

## **An Update On Waste Control Specialists' 2004 License Application For Safe Disposal Of Class A, B, and C Low-Level Radioactive Waste In Texas - 8312**

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### **ABSTRACT**

On December 10, 2007, Waste Control Specialists LLC (WCS) received notification that the Executive Director of the Texas Commission on Environmental Quality (TCEQ) had prepared an interim draft license and made a preliminary decision that it met all statutory and regulatory requirements for safe disposal of low-level radioactive waste (LLW) at the WCS' site in Texas. Pursuant to this interim draft license, WCS will be authorized to dispose Class A, B, and C LLW in two enhanced near-surface landfills at WCS' 5.4-square-kilometer (1,338-acre) treatment, storage, and disposal (TSD) site in Andrews County, Texas (Fig. 1). One landfill will be dedicated to LLW generated within the member/party states of the Texas Compact (Texas and Vermont), while the other will be dedicated to LLW generated by the federal government. The *calculated annual peak dose* to the maximally exposed member of the general public, i.e., an adjacent resident, from any of the proposed LLW-disposal landfills occurs approximately 36,400 years after closure and is *0.034 millisievert (mSv)* (3.4 millirem {mrem}), which is less than 14 percent of the applicable regulatory limit of 25 mSv (25 mrem).

The draft license will be published in February 2008, which will be followed by 12 months of public hearings, and three months for preparation of the final license. Based on this schedule, the final license is due in May 2009. When opened, the WCS site will achieve a national milestone; it will be the first new Compact LLW-disposal site in the USA to open under the Low-Level Radioactive Waste Policy Act of 1980, as amended in 1985.



Fig. 1. View from southwest of the western and central portions of the WCS TSD site (the proposed new landfills will be located adjacent to and north of the current landfill).

## INTRODUCTION AND BACKGROUND

Waste Control Specialists LLC (WCS) has been responsibly engaged in (1) the safe *treatment, storage, and disposal of hazardous and toxic wastes* regulated under the Resource Conservation and Recovery Act (RCRA), the Comprehensive Environmental Compensation and Liabilities Act (CERCLA), and the Toxic Substances Control Act (TSCA), and (2) the safe *treatment and storage of radioactive wastes*, including greater than Class C (GTCC) low-level radioactive waste (LLW), and radioactive waste mixed with regulated hazardous and toxic constituents for more than a decade at its 5.4-square-kilometer ( $\text{km}^2$ ) (1,338-acre) site in Andrews County, Texas (Fig 1). The WCS site is located near Texas State Highway 176 along the Texas border with New Mexico and is surrounded by a 54.7  $\text{km}^2$  (13,527-acre) land parcel also owned by WCS. Waste can be shipped to the site by truck and rail in bulk or packaged/containerized.

On August 4, 2004, WCS submitted a license application to the Texas Commission on Environmental Quality (TCEQ) seeking authorization to develop, operate, and close two enhanced near-surface landfills at the WCS site for safe disposal of Class A, B, and C LLW.[1] One of the proposed landfills, referred to as the Compact Waste Facility (CWF in Fig. 2), will be dedicated to safe disposal of LLW generated within the member/party states of the Texas LLW Compact. The other, referred to as the Federal Waste Facility (FWF in Fig 2), will be dedicated to safe disposal of LLW generated by the federal government, i.e., the U.S. Department of Energy (DOE) and the U.S. Navy.

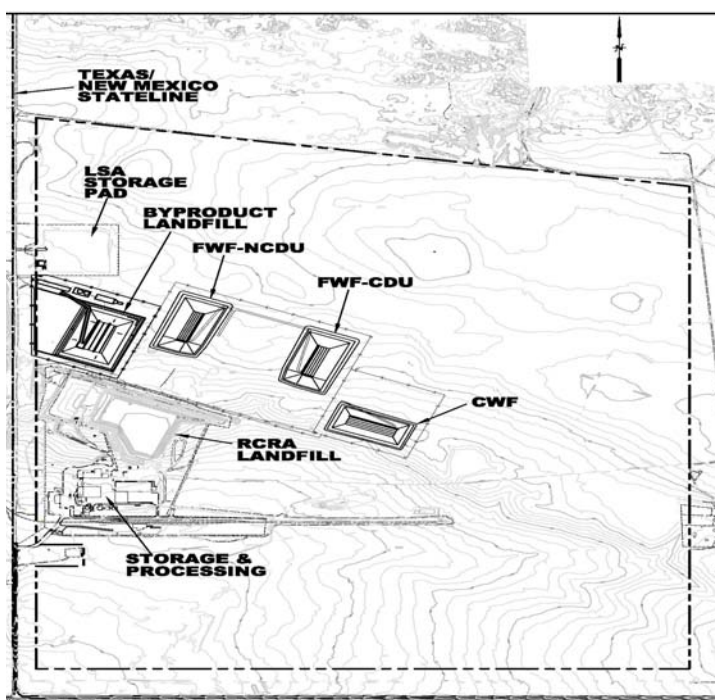


Fig. 2. Plan map of the 5.4  $\text{km}^2$  (1,338-acre) WCS site (dashed line) showing the proposed locations of the Texas Compact Waste Facility (CWF) and the Federal Waste Facility (FWF)(indicated by the boundary surrounding the “FWF-NCDU” and “FWF-CDU”) relative to existing “storage & processing”, “RCRA landfill”, and “LSA storage pad” facilities and the proposed byproduct (material) landfill.

