptors that are potentially significant determinants for site performance.

11.6.1 Short-Term Environmental Effects

(1) Site Preparation and Construction Effects

Site preparation and construction activities are not expected to adversely impact or appreciably effect releases of radioactivity to the environment or the general population. There are no radioactive materials, with the exception of NORM present in all natural soils, disturbed during site preparation and construction activities. The potential pathways for radiation exposure during site preparation and construction activities include the inhalation and ingestion of fugitive dust.

Dust control activities will be implemented during site activities as required to reduce potential worker exposure and off-site transport of potential contamination. Background data for the soils on the Site do not indicate concentrations of NORM that could reasonably be expected to result in adverse environmental impacts or individual exposures that may exceed the dose limits required by 30 TAC §336.724. These potential pathways are likely affected more by existing climatic conditions (i.e., wind re-suspension of particulate matter) than those associated with site preparation and construction activities. Fugitive dust emissions would be the greatest during site preparation and active construction because of increased vehicle traffic at the site. The site preparation and construction areas would be sprayed with water periodically so that these emissions can be reduced to a minimum.

Volatile organic emissions from construction activities are expected to be small since vehicles would only be refueling a few times per day. Emissions of criteria pollutants (NOx, SOx, CO, PM, Pb) and hydrocarbons from internal combustion engines would have a negligible impact on air quality. The quantity of criteria, volatile, and other pollutants released during construction would generally be low and vary on an hourly and daily basis as construction progresses.

Screening assessments conducted for similar construction projects have shown that the carbon monoxide concentration would be less than the National Ambient Air Quality Standard (NAAQS) standards of 35 ppm and 9 ppm for the one-hour and eight-hour concentrations. Fugitive dust emissions were estimated using EPA guidance document, *Compilation of Air Pollutant Emission Factors* (EPA 1998). The estimated emissions are within the range of routine impacts for similar construction projects.

Construction and operation of the disposal cells will have a small impact on soils in the immediate area. Surface soils from the proposed Site will be removed and stockpiled for later use in construction of the cover system. Impacts to the subsurface will be confined to the immediate area of the excavations for the disposal cells. The excavations will extend to a maximum depth of 120 feet below the surface. Pumping of groundwater is not proposed as part of the disposal project. Construction and operation of the proposed facilities will have no significant effect on petroleum or other resources in the local area.

The proposed Site is currently permitted for RCRA waste disposal and has been reserved for industrial use. Site preparation and construction would therefore not constitute a change in land use for construction of the proposed facilities. Of approximately 1,400 acres within the WCS property permitted for waste disposal, approximately 120 acres will be used for the proposed LLRW disposal cells and supporting facilities. Existing disposal and waste storage facilities occupy approximately 120 acres of the property. The proposed Site is surrounded and buffered by approximately 14,000 acres that are owned and controlled by WCS.

While most of the property surrounding the permitted WCS property within a one-mile radius is undeveloped and is used as rangeland; other industries are present or proposed as described in Section 11.2. The adjacent facilities are shown on Figure 2.2.1-1. The construction of the proposed facilities will have no adverse impact on the lands surrounding the WCS property. Construction activities are not expected to significantly increase traffic on local roads.

There are no surface waters in the vicinity of the proposed Site and appreciable groundwater resources are located at depths greater than 800 feet. The Site region has semi-arid climate, with low rainfall and minimal surface water occurrence except during large precipitation events. The potential for adverse impacts on groundwater resources are very low due to formidable natural barriers in the subsurface. Groundwater at the site would not likely be impacted by any releases during construction.

(2) Facility Operation Effects

This section provides a summary of the potential worker and general population exposures to radiological contaminants via applicable pathways during operations. Table 8.3-2 includes the performance assessment dose summary for all applicable pathways and exposure scenarios for workers and resident populations. See Section 8.0 for a complete description of the performance assessment.

Workers at the proposed facilities may potentially be exposed to direct radiation, airborne radioactivity, and surface contamination. The risk of exposure to the general public is much lower as is evident by the results of the performance assessment in Section 8.0. The viable pathways for radiological exposure to workers and the general population are inhalation of particulates and gases, ingestion of contaminated materials, and direct ionizing radiation from proximity to the wastes. These pathways are listed in Table 8.3-1 and are discussed in detail in Appendices 8.0-3 and 8.0-6.

Site procedures, radiation work permits (RWP), and waste form acceptance criteria will be implemented to reduce worker exposure and ensure potential exposure remains as low as reasonably achievable (ALARA). These principles are discussed further in Section 5.0. Estimates for worker exposures are included in Section 8.3. As discussed in Section 8.3, the estimated exposure to the nearest resident (about 3.5 miles west of the proposed Site) is expected to be extremely low and far less than the required limit for exposure to the general population of 25 mrem/yr.

Operations will be conducted to ensure that waste material will be handled with appropriate controls implemented to limit potential airborne emissions and accumulation in surface soils. A minimum amount of waste material will remain exposed during the operational day prior to covering or backfilling at the end of the workday. The waste material will be confined to the limits of the proposed disposal cell as required. Operational procedures including those for waste handling and disposal are provided in Appendix 5.5. The performance assessment provided in Section 8.0 discusses the potential for accumulation in the environment during operations.

(3) Facility Closure Activities Effects

This section provides a summary of the potential worker and general population exposures to radiological contaminants via applicable pathways during the closure of the facilities. Table 8.3-2 includes the performance assessment dose summary for all applicable pathways and exposure scenarios for workers and resident populations. See Section 8.3 for a complete description of the performance assessment.

Workers at the proposed facilities may potentially be exposed to direct radiation, airborne radioactivity, and surface contamination during the closure period. The risk of exposure to the general public is much lower, as is evident by the results of the performance assessment in Section 8.0. The viable pathways for radiological exposure to workers and the general population during closure are listed in Table 8.3-1 and are discussed in detail in Section 8.3. Appendix 8.0-4 provides the complete worker dose assessment. The analyses clearly demonstrate with reasonable assurance that the potential exposures to humans from the release of radioactivity via these combined pathways will not exceed the limits of 25 mrem/yr specified in 30 TAC §336.724.

Impacts related to facility closure will be relatively minor due to the progressive placement of the interim disposal cell cover as waste is placed into the facilities. In general, the impacts will be similar to those discussed above for construction activities, but on a smaller scale. Portions of the facility will be closed as the cells are completed, thereby minimizing the level of activities required for end closure. Similar practices will be adopted for erosion and storm water control and landscape and habitat restoration, as discussed in Section 6.0. Native grasses will be planted to help stabilize the soil to avoid soil loss from wind erosion. The support facilities will be removed from around the disposal cell and the soil will be seeded to reestablish vegetative cover.