WCS has also submitted a permit application to TCEQ seeking authorization to safely dispose of LLW mixed with RCRA-regulated constituents (MLLW) in the FWF.[2] The continued schedule for this permit application is expected to be bound by and of no time significance to the schedule shown for the LLW-disposal license application in Fig. 3.

In addition, on June 21, 2004, WCS submitted an application to the Texas Department of State Health Services (DSHS) seeking authorization to safely dispose of byproduct material in another

dedicated enhanced near-surface landfill (Fig. 2).[3] The byproduct material disposal application was transferred from DSHS to TCEQ in July 2007.[4] On October 22, 2007, the Executive Director of TCEQ issued a draft byproduct material disposal license for public review and comments.[5] Public comments were submitted to TCEQ by November 22, 2007. Key milestones projected by the WCS for the continued licensing process and the opening of the byproduct material disposal facility are shown in Fig. 3. Based on these projections, WCS expects byproduct-material disposal to commence in April 2009, beginning with the disposal of 3,776 containers with low-specific-activity (LSA) waste from the DOE's clean up of the Fernald site in Ohio currently stored on the WCS site

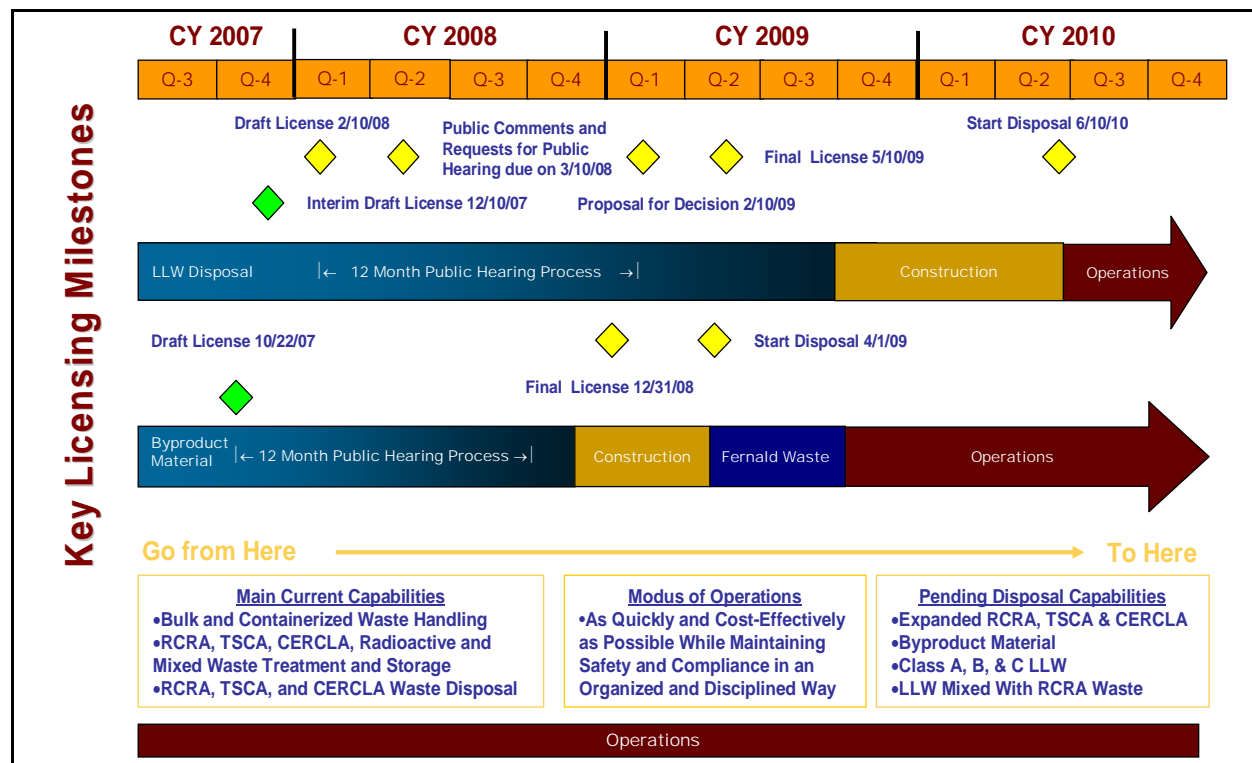


Fig. 3. WCS' end-of-2007 Vision of the Future.

As shown in Fig. 3, the publication of the draft LLW-disposal license is expected in February 2008. It will likely be followed by an up to 12-month-long public-hearing process, including a 30-day public comment period.[6] Based on a 12-month-long public hearing process and a favorable outcome, (a) the final license for LLW disposal will be issued no later than 15 months after the publication of the draft license, i.e., in May 2009, and (b) WCS should be able to commence LLW/MLLW disposal no later than in June 2010 (Fig. 3). When opened, the WCS site will achieve a national milestone; it will be the first new Compact LLW-disposal site in the USA to open under the LLW Policy Act of 1980, as amended in 1985.[7,8]

*The subsequent text focuses on the LLW disposal application. Concise descriptions of the designs and the projected long-term performance of the proposed enhanced LLW-disposal landfills are provided below. A summary of conditions and potential challenges that may impact the expected opening date concludes the main text. By the time this paper is published, more*

recent information on the LLW and byproduct material disposal applications may be available on the WCS web site ([www.wcstexas.com](http://www.wcstexas.com)).

## MAIN DESIGN COMPONENTS OF THE PROPOSED LLW-DISPOSAL LANDFILLS

The locations of the proposed LLW-disposal landfills shown in Fig. 2 were carefully chosen to optimize the inherent favorable benefits of the natural materials at the site in terms of containing and isolating waste disposed of in near-surface landfills. The extensive database on past, current, and projected climates, and surface and subsurface conditions supporting the license application included 70 years of aerial photographs, geophysical surveys, more than 250 carefully located, characterized, and selectively sampled boreholes, more than 160 groundwater-monitoring wells, and detailed stratigraphic evaluation and age dating of the natural materials in 12 strategically-located soil pits, augmented by the information gained during the incremental development and safe 10-year operation and monitoring of the disposal units in the RCRA landfill (Figs. 1 and 2).

Additional assurance that all disposed waste will be more than adequately contained and isolated is provided by multi-layered (15-16-layers) man-made (engineered) structures with known characteristics that are compatible with the prevailing natural environment and barrier materials, and the projected waste to be disposed. Only the man-made structures are concisely described in this section. The main natural materials and their characteristics are summarized in conjunction with the concise description of the performance assessments in the subsequent section. Suffice it to mention here that all waste will be disposed of *at least*:

1. Eight meters (m) (25 feet {ft}) below the current (and post-closure) ground surface and well within the virtually-impermeable, more than 200-m-thick (600-ft-thick) Cooper Canyon red bed claystones of the Tertiary-aged (between 1-70 million years old) Dockum Group (“Natural Undisturbed Red Bed Clay” in Fig. 4).
2. Seven meters (21 ft) above current and projected groundwater-table elevations within the foot prints of the landfills.

As indicated in Fig. 2, the CWF and the FWF will be developed in phases. This will be done by the staged development of individual disposal cells. Whereas the CWF only has one type of cells, the FWF has two types based on waste characteristics. *Low-specific-activity (LSA) Class A LLW* will be safely disposed; contained, and isolated in cells within the non-canister (bulk) disposal unit (NCDU). *Above-LSA Class A, and Class B and C LLW* will be safely disposed; contained, and isolated in cells within the canister disposal unit (CDU).

Fig. 4 illustrates the main design (man-made) components of the NCDU cells of the FWF. An important design feature common to all the LLW-disposal units is the 60-cm-thick (two-ft-thick) drainage layer in the uppermost portion of the performance cover that is connected with “surface drainage” features. These drainage features will minimize the potential for post-closure infiltration of liquids into any of the LLW-disposal units even during high-precipitation events. Actually, the possibility of surface infiltration is very low due to the facts that (a) the proposed landfills are aligned along a topographic high that will be restored at closure of the disposal units, and (b) the recorded average annual precipitation is less than 40 centimeters (cm) (16 inches), which is only about one-third of the reported average evaporation rate of 152 cm (60

inches) in the semi-arid region in which the WCS site is located. There are, however, the following important design variations among the three proposed LLW-disposal units:

- Due to the fact that MLLW will only be disposed of in the FWF, the CWF will not have (a) the extra high-density polyurethane sheet/layer in the performance cover system or (b) the multilayered, interconnected, leachate collection system that all FWF units have; and,
- In addition to the barriers shown in Fig. 4 for the FWF-NCDU, both the CWF and the FWF-CDU will have a 30-cm-thick (one-ft-thick) reinforced, high-strength, concrete barrier on top of the sand drainage layer shown at the bottom of the FWF-CDU in Fig. 4. This concrete barrier will extend up towards the ground surface along the side walls all the way to the concrete layer in the performance cover system (shown in grey in Fig. 4). In other words, after closure, all Compact LLW and containerized federal LLW and MLLW will be contained at least 8 m (25 ft) below the current (and post-closure) ground surface within a sarcophagus having 30 cm-thick (one-foot-thick) walls of reinforced, high-strength, concrete.