The final footprint of the closed facilities will cover approximately 120 acres. Fences will enclose and separate the Compact and the Federal Facilities areas. The Federal Facility will transfer to the Federal government and the Compact Facility will transfer to the State of Texas. Institutional controls will be used to maintain the integrity of the closed disposal cell throughout the institutional period of 100 years.

11.6.2 Long-Term Environmental Effects

(1) Environmental Effects of Long-Term Containment

The long-term environmental effects of containment are presented in detail in Section 8.0. In general, the engineering design of the facility (discussed in Section 3.0), including the canister and waste packaging design and monitoring systems, combined with the natural site characteristics (including a thick red bed formation with low permeability and extensive vertical depth to an appreciable but non-potable aquifer) account for the extreme long-term stability of the proposed facilities. Other factors contributing to long-term isolation and stability include the use of reinforced concrete canisters, waste package and array design, grouting systems, the depth of the waste, and the cover system design.

(2) Environmental Effects of Potential Radionuclide Releases

The performance assessment (Section 8.0) presents the evaluation of the pathways for long-term radiation exposure, the radiation doses, and the effects of radiation releases. The proposed facilities are designed to function with minimal leakage into the subsurface geologic formations through the engineered low-permeability cover and liner system. The performance assessment was conducted to determine the fate and transport of contaminants over time and the resulting potential environmental and human health effects. The performance assessment indicates that appreciable releases to the air, surface soil, or groundwater following closure of the site are highly unlikely to occur within a 10,000-year timeframe. Contaminant transport in the subsurface modeled over 10,000 years indicated no contamination in any of the modeled pathways.

The potential release pathways applicable to impacting long-term containment include groundwater, gas release, and plant and animal intrusion. A summary of pathways analyzed in demonstrating protection of the general population from releases of radioactivity is provided in Table 8.3-1. The detailed pathways analysis is included in Appendices 8.0-3 (qualitative analysis) and 8.0-6 (quantitative analysis). The analyses clearly demonstrate with reasonable assurance that the potential exposures to humans from the release of radioactivity via these combined pathways will not exceed the limits of 25 mrem/yr specified in 30 TAC §336.724.

The impacts due to non-radiological chemical contaminants were evaluated qualitatively following the same pathway analysis conducted for radiological contaminants. The principal source for non-radiological contaminants would be the leachate generated from disposal operations that could potentially impact groundwater. Section 3.6.2 discusses the minimization of water contacting waste as well as the drainage of water within the cell and measures for preventing water accumulation. As stated in Section 3.1.3, the OAG formation will be excavated to the red bed interface over the disposal unit during construction, but then over excavated horizontally to provide an access terrace. This terrace will be used to remove storm water/leachate while the cell is open, and will intercept precipitation before it flows into the disposal cell.

Based on the results of the performance assessment conducted for radioactive contaminants, the estimated travel time to the low-permeability 225-foot zone sandstone (K ~ E-08 cm/s)[cmsw3] is more than 45,000 years. Additional tens of thousands to hundreds of thousands of years would be required for radioactive contaminants to reach the first appreciable, but non-potable, groundwater source at about 600 feet below ground surface.

11.7 Environmental Effects of Accidents

Discuss environmental effects of postulated operational and transportation accidents. [30 TAC §336.708(a)(9)]

This section provides analyses of potential environmental and health effects due to accidents during handling, storage, and disposal of LLRW. Operations will be performed in a manner consistent with industry standards to ensure the accident-related risk to workers and members of the public is minimized. Risk includes consideration of both the frequency of occurrence of a given accident scenario, and the potential environmental and human health-related consequences of the given accident scenario. Hence, accidents with a relatively high likelihood of occurrence but relatively small consequences are evaluated, as well as accidents with a relatively small likelihood of occurrence but potentially large consequences. After reviewing relevant design and operations-related information, the following accidents were evaluated. This set is considered to portray a proper and sufficiently comprehensive radiological accident-related risk profile for the proposed waste disposal facilities.

- Waste canister breach
- Explosion or fire
- Crane malfunction or equipment failure
- Transportation vehicle accidents
- Operational accidents

Waste Canister Breach – Canisters can be breached by various mechanisms, including dropping, collision, crushing, canister defect, or spills. These mechanisms for breaching or rupturing a canister could occur during vehicle transport or handling on-site during a number of operational activities. One envisioned accident scenario involves a substantial spill or release from a full 55-gallon drum containing radioactive waste material. The waste is contaminated with radionuclides, as shown in Appendix 8.0-1 and 8.0-2 for the Compact and Federal facilities, respectively. Quantities of radioactive material released and supporting dose calculations are detailed in Appendix 8.0-5.

For the breach or rupture of a 55-gallon drum at the Compact Facility, the committed effective dose equivalents to receptors at 10 meters, 100 meters, and 6,000 meters are 1.31E+02 mrem, 3.06E-01 mrem, and 2.76E-05 mrem, respectively. The dose to the on-site worker is well below the annual occupational dose limit of 5 rem stipulated in 30 TAC §336.305. The dose to the off-site receptor is well below the dose limit of 100 mrem for a member of the public, as stipulated in 30 TAC §336.313. The results indicate that a volume of waste equivalent to 326 times 55 gallons could be involved in a breach or rupture accident with the dose to an off-site receptor remaining below 100 mrem.

For the breach or rupture of a 55-gallon drum at the Federal Facility, the committed effective dose equivalents to receptors at 10 meters, 100 meters, and 6,000 meters are 5.67E+01 mrem, 1.32E-01 mrem, and 1.19E-05 mrem, respectively. The dose to the on-site worker is well below the annual occupational dose limit of 5 rem stipulated in 30 TAC §336.305. Workers will be trained in emergency procedures and will leave the area in the event of accident, so the dose to workers will likely be much lower.[cmsw4] The dose to the off-site receptor is well below the dose limit of 100 mrem for a member of the public, as stipulated in 30 TAC §336.313. The results indicate that a volume of waste equivalent to 757 times 55 gallons could be involved in a breach or rupture accident with the dose to an off-site receptor remaining below 100 mrem.

Explosion or Fire – The likelihood of an explosion or fire that involves a significant quantity of waste is considered extremely unlikely. Several studies indicate that a fire started in one drum would not be likely to propagate to other drums or canisters nearby and even waste canisters that are involved in an external fire (e.g., a “pool” fire) often do not release significant quantities of their inventory.

A typical forklift or truck accident is considered to be the dominant means for a fire or explosion that involves a substantial quantity of waste. However, for the proposed facilities, the likelihood of such an event is extremely small and borders on the threshold of credibility. Using commercial data, truck accidents that involve fires occur with a frequency of less than 7 in one billion per mile traveled.