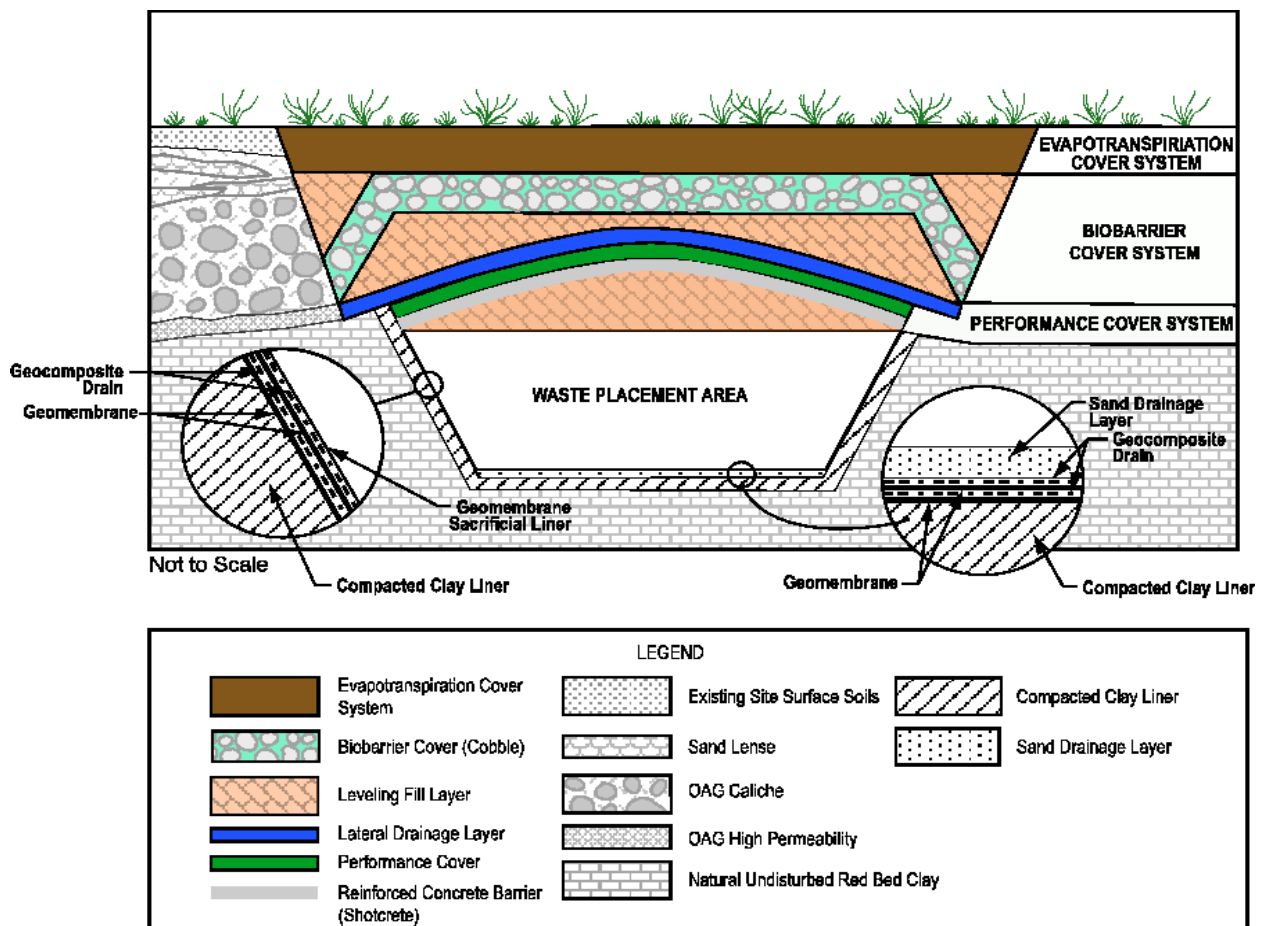


Fig. 4 Cross section showing the main design components of the NCDU cells in the FWF.

In summation, all proposed LLW-disposal units have an outer, multi-layered, virtually-impermeable, containment and isolation shell comprised by a combination of carefully selected

natural and engineered materials with excellent characteristics for (1) resisting erosion, (2) containing and isolating the waste disposed of in the unit and (3) preventing liquid from entering or exiting the unit. Indeed, to the best of our knowledge, the design of the enhanced LLW-disposal landfills proposed by the WCS incorporates/contains more effective barriers against radionuclide migration than any other LLW landfill currently in operation in the USA.

## **PROJECTED PERFORMANCE OF THE PROPOSED LLW-DISPOSAL LANDFILLS**

The post-closure performance of the proposed landfills is largely governed by the following parameters:

1. The rate of infiltration of liquid into and out of the landfills.
2. The radionuclide inventory (source term).
3. The characteristics of the surrounding natural materials.

The design is of particular importance to parameter 1. The radionuclide inventories used in the license application for the FWF and the CWF are based on data published by the DOE and the State of Texas, respectively. The characteristics of the surrounding natural materials were determined based on more than 10 years of landfill-related site characterization activities.

The performance assessments supporting the LLW-disposal license application include 27 potential exposure pathways/scenarios covering the following base scenarios:

- Normal operation;
- Institutional control period (the first 100 years after closure);
- Post-institutional control period (follows the institutional control period and extends beyond the peak dose period); and
- Accident.

The following six environmental pathways were evaluated (a) during operation and (b) after closure of the LLW-disposal facilities: (1) Air; (2) Soil; (3) Groundwater; (4) Surface water; (5) Plant uptake; and (6) Exhumation by burrowing animals. Computer models used in the performance assessment include the RESRAD code for multipathway analysis, the MicroShield® model for external radiation exposure, and the HELP model for water infiltration.