The assessment of an explosion or fire involving a 55-gallon drum uses the same assumptions as those used in the canister breach evaluation as discussed above and detailed in Appendix 8.0-5. For an explosion or fire involving a 55-gallon drum at the proposed Compact Facility, the committed effective dose equivalents to receptors at 10 meters, 100 meters, and 6,000 meters are 1.58E+02 mrem, 4.90E+01 mrem, and 7.70E-02 mrem, respectively. The dose to the on-site worker is below the annual occupational dose limit of 5 rem stipulated in 30 TAC §336.305. The dose to the off-site receptor is below the dose limit of 100 mrem for a member of the public, as stipulated in 30 TAC §336.313. The results indicate that a volume of waste equivalent to two drums (110 gallons) could be involved in a highly energetic event with the dose to an off-site receptor remaining below 100 mrem.

For an explosion or fire involving a 55-gallon drum at the proposed Federal Facility, the committed effective dose equivalents to receptors at 10 meters, 100 meters, and 6,000 meters are 6.82E+01 mrem, 2.11E+01 mrem, and 3.32E-02 mrem, respectively. The dose to the on-site worker is below the annual occupational dose limit of 5 rem stipulated in 30 TAC §336.305. The dose to the off-site receptor is below the dose limit of 100 mrem for a member of the public, as stipulated in 30 TAC §336.313. The results indicate that a volume of waste equivalent to four drums (220 gallons) could be involved in a highly energetic event with the dose to an off-site receptor remaining below 100 mrem.

Crane Malfunction or Equipment Failure – A crane malfunction or other equipment failure could result in a waste canister remaining in a given location for an extended period of time. As discussed in detail in Appendix 8.0-5, this accident scenario assumes that the suspended waste canister has a dose rate of one rem per hour at 30 centimeters. Probability estimates for occurrence of this scenario are greater relative to the other scenarios addressed in this section. Strict procedures and protocols will be followed concerning the operation and maintenance of all waste handling equipment to ensure that the risk of an equipment or related operational failure is minimal.

At a distance of one meter, 10 meters, 100 meters, and 4,000 meters (used to conservatively estimate the dose rate for a receptor associated with the nearest residence 6 km away), the dose rates are 90 mrem/hr, 0.89 mrem/hr, 7.54E-03 mrem/hr, and 1.23E-19 mrem/hr, respectively. An on-site worker would need to be in close proximity to the suspended waste canister for many hours to exceed the annual occupational dose limit of 5 rem stipulated in 30 TAC §336.305. For an individual member of the public, 30 TAC §336.313 states that the dose rate in any unrestricted area from external sources shall not exceed 2 mrem per hour. The dose rate associated with this scenario is substantially less than 2 mrem/hr for an off-site individual.

Off-Site Transportation Accidents – Radiological and non-radiological impacts of accidents occurring during the transportation of Compact and Federal waste within and through the state of Texas to the proposed Site have been examined. The methodology, required data, and results of the analysis and assessment are presented in detail below.

"Worst-Case" Off-Site Accident – An estimate of an extreme but highly unlikely accident involving LLRW shipments in Texas was assumed involving a cask and a fully loaded 55-gallon drum truck carrying "high-dose" LLRW through Dallas, the area with the highest population center. It was conservatively assumed that each accident released all radioactive contents and the contents were then completely dispersed into the air. Finally, all dispersed materials were assumed to be fully respirable to persons in the exposed area.

Analysis revealed that the maximum population dose for an extreme drum accident occurring in Dallas County is about 822 person-rem and about 14,200 person-rem for an extreme cask accident. Additionally, the average individual weighted dose is about 0.12 mrem from the drum accident and 22.4 mrem from the cask accident. It should be noted that a dose of 22.4 mrem is about 6 % of the U.S. average annual background dose of 360 mrem. These doses could be greatly reduced if, as is likely, the area downwind and close to the accident is evacuated until the dispersed radionuclides are cleaned up. This would eliminate approximately 95% of the dose from a drum accident and 98% of the dose from a cask accident. The actual probability of such accidents happening during the operating life of the proposed facilities is estimated at about 1 in 10 million for drum shipments and 1.4 in a million for cask shipments. The detailed analysis is provided in Appendix 11.7.

On-Site Traffic Accidents – Site traffic may also be involved in non-radiological accidents. The increase in non-radiological vehicle traffic potential is directly related to the increased amount of traffic generated by the Site. However, the Site-generated traffic is estimated to be quite low, totaling about 90 daily trips, primarily from employees, deliveries, and visitors. As local Site-generated traffic moves farther from the Site, it disperses onto an every-expanding road network and becomes insignificant as a percentage of total traffic on the road segment.

Additionally, the majority of employee and visitor traffic, which makes up more than 99% of the daily site-generated traffic, will end within a relatively short travel distance from the Site. For these reasons, the vast majority of non-radiological accident potential is limited to Interstate Highway 20, which is proximate to the Site. Probability estimates indicate that traffic near the proposed Site could result in about six additional accidents over the 35-year anticipated operating life of the proposed facilities.

11.8 Summary Evaluation of Proposed Project

The information in this section should summarize the important adverse environmental impacts and the overall benefit-cost analysis for the proposed project. It is understood that not all benefits and adverse impacts can be stated in monetary terms but this should not be taken as reason to automatically quantify the impact as trivial. An attempt should be made to state the benefit or adverse impact in the terms that best describe it. The following impacts discussions should be provided:

11.8.1 Unavoidable Adverse Environmental Impacts

This section summarizes the potential unavoidable adverse impacts associated with construction and operation of the proposed facilities. Unavoidable adverse impacts that would remain after incorporating all appropriate mitigation measures are identified.

Proposed Action – The proposed construction, operation, and closure actions would cause some unavoidable adverse environmental impacts even though mitigation measures will be taken to reduce environmental impacts. The following sections include discussions of adverse effects that mitigation measures could not completely reduce or avoid.

Land Use – The proposed disposal site is privately owned and permitted for waste disposal. It does not represent a change in land use or a loss of desirable farmland or grazing area. The proposed site is also located within an area currently housing a RCRA/TSCA landfill permitted by the State of Texas.

During construction and operation, minor impacts are unavoidable due to the need for additional electric power, water, wastewater disposal, and waste disposal operations. These impacts are relatively small and would not place an undue burden on available resources. Utilities would be extended on site, without the need for new main utility connections to Eunice, NM. Sewage and other wastewater will be collected in underground holding tanks and to be disposed of according to the Holding Tank Schedule on Drawing C0.03. Additional staffing during construction and operation phases is not expected to stress the municipal source of potable water. Following closure, the proposed disposal site will continue to be unavailable for recreational, commercial or agricultural use.