The RESRAD code, Version 6.3, calculates radiation doses and risks from radionuclides in soil, air, groundwater, plants, and animals. The model calculates the transport of radionuclides through environmental media and exposures to humans. The radionuclide source is specified in terms of the initial concentrations of radionuclides in soil. The model calculates the subsequent releases of radionuclides from soil and their transport to groundwater, air, and into the food chain. The exposure pathways evaluated in the RESRAD model include drinking water, crop irrigation, direct radiation from soil, dust inhalation, radon gas inhalation, production of food crops and livestock (milk and meat) on contaminated soil, soil ingestion, and aquatic foods. The RESRAD model was selected for this analysis because it includes all of the environmental exposure pathways recommended by TCEQ guidance. The RESRAD model uses a level of

complexity that is consistent with the available site characterization information for the WCS site. It is also consistent with the site conceptual model and the pathways conceptual model.

The MicroShield® model, Version 5, calculates radionuclide exposures and doses from external radiation. The model uses analytical expressions and numerical integration to evaluate the radiation exposures from a range of source configurations. The radionuclide source term is specified in terms of the individual radionuclide concentrations and the source configuration. Shielding dimensions and materials are specified, as well as the dose receptor location relative to the source and shields. The output from MicroShield® shows the exposures rate and absorbed dose rate at the receptor location. The MicroShield® model was used to calculate external doses for workers and doses for the inadvertent intruder drilling scenarios. The model was selected because it is consistent with the Pathways Conceptual Model; the model is widely accepted, easy to use, and well documented.

The HELP model, Version 3, calculates water infiltration rates through the engineered cover system. Input data for the HELP model include weather, soil, and cover design information. The model considers runoff, infiltration, water storage, evapotranspiration, vegetative growth, and lateral drainage. The solution methods in HELP generally use the saturated hydraulic conductivity of the soil layers, which tends to overestimate water infiltration through the layers. The HELP model was selected for this analysis because it uses simplified solution methods, it is consistent with the pathways conceptual model, and it is widely used and well documented.

A sensitivity and uncertainty analysis was conducted with the RESRAD and HELP models to identify important input parameters and to address the effects of variations in input parameters and changing site conditions. However, the focus below is on the following select post-closure performance assessments components of the institutional and post-institutional periods:

1. The framework for WCS' post-closure performance assessments.
2. The main site characteristics for radionuclide containment and isolation.
3. The main performance assessment assumptions made.
4. The results of the post-closure performance assessments.

## **Regulatory Framework**

Texas Administrative Code (TAC) defines the following key *post-closure performance assessment* requirements for the LLW-disposal landfills proposed by WCS (*emphasis added*):

1. "Pathways analyzed in demonstrating protection of the general population from releases of radioactivity including air, *soil, groundwater, surface water, plant uptake, and exhumation by animals 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 specified in 30 TAC §336.724 (relating to Protection of the General Population from Releases of Radioactivity). *A minimum period of 1,000 years after closure or the period where peak dose occurs, whichever is longer, is required as the*

*period of analysis (emphasis added), to capture the peak dose from the more mobile long-lived radionuclides and to demonstrate the relationship of site suitability to the performance objective in 30 TAC §336.709(1) and to the performance objective in 30 TAC §336.724” (TAC, Title 30, Part 1, Chapter 336, Subchapter H, Rule 336.724).”*

2. “Concentrations of radioactive material which may be released to the general environment in groundwater, surface water, air, soil, plants, or animals shall not result in an annual dose above background exceeding an equivalent of 25 millirems to the whole body, 75 millirems to the thyroid, or 25 millirems to any other organ of any member of the public. Effort shall be made to maintain releases of radioactivity in effluents to the general environment as low as is reasonably achievable” (= the performance objective in 30 TAC §336.724).”

### Main Site Characteristics for Radionuclide Containment and Isolation

All proposed LLW-disposal (and byproduct material disposal) landfills will be located along a topographical-high feature on the site that largely coincides with the crest line of the so-called “red bed ridge.” The FWF will extend approximately 25 m (80 ft) and the CWF will extend approximately 16 m (50 ft) into the more than 200-m (600-ft) thick, more than 1 million-year-old Cooper Canyon red bed claystones (the claystones) of the 470-m (1,400-ft) thick Dockum Group. As illustrated in Figs. 4 and 5, all LLW/MLLW will be disposed of in the claystones.