Ecological – No critical habitats for threatened or endangered species would be significantly affected. Habitats for other plant and animal species would be made unavailable in the immediate area of the proposed disposal site, but these habitats are already located near areas of industrial use, which tends to reduce the utility of the habitats even without the proposed project. Section 2.2 in Appendix 11.1.1 provides the detailed ecological assessment.

Socioeconomic – An expanded discussion of socioeconomics is presented in the socioeconomic report included as Attachment A to Appendix 11.1.1, “Environmental Report”. Negative economic impacts are not foreseen. The labor requirements are not expected to outstrip the supply of affordable housing, public education, or governmental services provided in the area. Property values in the vicinity of the WCS property should not be affected due to the new construction and operations.

Some health risks to workers and, to a much lesser extent, the public will be unavoidable. Workers performing construction and operations activities as described in Sections 4.0 and 5.0 of the LA are subject to the same types of injuries and accident risks that workers experience elsewhere in industry. Mitigation will be through worker safety training on the site health and safety plan, proper use of personal protective equipment (PPE), OSHA construction and trenching standards, and task-specific procedures.

Radiological – Workers may be subject to potential health risks of exposures to radiation and hazardous chemicals. Mitigation will be through strict implementation of the site health and safety plan and adherence to requirements of radiation and industrial work permit(s). An expanded discussion of potential radiological impacts is included in Section 5.1.2.2 of the Environmental Report (Appendix 11.1.1).

The public would be at much lower risk for injury or illness from proposed operations. The operational environmental monitoring program is intended to provide early warning of potential releases through air, soil, groundwater, and related exposure pathways, as detailed in Section 8.3 and associated appendices. Potential impacts due to transportation of wastes to the Site would be extremely low, as discussed further in Section 11.7 of the LA.

11.8.2 Irreversible and Irretrievable Commitments of Resources

This section identifies the irreversible and irretrievable commitment of resources that would result from the construction, operation, and closure of the proposed disposal facilities. A commitment of resources is irreversible when its primary or secondary impacts limit the future options for a resource. An irretrievable commitment refers to the use or consumption of resources neither renewable nor recoverable for later use. The major irreversible and irretrievable commitment is land use, with lesser commitments of harvestable products, materials, groundwater, and energy.

Land Use – Use of the proposed disposal site for waste disposal would result in an irreversible and irretrievable commitment of the site and surrounding buffer areas. Land use would be restricted, along with access to the subsurface. Some surface areas would be reclaimed upon closure and would provide natural habitat.

Material Resources – Construction materials, including sand, aggregate, clay, and geomembrane fabric, would be used by the project and could not be recovered for reuse. Soils from the disposal cells would be stockpiled for later use during closure and excess will be available for other uses. Water used during the construction, operation, and closure would be committed to the project. Electric power and fossil fuels would be committed to the construction, operation, and closure of the proposed facilities. Fossil fuels also would be committed to the transport of LLRW. Steel and other materials used in surface structures may be recyclable and, therefore, are not an irreversible or irretrievable commitment; steel and materials used for disposal cell construction will not be reclaimed. The quantities of resources consumed are likely to be small in comparison with their national consumption or their availability to consumers in the region.

11.8.3 Relationship Between Short-Term Uses and Long-Term Productivity of Man's Environment

The facilities proposed for the site will be dedicated to the isolation of radioactive and hazardous wastes from the environment for greater than 10,000 years. Over the long term, contaminants from proposed waste disposal cells may reach the vadose zone beneath the cells. However, as the performance assessment presented in Section 8.0 of this LA indicates, based on the location, time of interest, and projected concentrations of radionuclides in the subsurface, it is not likely that it would be necessary to place any restrictions on groundwater usage. In addition, the performance assessment indicates that there will be no other short-term or long-term adverse environmental impacts that may realistically be expected to result from the operation of the proposed facilities.

In time and with the absence of human activities, flora and fauna common to the area in the past likely would re-occupy the surface areas of the Site and would probably be indistinguishable from nearby undisturbed areas. However, land-use covenants will be instituted to prohibit future land disturbance by humans and to reduce the likelihood of inadvertent intrusion at the Site for as long as institutional controls are maintained.

11.8.3 Benefit-Cost Balance

Sections 2.5.2 and 2.5.3 of the Socioeconomic Report in Attachment A of Appendix 11.1.1 include the cumulative socioeconomic and cost-benefit analysis for the proposed facilities. A summary is provided in the sections below.

Project Benefits – The economic benefits of the proposed WCS LLRW disposal facility in Andrews County, Texas, including the direct impacts of the facility employment, incomes accruing to households, employment, and increases in revenues of state and local government are included in Attachment A to Appendix 11.1.1.

The economic effects of the waste disposal facility are considered beneficial to the Andrews/Lea County areas by adding approximately 26 permanent full-time jobs and creating additional indirect employment opportunities through the need for additional services. This will infuse monies into the local economy and increase the tax base. Secondary local businesses that may prosper during construction and operation are machine shops, regional construction and safety supply vendors, and logistics companies providing supplies and service. This will support the diversification and stabilization of the regional economy as it reduces the dependence on the petroleum industry.

The addition of temporary construction and permanent operational jobs will improve the economies of Lea and Andrews counties. Demand for consumer commodities, ranging from banking services, automobiles and groceries, are beneficial to the area. Project benefits are summarized in Table 11.8.4-1.

Project Costs – The costs of the project from the perspective of WCS investments in capital and operating expense are included in Section 12.0 of the Application. Local communities would also make investments in the form of expanded service. The socioeconomic cost-related impacts from facility construction and operation are discussed in Section 2.5.2 of the socioeconomic report included as Attachment A to Appendix 11.1.1.

Table 11.8.4-1. Benefits of the Proposed Project

Qualitative Benefits	
Permanent increased employment and population in Lea and Andrews counties.	Beneficial
Potential for growth and expansion of local and regional businesses supporting WCS	Beneficial
Increased demand for retail trade and consumer commodities	Beneficial
Increased tax and fee revenues for local and state governmental services including education, fire, law enforcement, other services	Beneficial
Opportunity for increased home ownership rates with increasing real estate demand and values.	Beneficial
Continued corporate viability for WCS at this property	Beneficial
Provides a LLRW disposal facility for Texas and Compact agreement state Vermont	Beneficial
Provides a competitive private industry LLRW disposal location	Beneficial

11.9 Environmental Measurements and Monitoring Programs

Provide a description of baseline, operational, and long-term environmental monitoring programs, including radioactive and chemical characteristics, and the plan for taking corrective measures if migration of radionuclides or chemical constituents is indicated. [30 TAC §336.708(a)(10)]

This section provides a summary of the environmental monitoring program. WCS is currently conducting monitoring under the Radiological Environmental Monitoring Program (REMP) presented in Appendix 2.10.1-2, and in accordance with the requirements for the existing RCRA facility. A Non-Radiological Environmental Monitoring Plan, presented in Appendix 2.10.2-2, is proposed for the Federal and Compact facilities. The pre-operational program is also discussed in detail in Section 2.10 and the Environmental Report (ER) Section 8.1 included as Appendix 11.1.1 to the LA. The operational and post-operational monitoring programs are provided in more detail in ER Sections 8.2 and 8.3, respectively, and for groundwater, in Section 6.3 of the Geology Report included as Appendix 2.6.1 to the Application.

The environmental monitoring program consists of three phases: (1) pre-operational monitoring to establish background levels comprised of background, baseline and pre-operational sub-phases; (2) operational monitoring of releases during the operation of the proposed facilities; and (3) post-operational monitoring to identify any significant releases after closure of the facilities.

The primary purposes of the environmental monitoring program are to:

- Provide basic environmental data to establish levels of radiological and non-radiological constituents for determining background concentrations and the suitability of the proposed Site
- Provide data to evaluate the potential health and environmental impacts during construction and operation of the facility, and the potential long-term effects from the operation of the proposed facilities
- Assist in demonstrating compliance with the performance objectives of Sections 336.724-336.726 of the Rules, and provide an “early warning” of unanticipated releases to avoid or mitigate adverse impacts to the environment and the public

Data collected as part of the current REMP (Appendix 2.10.1-2), the Non-Radiological Environmental Monitoring Plan (Appendix 2.10.2-2), in conjunction with the data collected under the WCS RCRA monitoring program for the existing RCRA facility, provides the site’s data set. Together, these monitoring programs formed the basis for the pre-operational monitoring program developed for the proposed facilities. Enhancements to the program will refer to guidance provided in NUREG-1388, “Environmental Monitoring of Low-Level Radioactive Waste Facility.”

11.9.1 Pre-Operational Environmental Programs

A pre-operational monitoring program shall be conducted to provide basic environmental data on the disposal site characteristics. For those characteristics that are subject to seasonal variation, data must cover at least a 12-month period. The report shall address the following topics: [30 TAC §336.731(a)]

(1) Meteorological Baselines

(2) Hydrology and Water Quality

(3) Terrestrial Environment

(4) Radiological Baselines

The objectives of the pre-operational monitoring program are to:

- Provide site characterization information on the natural radiological and non-radiological constituent concentrations at the Site to assess the potential for impacts from operations or after closure of the Site.
- Demonstrate site suitability and acceptability.
- Obtain background or baseline data.
- Provide records for regulatory review. The records from pre-operational monitoring act as the regulatory record that may be used to assess environmental impact and overall performance of the disposal facilities.

Natural Background Radiation – A study of background radiation was conducted in 1996 following the REMP procedure developed by WCS. This data was collected prior to the start of operations currently licensed by the State. The background study included the measurement of direct gamma radiation using TLDs, and the sampling and analysis of soil, groundwater, and vegetation. The locations of the data collection points are provided in Figure 2.10.1-1 and the analytical results of background data sampling are included in Tables 2.10.1-1 through 2.10.1-5. Station 20 (control point), located in Andrews, Texas, is not illustrated in Figure 2.10.1-1.

Only naturally occurring isotopes and isotopes that are ubiquitous in soil in the Western U.S. from fallout (e.g., Cesium-137) were detected. The TLD data showed results within expected ranges for the region. Groundwater data results were below the quantitation limit for all radiological isotopes reported. The results of the current baseline data assessment indicate no impact to background radiological, chemical, or environmental parameters due to existing operations adjacent to the proposed disposal site.

Much of the information collected during the existing REMP and RCRA monitoring programs will serve to satisfy the objectives of the pre-operational monitoring program. WCS has implemented additional monitoring under the current site REMP, provided in Appendix 2.10.1-2, to conform to the TCEQ regulations for pre-operational monitoring. Procedures have been developed to support the REMP for each type of environmental sampling.

The pre-operational environmental program is intended to collect and assess baseline data and to evaluate possible seasonal fluctuations and spatial and temporal variability. This program is ongoing, and will be expanded at least one year prior to operation of the proposed facilities to include monitoring at new stations to be added at the fenceline of the proposed Federal and

Compact facilities and at other selected locations as identified in the REMP and, for groundwater, in Section 6.3 of the Geology Report included as Appendix 2.6.1. Data from the pre-operational monitoring program are used to establish baseline reference conditions and contaminant levels to measure any impact from future operations. They will also provide the basis to establish analyte concentrations at which further investigations must be undertaken to determine if radioactive or hazardous materials have migrated from the facility or entered the food chain. Sufficient data are collected to demonstrate current property conditions do not include high natural radioactive or hazardous background concentrations of analytes that would interfere with operational or post-closure monitoring.

Meteorological Baselines – WCS operates a meteorological data station at their existing facility. Data collected from the on-site station, including precipitation, temperature, wind speed and direction, and other parameters, are discussed in Section 2.3.1 and included in Appendix 2.3.1. Meteorological data have also been collected from four local NOAA regional stations located in the vicinity of the proposed Site. Thirty-year records for the Andrews, Midland-Odessa, Hobbs, and Jal stations are also included in Appendix 2.3.1. See Section 2.3.1 for additional information.

Pre-operational meteorological parameters will continue to be monitored by the on-site station. Regional NOAA station data for the same parameters will continue to be collected, and data from other NOAA regional stations will be reviewed and analyzed periodically as required. Extreme weather data, including data related to tornado formation and thunderstorms, will be closely monitored.

Hydrology and Water Quality – Data on Site hydrology is updated through routine sampling and analysis events prescribed through the existing REMP and RCRA groundwater sampling programs. Site hydrology is described in Sections 2.4, 2.5, and Appendix 2.6.1 of this LA.

Groundwater quality is monitored through the ongoing RCRA sampling program for non-radiological constituents. Data for the RCRA program are provided in Appendix 2.10.2. Data from sampling events related to Site investigations conducted between 1993 and 2004 are provided in Appendices 2.6.1, “Geology Report,” and 2.6.2, “Water Quality Analyses”.