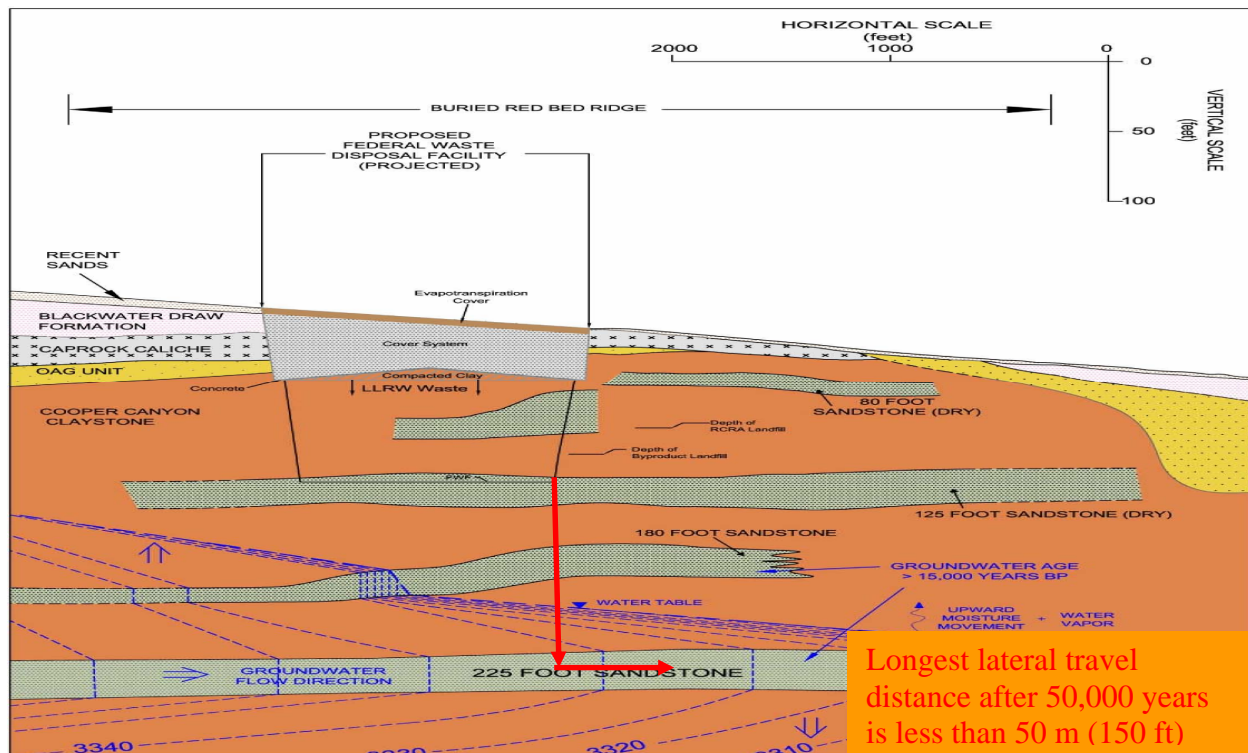


Fig. 5. North to South trending cross-section-schematic illustrating the main stratigraphic and hydrogeologic features at the WCS site with the “fastest” hypothetical groundwater-related radionuclide migration pathway (indicated by red arrows).



As schematically illustrated in Fig. 5, the claystones are interspersed in the vertical direction by laterally discontinuous and continuous interbeds at depths of approximately 25, 38, 55, and 69 m (80, 125, 180, and 225 ft) below the current ground surface at the proposed landfill locations. These interbeds typically have higher percentages of coarser-grained sediments, i.e., silt and sand, and higher pore volume than the claystones, and are thus less resistant to groundwater movements. Nevertheless, the hydraulic conductivities of the interbeds, typically one to two orders of magnitude higher than those of the claystones, are still very low; the hydraulic conductivities of the interbeds and the claystones at the WCS site are less than  $1.0E-7$  centimeter per second (cm/sec), and less than  $1.0E-9$  cm/sec, respectively. Specifically, the horizontal groundwater travel distance in the 69-m (225-ft) interbed, which is the uppermost potential radionuclide pathway, is on the order of 1.3 m (4 ft) per 1,000 years (yr). Based on carbon-14 (C-14) age dating, its groundwater is at least 16,000 years old (late Pleistocene), which means that it was recharged near the end of the last period of glaciation in North America, i.e., approximately 18,000 - 20,000 years ago. It should be noted, however, that none of the aforementioned interbeds will support a well because they are dry or, where saturated, they have a very low hydraulic conductivity. *The first usable aquifer is located approximately 200 m (600 ft) below the ground surface.* In summation, the claystones in which the proposed WCS landfills are located are both dry and virtually impermeable.

Given these inherent hydrogeologic site characteristics, the probability for any leakage of groundwater from these interbeds into any of the proposed disposal units is very low. The probability is also very low for lateral transport of dissolved radionuclides from any of the disposal units through the hydrogeologic units surrounding the landfills, i.e., the red bed claystones, because they are either dry or they don't outcrop in the vicinity of the proposed disposal facilities. Consequently, there is virtually no potential for release of any radioactively-contaminated groundwater from these interbeds to the ground surface as springs or seeps.

### **Main Assumptions**

Due to the prevailing excellent characteristics of the natural materials at the WCS site for long-term radionuclide containment and isolation, WCS had to develop and evaluate a set of hypothetical, grossly-exaggerated, adverse, site conditions and radionuclide release scenarios in order to be able to quantify a readily-recognizable, conservative, upper exposure limit for the maximally exposed member of the general public, i.e., an adjacent resident. Following are the main performance assessment assumptions made by WCS:

1. A limited volume of liquid would pass through the virtually-impermeable man-made barriers surrounding the waste and reach the disposed waste.
2. This liquid would freely mix with the disposed waste, i.e., the containment and isolation provided by the containers and other man-made materials and features, and geochemical conditions surrounding the waste were not accounted for.
3. After mixing with the disposed waste, the liquid containing radionuclides would be allowed to freely leave the landfills through their bottoms, i.e., the containment and isolation characteristics of the virtually-impermeable, man-made, multi-layered, barriers at the bottom of the landfills, including a 30-cm (1-ft) thick, reinforced

concrete layer for the CWF and the FWF-CDU cells, and double leachate collection systems for all FWF units, were not accounted for.