Erosion – Erosion monitoring stations (Figure 2.10.3-1) have been established in areas that will not be disturbed by site construction or operations. The pins are placed in rows or grids perpendicular to the direction that erosion is expected to occur, in this case across gullies and slopes. Five stations (numbered 1, 2, 3, 4A/B, 5) were set up to serve as initial erosion monitoring locations on the WCS property in Andrews County, Texas (Figure 1). A sixth station will be installed in March 2007. Each station has four lines of pins, a set of two large diameter (10 millimeter (mm)) pins and a set of two small diameter (5 mm) pins, except for station 4B, which has two lines of large diameter pins only. The large diameter pins were installed for comparison purposes as well as for backup to the smaller diameter, less robust, 5-mm pins and washers. The first measurement occurred in the 4th quarter of 2006, with subsequent measurements scheduled quarterly.

Terrestrial Environment – The Site is located in the Southern High Plains region that is part of the central Great Plains. The vegetation cover is predominantly arid grassland with scattered shrub cover. Areas of pristine habitat do not exist near the proposed disposal site.

A discussion of the environment is included in Section 2.9 and Appendix 2.9.1. Common plants are indicators of historic overgrazing, and a variety of small reptiles, mammals, birds, and predators are present. Game species of peccaries, mule deer, and doves are present. Generally, the Site does not provide the preferred habitat for the lesser prairie chicken, Texas horned lizard, or other regulatory important species. Threatened and endangered species are discussed in Appendix 2.9.1 and in Section 2.2.3 of the Environmental Report.

Pre-operational baselines will be established for terrestrial resources using HEA methodology (see Section 4.0 of Appendix 2.9.1) and a values-based decision-framework to determine which ecological parameters are appropriate long-term measures. This approach will rely primarily on the seasonal information already gathered as part of the environmental report (Appendix 11.1.1), but will include additional parameters appropriate to the calculation of discount service acre years (DSAYs).

The Ecological Monitoring Plan (EcoMP) included in Appendix 11.9.1 was developed to establish the framework to conduct surveys at the pre-operational phase and continuing through subsequent operational phases. The EcoMP approach acknowledges that preservation of ecological values, including important species, ecological functions, and the human uses thereof, as the basis for identifying species to be monitored. Important species are those defined in NRC Regulatory Guide No. 4.18 (see Section 3.0 of Appendix 2.9.1).

Identification of ecological values involves a comprehensive and systematic process to first look at ecological values at higher levels of ecological organization, which then proceeds to functional groups, and eventually to important species. This hierarchy is illustrated in Figure 11.9.1-1. A detailed description of the approach is provided in Reagan (2002). Human use values are then identified (e.g., game and recreationally important species).

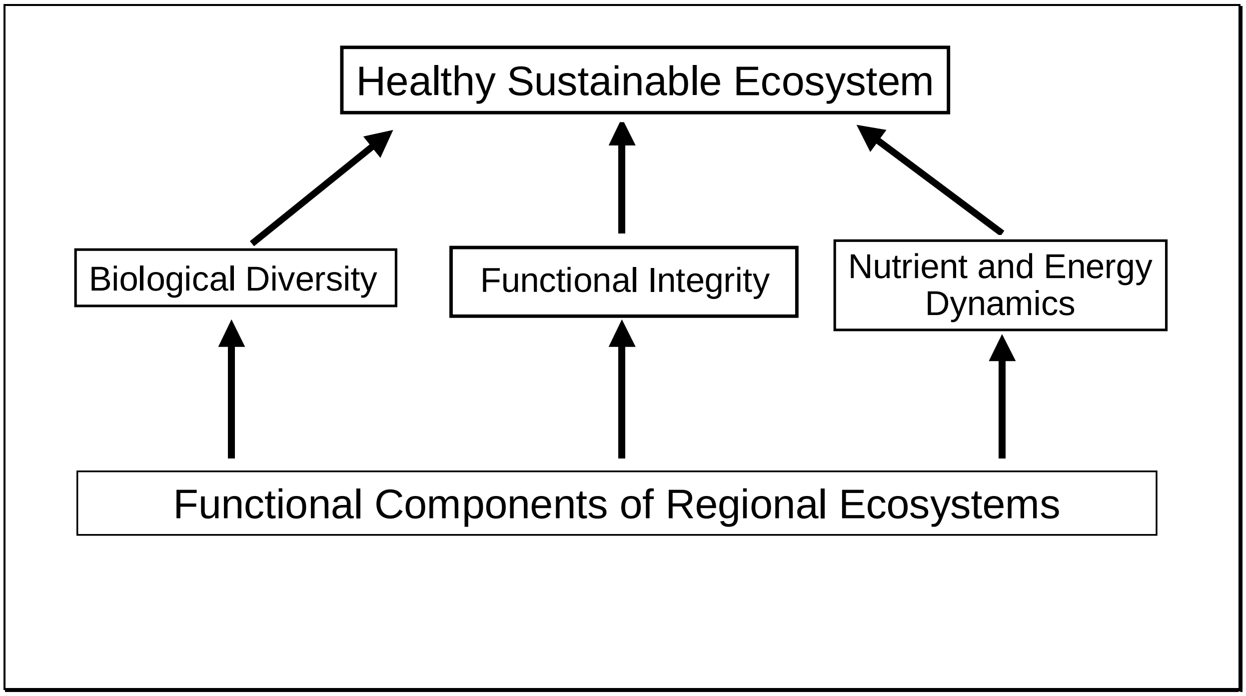
The EcoMP identified appropriate groups or species from media and groups potentially affected by site activities, including radiation. Key groups for monitoring are:

- Surface soils
- Herbaceous plants (e.g., grasses and forbs)
- Woody plants (e.g., mesquite)
- Herbivorous animals (e.g., quail, doves, some insects)
- Carnivorous animal species (e.g., roadrunner, coyote)
- Decomposers (e.g., fungi) as available

In addition to species and groups to be monitored periodically for radiation, the EcoMP allows for the evaluation of basic ecological functions, such as plant productivity or the prevalence of animal species. Animal populations will not be directly quantified on and near the site unless there are indications from tissue monitoring or evidence of other site-related activities that could cause adverse effects.

Baseline ecological monitoring surveys were conducted in June and September 2006 to collect pertinent data on habitat condition, plant and animal species present and their general abundance, spring migrants, and the potential use of the site for breeding by important species and major functional groups in terrestrial ecosystems. The objectives of the surveys were to establish baseline ecological conditions at the proposed Site. Baseline conditions (conditions that would have existed in the absence of a release or other site-related action) were estimated based on observations of plants and animals observed during surveys and analyzing data to compare existing with optimal conditions (i.e., those considered characteristic of an ideal undisturbed ecosystem). The Ecological Survey Baseline report is included as Appendix 11.9.2.