4. There is a hypothetical vertical post-closure pathway (open fissure/fracture) all the way from the bottom of each landfill down to the 69-m (225-ft) interbed that will remain open for at least 100,000 years.
5. There is a hypothetical well in the virtually impermeable 69-m (225-ft) interbed from which the adjacent resident obtains and consumes two liters (0.53 gallon) of contaminated groundwater per calendar day.

The above assumptions essentially eliminated:

- The long-term radionuclide containment and isolation provided by the multi-layered, virtually-impermeable, man-made/engineered components/barriers of the landfills in order to accommodate liquid inflow to and outflow from the landfills; and
- Several beneficial prevailing site conditions, including the stresses and the elastic moduli of the natural materials and other natural processes reducing groundwater flow with time in an “open” fissure, in order to allow the 32-m (100-ft) long (FWF) and the 42-m (125-ft) long (CWF) hypothetical vertical pathways (open fractures) to remain open for at least 36,400 years (FWF) and 15,400 years (CWF), respectively (Table 1). Again, WCS allowed these pathways to stay open 100,000 years in the performance assessments.

## Results

The calculated maximum doses to intruders are (1) an acute dose of 0.067 millisievert (mSv) (6.7 millirem {mrem}) to the intruder driller and (2) a maximum chronic dose of 0.046 mSv per year (mSv/yr) (4.6 mrem per year {mrem/yr}) to the intruder resident. The calculated maximum doses to an adjacent resident from each proposed LLW-disposal facility are summarized in Table I. It should be noted that 97% of the projected LLW inventory will decay within 100 years to levels that don't present an unacceptable hazard to the general population or to an inadvertent intruder.

Table I. Maximum post-closure exposures (peak doses) to a maximally exposed member of the general public, i.e., the adjacent resident.

<b>LANDFILL</b>	<b>PEAK DOSE*</b> (mSv/mrem)	<b>TIME OF OCCURRENCE AFTER CLOSURE</b>	<b>MAIN ISOTOPE(S)</b>
CWF	0.0058/0.58	15,600 years	Chlorine-36
FWF-CDU	0.011/1.1	36,400 years	Technicium-99 (95%)/ Iodine-129 (5%)
FWF-NCDU	0.034/3.4	36,400 years	Technicium-99

- \* Peak doses occur at different locations and times, and are thus not cumulative but even if added up, the cumulative peak dose would only be 20.3% of the regulatory limit.

The intruder driller is exposed to contaminated drill cuttings in the mud pit and radioactive gases emanating from the disposal units. The driller was assumed to drill through the particular waste

stream that causes the highest dose, rather than the facility average radionuclide mix. The intruder resident is exposed to the covered mud pit, radioactive gases from the disposal units, and groundwater. Although there are no regulatory dose limits for intruders, the calculated doses are below the 1 mSv/yr (100 mrem/yr) limit for doses to members of the public during normal operations defined in 30 TAC 336.313(a). A member of the public who resides immediately adjacent to the former disposal units may also be exposed to radioactive gases that may emanate through the cover system and to potentially contaminated groundwater.

As described above and schematically illustrated in Fig. 4, the 69-m (225-ft) interbed is the first saturated laterally continuous interbed below the proposed landfill locations that could provide a continuous conduit/pathway for groundwater/radionuclide migration. The vertical distances between the bottoms of the proposed FWF and CWF and the 69-m (225-ft) interbed are approximately 32 m (100 ft) and 42 m (125 ft), respectively. The calculated travel times for a radionuclide to reach the 69-m (225-ft) interbed from these landfills are 12,000 years and 15,000 years, respectively. Using 50,000 years after closure as a sample yardstick for performance and the “horizontal” travel velocity in the 69-m (225-ft) interbed being 1.3 m/1,000 yr (4 ft/1,000 yr), the furthest a radionuclide would be able to travel/migrate horizontally beyond the bottom foot prints of any of the proposed landfills during the remaining 38,000 years is < 50 m (< 165 ft). Without an open conduit between the landfills and the 69-m (225-ft) interbed, it would take more than 2 million years for a radionuclide to reach the 69-m (225-ft) interbed.

In summation, even if the man-made barriers are virtually ignored, all projected hypothetical “upper-bound” radiation exposures/doses to the maximally exposed member of the general public, i.e., an adjacent resident, are well below the 0.25 mSv (25 mrem) regulatory limit. Indeed, it is even less than the incremental radiation exposure/dose of about 0.05 mSv (5 mrem) received during a flight across the United States of America.