Figure 11.9.1-1. Hierarchy of Ecological Values



<u>Radiological Baselines</u> – The current data collected as part of the REMP program indicates no radiological contamination in all matrices tested. During 2001, tritium was detected in a few air samples collected on site. These detections were attributed to the handling of tritium-containing waste treated during that time period. The 1996 baseline study documented gross alpha levels in water that exceeded the 15-pCi/L limit prescribed by TCEQ. However, the 1996 data has not been verified and no determination can be made concerning the quality of this data. Isotopic analysis of groundwater indicated the presence of background isotopes in expected concentrations. Radioactivity concentration in soil, vegetation, biota, TLD, and air samples during the 1996 baseline measurements did not significantly exceed the minimum detectable activities for manmade isotopes, or expected background concentrations.

The current REMP describes existing and future monitoring activities, including ongoing baseline monitoring and additional pre-operational monitoring to be conducted specific to the Federal and Compact disposal facilities. The purpose of the additional pre-operational monitoring is to collect a more comprehensive data set prior to the start of operations. Background radiation levels were determined through analysis of soil, groundwater, vegetation, and ambient gamma radiation measurements. They indicate no pre-existing contamination or high natural background in any sampled matrix. Ongoing baseline monitoring data are currently being collected, as discussed previously under the current REMP provided in Appendix 2.10.1-2. The results of the current baseline data assessment indicate no impact to background radiological, chemical, or environmental parameters due to existing operations adjacent to the proposed Site. The locations, analytes, and matrices for the existing program are presented in the REMP.

More detailed information on the pre-operational monitoring program is included in Section 2.10 and Section 8.1 of Appendix 11.1.1, “Environmental Report”. The baseline data collected to date do not indicate high natural radioactive or hazardous background concentrations of analytes that would interfere with operational or post-closure monitoring. The monitoring program will be augmented as required during the operational period as discussed below and in Section 8.2 of the ER.

11.9.2 Operational Monitoring

During the land disposal facility site construction and operation, the licensee shall maintain a monitoring program. Measurements and observations shall be made and recorded to provide data to evaluate the potential health and environmental impacts during both the construction and the operation of the facility and to enable the evaluation of long-term effects and the need for mitigative measures. The monitoring system shall be capable of providing early warning of releases of radionuclides and chemical constituents before they leave the disposal site boundary. The applicant’s report shall address the following topics: [30 TAC §336.731(b)]

(1) Meteorological Monitoring System

(2) Hydrological Monitoring System

(3) Ecological Monitoring System

(4) Radiological Monitoring System

The pre-operational monitoring phase will transition into the operational monitoring phase. These pre-operational and operational programs are discussed in more detail in the Environmental Report, Sections 8.1 and 8.2, respectively, Appendices 2.10.1-2 (REMP) and 2.10.2-2 (NREMP) and, for the operational groundwater monitoring program, in Section 6.3 of the Geology Report included as Appendix 2.6.1. With the exception of groundwater monitoring, no significant changes in scope are identified between the pre-operational and operational monitoring programs. Additional locations will be added to the operational groundwater system for monitoring of radiological and non-radiological analytes; all other operational monitoring locations, sample media, and analytes, including all procedures and protocols, will remain the same as in the pre-operational program unless warranted by a future review and assessment of the complete pre-operational monitoring program. The operational monitoring plan will remain flexible for additional sampling locations or analytical methods, as may be appropriate, based on operational monitoring results, technical advances, or other factors. The operational monitoring program will be fully compliant with all licenses, permits and regulations governing the proposed facility.

The objectives of the operational monitoring program are to:

- Demonstrate compliance with applicable environmental and radiation protection standards. The results of sample analysis provide quantitative information that can be compared against environmental and health and safety limits in a continuing demonstration of compliance.

- Obtain data on exposure pathways. The results of sample analysis provide information that can be used to estimate potential doses to the public and to evaluate overall facility performance relative to analyses prescribed in the LA. In essence, the operational monitoring program allows comparisons of site impacts to performance objectives and ensures that environmental impacts are as low as reasonably achievable.
- Provide records for regulatory review. The records from operational monitoring act as the regulatory record that may be used to assess environmental impact and overall performance of the disposal Site throughout its life.

To meet these objectives, the operational monitoring program will rely on the information gathered to date as well as the data collected during the pre-operational monitoring program. WCS recognizes that the operational monitoring program as proposed could change given the eventual review of the data gathered during the pre-operational and operational monitoring programs.

Meteorological Monitoring System – Pre-operational parameters will continue to be collected and monitored by the on-site station. Regional data collected from selected NOAA stations in the vicinity of the proposed Site will be reviewed and analyzed as required.

Hydrological Monitoring System – The pre-operational groundwater network will be maintained and expanded, as described below. Baker Spring and ephemeral playas may be sampled when water is present. The operational groundwater monitoring program for the FWF and CWF is presented in Section 6.3 of the Geology Report included as Appendix 2.6.1. As described therein, the proposed operational groundwater monitoring program includes monitoring of the OAG, the 125-foot sandstone, and the 225-foot sandstone, and includes downgradient monitoring locations at an approximate spacing of 600 feet in the 125-foot sandstone and the 225-foot sandstone. The operational radiological groundwater monitoring program for the FWF and the CWF, as described in the current site REMP contained in Appendix 2.10.1-2, will be revised to be consistent with the approved groundwater monitoring program prior to initiation of operations under the LLRW disposal license.

Erosion Monitoring System – Erosion monitoring stations (Figure 2.10.3-1) have been established in areas that will not be disturbed by site construction or operations. Erosion pins (metal pins hammered into the ground with a washer around the pin which sits on the natural ground surface) have been installed at the erosion stations. Erosion monitoring consists of measuring the distance from the top of pins to the washer. The pins are placed in rows or grids perpendicular to the direction that erosion is expected to occur, in this case across gullies, slopes and the ranch house drainage. Five stations (numbered 1, 2, 3, 4A/B, 5) were set up to serve as initial erosion monitoring locations on the WCS property. A sixth station will be installed in March 2007. Each station has four lines of pins, a set of two large diameter (10 millimeter (mm)) pins and a set of two small diameter (5 mm) pins, except for station 4B, which has two lines of large diameter pins only. The first measurement occurred in the 4th quarter of 2006, with subsequent measurements scheduled quarterly.