## **SUMMARY OF OBSERVATION AND POTENTIAL CHALLENGES**

As demonstrated by the information presented in the WCS LLW-disposal license application, the site and the proposed landfill locations are very-well located and characterized, structurally stable, and meet all applicable “earth-sciences-related” licensing requirements. Indeed, as demonstrated by the very conservative performance assessments, the prevailing and projected natural conditions alone will safely contain and isolate all radioactive constituents until they are either deemed harmless to humans or have reached peak dose. Furthermore, the calculated peak dose of 0.034 mSv/yr (3.4 mrem/yr) to a maximally exposed member of the general public from the FWF (Table I), which is higher than that calculated for the CWF, is < one seventh (1/7), i.e., < 14 %, of the TCEQ’s acceptable radiation dose of 0.25 mSv/yr (25mrem/yr) to a member of the public (see above).

However, as mentioned above, in order to get liquids into and radionuclides out of any of the landfills, WCS had to disregard the existence and characteristics of several existing man-made barriers and natural conditions. For example, it was assumed that limited amounts of liquids unencumbered accessed, dissolved, and moved radionuclides from the landfills to the 69-m (225-ft) interbed (Fig. 5). In actuality, the only driving force available to move a radionuclide from the landfills to the 69-m (225-ft) interbed is gravity, i.e., the minute

density of the radionuclide. Furthermore, the 69-m (225-ft) interbed neither yields enough water to supply a drinking-water well nor does it reach the surface. Consequently, radionuclides reaching the surface by being pumped from the 69-m (225-ft) interbed or through a surface exposure of the 69-m (225-ft) interbed are not scientifically viable scenarios. WCS is thus confident that the scientific and technical merits of the proposed LLW-landfills have been demonstrated beyond any reasonable doubt.

Notwithstanding the unrealistic assumptions and scenarios used by WCS to derive the above exaggerated radiation exposure numbers, the temporal scale involved is unprecedented for LLW-disposal, which may lead to additional, highly-speculative, very-low-probability, scenarios. Furthermore, numbers are often used out of context without a full understanding of the technical disciplines involved, the temporal and spatial scales inherent in the assumptions, the limitations of the models and codes used, and the safety embodied in the conservativeness of the related input to the models that exaggerate any projected potential risk/dose.

Lastly, a common domestic and international challenge to the siting and development of nuclear-related facilities is public fear and opposition to anything containing the words nuclear or radioactive, commonly referred to as the “Not In My Backyard” (NIMBY) syndrome. WCS and its waste management operations in Andrews County benefit from more than 10 years of unwavering acceptance by and support from near-by residents and local public and political organizations and institutions. This support was instrumental in the successful permitting and licensing of the currently-operating hazardous (RCRA Class C) waste landfill and the mixed waste treatment and storage facilities. For example, in addition to the long-standing support received from residents and local and political organizations and institutions in our host community, Andrews County, resolutions of support for the LLW-disposal (and byproduct material disposal) license application(s) have also been received from neighboring Lea County, New Mexico, and the nearby cities of Eunice, Hobbs, Jal, Lovington, and Tatum in New Mexico. We are therefore confident that it is not a matter of if but a matter of when the LLW (and byproduct material) disposal facilities proposed by WCS will be successfully licensed and opened. The three main reasons for our confidence are:

1. **Excellent Site Safety** - The site has been thoroughly characterized and analyzed (= sound science), the designs are based on state-of-the art man-made components (= good engineering practice), and it has been found very suitable for safe disposal of LLW (and byproduct material). Indeed, as demonstrated by the overly conservative performance assessment calculations, the natural conditions alone provide more than seven times higher confinement and isolation of the disposed radionuclides than that required by the applicable TCEQ regulations, i.e., 0.034 mSv (3.4 mrem) versus 0.25 mSv (25 mrem).
2. **Very-High Local Acceptance** - Local residents, organizations, and institutions welcome and support the proposed LLW-disposal (and byproduct material disposal) facilities. Integral to this support is more than 10 years of safe operation of hazardous, toxic, and radioactive waste management facilities at the site.
3. **Excellent Financial Assurance** - WCS readily meets all applicable financial requirements.

## REFERENCES

1. Waste Control Specialists LLC, “Application For License to Authorize Near-Surface Land Disposal of Low-Level Radioactive Waste” (2004), as amended (available on WCS’s home page – <http://www.wcstexas.com>).
2. Waste Control Specialists LLC, “RCRA Permit Application for the Federal Facility Waste Disposal Facility - Proposed Hazardous Waste Permit No. 50397” (2006).
3. Waste Control Specialists LLC, “Byproduct Material Disposal Facility License Application” (2004).
4. The 80<sup>th</sup> Legislature of Texas, “Senate Bill 1604 - An Act relating to responsibilities of certain state agencies concerning radioactive substances; imposing fees and surcharges; providing administrative and civil penalties” (2007).
5. Texas Commission on Environmental Quality, “Proposed Radioactive Material License Number R05807” (2007).
6. The 78<sup>th</sup> Legislature of Texas, “House Bill 1567 – An Act relating to the disposal of low-level radioactive waste; authorizing the exercise of the power of eminent domain” (2003).
7. Public Law 96-573, “The Low-Level Radioactive Waste Policy Act of 1980.”
8. Public Law 99-240, “The Low-Level Radioactive Waste Policy Amendments Act of 1985.”