Ecological Monitoring System – Flora and fauna data will be included as part of the monitoring program and periodically updated. Operations will be reviewed in response to current Federal and State requirements and protection listings. Data from monitoring will be compared with baseline data to discern trends or abrupt changes in important ecological parameters. Because data are collected to make decisions, the results of monitoring will analyzed and compared to the established decision criteria to determine if:

- Results fall within an acceptable range
- Results fall outside of an acceptable range

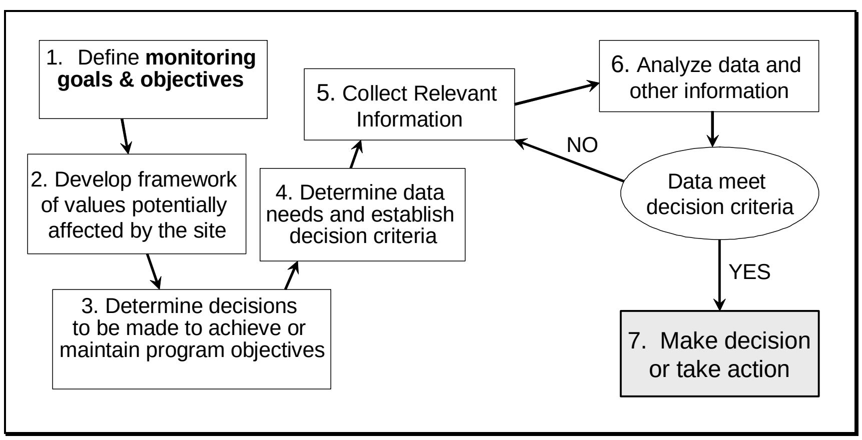
If data fall outside of an acceptable range (e.g., if they indicate the absence of an important species noted regularly in the area), decisions will be made to either collect additional data (e.g., increase the frequency of monitoring of particular parameters, take more quantitative data on a particular aspect of the monitoring regime) or take some corrective action. Figure 11.9.2-1 presents the conceptual approach to ecological monitoring.

Radiological Monitoring System – The monitoring program will be augmented as required during the operational period as discussed further in Section 8.2 of the ER.

This program will be coordinated with the ecological monitoring program to ensure consistency, efficiency, and adequacy.

Further information on the operational monitoring program including proposed monitoring locations is provided in Section 5.7.2, in the REMP (Appendix 2.10.1-2), in Section 8.2 of the Environmental Report (Appendix 11.1.1), and, for groundwater, in Section 6.3 of the Geology Report (Appendix 2.6.1).

Figure 11.9.2-1. Conceptual Framework for Ecological Monitoring



11.9.3 Post-Operational Monitoring

Provide a post-operational surveillance monitoring program based on the operating history and the closure and stabilization of the disposal site. The monitoring system shall be capable of providing early warning of releases of radionuclides and chemical constituents before they leave the disposal site boundary. [30 TAC §336.731(c)]

The objectives of the post-operational monitoring program are to:

- Ensure that the closed disposal units continue to meet closure requirements. This objective will be met through Site surveillance and media sampling.

- Provide data to support long-term impact evaluations. The results from continued and focused media sampling will enable analyses to confirm predictions of disposal site performance, as necessary.
- Provide records for review. The results from post-operational monitoring act as the record that may be used to document site closure information and for public consideration.

The site will undergo periodic surveillance to ascertain the extent to which active and passive institutional controls are needed. WCS will undertake any custodial care efforts during the post-operational monitoring period as needed. Surveillance and custodial care will continue for as long as required by license conditions.

The post-operational monitoring program will rely on the information gathered during the pre-operational and operational monitoring programs to meet the objectives described above. WCS recognizes that the post-operational monitoring program as proposed could change given the eventual review of the data gathered during the pre-operational and operational monitoring programs. Prior to closure, the post-operational monitoring plan will be reviewed in view of the characteristics of the waste materials placed in the disposal facilities and the data collected from both the pre-operational and operational monitoring phases. The goal of post-closure monitoring is to continue earlier monitoring of the facility, scaled to an appropriate level, while maintaining valid data comparability.

Further information on the post-operational monitoring program is located in Section 8.3 of the Environmental Report (Appendix 11.1.1).

11.10 Status of Compliance

Provide a list of all permits, licenses, approvals, and other entitlements required by Federal, State, local, and regional authorities that must be obtained for protection of the environment, and discuss the status and history of compliance with these requirements. The discussion of alternatives in the report should include a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements.

A list of all permits and licenses issued or currently pending for the facility are included in Section 1.24. Section 1.23 includes compliance histories from the TCEQ, the TSDHS and the EPA.

Table 11.10.1-1. Permits and Licenses

Permit/License Name	Agency	Media/Materials Regulated	Date Approved or Renewed
Low Level Radioactive Waste Treatment, Processing & Storage License TDH License #L04971	Texas Department of Health	LLRW Processing and Storage	February 1997 (renewal submitted 2003)
Amendment – Exemption from Part 70 (Special Nuclear Material (SNM) concentration-based limitations)	Texas Department of Health	Storage of Transuranic (TRU) wastes.	Amendment – October 15, 1998
Industrial Solid Waste and Hazardous Waste Storage, Processing, and Disposal (Resource Conservation and Recovery Act Wastes) Permit TNRCC Permit # HW-50358	Texas Commission on Environmental Quality (TCEQ)	Industrial solid waste, hazardous waste and mixed waste In combination with the LLRW Processing and Storage license, this allows WCS to treat, process and store mised wastes (hazardous wastes with radioactive contamination)	Issued – August 5, 1994 Renewal and amendment issured October 5, 2005
Toxic Substances Control Act Land Disposal Authorization EPA ID # TXD988088464	U.S. Environmental Protection Agency	PCBs. Treatment, storage, and land disposal of TSCA waste (PCBs). In combination with the RCRA permit and LLRW processing and storage license, this allows WCS to treat, process, and store hazardous and non-hazardous wastes containing PCBs, including wastes withradioactive contamination.	December 2, 1994; Reauthorized November 22, 1999 and September 19, 2005
Texas Pollution Elimination System (TPDES) Permit # 04038	Texas Commission on Environmental Quality (TCEQ)	Potential liquid effluent discharges to unnamed ditches from the hazardous waste; treatment, storage and disposal (TSD) facility that additionally stores and processes LLRW.	Issued – December 2, 1999; Renewal and amendment issued May 31, 2005
Air Quality Permit # 72653	Texas Commission on Environmental Quality (TCEQ)	Potential air emissions associated with construction and operation of the commercial, industrial, and hazardous waste management facility that additionally stores and processes LLRW	Issued – September 29, 2005

11.10.1 Compliance Status

Existing operations and monitoring programs described in this LA are in compliance with existing permits and licenses. As permits and licenses are issued, modified, and renewed, operational parameters and monitoring will be adjusted to remain in compliance. A copy of the current compliance history for WCS is included as Appendix 11.10.2.

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